

# The Texas Instruments User's Encyclopedia (TI-99/2,4,4A)

Gary Phillips and David Reese



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**THE  
TEXAS INSTRUMENTS  
USER'S ENCYCLOPEDIA  
(TI-99/2, 4, and 4A)**

by  
**Gary Phillips and David Reese**



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David Reese wishes to acknowledge the support of his wife Cathi Reese and his daughter Brooke Murray who made it possible for him to complete his parts of the encyclopedia.

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ISBN 0-912003-15-4

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## PREFACE

The *TI-99/2, 4, 4A User's Encyclopedia* is your one definitive reference book for your TI-99 Computer. By deciding to own it, you have made an investment in your computing future. It will save you hundreds of hours by bringing material from many sources into a single, easy-to-use, alphabetical reference handbook.

Much of the material is not available anywhere else. Here you will find the essential background material you will need to answer your questions and solve problems on the TI-99.

Your *Encyclopedia* guides you through machine operation, BASIC programming, and what's available in software and hardware. Your *Encyclopedia* will quickly pay for itself through product information alone. And it is a comprehensive source of information about the whole area of microcomputers. The entries are short, clear, self-contained, and understandable. Should you desire additional information, hundreds of cross references point you to related entries in the *Encyclopedia*. You will find it the most frequently used and most highly treasured book in your personal computer library. Many who buy the *Encyclopedia* come to swear by it.

While your *User's Encyclopedia* was written in simple language so beginning users can understand it, you will continue to find it indispensable as your knowledge of computers grows. It does not cover Machine language or the internal electronic details of the TI-99 computers. It does, however, provide a complete reference on BASIC programming, general operation of the computer and its accessories, and available products.

You will usually use your *TI-99 User's Encyclopedia* as a quick reference source. You will probably keep it near your computer—right by it—instantly available when you encounter difficulties or want a more complete understanding of what your TI-99 is doing. You will also enjoy just browsing through its many short, easy-to-read-and-understand entries. This will allow you to easily and casually increase your general knowledge of the TI-99, and microcomputers in general. And now that you own it, you will probably find still other uses for the most universal, valuable, easy-to-use book available for the TI-99.

The *TI-99 User's Encyclopedia* was produced for you by Gary Phillips & Associates. Gary Phillips & Associates also provide *User's Encyclopedias* for the IBM PC, Apple, Atari, TRS-80, and many other personal computers. The *User's Encyclopedia* will serve as your first reference source for most questions. Manuals from TI and other books provide a valuable backup to the *User's Encyclopedia*—when you have time to explore a topic in traditional book presentation. But when time is pressing and you want information fast, you will rely on the *TI-99 User's Encyclopedia*.

The *TI-99 User's Encyclopedia* is organized alphabetically, with numbers and special symbols following "Z." Here are some special pointers for understanding the format of the *Encyclopedia*:

Variable types in various statements and commands are placed between arrow brackets. For example, <line number> means you would use a specific line number from your BASIC program. Similarly, <variable> indicates any variable you are using in your program. For example, the statement to display a variable's value is PRINT <variable>. To print out the contents of the variable Count, you would replace <variable> with Count, giving PRINT Count. Parentheses ( ) around an item in a command or instruction should be typed by the user at the keyboard. However, brackets [ ] indicate only that the enclosed material is optional; these brackets should never be entered into the computer. Also, q.v. is used after a word or phrase to direct you to other entries that you may want to see for additional information (q.v. from the Latin quo vide, "which see"). The names and addresses of all software and hardware manufacturers are listed alphabetically in the Vendors listing in the back of the book.

We have made every effort to make your *TI-99 User's Encyclopedia* complete, accurate, and up-to-date. The descriptions of products are identified by an "\*" following the product name. These are not usually reviews, but



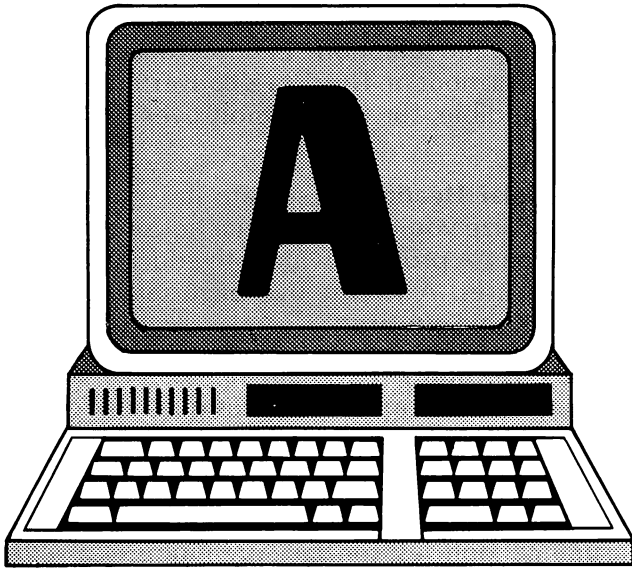
brief descriptions to help you find products you may want and acquire further information. You will need to check with the manufacturer or a retail outlet to verify the suitability of the product for your needs and to determine its price and availability. Similarly, you should verify any technical information in the *Encyclopedia* before relying on it for a major decision. Neither the authors, Gary Phillips & Associates, nor The Book Company will be liable for any errors or omissions in the *User's Encyclopedia*. If you should find an error, omission, or have any suggestions for improvements or additions to future printings or revisions of the *TI-99 User's Encyclopedia*, please write us:

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Manufacturers of hardware or software who would like to be included in the next revision of the *TI-99 User's Encyclopedia* may send review copies and descriptive literature to the same address.

Thank you for deciding to own the one definitive reference source for the TI-99 family of computers. We know you will enjoy and profit from it in the months to come.

Gary Phillips  
David Reese  
Staff of Gary Phillips & Associates.



**A** Codes. ASCII 65, HEX 41. a—ASCII 97, HEX 61.

**A** Accumulator or Address line. Also the hexadecimal sign for the decimal integer 10: A base 16 = 10 base 10 = 12 base 8 = 1010 base 2.

**Å** Symbol for angstrom, equaling one billionth of a meter (one nanometer).

**A Day At the Races\*** All the excitement of horse racing and betting is yours with this entertaining package. It can also be expanded to include speech. Requires Extended BASIC cartridge. Disk or cassette. W.R. Wilson, Inc.

**ABS** BASIC Function. ABS returns the positive (absolute) value of the expression x without regard to negative signs. The format is:

`<variable> = ABS(<x>)`

`<x>` is any numeric expression. For example:

`>PRINT ABS(-100)`

`>100`

The positive (absolute) value of -100 is 100.

**Absolute Value** The value of a number expressed as a positive number. Denoted by enclosure in vertical bars (|). Thus, if a number is positive or zero:  $|x| = x$ . If x is negative:  $|x| = -x$ . See ABS.

**A-Bus** The primary internal source-bus to the Arithmetic Logical Unit in any processor.

**AC** Alternating electrical Current. Or, ACCumulator. Or, ACCess time.

**AC Circuit Analysis Library\*** Contains AC Circuit Analysis and AC Plot. Analysis of logarithmic or linear frequency sweep. Output of AC analysis can be printed or saved using the AC plot program. The

network description file can be sorted on disk for future use. Up to 11 nodes and 31 components can be analyzed without program modification. Texas Instruments.

**AC or ACC** ACCumulator, or ACCess time. The time required to retrieve a word from memory of any type.

**Acceleration\*** Calculate the velocity, distance, and time intervals of a moving object. Disk or cassette. Data Systems.

**ACCEPT** X BASIC Statement. ACCEPT is a multi-optional version of INPUT. The format is:

`ACCEPT[[AT(<row>,  
<column>)][VALIDATE  
(<data-type,...>)]  
[BEEP][ERASE ALL][SIZE  
(<x>)]:]<z or z$>`

AT(<row,column>) allows placement of the flashing cursor and beginning of the input field anywhere on the screen. Rows are numbered 1-24 and columns are numbered 1-28. Be aware that column 1 corresponds to column 3 in subprograms CALL HCHAR, CALL VCHAR, and CALL GCHAR.

VALIDATE(<data-type,...>) limits keyboard entry to certain characters.

“data-type” defines what characters will be accepted. Here are the four data-types:

1. UALPHA—Allows all upper case alphabetic characters.
2. DIGIT—Allows numbers 0-9.
3. NUMERIC—Allows numbers 0-9, as well as the following symbols: . , + - —E.
4. x\$—allows any group of characters you specify.

BEEP produces an audible sound through the monitor's speaker, indicating that the computer is ready to accept input.

ERASE ALL blanks the screen.

SIZE(<x>) allows input of <x> number of characters. If <x> is positive, the display area on the screen is cleared. If <x> is negative, the display area is not cleared. This allows you, by pressing ENTER, to put a default value on the screen in place of the flashing cursor. If no SIZE clause is used, the row is blanked from the flashing cursor to the end of that row.

All of the options (AT, BEEP, etc) can be used as necessary in any combination and any order.

<z or z\$> is the variable that will be assigned to the input data. ACCEPT is also available in TI BASIC using “Programming Aids I.” Disk or cassette. See Programming Aids I.



**Access Time** Time required to retrieve a word from memory.

**Accounting Assistant\*** Helps administrators create and maintain budgets. Record your transactions and generate lists and check registers. Requires dual disk drive, RS-232 interface, and printer; disk. Scott, Foresman and Co.

**Accounting Ledger\*** Select by name up to 100 records for income and expenses to be kept monthly and year-to-date. Calculates and prints the total, subtotal, and net profits. Memory Devices.

**Accounting Package\*** Establish a complete accounting system using the training and accounting materials in this package. Cassette. Anthistle Systems & Programming, Ltd.

**Accounting Software** See Accounting Assistant, Accounting Package, Activity Accountant, Accounting Ledger, Actuary, Amortization, Amortization Schedule, Business Data Base, Compound Interest Business Package, Financial Partner, Financial Package, Financial Record Keeping, Financial Software, Futura Accounts Payable/Futura Accounts Receivable/Futura General Ledger/Futura Payroll, Ledger Package, Mortgage and Loan Amortization Schedule, Payroll 2, Professional Billing/Receivables, Rental Property, Small Business Accounts Payable.

**Accumulator** A register which stores the results of arithmetic operations. More than one accumulator can be present in a central processor. The TI-99's TMS 9900 has no true data register, but can perform operations directly on RAM locations, including ordinary data locations and "software" registers (workspace registers). See Workspace Registers.

**ACIA** Asynchronous Communication Interface Adapter.

**ACK** ACKnowledge character in ASCII, a 06 base 16. This is used in communications to complete a handshaking sequence. The ACK signal indicates that the information has been accepted.

**ACM** Association for Computing Machinery. ACM is the major international society for computer technology. Because of its numerous publications and special interest groups, ACM is an important resource for TI users. For more information, write to ACM or find the *Journal of the ACM* at your library.

11 W. 42nd St. 3rd Floor  
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212-869-7440

**Acoustic Coupler** A mechanical instrument for connecting the telephone handset to a computer. Used with a modem. The data is converted to tones, usually audible, for transmission over the phone lines.

**Active Solar Heating\*** Estimate the storage and collector size you need to heat a house of known dimensions. A program with both educational and practical uses. A twenty-five page manual is included. Kuhl Software.

**Activity Accountant\*** Maintain your organization's special accounts. Requires dual disk drives, RS-232 interface, printer, and cartridge; disk. Scott, Foresman and Co.

**Actuary\*** Compute premiums and evaluate your insurance policies for fair premiums. Cassette. Anthistle Systems and Programming, Ltd.

**A/D** "A to D", Analog-to-Digital. Conversion from a sensor's analog currents to the digital representation used by computer systems. The computer can then process data directly from the external world.

**ADC** Analog to Digital Converter.

**ADCCP** Advanced Data Communication Control Procedures. A standard, bit-oriented protocol developed by ANSI.

**Add Characters in Between Existing Characters** BASIC. Pressing FCTN 2(INSERT) (99/4-SHIFT G) will insert the next character entered in the line at the place where the cursor is currently placed.

**Adder** A processor unit that performs binary arithmetic.

**Addition\*** A teaching aid on addition for elementary students. Disk or cassette. Microcomputers Corporation.

**Addition\*** With this program, students in grades kindergarten through eight can learn the basics of adding and practice at progressive levels of difficulty. Cartridge. Texas Instruments/Addison-Wesley.

**Addition\*** A series of addition exercises designed to present a challenge to children and adults. Requires Extended BASIC cartridge; disk or cassette. W. R. Wilson, Inc.

**Addition/Subtraction 1\*** The first in a series of math modules developed by a major textbook publisher. Designed for the first grade level, this program covers basic addition and subtraction. Speech synthesizer is optional and recommended. Cartridge. Texas Instruments/Scott, Foresman and Co.

**Addition/Subtraction 2\*** Uses color graphics and sound to teach addition and subtraction to second and third grade students. Evaluates the progress of the user and either advances the level of difficulty or offers extra help. Speech synthesizer is optional. Requires Cartridge. Texas Instruments/Scott, Foresman and Co.

**Addition/Subtraction 3\*** Students in grades two through four can practice adding and subtracting numbers of two and three digits. Includes teacher's manual, worksheets, and forms. Speech synthesizer is optional. Cartridge. Scott, Foresman and Co.

**Add-On** System or circuitry attached to a computer to increase memory or performance. Add-ons for the TI-99 include the peripheral expansion system and associated cards, stand alone peripherals, cassette and diskette storage systems, and joysticks.

**Address** The position of a word in memory, expressed by a number. In the TI-99, addresses range from 0 to 64K. In the CRU, each bit is addressable.

**Address Mark** 8 bit code placed at the beginning of specific fields on a disk track, such as the index, identification, and data or deleted data.

**Address/Phone List Software** See Black Book, Flyer, Mailing List, Mail-out.

**Advance\*** A computerized board game combining features of popular games such as Backgammon and Monopoly to create a new and exciting hybrid. Moves include attacking or blocking opponents, buying squares, moving square by square, or making a run for it. Cassette. Not-Polyoptics.

**Adhesive Tab** Disk write-protection. A disk is write-protected if it does not have a write-protect notch about one inch down on the right side. The notch could be missing altogether or covered over with an adhesive tab. This blocks a small spring-loaded switch or a light beam inside the disk drive, and is sensed by the Disk Operating System. You will get an error message anytime you attempt to format or alter a write-protected disk by changing, deleting, or copying any of its files.

You are allowed to use, load, or copy files from the write-protected disk. Write-protection prevents accidental loss of programs or data. A sensible procedure is to copy the write-protected disk onto a notched disk, put away the write-protected disk as a permanent copy, then modify the notched disk. In some cases you may decide to remove the adhesive tab from the write-protect notch and pro-

ceed to change the disk. You should put an adhesive tab (supplied with boxes of disks) over the write-protect notch of any important disk before you back it up. Then if you accidentally ask for the backup in the wrong direction (from the new disk to your important disk), you will get a second chance to make the backup rather than lose your data.

**Advance One Line on the Printer** To advance one line on the printer without carriage return, enter BASIC statement:

PRINT #<n> CHR\$(10)

or use the "line feed" (LF) button of the printer.

**Advance to Top of Page** Enter BASIC statement:

PRINT #<n>: CHR\$(12)

or use the "top of form" or "form feed" manual control button (FF) on the printer.

You may then need to adjust the paper in the printer so it actually is at the perforated top of a page. When you write a program, you may want to provide instructions to the operator and a pause (q.v.) to allow for adjustment of the paper.

**Adventure\*** This cartridge, together with any game developed by Adventure International, will give you hours of fun. Refer to Adventureland Adventure Database\* for more selections. Disk or cassette. Texas Instruments.

**Adventureland Adventure Database\*** Travel through forests in search of lost treasures. Disk or cassette. Texas Instruments.

**Adventures International Series\*** The Adventure Cartridge can be used with any of eleven other games developed by Scott Adams. Includes The Pirate Adventure, Adventureland, Voodoo Castle, Strange Odyssey, Ghost Town, The Golden Voyage, and more. Texas Instruments.

**Advocaite Course Authoring System\*** Educators with no computer skills can develop their own computer-aided instruction courses with this easy-to-use interactive system, adding music or graphics to suit their needs. Requires disk drive; three drives are recommended to fully utilize this system; disk. Educaitor Incorporated.

**Aeronaut\*** Experience the sensation of being in a hot air balloon. Keep aloft by correctly reading detailed instrument readings. Requires cassette and Extended BASIC cartridge. Simulsoft.

**Airmail Pilot\*** Relive the pioneer days of aviation by piloting a fragile wood and canvas plane carrying mail on the Columbus to Chicago route. You



## Algorithm • Analog

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are faced with unpredictable weather and a fuel tank too small to hold enough gas for the whole trip, forcing you to refuel along the way. Cassette. Instant Software, Inc.

**Algorithm** Problem solving with step-by-step specifications ending in a finite time. You state the problem, then develop an algorithm to solve it. The steps toward solution are flow charted and a program, based on the flow chart, is written.

**Alien Addition\*** Fire correct answers to addition problems through your mobile laser cannon to "equalize" the enemy. Quick reflexes and rapid addition skills are strengthened with this educational game. Uses either keyboard or joystick control. Texas Instruments.

**All Star Baseball\*** Experience all the action of the major leagues in this game for two players. Cassette. Futura Software.

**All Star Bowling\*** Gives up to eight persons the competition of tournament bowling. Requires Extended BASIC cartridge; cassette. Futura Software.

**Alligator Mix\*** Open the mouths of the hungry alligators that lurk in a colorful swamp. They are finicky eaters and eat only apples with correct answers to addition and subtraction problems. Texas Instruments.

**Allocation of Space** Assigning particular areas of memory (internal, disk, etc.) to particular files, programs, or functions. The allocation is sometimes done by the programmer, and sometimes by a program such as the Disk Manager cartridge.

**Alpha and Beta Test Site** A test site helps the originators of a hardware or software product to test it in a real-world situation.

Alpha testing usually involves only a very few companies or individuals who realize that the product is incomplete or may have flaws. Alpha testers often work for the originating company or otherwise closely related.

Beta test sites are generally larger in number. They expect that the product is be essentially complete and correct, and agree to use it in a real-world production situation. If errors are discovered, the originators ordinarily attempt to fix them rapidly so the Beta sites can stay "on the air" with the new product. If numerous or serious bugs are found, the product may have to go back to alpha testing until an improved version can be presented for another round of Beta testing.

**Alphanumeric** A term which includes alphabetic, numeric, and special characters.

**Alpiner\*** A game in which one or two players can climb six mountains while facing hazards such as forest fires, avalanches, and the Abominable Snowman. Texas Instruments.

**Alterable Memory** Storage media, such as a disk or cassette, which can be written on or changed.

**Alternating Current** Any signal which is not constant. This term, however, usually means that the current changes polarity during time.

**ALU** See Arithmetic Logic Unit.

**A-Maze-Ing\*** A maze game in which you are the mouse trying to avoid a hungry cat. Thirteen options result in a total of 5,200 different variations. Texas Instruments.

**America\*** An easy method for learning TI BASIC that presents the music of America in graphic form. Disk or cassette. Microcomputers Corporation.

**American Baccarat\*** Simulates actual play and keeps track of the results of thousands of games, to reflect the real odds of winning with your system of play. Cassette. Anthistle Systems & Programming, Ltd.

**Amortization\*** An easy way to determine monthly costs of loans. Requires RS-232 interface, disk drive, printer, and Extended BASIC cartridge. Data Systems.

**Amortization Schedule\*** Give this program your loan amount, the number of periods it covers, and the periodic interest rate, and it will calculate and print your mortgage payment schedule, including the amount of interest, and principal, and the payment due. Ehninger Associates.

**Amortization Schedule\*** Compute schedule for mortgage repayment with data such as amount loaned, yearly interest rate, and payment period. Requires Extended BASIC cartridge; disk or cassette. Joe D. Fain.

**Ampere** Measurement of electrical current: the actual number of electrons moving past a stated point per second.

**Amplifier** A device or circuit that increases the power of a signal.

**Analog** Has a continuous range of voltage or current values. Contrast with Digital.

**Analogies\*** Teaches you to identify and define analogies and develop your skills in making and using them. Cassette. Program Design, Inc.

**Analysar/Analyzer** Any device that checks or regulates a component, board, or system, and presents the data for review.

**AND** Term for a logical procedure defined by the rule: If A AND B are 1, then C is 1, otherwise C is 0. The AND of 10110111 and 10000100 is 10000100. For logical situations such as the conditional test in an IF statement, substitute TRUE for 1 and FALSE for 0.

**AND** X BASIC. Use with IF...THEN...ELSE. Extended BASIC allows use of AND as a logical operator in the IF...THEN...ELSE statement. The complex condition created with AND will be true only if each of the two smaller logical expressions, one on the right and one on the left of AND, are both true. Here's an example:

```
100 IF X+3=14 AND Y<32 AND C$
="HI" THEN B$="YOU WIN" ::GOSUB 1250
```

**Andromeda\*** Protect your base ship while trying to destroy the enemy with your limited fleet. I & I Computer Programing Ltd.

**ANSI** American National Standards Institute.

**Ant Wars\*** An insect game with different armies of ants competing for available resources against such unexpected opponents as a towering spider. Cassette. Not-Polyoptics.

**Antonym Machine\*** Learn the meanings of semantically opposed pairs of words. Disk or cassette. Micro-Ed.

**APL** A Programming Language invented by Kenneth Iverson, used for algorithmic interactive programming.

**Append** To add to the end of a character string or list.

**Applications Software** A software package is a group of computer programs, possibly including data files and documentation, which perform a function or group of related functions on the computer. Applications software programs are devoted to an end user task. Examples of these are Word Processing and Accounting Packages. See Systems Software.

**Arbitration** Managing various claims of competing systems or processes for a limited resource. Bus arbitration allocates a system bus among the subsystem components, i.e. the CPU memory, or the disk controller and other external devices.

**Arcade Monopoly\*** Play a favorite game using two versions of this board game. The first is a graphic representation of the original board game. Using the second, you attempt to blitze through rapidly moving obstacles and take over more properties. Not-Polyoptics.

**Architecture** The special selection, design, and interconnection of the principal components of a system. In a microprocessing unit this could be the number and function of registers, the instruction addressing modes, and the bus structure and timing.

**Arctangent** BASIC. See ATN.

**Argument** Data passed from one process or program to another. Similar to a football pass, except that one or more bytes of data replaces the football, and the receiver is a program. The sender may be a program or a person typing the data onto a command line to be "passed" to a program. The two most common examples would be Disk Manager Cartridge passing parameters from the command line to a program (see Relocating Loader) and a BASIC program passing variables to a subroutine.

**Arithmetex\*** Compete with up to four other players in this arithmetic drill game. Record scores on a thermometer-type bar graph or on a digital readout. Fantasia'99.

**Arithmetic Logic Unit** ALU. The element which performs the basic data manipulations—add, subtract, complement, negate, rotate, AND, and OR—in the central processor.

**Arithmetic Statement** An instruction specifying an arithmetic operation.

**Arithmetic Tutor\*** Quizzes young students on addition, subtraction, multiplication, and division. Assigns ten additional problems if less than seven are answered correctly. Requires Extended BASIC cartridge; disk. Data Systems.

**ARQ** Automatic ReQuest for repeat. In telecommunications, a device capable of determining whether it has correctly received information transmitted from another source. It may automatically request a repeat transmission.

**Arrays** BASIC. See DIM and OPTION BASE.

**ASC** BASIC Function. ASC returns the ASCII code for the first character of the string <x\$>. The format is:

<variable> = ASC(<x\$>)

<x\$> may be any string expression. For example:



```
100 x$="SAMPLE"  
110 PRINT ASC(x$)  
RUN  
83  
**DONE**
```

In this example, the ASCII code for "S" is 83. "S" is the first character of the string "SAMPLE". If x\$ is null, the error message is returned. See ASCII Control Characters.

**ASCII** American Standard Code for Information Interchange established by the American National Standards Institute.

**ASCII Code to Characters** BASIC. See CHR\$.

**ASCII Codes for Characters** BASIC. See ASC.

**ASCII Control Characters** Printer with BASIC. To set the TI or Epson MX-80 printer's print size, strike method, or number of lines per inch, you must send control codes to the printer.

To return to the default, normal size of ten characters and six lines per inch, use the ASCII codes in the following table:

Type Format	Turn On	Turn Off
Compressed	143	146
Double Width	142	148
Emphasized	155,197	155,198
Double Strike	155,199	155,200
72/7 Lines/ Inch	155,49	155,50
8 Lines/Inch	155,48	155,50
6 Lines/Inch*	155,50	155,50
72/n Lines/ Inch#	155,193, n,155,50	155,193,12, 155,50

These codes will always work on the TI or Epson Printer.

\* Standard 12 dots per line (72/12=6 lines/inch) set when printer is initialized or powered on. Not effective after use of 155,193,n to redefine result.

#This resets the definition of "Standard".

See Type Formats for a full explanation and examples of type formats and line spacings.

**ASCII Keyboard** Includes three cases for each alpha character: upper case, lower case, and control. This keyboard provides keys for the set of ASCII characters.

**ASR** Automatic Send Receive. A terminal having a keyboard and printer, as well as an automatic reading and recording device, such as a cassette tape unit or a paper tape reader and punch.

**Assembler** Converts the mnemonic form of the computer's language into binary object code for

execution. Acts as a compiler for Machine language assembly programs.

**Assembly Language** Or, Assembler. A programming language closely related to the Machine language of the computer.

Usually an Assembly language program is longer and more difficult to understand (and to code) than a BASIC program. Originally, only Assemblers were available for writing programs. The time-consuming nature of Assembler programming led to the invention of "high level" languages such as BASIC, FORTRAN, COBOL, and Pascal. These languages are high level since they abbreviate the description of the work to be done by the computer. A complex translation process is required to turn the high level program into a Machine language program that the TMS 9900 can use. This translation process is time consuming and usually results in a Machine language program that runs many times slower than a corresponding program written in Assembly language.

The compiled program is usually many times larger than a corresponding program written in Assembly language. This is because higher level language simplifies the programmer's job by using very general program procedures which can handle all possible circumstances in which the statements might be used. Only a small fraction of this generalized code is needed, much of the generalized code is there because in another program it would be needed for a particular program, and the information required to specify whether or not it is needed is exactly what was left out in simplifying the higher level language.

Interpreted languages (such as BASIC) have an additional performance disadvantage. They translate higher level source code into Machine Code every time the program is executed, rather than only once.

Assembly language programs can run much faster, use less memory, and access more special machine level functions, such as direct I/O devices, than BASIC or other high level languages. Assembler is popular with software houses for writing programs that must run very fast (action games or programs to run fast devices such as disk drives, etc.). But because Assembler is harder to code, few individual users write programs in Assembler. Those who do, usually write only highly specialized or faster routines. A program written largely in BASIC, however, may use a short section of code written in Assembler to do one particular critical task. The Assembler code will be called as a subroutine by the BASIC program.

In summary, Assembly language is a highly technical language more adapted to the needs of the TMS 9900 processor than to the needs of the TI-99 user. Assembly is invaluable when speed or memory size is critical, for highly specialized applications and for commercial software development. But for most TI-99 users it will not be practical to use Assembler as a regular programming language. Most users rely on commercial software packages or write programs in a high level language such as BASIC. If an Assembly language program or subroutine is required for your application, paying an experienced Assembly language programmer is a good alternative to learning Assembler. But if you enjoy getting to the nuts and bolts of the computer, Assembly language is the quickest route to the inside workings of the TMS 9900. To learn more about Assembler, see the TI Editor/Assembler Manual.

**Assignment** Giving a value to a variable. In BASIC, a simple assignment is:

LET X=5

This assigns the value 5 to the variable X.

**Association for Computing Machinery** ACM is the major international society for computer technology. Through its numerous publication and special interest groups, ACM will be of interest to many TI users. For more information, find the *Journal of the ACM* at your library or write to the address listed below.

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**Asynchronous** An event or device which does not have the same timing as the central processing unit.

**Asynchronous Communication Adapter Control** These parameters for telecommunication are set by the OPEN statement or Terminal Emulator II cartridge.

**Atari** A prominent manufacturer of microprocessor-based games and personal computer systems.

**ATE** Automatic Test Equipment. These devices and/or programs (usually ROM resident) automatically perform routine checks on equipment. The tests may occur in response to an event, such as powering on or resetting the system, or on a time scheduled basis.

**ATN** BASIC Function. ATN returns the arctangent of x. The format is:

$v = \text{ATN}(\langle x \rangle)$

$\langle x \rangle$  may be a numeric expression of any numeric type. The evaluation of ATN is always performed in single precision. ATN returns the angle whose tangent is x, measured in radians in the range  $-\pi/2$  to  $+\pi$ .

**AT & T** American Telephone and Telegraph.

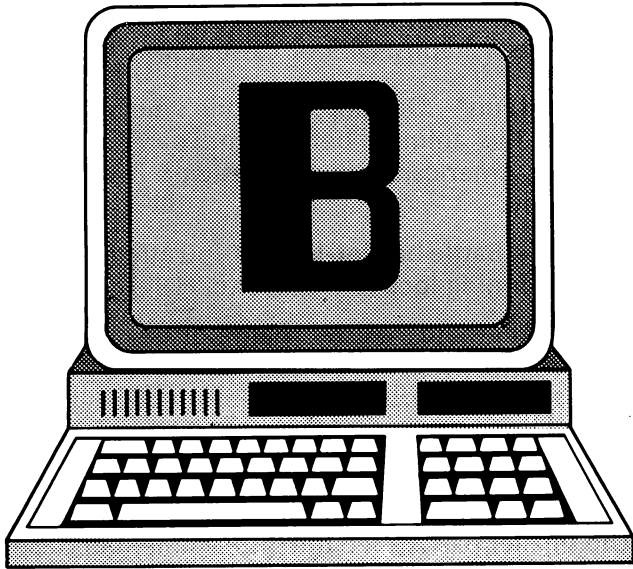
**Attenuation** The reduction in strength of an electrical impulse.

**Automatic Filer\*** A utility software developed by Eastbench Software Products.

**Automatic Program Execution** BASIC. A way to SAVE a program on tape so that, when LOADED, the program starts automatically. This is useful since LOADING a program and then typing RUN clears all the variables. To get a program to execute automatically, include a SAVE statement in your BASIC program. To save the program, GOTO the line with SAVE in it. When the program is LOADED again, it will automatically start executing the statement following the SAVE statement.







**B** Codes. ASCII 66, HEX 42. b—ASCII 98, HEX 62.

**B** Bytes. Also, Baud. B is used as an abbreviation for Bytes when referring to memory, or Baud rate when referring to communications. KB = 1000 bytes or baud (technically 1K = 1024 bytes).

**B** Bus line. Also, the hexadecimal symbol for the decimal number 11: B base 16 = 11 base 10 = 13 base 8 = 1011 base 2.

**Backgammon\*** Sprites and full graphics add extra excitement to this computer version of backgammon. Play alone against the computer or against another person. Extended BASIC. Cassette. Sunshine Software.

**Background Program** A low-priority program which is run when the processor has nothing else to do.

**Backplane** Also called a motherboard. The physical area in a system where the boards plug in. It usually contains the buses of the system in printed circuit or wire-wrap form.

**Backspace** The cursor is the flashing block (or, with some programs, a different symbol, such as a square) which appears on the screen to let you know where you are on the display. The cursor moves to the right as you type and backs up to the left when you press left arrow (FCTN S)(99/4—SHIFT S). Left arrow does not erase the characters from the screen as the cursor moves left.

Its location on the screen is also controlled by some programs with Home, End, Right arrow, Left arrow, Up arrow, Down arrow, and other keys.

**Backup Copy** A duplicate copy of a program or data stored on a diskette or cassette in case of loss or damage to the original.

**Backup Copy of a Disk** The Disk Manager Cartridge Command BACKUP DISK makes an exact backup copy of a diskette. The copy can be selective, allowing transfer of only certain files on the diskette, or nonselective, allowing transfer of all files to another diskette. Insert the Disk Manager (or Disk Manager 2) Cartridge. Choose

2 DISK MANAGER

If you have only one disk drive, choose:

4 SET ALL COMMANDS FOR SINGLE DISK PROCESSING

and press ENTER. The message SINGLE DISK PROCESSING HAS BEEN INITIALIZED will appear on the screen. For two drive systems, refer to the TI Disk Controller Manual. Now choose

2 DISK COMMANDS

and press ENTER. Then choose

2 BACKUP DISK

and press ENTER. The message

SELECTIVE (Y/N)?

will appear. If you want to make a complete copy of the entire diskette, simply press ENTER. (N is the default.) If you need backup copies of only certain files from the source diskette, type in a "Y" and press ENTER. In either case, instructions will appear at the bottom of the screen:

LOAD COPY DISK

PRESS: PROC'D, REDO

BEGIN, or BACK

Load the disk that will hold the backup, and press FCTN 6 (PROC'D)(99/4—SHIFT V). You then will be asked if you need the Copy Disk to be initialized. Make your choice, and press ENTER. Follow the directions for initialization, if chosen. The next instruction that appears is:

LOAD MASTER DISK

Remove the Copy Disk, insert the Master Disk, and press FCTN 6 (PROC'D)(99/4—SHIFT V).

To insure against loss of your valuable data and/or programs, cover the write-protect notch on the Source (Master) Disk with an adhesive tab. (Note that the following of the instructions will apply to a nonselective copy.)

A file is loaded into the computer from the Master Diskette. The instruction,

LOAD COPY DISK

appears. From here on, it's a matter of trading diskettes in the disk drive and pressing FCTN 6 (PROC'D). After all the files have been backed up to the Copy Diskette, the message

COMMAND COMPLETE  
PRESS: PROC'D, REDO,  
BEGIN, or BACK

appears on the screen. This means either the complete diskette or selected files on the disk have been duplicated.

**Backup Disks and Adhesive Tabs** A disk is write-protected if it does not have a write-protect notch one inch down on the right side. The notch could be covered by an adhesive tab or be missing altogether. This blocks a small spring-loaded switch or a light beam inside the disk drive, sensed by Disk Manager programs. You will get an error message, "I/O Error 61", whenever you attempt to alter, change, delete, copy, or format a write-protected disk.

The purpose of these limitations is to prevent accidental loss of your only copy of programs or data. In most cases the procedure is to copy the write-protected diskette onto a notched diskette, put away the write-protected diskette as a permanent copy, then modify the notched diskette. In some cases you may decide to remove the adhesive tab from the write-protect notch and proceed to change the diskette.

You should put an adhesive tab (supplied with boxes of diskettes) over the write-protect notch of any important diskette you backup. Then if you accidentally ask for the backup in the wrong direction, you'll get a second chance to make the backup and avoid losing your data.

**Backup of Diskettes** Because diskettes can be rendered unreadable by physical damage, magnetic contamination, or dirt, you should keep at least two copies of important information.

Use the Disk Manager Cartridge to copy files to a "backup" diskette. See Backup Copy of a Diskette for instructions.

**Balloon Voyage\*** An Extended BASIC game with multiple screens in which you fly across a city while avoiding birds and buildings. Pegasus Software.

**Bank** Usually 64K of memory, or any continuous block of memory devoted to a particular use. Or, a block enabled/disabled by a software or hardware switch.

**Bank Select** A method of extending a computer's RAM memory. Each bank responds to the same addresses, but only one is active at a time. Also called bank switching.

**Bar Code** The consumer product information code on products to be read by an optical wand which interprets the prices of various items.

**Bar Graph\*** Introduces the elementary grade student to bar graphs. Disk or cassette. Micro-Ed.

**Barnyard Fun\*** Develop your child's memory while finding the animals behind the barns. Disk or cassette. American Software Design & Distribution Company.

**Barrier\*** Battle barrier-lines as you attempt to get to the winning location. Cassette. Hall Software.

**BASE** Alternate business name of Bay Area Systems Engineering, developers of the *TI 99/2,4,4A,8 User's Encyclopedia* and other information sources for the home computer user.

**Base Register** The register containing the longer part of a two-part Assembly language instruction. The smaller part, called the displacement or offset, is contained in the Assembly language instruction. The data that the instruction is to operate on is located at the "effective address"—the byte of memory whose address is the sum of the number in the specified base register and the offset given in the instruction. This method of specifying addresses allows data to be located with fewer bits than would a full, explicit address. Any workspace register of the TI 9900 MPU, except R0, can be used as a base register. See Index Register, Workspace Registers, Workspace Pointer Register, and Context Switch.

**BASF** Badische Anillin und Soda Fabrik, a manufacturer of magnetic storage media, including diskettes.

**BASF/-DPS Computer Cassettes\*** Standard cassettes with premium five screw shells. Money back guarantee if not fully satisfied. BASF.

**BASIC** Beginner's All-purpose Symbolic Instruction Code. A popular computer language invented at Dartmouth for educational purposes. Similar to the FORTRAN programming language, BASIC is easy to learn and use, and is now on almost all microcomputer systems. Some BASICs have just the bare essentials of regular BASIC, which is a form of the Dartmouth original BASIC. Super BASICs may have features from other languages. Compatibility problems between various BASICs do exist.

**BASIC—Largest Line Number** The largest possible line number for a BASIC program is 32767.

**BASIC—LIST—Display Program Lines on Screen** To display all program lines, enter:

LIST

To display program lines from start up to line 100, enter:

## LIST -100

To display program lines from line 100 to end, enter:

## LIST 100-

To display program lines from line 100 to line 200 enter:

## LIST 100-200

To display program line 100 only enter:

## LIST 100

### BASIC—Listing of Files or Programs on Diskette

There are two methods of obtaining a list of programs and/or files on a diskette. One is to use the CATALOG DISK option on the Disk Manager or Disk Manager 2 cartridge. The instructions are clear, and options are given for listing on the screen, to a printer, or other device. The other method is to use a BASIC program that mimics the actions of the Disk Manager Cartridge CATALOG DISK Command. Several versions of this program exist. One source is TI's *Programming Aids I* package which contains the CATALOG program. See *Programming Aids I*.

**BASIC—LOAD Instructions** To LOAD a program saved on cassette, enter

OLD CS1

and follow the directions that appear on the screen for loading cassette-based programs.

To LOAD a program saved as "SAMPLE" on diskette, enter:

OLD DSK1.SAMPLE

Typing RUN will begin execution of the program. Extended BASIC allows the use of RUN in place of OLD. In this case, the program is automatically executed after being loaded. Here are some examples (note the use of quotation marks):

RUN "CS1"

or

RUN "DK1.SAMPLE"

**BASIC—NEW Programs** Erasing Old Program Lines. To start a new program, enter:

NEW

This completely erases all lines in BASIC's memory, so if it's something you want to keep and haven't already saved on cassette or diskette, SAVE it first. If you don't erase the program in memory before starting on another, you will usually wind up with an unusable combination of mixed lines from your old and new programs.

**BASIC—Prompts** > and ? are prompts from the BASIC language. > is the prompt from BASIC or

Extended BASIC indicating that you can now enter a BASIC command or statement. ? is the prompt from a program written in the BASIC language indicating that you must type in data to answer a question. When programming, include a description in the program, such as "Enter check amount 9999.99", so the user will know exactly what should be entered in response to the prompt. For example:

```
100 INPUT "ENTER CHECK AMOUNT
      9999.99":CHECKAMOUNT
```

This program line will give the operator this prompt upon the screen:

ENTER CHECK AMOUNT 9999.99

**BASIC—Reserved Words** Reserved words have particular meanings in BASIC and are used for commands, statements, functions, and operator names. These words cannot be used as variable names in TI BASIC. If you accidentally use one of the reserved words, you may see an error message or have strange results when you execute the program.

The reserved words in BASIC are:

ABS	GOTO	RESEQUENCE
APPEND	IF	RESTORE
ASC	INPUT	RETURN
ATN	INT	RND
BASE	INTERNAL	RUN
BREAK	LEN	SAVE
BYE	LET	SEG\$
CALL	LIST	SEQUENTIAL
CHR\$	LOG	SGN
CLOSE	NEW	SIN
CON	NEXT	SQR
CONTINUE	SUM	STEP
COS	NUMBER	STOP
DATA	OLD	STR\$
	ON	SUB
DEF		SUM
DELETE	OPEN	TAB
DIM	OPTION	TAN
DISPLAY	OUTPUT	THEN
EDIT	PERMANENT	TO
ELSE	POS	TRACE
END	PRINT	UNBREAK
EOF	RANDOMIZE	UNTRACE
EXP	READ	UPDATE
FIXED	REC	VAL
FOR	RELATIVE	VARIABLE
GO	REM	
GOSUB	RES	

Extended BASIC adds the following reserved words to the above list.



## BASIC—Special Characters • BASIC—Statements

ACCEPT	LINPUT	RPT\$
ALL	MAY	SIZE
AND	MERGE	SUBEND
AT	MIN	SUBEXIT
BEEP	NOT	UALPHA
DIGIT	NUMERIC	USING
ERASE	OLD	VALIDATE
ERROR	OR	WARNING
IMAGE	PI	XOR

**BASIC—Special Characters** The following characters have special meanings in TI BASIC and Extended BASIC. These characters can not be used to have meanings other than what is stated below:

- blank space
- + plus sign
- / slash or division symbol
- ^ caret or exponential symbol
- \$ dollar sign or string
- ! abbreviation for REM
- ' apostrophe
- ; semicolon, print the following
- ) right parenthesis
- ( left parenthesis
- = equal sign or assignment symbol
- minus sign
- \* asterisk or multiplication
- # device IOCB device number to follow
- " double quotation mark or literal delimiter
- ' TAB 10 spaces or the value of PEEK (201) spaces
- . period or decimal point
- : statement separator or drive name delimiter
- < greater than
- > less than
- ? question-mark or PRINT abbreviation

**BASIC—Statements Cross-Referenced by Function**  
(Statements followed by {XB} are available in Extended BASIC only.)

- Arctangent—ATN
- Arrays—DIM and OPTION BASE
- ASCII codes for characters—ASC
- ASCII code to characters—CHR\$
- Branch—GOTO
- Call BASIC subroutine—GOSUB and RETURN
- Change a BASIC line—EDIT
- Character read from keyboard—KEY
- Clear the screen—CLEAR
- Color of characters—COLOR
- Color of screen—SCREEN
- Compare 2 numeric expressions—MAX{+XB}, MIN{XB}
- Convert number to string—STR\$

- e—powers of—EXP
- End of File—EOF
- Erase a file from BASIC—DELETE
- Erase current BASIC program and variables—NEW
- Error code number of last error—ERR{XB}
- Execute BASIC program—RUN
- Exponential—EXP
- File—erase from BASIC—DELETE
- Format data on screen—IMAGE{XB}
- Generate line numbers automatically—NUM
- Graphics—CHAR, COLOR, VCHR, SCREEN, HCHAR, SPRITE{XB}
- Immediate response to one-character answers (without using enter key)—KEY
- Integer—convert to by rounding—INT
- Joystick button—KEY
- Joystick, find coordinate of—JOYST
- Keyboard—read characters—KEY
- Keyboard, read data from—INPUT, LINPUT, ACCEPT
- Length of string—LEN
- Line numbers—generate automatically—NUM
- Line numbers, renumber—RES
- Line number where error occurred—ERR(XB)
- Load BASIC program into memory—OLD
- Load and Run XBASIC program—RUN(XB)
- Load binary data (Machine language programs, etc.)—LOAD(BX)
- Loop—FOR and NEXT statements
- Machine language program, load XBASIC—LOAD
- Memory—amount free—SIZE(XB)
- Memory—read byte—PEEK(XB)
- Music—PLAY (string), SOUND
- Natural logarithm—LOG
- NEXT—end of FOR...NEXT to
- p—FOR TO STEP...NEXT
- Number, convert from string—VAL
- Number, convert to string—STR\$
- Numeric value of string—VAL
- Print BASIC program listing on printer—PRINT# <n>
- Print on printer—PRINT# <n>
- Program, BASIC—run or execute—RUN and LOAD
- Put information on screen—PRINT, DISPLAY, DISPLAY at (XB)
- Random number—RND
- Read character from keyboard—KEY, INPUT, ACCEPT(XB)
- Read data from file—INPUT# LINPUT# (XB) (READ reads from DATA statements)
- Repeat a character (n) times—RPT\$ (XB)
- Repeat program lines—FOR TO STEP
- Screen—clear—CLEAR
- Screen, graphics CHAR, SPRITE (XB), COLOR, HCHAR, VCHAR, SCREEN
- Search string for character of shorter string—POS

Sign—SGN  
Speaker—BEEP and SOUND  
Square Root—SQR(x)  
Stop BASIC program—END, BREAK, STOP  
String, convert from number—STR\$  
String, convert to number—VAL  
String, length of—LEN  
String, numeric value of—VAL  
Subroutine—GOSUB

**BASIC—Variable Names** See Names, Variables.

**BASIC—Words, Reserved** See BASIC—Reserved Words.

**BASIC Compiler** See BASIC Interpreter.

**BASIC Disk Utility\*** Two versions of a program for cataloging your disks. They produce listings of your disk and file names, available and unavailable disk sectors, file length, type, and protection information. Version 2.0 is for BASIC; and version 4.0 is for Extended BASIC and has the additional capability of running any Extended BASIC program with the touch of a key. Vid-Com.

**BASIC Interpreter** All programs running directly on the TI-99 are Machine language programs, in the actual numeric instruction code of the TI 9900 microcomputer chip. Most were originally written as text files known as source programs. The source program contains readable statements in a language such as FORTRAN, COBOL, or BASIC. These were then translated by a compiler program to produce an object program.

The object program contains the Machine language instructions for the TI's 9900, which correspond to the instructions of the original source program. BASIC programs work in this way with a BASIC compiler.

Regular BASIC, however, is a program (in Machine language) that uses your BASIC program to tell it what to do. BASIC is an interpreter, processing each line of your source program and interpreting what should be done. Since it must reinterpret your source program each time you run it, interpreted BASIC can be as much as 100 times slower than compiled BASIC.

When you write a BASIC program, you have produced a source program in text form. The BASIC interpreter, itself a Machine language program, uses your source program as data—a source of commands or instructions for its execution. See BASIC Compiler.

**BASIC Program—SAVE Instructions** For a program named "SAMPLE," on diskette, enter:

SAVE DSK1.SAMPLE

On cassette, enter:SAVE CS1

and follow instructions displayed on the screen.

To run the program later, use the OLD command to copy it from the diskette (cassette) back into the TI-99's memory. See OLD.

Extended BASIC allows the use of two additional options with SAVE: MERGE and PROTECTED.

The MERGE option allows the program to be merged later into a program already in memory. See SAVE. With the PROTECTED option, a program may be loaded and run, but cannot be listed, edited, or saved. See SAVE.

The SAVE instruction does not alter your program in memory. If you write a BASIC program, it will be erased unless you SAVE it before turning off the TI-99, or use the NEW or BYE command. See Editor.

**BASIC Releases** TI BASIC is available in two editions: Console BASIC and Extended BASIC. Extended BASIC is a more powerful BASIC implementation in the 99/4 and 99/4A computers. Sprites (moving graphics), multiple statement lines, and commands such as ACCEPT AT, DISPLAY AT, and MERGE are discussed throughout this volume.

**BASIC Statements—Multiple On One Line** XBASIC. Using a double colon (::) as a statement separator, you are allowed to put more than one statement on each line. For example:

100 FOR I=1 to 10 :: PRINT I :: NEXT I

**BASIC Statements—Table of Formats and Descriptions** Italicized commands, statements, and functions are available only in extended BASIC. C = Commands, S = Statement, F = Functions.

Table follows on next page.

## BASIC Statements—Table of Formats

Statement	Description	Type
ABS(<x>)	Returns the positive (absolute) value of the argument <x> (without regard to the negative signs)	F
ACCEPT [[AT(<row>, <column>) [VALIDATE(<data type....>)] [BEEP] [ERASE ALL][SIZE(<x>) ]:]<z or z\$ >	A more flexible and option-filled version of INPUT. <data types> for VALIDATE: UALPHA is any upper-case alphabetic character. DIGIT is numbers 0-9. NUMERIC is numbers 0-9 and the symbols E . + -. In addition, a list of characters that the programmer wants allowed may be used. BEEP sounds a tone. ERASE ALL clears screen. SIZE allows only <x> characters to be entered. Positive <x> erases <x> number of screen positions; negative <x> does not erase them. <z or z\$ > is the variable assigned to the input.	C,S
ASC(<x\$>)	Returns an ASCII code for the initial character of the argument string <x\$>.	F
ATN(<x>)	Returns the arctangent of <x>.	F
BYE	Closes all open files, erases any program in memory, and returns to the title screen.	C
BREAK[<linenum>,...]	Causes a temporary stop in program in memory, and returns to the command mode. <linenum>: may be optionally specified.	C,S
CALL <subprgm name>	Allows use of subprograms resident in the computer (such as CLEAR, CHAR, etc.).	C,S
CALL <subprgm name>[(<arg>,...)]	Extended BASIC offers additional resident subprograms and the ability to call user-written subprograms. <arg> is an optional argument passed from the main program to the subprogram.	S
CALL CHAR <(code>,<x\$>[,...])	Allows you to change the shape of any ASCII character. <code> is the ASCII code number to be redefined. <x\$> is the 0-64 hex-digit pattern identifier.	C,S
CALL CHARPAT <(code>,<x\$ >[,...])	Assigns to <x\$> the sixteen hex-digit pattern identifier that defines the pattern of <code>. CALL CHARPAT is the inverse of CALL CHAR.	C,S
CALL CHARSET	Changes ASCII codes 32-95 back to their preset patterns and colors.	C,S
CALL CLEAR	Erases the screen.	C,S
CLOSE #<filenum>[:DELETE]	When the CLOSE command/statement is executed, association between a particular file number and device is ended, and the contents of the buffer is written to the file. <filenum> is the number of a file opened earlier in the program. DELETE is an option available on diskette only and erases <filenum> from diskette.	C,S
CALL COINC(#<sprite a>,#<sprite b>,<tolerance>,<x>) CALL COINCE (#<sprite>, <pixel row>, <pixel column>, <tolerance>,<x>)	Used to detect a coincidence between two or more sprites, or between a sprite and a location on the screen. <sprite> is a sprite number defined earlier in the program. <pixel row, column> defines a location on the screen. <tolerance> is a number	C,S

## BASIC Statements—Table of Formats

Statement	Description	Type
CALL COINC(ALL, <x>)	from 0-255. <x> is the variable assigned to the coincidence report: -1 if there is a coincidence; 0 if there isn't.	
CALL COLOR(<char. set>, <foreground color>, <background color> [...])	Allows you to define colors for characters displayed on the screen. <char. set> is a number (1-16 in BASIC, 1-14 in XBASIC) referring to a specific group of ASCII codes. <foreground, background colors> are the color numbers that define the character and the balance of the screen position.	C,S
CALL COLOR(#<sprite>, <foreground color>[,...])	Extended BASIC also allows you to use CALL COLOR to change the color of an existing <sprite> number to a new <foreground color>.	C,S
CHR\$ (<x>)	Converts the ASCII value of <x> to the character it represents.	F
CON	Typing CON and pressing enter will restart (CONTINUE) a program after a BREAK has occurred.	C
COS(<x>)	Returns the trigonometric cosine of <x>.	F
DATA <data group>[,<data group>,...]	Provides a storage place for numeric and/or string data within a program.	C
DEF <name>[(<arg>,...)] = <expression>	Defines and names a function. <name> is the programmer-defined function name. <arg> is an optional argument. <expression> is the programmer-defined numeric or string expression.	S
DELETE "DSK<n>.<filename>" DELETE "DSK<n>. <program name>"	Erases a file or program from a diskette. <n> is the disk drive number, 1 or 2 or 3.	C,S
CALL DELSPRITE(#<sprite> [...]) CALL DELSPRITE(ALL)	Erases <sprite> from the screen and the computer's memory. ALL erases all sprites.	C,S
DIM <name>(<int a>[,<int b>][,...])[,...]	Used to reserve space in computer memory for numeric and string arrays. <name> is the array name. <int> is the "space reservation" integer. BASIC allows up to 3 dimensional arrays. Extended BASIC allows up to 7 dimensional arrays.	C,S
DISPLAY[[AT(<row>,<column>)] [BEEP][ERASE ALL][SIZE(<x>)]:< list of expressions>	A more flexible and option-filled version of PRINT. BEEP sounds a tone. ERASE ALL clears the screen. SIZE clears the screen for <x> number of characters. <list of expressions> is the data to be displayed.	C,S
DISPLAY[options>:] USING <x\$> [:<list of expressions>] DISPLAY [options<:] USING <linenum>[: <list of expressions>]	Gives you all the options of the DISPLAY statement, with the added ability to format the data being DISPLAYed with the USING clause. <x\$> defines the format of <list of expressions>. <linenum> is the line number of an IMAGE statement. See IMAGE. <list of expressions> is the data to be displayed.	C,S
CALL DISTANCE(#<sprite a>, #<sprite b>,<x>) CALL	Assigns to <x> the square of the distance between two sprites, or between a sprite and a location on	C,S



## BASIC Statements—Table of Formats

Statement	Description	Type
DISTANCE(#<sprite>,<pixel column>,<x>)	the screen. <sprite> is a sprite number defined earlier in the program. <pixel row, column> is a location on the screen. <x> is the variable assigned to the distance computation.	
END	Used to stop program execution and return to command mode.	S
EOF(<filenum>)	Indicates end of file condition—0: not end of file, 1 is logical end of file, -1: physical end of file. <file-num> is the number of a file opened earlier in the program.	F
CALL ERR(<error code>,<error type>[,<error severity>, <linenum>])z	Assigns value to the most recent uncleared error <error code>. Refer to TI Extended BASIC manual: p.86, and appendix N. <error type>: a negative number is the execution error; a positive number is the number of file in which error occurred.	C,S
EXP(<x>)	Calculates the exponential function and returns the number “e” raised to the <x> power, where “e” is 2.718281828.	F
FOR <variable>=<x> TO <y> [STEP<z>].....NEXT <variable>	The FOR statement, used in conjunction with the NEXT statement, repeats a series of instructions (the program lines between FOR and NEXT) for a given number of times. <variable> is the variable to be used as a counter. <x> is the initial value of <variable>. <y> is the final value of <variable>. <z> is an optional increment.	S,C
CALL GCHAR(<row>, <column>,<x>)	Assigns to <x> the ASCII value of a character located at <row>,<column> on the screen.	C,S
GOSUB <linenum> GO SUB <linenum>	Used in conjunction with RETURN to access programmer-written subroutines.	C,S
GOTO <linenum> GO TO <linenum>	Transfers control from the program sequences to <linenum>.	S
CALL HCHAR(<row>,<column>, <code>[,<repeat>])	Used to display a character at <row>,<column> on the screen. Optionally, it can be repeated horizontally. <code> is the number of the ASCII code to be displayed. <repeat> is the number of times <code> is to be repeated.	C,S
IF <expression> THEN <linenum a> [ELSE <linenum b>] IF <x> THEN <linenum a> [ELSE <linenum b>]	IF...THEN makes a decision regarding program flow based on the result of an expression. IF <expression> is true (or IF <x> is greater than or less than 0), THEN <linenum a> is executed next, if false (or <x> equals 0) the ELSE <linenum b> is executed next.	S
IF <expression> THEN <clause > [ELSE <clause>] IF <x> THEN <clause> [ELSE <clause>]	Extended BASIC allows added flexibility in the IF...THEN...ELSE statement. A <clause>, which is a list of statements, can be used instead of <linenum>.	S

## BASIC Statements—Table of Formats

Statement	Description	Type
IMAGE <x\$>	Allows you to specify the format of the data when used with the PRINT...USING and DISPLAY...USING statements.	S
CALL INIT	Prepares the computer to load and run Assembly language subroutines and programs.	C,S
INPUT #<filenum> [,REC <recnum>]:<z or z\$ >	Reads data items from a device or file and assigns them to program variables. <filenum> is the number of a file opened earlier in the program. <recnum> is the record number to be read. <filenum> must have RANDOM file organization when using REC <recnum>. <z or z\$ > is the variable assigned to the input.	S
INT(<x>)	Returns the largest integer less than or equal to <x>.	F
CALL JOYST(<key unit>,<x>,<y>)	Used to accept data into a program from the wired remote controllers (joysticks). <key unit> is the joystick number (1 or 2). <x,y> are the variables assigned to the values determined by the joystick's position.	C,S
CALL KEY(<key unit>,<ret. variable>,<stat. variable>)	Assigns to <ret. variable> a character value read from the keyboard. <key unit> is the variable assigned to the keyboard scan to be used. See TI Reference Manual for keyboard scan "maps". <ret. variable> is the variable assigned to the ASCII number of the key being pressed. <stat. variable> is the variable assigned to keyboard status. 1 means a new key has been pressed, 0 means no key has been pressed, -1 means the same key is being pressed.	C,S
LEN(<x\$>)	Returns the number of characters in <x\$>.	F
[LET] <x>[,<y>,...]=<num. expression> [LET] <x\$ > [,<y\$ >,...]=<string expression>	Assigns a value to a variable.	C,S
CALL LINK(<subprgm name> [,<arg>,...])	Passes control to Assembly language <subprgm name>. <arg> is an optional argument passed from the main program to <subprgm name>.	C,S
LINPUT ["<prompt>":]<x\$ >	Reads an entire line of up to 254 characters from the keyboard, ignoring delimiters (commas,etc.). <prompt> is a message to be displayed on the screen. <x\$ > is the variable assigned to the input.	S
LINPUT #<filenum>[,REC <recnum>]:<x\$>	Reads an entire line from <filenum>, ignoring delimiters <commas, etc.>. <filenum> is the number of a file opened earlier in the program. <recnum> is the record number to be read. <filenum> must have RANDOM file organization when using REC <recnum>. <x\$> is the variable assigned to the input.	S

## BASIC Statements—Table of Formats

Statement	Description	Type
LIST ["<dvcname>":][<linenum> [->linenum>]]	Displays the program currently in computer (RAM) memory. The listing is either on the screen or on <dvcname>.	C
CALL LOAD(<access name> [,access name,...>]) CALL LOAD (<memory address>,<value> [,<value,...>])	Loads an Assembly language subroutine into memory expansion so that it can be executed using CALL LINK, or loads a specified <value> into <memory address>.	C,S
CALL LOCATE (#<sprite>, <pixel row>,<pixel column>[,...])	Relocates an earlier defined <sprite> number to <pixel row>,<pixel column> on the screen. <pixel row>: numbers from 1-192, 1 at the top. <pixel column>: numbers from 1-256, 1 at the left.	C,S
LOG(<x>)	Returns the natural logarithm of <x> (log to the base "e").	F
CALL MAGNIFY(<mag factor>)	Used to specify the size of sprites and the number of characters making up each sprite <mag factors> are: 1: single size, unmagnified 2: single size, magnified 3: double size, unmagnified 4: double size, magnified	C,S
MAX(<x>,<z>)	With the MAX function, the computer determines which of two numbers (<x> or <z>) is larger, and then returns that number's value.	F
MERGE [""]DSK<n>.<program name>[""]	Allows you to put additional lines into a program that's currently in (RAM) memory. It can only be used with diskettes. <n> is the disk drive number, 1 or 2 or 3. <program name> is a program previously saved with the MERGE keyword. See SAVE.	C
MIN(<x>,<z>)	With the MIN function, the computer determines which of two numbers (<x> or <z>) is smaller and returns that number's value.	F
CALL MOTION(#<sprite>,<row velocity>,<column velocity>[,...])	Used to change the speed and/or direction of sprites on the screen. <row, column velocity> are represented by numbers from -128 to 127 that determine sprite speed and direction.	C,S
NEW	Deletes the program currently in computer memory (RAM) and clears all variables.	C
NEXT<variable>	See FOR.	C,S
NUMBER [<startline>][,<increment>] NUM [<startline>][,<increment>]	Used to automatically generate sequenced line numbers for programming purposes.	C
OLD CS1 OLD DSK<n>.<program name>	Used to load a program saved on cassette or diskette into the computer's (RAM) memory.	C
ON BREAK STOP ON BREAK NEXT	Used to change the action taken when a BREAK <linenum> statement is encountered during program execution, or when FCTN 4 (CLEAR) is used to	S

Statement	Description	Type
ON ERROR STOP ON ERROR <linenum>	stop a program. ON BREAK STOP, default ON BREAK NEXT, causes breakpoints to be ignored.  Used to change the action taken when an error occurs in a program. ON ERROR STOP: default ON ERROR. <linenum> transfers control to <linenum> when an error occurs. See RETURN.	S
ON <x> GOSUB <linenum a>,<linenum b> [...], ON <x> GO SUB <linenum a>,<linenum b>[,...]	Provides an efficient way of branching to sub routines based on numeric input (<x>) from the operator or program.	S
ON <x> GOTO <linenum a>,<linenum b>[,...], ON <x> GO TO <linenum a>,<linenum b>[,...]	Provides an efficient way of branching to subroutines based on numeric input (<x>) from the operator or program.	S
ON WARNING PRINT ON WARNING STOP ON WARNING NEXT	Used to change the action taken when a warning occurs during program execution. ON WARNING PRINT: default ON WARNING STOP stops program execution. ON WARNING NEXT causes program execution to continue without a warning message printed.	S
OPEN#<filenum>:"<device>[.<filename>]"[,<fileorg>][,<filetype>][,<mode>][,<rectype>]	The OPEN mode allows a program to use a given <device>[.<filename>]. <filenum>:0-255 <fileorg>:RELATIVE or SEQUENTIAL <filetype>: DISPLAY or INTERNAL <mode>: INPUT, OUTPUT, UPDATE, or APPEND <rectype>: FIXED or VARIABLE	C,S
OPTION BASE 0 OPTION BASE 1	Used to set the lowest allowable subscript of arrays to 0 or 1. 0 is the default.	S
CALL PATTERN(#<sprite>,<code>[,...])	Allows you to change the pattern of a sprite without changing its other characteristics (color, position, direction, etc.) <sprite> is a sprite number defined earlier in the program. <code> is the 0-64 hex-digit pattern identifier that will redefine the sprite's shape. See CALL CHAR.	
CALL PEEK(<memory address>,<numeric variable>[,<numeric variable>...])	Assigns the contents of a specified <memory address> to specified <numeric variable>.	C,S
PI	Can be used as a number in Extended BASIC (3.1459-265359).	F
POS(<a\$ >,<b\$ >,<x>)	With the POS function, the computer will search <a\$> beginning at position <x> for an occurrence of <b\$ >. It returns the position of the first occurrence.	F
CALL POSITION(#<sprite>,<pixel column>[,...])	Assigns to the variables <pixel row> and <pixel column> the location of <sprite>.	C,S
PRINT [<list of expressions>]	Displays data on the screen. <list of expressions> is the data to be printed	C,S



## BASIC State—Table of Formats

Statement	Description	Type
PRINT #<filenum>[,REC <recnum>]:[<list of expressions>]	Writes data to an accessory device. <filenum> is the number of a file opened earlier in the program. <recnum> is the record number to be written on. <filenum> must have RANDOM file organization when using REC <recnum>. <list of expressions> is the data to be written to <filenum>.	C,S
PRINT [#<filenum> [,REC<recnum>],] USING <x\$>: <list of expressions> PRINT [#<filenum>[,REC <recnum>],] USING <linenum>:<list of expressions>	Gives you all the options of the PRINT # statement, with the added ability to format the data being PRINTed. <filenum> is the number of a file opened earlier in the program. <recnum> is the record number to be written on. <filenum> must have RANDOM file organization when using REC <recnum>. <x\$> is a string expression that defines the format. <linenum> is the line number of an IMAGE statement. See IMAGE. <list of expressions> is the data to be printed or written to <filenum>.	C,S
RANDOMIZE [<x>]	Reseeds the random number generator. The sequence is made repeatable with the use of <x>.	C,S
READ <variable>[,<variable>,...]	Assigns a string or numeric <variable> to a corresponding DATA statement when the program executes.	C,S
REC(<filenum>)	The REC function tells you where the internal record "pointer" is within a file. <filenum> is the number of a file opened earlier in the program. The file must have RELATIVE file organization, and INTERNAL file type.	F
REM <remark> ! <tail remark>	Used to preface comments or remarks so they will be reproduced intact when a program is listed. Extended BASIC allows the use of the exclamation point (!) in place of REM, both at the beginning of a statement and as a tail remark.	S
RESEQUENCE [<startline> [,<increment>] RES [<startline> [,<increment>]	Changes the line numbers of a program in the computer's (RAM) memory.	S
RESTORE [<linenum>]	Tells the computer to begin the next READ operation taking data from the first DATA statement in the program or, optionally, after <linenum>.	C,S
RESTORE #<filenum> [,REC<recnum>]	Resets the record number used by a PRINT, INPUT, or LINPUT statement. <filenum> is the number of a file opened earlier in the program. <recnum>: the record number to be used next. <filenum> must have RANDOM file organization when using REC <recnum>.	C,S
RETURN	Transfers control from a subprogram to the next line following GOSUB or ON...GOSUB.	S
RETURN [<linenum>] RETURN NEXT	Used with ON ERROR, this version of RETURN allows you to direct the program to <linenum>, or	S

## BASIC State—Table of Formats

Statement	Description	Type
	to the statement following the one in which the error occurred.	
RND	The RND function generates a psuedo-random number greater than or equal to 0 and less than 1. RND is used as a number in a numeric expression.	F
RPT\$(<z\$ >, <x>)	Used to make a “multiplied version” of a string expression. With RPT\$, the computer writes <z\$>, <x> number of times.	F
RUN [<linenum>]	Begins program execution, starting at the lowest line number or at the number specified by <linenum>.	C,S
RUN “<device>.<program>”	Extended BASIC loads and executes a program using RUN “<device>.<program name>” as a command or as a statement within a program.	C,S
SAVE <device>[.<program name>]	Copies the program currently in memory on <device>.	C
SAVE<device>. <program name>[,PROTECTED] SAVE <device>. <program name>[,MERGE]	Allows two additional options to SAVE programs on cassette or diskette. PROTECTED: usable with cassette or diskette; makes LISTing, SAVEing, or further changes impossible. MERGE: usable only with diskette; allows later merging with another program. See MERGE.	C
CALL SAY (“<wo\$>” [,<d\$>][,...])	Allows the computer to speak through the monitor speaker, using the Speech Synthesizer. <wo\$>:word string. One of the resident vocabulary words, enclosed in quotes. <d\$>: direct string, a string variable that is one of the resident vocabulary words, or called using SPGET. See SPGET.	C,S
CALL SCREEN(<color number>)	Changes screen color to <color number>.	C,S
SEG\$(<x\$ >,<position>,<length>)	Returns a “piece” of <x\$ >, beginning at <position> and extending for <length> characters.	F
SGN(<x>)	Gives the sign of <x>. If <x> is positive, SGN returns 1. If <x> is 0, SGN returns 0. If <x> is negative, SGN returns -1.	F
SIN(<x>)	Returns the trigonometric sine function of <x>.	F
SIZE	When you type SIZE and press ENTER, the amount of unused memory is displayed on the screen.	C
CALL SOUND(<dur.>,<freq.1>,<vol.1>[...,<freq.4>,<vol.4>])	Used to generate tones and/or noise through the monitor speaker. <dur>: duration; 1 through 4250 msec., -4250 through -1 msec. A negative duration causes immediate sound update. <freq.>: frequency; 110 through 44733 for tone, -1 through -8 for noise. <vol.>: volume; 0(loudest) through 30 (softest).	C,S
CALL SPGET(<wo\$ >,<r\$ >)	Calls the code pattern from the speech synthesizer for <wo\$ > and assigns it to <r\$>.	C,S

## Basketball Statistician • Baud Rate

Statement	Description	Type
CALL SPRITE(#<sprite>,<code>,<color>,<pixel row>,<pixel column>[,<row vel.>,<column vel.>][,...])	Used to create sprites. <sprite>: the sprite number, 1-28. <code>: the ASCII code(s) that defines the sprite. See CALL CHAR. <color>: the foreground color of the sprite. See CALL COLOR. <pixel row, column>: determines the beginning location of the sprite. See CALL LOCATE. <row,column vel.>: determines the speed and direction of the sprite. See CALL MOTION.	C,S
SQR(<x>)	Used to find the square root of <x>.	F
STOP	Used to terminate program execution.	S
STR\$(<x>)	Converts <x> to a string value.	F
SUB <name>[(<arg>>)[,...]]	Used as the first line in a programmer-defined subprogram. <name>: the programmer-defined subprogram name. <arg>: an optional argument passed from the main program to the subprogram.	S
SUBEND	Must be used as the last line in a programmer-defined subprogram. It transfers control to the statement after the one that called the subprogram.	S
SUBEXIT	Used to pass control out of a user-defined subprogram before its end (marked with SUBEND).	S
TAB(<x>)	Used to "move over" to column number <x> before executing a PRINT or DISPLAY statement.	F
TAN(<x>)	Used to find the trigonometric tangent of <x>.	F
TRACE	Instructs the computer to print the line numbers on the screen as a program is being executed.	C,S
UNBREAK[<linenum>[,...]]	Cancels the TRACE command/statement.	C,S
VAL(<x\$>)	Converts <x\$> to a numeric value.	F
CALL VCHAR(<row>,<column>,<code>[,<repeat>])	Used to display a character at <row>,<column> on the screen. Optionally, it can be repeated vertically. <code>: the number of the ASCII code to be displayed <repeat>: the number of times <code> is to be repeated.	C,S
CALL VERSION(<x>)	Allows you to determine the version number (<x>) of the Extended BASIC you own.	C,S

**Basketball Statistician\*** Helps the coach keep individual and team statistics on shots taken, shots made, rebounds, and assists. Texas Instruments.

**Batch Processing** Program or series of programs run to completion or aborted with little or no possible interaction between the user and the program.

**Battery** A device that produces electrical power by chemical means.

**Battery Backup** Batteries provide auxiliary power to the processor so volatile information can be stored during a power failure.

**Battle Over Titan\*** Space battle game that features color graphics and sounds. Requires extended BASIC cartridge; disk or cassette. Millers Graphics.

**Battlestation\*** Destroy the invading aliens before they destroy you. An Extended BASIC Game. Mirage Software.

**Baud** Measure of binary units of information (usually bits) transmitted per second.

**Baud Rate** TI BASIC allows the setting of Baud Rate in the OPEN statement. The format is:

OPEN #<n>:"RS232.BA=<rate>"

<n> is the file number.

<rate> is the Baud Rate. TI BASIC allows the following Baud Rates: 110, 300, 600, 1200, 2400, 4800, and 9600.

For telecommunications, the Baud Rate is set with the Terminal Emulator II Cartridge. See the instructions that come with TE II for more information.

**Baud Rate Generator** A usually adjustable oscillator providing clock signals for connection of a peripheral. Typical rates are 110, 300, and up to 9600 baud.

**Baudot** An older communications code, named for the man who invented it, and used for 5-level (hole) teletypewriter and telex machines. Other codes used are ASCII and EBCDIC, which are eight level codes.

**Bay Area Systems Engineering** BASE. Developers of the *IBM PC Reference Encyclopedia*, the *TI User's Encyclopedia*, and other guides for the personal computer user.

**B-Bus** The second source-bus to the arithmetic logical unit in a 2-or 3-bus processor.

**BCD** Binary Coded Decimal. A 4-bit binary representation of the 10 decimal digits 0 through 9. Six of sixteen possible codes are unused, requiring the use of a "Decimal Adjust" instruction for correct binary addition. 1 is encoded as 0001, 9 as 1001. Two BCD digits are usually packed in a byte.

**BCP** Byte Control Protocol. A protocol for communications between two computers or devices which use a special character to identify the start of a message which includes a count of both the number of data bytes and actual data bytes. Also called byte count oriented protocol.

**Bedrock BASIC\*** A simple overview of TI BASIC. Disk or cassette. Creative Expressions, Inc.

**Beef Production Program\*** Records on breeding and calving dates, weight comparison, and age are available along with production records. Requires dual disk drive, RS-232 interface, printer, and Extended BASIC cartridge; disk. Computech Distributing.

**Beginner's BASIC Tutor\*** An introduction to BASIC, containing eight lessons and test questions. Disk or cassette. Texas Instruments.

**Bell Laboratories** Research laboratories in New Jersey. Responsible for many discoveries in the electronic and computer fields.

**Benchmark Program** A program written to calibrate the speed of a computer in well defined situa-

tions or types of computation. For example: scientific "number crunching," sorting, or compilation.

**Berzerkie\*** Navigate the secret caverns of the evil King, plunder his wealth, and attempt to escape from the caverns while fighting off the fierce robots who guard his treasure. Graphic Software.

**Beta Test Site** See Alpha and Beta Test Sites.

**Bev The Vet (Short "E")\*** Vowel sounds, spelling and comprehension skills are introduced to the beginning reader. Features music, sound and graphics. Disk or cassette. Computer-Ed.

**Bi-Directional** Data flows in either direction on a wire. At each end there are transceivers to both receive and transmit. Common bi-directional buses are tristate or open collector transistor-transistor logic (TTL). See Transistor-Transistor Logic.

**Bi-Directional Printing** Alternately printing in both directions. A line printed left to right is followed by a line printed right to left, avoiding carriage returns and resulting in a faster printing speed.

**Big Sid's Ribs (Short "I")\*** Vowel sounds, spelling, and comprehension skills are introduced to the beginning reader. Features music, sound, and graphics. Disk or cassette. Computer-Ed.

**Bigchick\*** This game features six levels of action for entertaining children and adults. Sof-Tex.

**Binary Counter** Outputs a sequence of ascending or descending binary numbers.

**Binary Number** An integer as a sum of powers of 2, using a sequence of 0s and 1s.

**Binary Search** Search divided by two at every interval.

**Biorhythm\*** Plots the interaction of your three internal biorhythmic cycles: emotional, intellectual, and physical. Forecasts your good and bad days. Arro-Soft Systems.

**Biorhythms\*** Chart the emotional, physical, and mental cycles of your biorhythm or the biorhythm of any person born since 1801. Findings for any given day are displayed in graphic color, accompanied by audio comments. Also determines the compatibility of any pair of individuals. Cassette. PRP Compugraphics.

**Biorhythm\*** Forecasts your biorhythmic cycles for the next 32 days, using your birth date and current day's date as input. The emotional, physical, and intellectual cycles are represented as sine waves of different colors. Anthistle Systems & Programming, Ltd.



**Biorythm\*** Will predict your high and low days and display results via your screen or printer. Sof-Tex.

**BIOS** Basic Input/Output System—TI's equivalent for BIOS, a set of device service routines (DSR). ROM resident programs are located in each peripheral except the cassette. Cassette device service routines are located in the 4/L of console ROM at 0000-1FFF, along with console BASIC. All devices with DSR share the peripheral ROM at 4000-5FFF. Each ROM is bank selected by the CPU.

**Bipolar** Integrated circuit fabrication using transistor switching elements based on majority carriers for switching and amplification. See MOS.

**Bistable** Always in one of two possible stable states.

**Bistable Multivibrator** Flip-flop. Active elements able to assume one or another stable states that characterize a flip-flop circuit.

**BISYNC ("by-sink")** Blnary SYNchronous Communications protocol.

**Bit** Binary digit. A bit is a 0 or a 1. Bits are used in computer systems to code information, instructions, and data. Larger units of bits are: nibbles (4), bytes (8), or words (16, 24, 32, 96 or more).

**Bitmanipulator\*** Converts integers into 16-bit and hexadecimal forms. Any of the 16 bits can be converted and the hexadecimal results displayed. p-Code required. Thermal printer is optional. 32K; disk or cassette. Eastbench Software.

**Bit Parallel** Data transmission method by which every digit of a binary number is sent over a separate wire simultaneously.

**Bit-Slice** A verical slice of a computer. An n-bit slice of a traditional CPU, minus control. Usually n=4. A bit-slice implements a complete data path across the CPU, including multiplexers, ALU, shifters, registers, and accumulators.

**Black Bomber\*** The Black Bomber firebombs you. Your only defense is a bucket of water. The faster you catch the bombs, the faster they fall. Requires Extended BASIC. Graphic Software.

**Black Book\*** Organize names, addresses, and phone numbers for quick personal reference. Cassette. Denali Data Design.

**Black Market\*** A game of financial strategy for adults. Balance opportunities for making huge profits on the Black Market against the risks of getting arrested. Use the keyboard or the joystick

to obtain load risk charts and odds tables. For two to eight players. JCL Software.

**Blackbeard's Treasure\*** You're part of a five-man diving team, trying to recover Blackbeard's sunken treasure in shark-infested waters, while trying to avoid the grasp of the two giant octopi guarding the chest. Featuring multiple levels of play and full color graphics. Millers Graphics.

**Blackjack\*** Play this rapid version of Blackjack using Las Vegas rules—recognizing five cards under 21 and Blackjack. The computer deals the cards from a 52 card deck, and scoring is onscreen. Cassette. PRP Computergraphics.

**Blackjack\*** Play the famous card game in authentic gambling hall style. Requires extended BASIC; cassette. Hall Software.

**Blackjack and Poker\*** Computer simulated card games that allow you to bet with the bankroll you wish you had. For up to four players. Texas Instruments.

**Blackjack Professor\*** Learn playing techniques under simulated gambling conditions. Disk or cassette. Prometheus Software.

**Blackjack Strategy\*** Analyze your betting strategy with this simulated play. Designed not as a game but as a tool for the serious student of Blackjack. Eastbench Software.

**Blade Runner 2020\*** Police the skies for the Evil Star Raiders and shoot down the Red Robot Ships. Requires Extended BASIC and a joystick. Best Software.

**Blank Line—Print on Printer** An LPRINT statement with no other specifications will print a blank line. Feed the paper up one line and return to the left margin to space your printout format neatly.

**Blanking** Leaving a space on the monitor screen.

**Blasto\*** Try to destroy a mine field while avoiding your opponents' fire. For ages 10 and up. Created by Milton Bradley Company. Texas Instruments.

**Block** Storage unit of information within a logical record. Also means a collection of logical records, as in blocked records or blocking factor. Block size is usually expressed in bytes.

**Block Of Memory** A series of consecutively numbered bytes, usually in an internal memory device.

**BNPF Representation** An older data encoding format for PROM programmers using the characters B = beginning, F = finish, N = negative (1), P =

positive (0). For example, the byte 100101102 is represented as BNPPNPNNPF.

**Board, Breadboard** A fiberglass or pressed paper sheet containing integrated circuits. Interconnections may be wire-wrapped, soldered, or printed on the board. The term breadboard refers to a prototype circuit and dates from the time when radios were made on mother's breadboard. Also called a card when referring to smaller boards that plug into the motherboard or expansion system.

**Boards/Cards** See Disk Drive Controller Card, EIA RS-232C Interface, ICS 1000 32K Memory Cards, Memory Expansion Card, P-Code Card, RS-232 Interface Card, SAT 4512 Wire Wrap Prototype Board, 40 Column Display Enhancement.

**Boards-Expansion** See Disk Controller Card, Memory Expansion Card, P-Code Card, Peripheral Expansion System, RS-232 Interface Card, and Speech Synthesizer.

**Board-Tester** A computer controlled device that performs electronic tests on printed circuit boards.

**Bomb Squad\*** Use your logic to defuse the bomb. Determine which wires to cut and when. If you fail to complete your task in the time allotted, then...BOOM!!! Disk or cassette. American Software Design & Distribution Company.

**Bookkeeper\*** Record your personal finances to save on disk. Requires dual disk drive and p-Code; 32K; disk or cassette. Eastbench Software.

**Boolean Logic** Named after George Boole, who, using the values true and false, defined an algebra of logical operations—And, Or, and Not.

**BOOT** To use a bootstrap. Used to describe starting up a computer.

**BOP** Bit-Oriented Protocol. A protocol for communications between two computer systems which causes a special bit pattern to separate groups of data bits. See also Byte Control Protocol.

**Bouncer\*** Guide Bouncer from one square trampoline to the next, changing them all before time runs out. Six different game screens of increasing difficulty. Extended Software Company.

**Bouncing** Intermittent conduction from vibration of switch contacts after closure. Usually present in keyboard input and eliminated by special hardware or software (debouncing).

**Bound** Processor-bound or I/O bound. Indicating which component of a system is the bottleneck preventing faster performance.

**Box Lines\*** A computer version of the game in which players connect dots in a grid to form and capture boxes. The computer fills in the captured box with the player's color and updates the numeric scoring onscreen. Up to 100 boxes can be defined before the game is over. Cassette. PRP Computergraphics.

**BPI** Bits Per Inch. Used to specify the density of data recorded on tape or disk.

**Brain Games\*** A package containing five different games, including European Maps, Parrot, and Tunnel Vision. Cassette. Creative Computing.

**Branch** A programming instruction transferring control to another program sequence. In BASIC, the GOTO statement.

**Branch** BASIC. See GOTO and GOSUB and RETURN.

**BREAK** BASIC Command. BREAK causes a temporary stop in program execution and returns to the immediate mode. The format is:

BREAK [<line>[<,...>]]

<line> is the number (or numbers) of the line(s) at which the computer should stop. The stop occurs before <line> is executed.

Pressing FCTN 4 (CLEAR) (or SHIFT C (CLEAR) on the 99/4) causes a break in program execution. Type CON and press ENTER to continue. When a break occurs, all redefined characters are returned to standard character definitions. Standard colors are also restored.

Break points are removed from a program with the UNBREAK command, and when a program is SAVED.

**BREAK** XBASIC Command. Extended BASIC allows use of ON BREAK as a way to handle breakpoints. When a breakpoint occurs in Extended BASIC, sprites are erased from the screen, sprite magnification is reset to 1, and sprites do not reappear with the execution of CONTINUE. See ON BREAK.

**Break-FCTN 4(CLEAR)** To end or break current function in any program at any time, press FCTN 4(CLEAR)(99/4-SHIFT C).

**Breakpoint** A point at which the processor will stop a program sequence and display the current machine status, implemented through hardware, software, or a combination of both.

**Bridge Bidding I\*** Learn the art of expert bidding, for intermediate and advanced players. Allows you to bid three times. If you do not give the best bid,

the computer will give you the answer along with an explanation. Disk or cassette. Texas Instruments.

**Bridge Bidding II\*** Learn about the art of asking for aces, the sources of tricks, what is an adequate trump suit, cue bidding, Grand Slam force conventions, and more. The second of three programs was developed for TI by Robert Hammon and Robert Wolff of the Dallas "Aces." Texas Instruments.

**Bridge Bidding III\*** Get tips on bridge discipline, partnership trust, take-out bids, preemptive bids, high level judgment, Michael's unusual no trump, and Landy conventions. Third in a series of bridge bidding programs. Texas Instruments.

**BTAM** Basic Telecommunications Access Method. IBM term used on mainframes.

**Bubble Memory** Memory utilizing microscopic magnetic domains in an aluminum or garnet substrate. Present memories have 92K bits per device. Future devices should boast better than 1 million bit storage density per chip.

**Budgie\*** Set up a budget using your own categories (as many as 25) which may contain up to 775 numbers in all. The first 15 categories are displayed on one screen and the next 10 on the second screen. This menu-driven worksheet format sums each category and page daily, adds all days at the end of the month, and creates a year-to-date total. Totals are available upon request for all categories, separately or together, over a monthly, yearly, or any specified time period less than one year. This program also features a specially designed and copywrited method for packing data onto tape for unusually fast loading and saving. D.M.Jackson, P.E.

**Buffer** In software, any memory structure provided for the temporary storage of data. In hardware, a device which restores logic drive signal levels in order to drive a bus or a large number of inputs.

**Buffering** Temporary storage of data in a data communications path.

**Bug** Error in a program. A programmer must insure that a program will correctly process all of the types of data for which it is intended. Samples of the data are prepared (test data) and the program is executed using this data (a test run). The program's outputs (reports, screen displays, files, etc.) are then verified to be as specified. An error in the processing logic of a program is called a "bug," hence the terms "debug" and "bug-free."

**Building Level System\*** School administration package that includes Attendance Recorder, Class Data Recorder, School Mailer, Personnel Data Recorder, Activity Accountant and Property Manager. See individual descriptions for peripheral requirements. Scott, Foresman and Co.

**Bulk Storage** Large capacity long term data storage.

**Bullseye Addition Facts 10-14\*** Addition drills with moving color graphics and sound for the elementary school student. Disk or cassette. Computer-Ed.

**Bullseye Addition Facts 15-19\*** Addition drills with moving color graphics and sound for the elementary school student. Disk or cassette. Computer-Ed.

**Bullseye Division Facts 2-5\*** Division drills with moving color graphics and sound for the elementary school student. Disk or cassette. Computer-Ed.

**Bullseye Division Facts 6-9\*** Division drills with moving color graphics and sound for the elementary school student. Disk or cassette. Computer-Ed.

**Bullseye Multiplication Facts 2-5\*** Multiplication drills with moving color graphics and sound for the elementary school student. Disk or cassette. Computer-Ed.

**Bullseye Multiplication Facts 6-9\*** Multiplication drills with moving color graphics and sound for the elementary school student. Disk or cassette. Computer-Ed.

**Bullseye Subtraction Facts 10-14\*** Subtraction drills with moving color graphics and sound for the elementary school student. Disk or cassette. Computer-Ed.

**Bullseye Subtraction Facts 15-19\*** Subtraction drills with moving color graphics and sound for the elementary school student. Disk or cassette. Computer-Ed.

**Burger Builder\*** You have only five minutes to help the Burger Builder Chef build four hamburgers at the bottom of the screen. If you can squash the Enemy under a bun you get extra points. Software Specialties, Inc.

**Burn-In** A phase of component testing where basic flaws or early failures are screened out by running the circuit for a specified length of time—usually at a high temperature—in an oven.

**Bus** Path for signals having a common function. Every Standard MPU creates three buses: the data bus, the address bus, and the control bus.

**Bus Controller** The unit in charge of generating bus commands and control signals.

**Bus Extender** A device which allows additional cards to be plugged into a computer's bus. Also known as an expansion chassis.

**Bus Termination** Electrical means of preventing reflections at the end of a bus. Only necessary in high-speed (and some low-speed) systems. Some I/O units require termination, such as the last diskette drive on a chain.

**Business Aids Library—Cash Management\*** Make accurate managerial decisions by forecasting cash flow. Project up to six forecasts with up to twelve periods per forecast. Twenty categories of data are contained in each forecast, including expenses and income, a category for automatically calculated gross margin, and one for sales unit. Requires Extended BASIC. Texas Instruments.

**Business Aids Library—Finance Management\*** A system to aid in making financial projections, cost of capital and financial needs, cash flow analysis, depreciation and loan payment schedules. Requires Extended BASIC cartridge; disk. Texas Instruments.

**Business Aids Library—Financial Management\*** Calculates cash and capital costs projections, depreciation, cash flows, annuities, and amortization. Requires Extended BASIC. Texas Instruments.

**Business Aids Library—Inventory Management\*** A program for updating inventory, tracking its movement, and performing stock evaluations by profit margin, price, or cost. Requires one of two cartridges for preliminary sorting and statistical evaluation: Personal Record Keeping or Statistics Solid State Software. Texas Instruments.

**Business Aids Library—Invoice Management\*** A system for maintaining accurate customer information such as addresses, taxes, and available discounts. Seven programs are included. Texas Instruments.

**Business Aids Library—Lease Purchase Decisions\*** Determine the economic benefits of an investment using the Capital Investment Analysis model. The Lease Evaluation model allows lessees, third party lenders, and lessors an opportunity to review a lease agreement. Also includes The Lease or Buy Decision model, allowing for review of different methods of financing. Texas Instruments.

**Business Application Software** See Business/Sales Analysis Software, File Management, Financial

Planning Software, Stock Market Software, Word Processors.

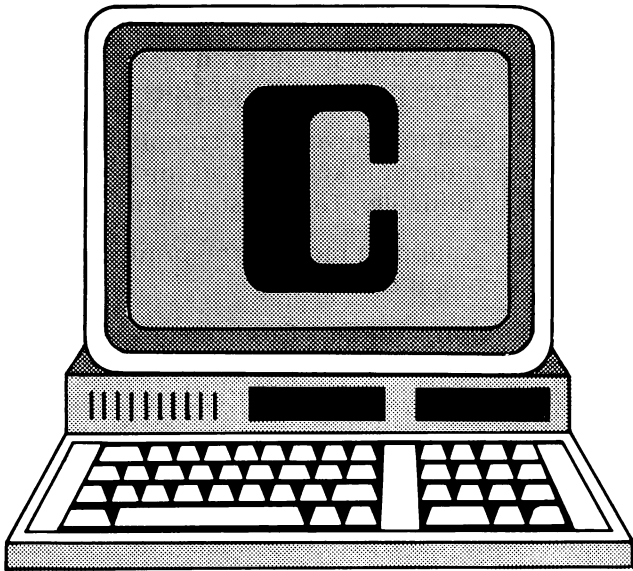
**Business Data Base\*** Build your own Data Base, including inventory control, general ledger, accounts receivable, and accounts payable. Custom design your own worksheets, result columns, and report formats and calculate, search, sort, and display needed information. Requires the TI Extended BASIC.

**Business/Sales Analysis Software** See Business Aids Libraries, Cow/Calf Enterprise Analysis, Dairy Program, Depreciation, Ewe/Lamb Enterprise Analysis, Futura Inventory Management, Graphics, Microsoft Multiplan, Newspaper Route, Point of Sale, Sow/Pig Enterprise Analysis, and TI-Count Business Packages.

**BYE** BASIC Command. Typing BYE and pressing ENTER is the safest way to end TI BASIC or XBASIC. Unlike using FCTN = (QUIT), the BYE command closes all open files. The BYE command also erases all programs from memory, resets the computer, and returns to the Master Title Screen.

**Byte** A group of 8 bits, used universally to represent a character. Microcomputer instructions generally require one, two, or three bytes. One byte contains two nibbles (4 bits each).





**C** Codes. ASCII 67, Hex 43. c—ASCII 99, Hex 63.

**C** Used in setting printer page length. To set page length (for example) to 55 lines per page, enter BASIC statement:

```
PRINT #<n> CHR$(155);"C"
```

**C** Symbol for the Carry bit; the Clock; and the hexadecimal notation for the decimal number 12: C base 16 = 12 base 10 = 14 base 8 = 1100 base 2.

**C—Programming Language** C is a high-level programming language developed at Bell Laboratories, for use with the UNIX operating system.

**Cables—How to Hook Up Cassette** The cassette interface cable. The white lead on the "CS1" side of the cable (marked with "1") is inserted into the earphone jack of your cassette recorder. Red leads are plugged into the microphone jack, and black leads are inserted into the remote jack on the recorder. If you are having a problem with computer-cassette motor control, see Tex-Sete Adaptor.

**Cache** High-speed buffer between the central processor and main memory. Filled at medium speed from main memory. Once programs and instructions are found in the cache, they can operate at high speed. If a new instruction sequence is not found in the cache, it is loaded from the main memory.

**CAD** Computer-Aided Design.

**CAI** Computer-Assisted Instruction.

**Calendar\*** Create an accurate calendar for any month of any year—past, present, or future. Marks holidays and your own special dates as well. Includes an explanation of the Gregorian Calendar. Bee Jay Funware.

**CALL** BASIC Statement. Allows use of subprograms resident in the computer. The format is:

```
CALL <program name>
```

<program name> is the subprogram name.

TI BASIC allows use of the following subprograms:

CHAR	KEY
CLEAR	SCREEN
COLOR	SOUND
GCHAR	VCHAR
HCHAR	
JOYST	

Each subprogram is discussed (under its own heading) in detail elsewhere in this encyclopedia.

**CALL** XBASIC Statement. Extended BASIC offers additional resident subprograms (listed below), and the ability to CALL user written subprograms. The format is:

```
CALL <program name>[x<x or x$ >,.... ]
```

<program name> is the subprogram name. The following are the additional subprograms that Extended BASIC allows:

CHARPAT	INIT	PATTECHARSET
COINC	LOAD	POSITION
DELSprite	LOCATE	SAY
DISTANCE	MAGNIFY	SPGET
ERR	MOTION	SPRITE
LINK	PEEK	VERSION

Each is discussed elsewhere in this encyclopedia under its own heading.

<program name> may also be the name of a subprogram written by the user. See SUB for more information.

[<x or x\$ >,...] is a group of variables to be transferred over to the subprogram. See SUB for more information on variable transfer.

**Call** Program execution is temporarily transferred to a subroutine or subprogram. When completed, execution resumes at the instruction following the call.

**Call** BASIC Subroutine. See GOSUB and RETURN.

**Call by Reference** The actual storage locations of the parameters are passed to the subroutine by the call, rather than a copy of the values being passed.

**Call by Value** A subroutine or procedure call in which the actual values of the parameters are passed to the subroutine.

**CALL CHAR** See CHAR.

**CALL CHARPAT** See CHARPAT.

## CALL CHARSET • Casino Blackjack\*

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**CALL CHARSET** See CHARSET.

**CALL CLEAR** See CLEAR.

**CALL COINC** See COINC.

**CALL COLOR** See COLOR.

**CALL DELSPRITE** See DELSPRITE.

**CALL DISTANCE** See DISTANCE.

**CALL ERR** See ERR.

**CALL GCHAR** See GCHAR.

**CALL HCHAR** See HCHAR.

**CALL INIT** See INIT.

**CALL JOYST** See JOYST.

**CALL KEY** See KEY.

**CALL LINK** See LINK.

**CALL LOAD** See LOAD.

**CALL LOCATE** See LOCATE.

**CALL MAGNIFY** See MAGNIFY.

**CALL MOTION** See MOTION.

**CALL PATTERN** See PATTERN.

**CALL PEEK** See PEEK.

**CALL POSITION** See POSITION.

**CALL SCREEN** See SCREEN.

**CALL SOUND** See SOUND.

**CALL SPGET** See SPGET.

**CALL SPRITE** See SPRITE.

**CALL VCHAR** See VCHAR.

**CALL VERSION** See VERSION.

**CAM** Content Addressable Memory. Associative memory, addressed by contents rather than location.

**CAMAC** Computer Automated Measurement And Control. An application where a computer measures a process and controls one or more devices affecting the process automatically, based on the measurements taken. Also called process control.

**Cancel Current Line** Press 3(ERASE)(99/4-SHIFT T) to delete the current line. This is valid in BASIC. See EDIT.

**Cancel the Current Operation** To cancel the current operation, press FCTN 4(CLEAR)(99/4-SHIFT C).

**Cape Cod Golf\*** Play nine holes of golf with this game. Features realistic graphics and joystick control. For up to five players. Harry P. Richard.

**Car Wars\*** Out maneuver your computer opponent before your car is knocked off the field. Various levels of difficulty. Texas Instruments.

**Card Cage** A support rack for the printed circuit boards in a computer.

**Cards, Expansion** See Disk Controller Card, Memory Expansion Card, P-Code Card, Peripheral Expansion System, RS-232 Interface Card, and Speech Synthesizer.

**Carriage Return** A standard typewriter key which returns the printing element to the beginning of the line. To move the paper up, a separate line feed must be added. Frequently, the microprocessor interprets a carriage return as an end of line or command. On 99/4 and /4A the ENTER key is the carriage return.

**Carriage Return** Press Enter to end the current line, give the line to the requesting program, and move the cursor to the start of the next line.

**Carrier** A frequency modulated to denote 0 or 1 used to "carry" information.

**Carry** In the status register of the central processor a carry is a flag bit which indicates an operation overflow by the arithmetic logic unit. The carry is also used during shifts.

**Carry Look-Ahead** A circuit which predicts, from partial adders, the final carry from an addition. Binary addition is speeded up significantly by eliminating the carry propagation delay.

**Cars and Carcasses\*** Liberate your city from ghoulish interlopers by running them down with your car. Practice your driving skills. Cassette. Not-Polyoptics.

**Cartridge** Preprogrammed "Firmware," software in ROM. Many are available from TI and third party vendors. The cartridge inserts into the slot in the front of the console, eliminating the user's need for extensive programming experience.

**CAS** Column Address Strobe. Used for addressing in dynamic memory control.

**Cash Flow\*** Take into account historical data to make an estimated projection of next year's budget. Disk or cassette. Requires RS-232 interface, printer, and Extended BASIC cartridge. Joe D. Fain.

**Casino Blackjack\*** An accurate version of the famous casino game. Includes teach, test, and play



modes. Disk or cassette. Requires Extended BASIC cartridge. Millers Graphics.

**Casino Pack\*** A series of three gambling games. Includes Slot Machine, Dice Game, and Card Game. Disk. Futura Software.

**Cassette** A small plastic cartridge containing two spools of 1/8" magnetic tape, frequently used in audio recording. Applied to the mass storage requirements of micro- and minicomputers, a "digital" cassette meets standards for digital recording.

**Cassette—Load Instructions** To load a BASIC program which was SAVED on cassette back into the TI's memory, enter:

OLD CS1.

All OLD instructions erase any program lines in memory before you enter OLD. To RUN the program, type in RUN and press ENTER after the program has been successfully loaded into memory. Extended BASIC allows the use of:

RUN "CS1"

instead of OLD. This causes the program loaded from cassette to automatically begin execution.

**Cassette—SAVE Instructions** BASIC Program—To SAVE a program on cassette, enter:

SAVE CS1

and follow the directions on the screen. To run the program at a later time, use the OLD command to copy it from the cassette you saved it on back into the TI's memory. See OLD. The SAVE instruction does not alter your program in memory. It is important to be aware that if you write a BASIC program, it will be lost (erased) unless you SAVE it before you: turn off the console, type in either NEW or BYE, or use the FCTN=Quit command. See also EDIT. Instructions for SAVEing a program named "SAMPLE" on diskette are as follows:

SAVE DSK1. SAMPLE

**Cassette—Types of Files** The following choices are available for cassette-based file processing in TI BASIC and XBASIC:

SEQUENTIAL File Organization  
DISPLAY or INTERNAL File Types  
UPDATE, INPUT, OUTPUT, or APPEND Open Modes  
VARIABLE of FIXED Record Lengths

**Cassette Motor Control** The computer has the ability to turn on and off the motor of a cassette recorder. The recorder must have a subminiature jack for remote applications, and the jack's polarity needs to match that of the computer's cassette

cable interface remote (the black lead) plug. If you are having trouble with computer-cassette motor control, see Tex-sette Adaptor.

**Cassette Tape—How to Hook up Cables** The dual or single cassette interface cable is hooked up to the right rear of the console. The white lead on the "CS1" side of the cable (marked with "1") is inserted in the earphone jack of the cassette recorder. Red leads are plugged into the microphone jack, and black leads are inserted into the remote jack. If you're having a problem with computer-cassette motor control, see Tex-Sette Adaptor.

**Castle Nova\*** Guide Casanova through the mazes of his castle to find the girl of his dreams. Five levels of difficulty; and features an invisible maze option. Growing Fantasia '99 Software.

**Caterpillar\*** Maneuver your caterpillar through a series of mazes that get more and more complex. A non-violent computer game for the entire family. The Softies.

**CATV** CAbLe TeleVision.

**Cavern Quest\*** Slay cruel monsters deep in the secret caverns while searching for the twenty secret treasures. A multiple-screen maze game. Moonbeam Software.

**CBASIC** A popular BASIC language compiler for 8080, Z80, 8085, and 8086/8088 microcomputers. CBASIC is not available for the TI-99 4/4 and /4A.

**CCD** Charge Coupled Device. A storage device using metal oxide semiconductor capacitors. It transfers charge from one cell to another in a recirculating pattern.

**CDC** Control Data Corporation, a manufacturer of large computer systems, peripherals, and diskettes. Also author of the Plato Computer Aided Instruction Software series. See PLATO.

**CDILP** Ceramic Dual In Line Package. See DIP.

**Cell** A repeated unit in a RAM chip. Stores one unit of information in a RAM chip and returns it in response to a particular address signal. Also a position where a row and column intersect on a spreadsheet, such as Multiplan or VisiCalc.

**CERDIP ("sir-dip")** CERamic Dual-In-line Package.

**Chaining** Allowing the execution of programs larger than the computer's main memory by loading and executing modules of the same program sequentially.

## Challenge Poker\* • Character Definition Graphics Form\*

**Challenge Poker\*** Lay out twenty-four playing cards on a bingo-type board to create the best possible poker hands diagonally, vertically, and horizontally. Each player gets the same hand, so no luck is involved. Pewterware.

**Challenge I\*** Two games based on the idea of leapfrog. Cassette. Futura Software.

**Challenge II\*** Contains Tic-Tac-Toe and a game of elimination. Requires cassette. Futura Software.

**Change a BASIC line** See EDIT.

**Change Name of a File** Use the menu-driven Disk Manager Cartridge to change a file name on diskette. Insert the Disk Manager Cartridge in the console, choose Disk Manager, and when the Main Menu appears, choose:

### 1 FILE COMMANDS

And follow directions displayed on the screen. Note: When the "SCREEN IS COMPLETE" statement appears on the screen, press FCTN 6 (Proc'D) (99/4-SHIFT V) to carry out the command.

**Channel** Logical connection from a CPU to an I/O device. To optimize communications, channels may be multiplexed, have dedicated ports, or a dedicated channel processor. See also DMA.

**CHAR** BASIC Subprogram. CALL CHAR allows you to change the shape of any of the ASCII character set. The format is:

CALL CHAR (<code>,<x\$>[. . .])

<code> is the ASCII character code (32 through 159) that you want to redefine.

<x\$> is the pattern identifier; it is a string expression with up to 64 characters.

Here's how the CHAR subprogram is used: Each one of the computer's ASCII characters is made up of an 8 X 8 dot "Box" for a total of 64 dots. This box is divided into 16 groups of 4 dots each (see illustration below).

01	01	01	01	02	02	02	02
03	03	03	03	04	04	04	04
05	05	05	05	06	06	06	06
07	07	07	07	08	08	08	08
09	09	09	09	10	10	10	10
11	11	11	11	12	12	12	12
13	13	13	13	14	14	14	14
15	15	15	15	16	16	16	16

Each character in <x\$> defines one group of dots. The procedure is as follows:

First, figure out the shape of your new character.

It's a good idea to lay it out on a piece of graph paper like the one above. Certain dots will be filled in, and others left open. After your character has been laid out, use the accompanying chart to "build" the pattern identifier string. The pattern identifier will then be made up of a hexadecimal code, 16 digits long, that identifies your new graphics character to the computer.

Group of Dots				Hex Code Number
-	-	-	-	0
-	-	-	X	1
-	-	X	-	2
-	-	X	X	3
-	X	-	-	4
-	X	-	X	5
-	X	X	-	6
-	X	X	X	7
X	-	-	-	8
X	-	-	X	9
X	-	X	-	A
X	-	X	X	B
X	X	-	-	C
X	X	-	X	D
X	X	X	-	E
X	X	X	X	F

If <x\$> is less than 16 characters, the computer assumes the remaining characters to be zeros. If <x\$> is more than 16 characters, the computer assigns the first group of 16 characters in <x\$> to <code>, the next group to <code> + 1, the next group to <code> + 2, and the final group to <code> + 3.

Up to 64 characters may be used in <x\$>; if fewer are used, the computer breaks them into groups of 16, adding zeros to the end of the final group, if needed, and assigning them to the appropriate ASCII character codes.

**CHAR** XBASIC-Changes and additions. With CALL CHAR in Extended BASIC, please note that only ASCII codes 32 through 143 are available for definition. The memory area used for codes 144-159 in TI BASIC is used in Extended BASIC to keep track of sprites. Also note that CALL CHAR is used to define character shapes for use in CALL SPRITE. See SPRITE.

**Character Definition Graphics Form\*** Holds a four by four character matrix that can be used to define any graphic design. Also included are a pixel

to hex conversion chart and space for program statements. Comes in pads of 40 sheets each. TENEX Computer Marketing Systems, Inc.

**Character Generator** A circuit which forms letters or numbers on a screen or printer.

**Character Insert** BASIC. Pressing FCTN 2-INSERT (99/4-SHIFT G) will insert the next character entered where the cursor is currently placed.

**Character Read from Keyboard** BASIC. See KEY and INPUT.

**Character Set** The collection of characters available for display or processing on a particular computer or peripheral.

**Character String** A one-dimensional array or sequence of characters, encoded as bytes. Character strings have a length field, or are terminated by the zero byte.

**Characters Per Inch-10** Normal Size Print. To return to normal ten characters per inch print size, you must turn off all non-standard print options. See Compressed Print, Double Width Type Format, and Type Formats.

**CHARPAT** XBASIC Subprogram. The format is:

CALL CHARPAT(<ASCII code>,<x\$>[,...])

CALL CHARPAT assigns to <x\$> the 16-character pattern identifier that defines the pattern of (ASCII code). For an explanation of this 16-character pattern identifier. CALL CHARPAT is the inverse of CALL CHAR. See CHAR.

**CHARSET** XBASIC Subprogram. CALL CHARSET changes ASCII codes 32-126 back to their preset patterns and colors.

**Charting with Income and Expense Records\*** Provides easily accessible, user-defined income and expense charts to record personal and business data for tax preparation. Cassette. Western Properties Investment Co.

**Checkbook Manager\*** Use this program to keep your checking account information up-to-date. A running balance is maintained, enabling you to sort and add sums within individual accounts. Disk. Texas Instruments.

**Checkers\*** An excellent version of the old world classic. Disk or cassette. Prometheus Software.

**Checksum** A field of one or more bytes appended to a block of n words containing a truncated binary sum or some other function value based on the contents of that block. The sum is used to verify the integrity of data.

**Chemtutor 1\*** A chemistry teaching aid containing several kinds of problems. Requires cable and the Extended BASIC cartridge. Disk or cassette. Data Systems.

**Chemtutor 2\*** Deals with the ground state of electronic sub-orbitals for selected elements. Requires the Extended BASIC cartridge. 32K; disk or cassette. Data Systems.

**Chip** A rectangular silicon die cut from a wafer. See entries by number for each commonly used chip.

**Chip Select** Most large scale integration chips normally have one (or more) chip selects. These activate the chip to examine the rest of its pins; for example the address bus. This information will in turn specify a location/register within the chip. Multiple chip selects can replace decoders external to the chip, but do require extra pins.

**Chisholm Trail\*** Move a "steer" to kill five different monsters. Texas Instruments.

**Chopper Ace\*** Defend your desert drilling team against revolutionaries who are trying to overthrow the friendly native government. Features 3-D color graphics and sound. Requires Extended BASIC.

**CHR\$** BASIC. Function converts an ASCII code to its character equivalent. The format is:

<stringvariable\$> = CHR\$( <n> )

For example, CHR\$(83) would return the one-character string "S". For a listing of ASCII codes, refer to your TI reference manual or reference card.

**Chutes & Sharks\*** You're on a rescue mission in shark-infested waters to save all of your crew. Requires Extended BASIC cartridge; cassette. Futura Software.

**CIA Adventure\*** Your mission is to guide your assistant via walkie talkie on a quest for the missing diamonds, located in a dangerous spy nest. 32K; disk version requires Extended BASIC. Ehninger Associates, Inc.

**Circle From 3 Points\*** When three points are given in coordinate form, the center and radius will be displayed. Disk or cassette. Data Systems.

**C.ITOH Prowriter\*** This printer handles 120 characters per second and 63 lines per minute. It features a standard 2K buffer and bidirectional printing with high-resolution graphics. Forward or reverse paper feed, by friction or tractor. C. ITOH.

**Class Data Recorder\*** Store and update student records, as well as compute averages, ranks, and

other information. Requires disk drive, RS-232 interface, and compatible printer. Scott, Foresman and Co.

**Classroom Level System\*** A school administrative aid with two programs: Class Data Recorder and Property Manager. Scott, Foresman and Co.

**Clear** Signal to place a device or a circuit in an initial, usually zero state.

**CLEAR** BASIC Subprogram. CALL CLEAR is used to erase the screen. It can be used as a statement in a program or as a command.

**Clear the screen** BASIC. See CLEAR.

**CLK** Clock. The reference timing source in a system. Provides regular pulses that trigger or synchronize functions. Most microprocessor clocks operate in the range of 1 to 8 MHz, where as real-time clocks usually operate at 1, 10, or 100KHz. A system usually requires a CPU clock, a timer clock, and other clocks for specific I/O devices.

**Clock\*** For children learning to tell time. Displays hand clock faces and requests them to input the time represented. Clock will not accept incorrect answers, so learners are guided to the right responses. Disk or cassette. Micro-Ed.

**Clock Frequency** The oscillation rate of a clock, usually expressed in Megahertz. Also known as Clock Rate.

**CLOSE** BASIC Statement. When the CLOSE statement is executed, association between a particular file number and device is ended, and the contents of the buffer is added to the file. The format is:

CLOSE#<filenum> [:DELETE]

<filenum> is the number of the file you want to close. DELETE indicates that you want the file erased at the same time it is closed. This option works only with diskettes.

**Close** Disassociating a file from a particular program, including flushing unwritten buffers and updating the directory and file allocation table if required.

**CMOS** Complementary Metal Oxide Semiconductor. Technology characterized by extremely low power consumption. Widely used for portable applications and battery-assisted memory systems. CMOS requires both p-channel and n-channel transistors, with speed and density characteristics between NMOS and PMOS. CMOS devices may operate between 3v to 12v and have ideal noise immunity characteristics.

**CMR** Common Mode Rejection.

**CMRR** Common Mode Rejection Ratio. Operational amplifiers common mode gain.

**Coax** Coaxial cable. A transmission line with an inner conductor and an outer shield conductor.

**COBOL** COmmon Business Oriented Language. A high level English-based programming language developed for business applications. Popular on mainframes, this language is not yet available for the TI-99/4A.

**Cobra Command\*** Pilot a Cobra Helicopter over dangerous terrain, while battling Sorex fighters, Nemats, and Heavys. Neutralize the armed bunkers so you can land and rescue your people. A fast action game, written in Assembly language. C.A. Root.

**Cockroach Races\*** Place your bets on one of six different roaches as they race over a variety of obstacles. Jerseyware Microcomputer Software.

**Code** A synonym for program instructions, language statements, or a symbolic representation for data in any language, including BASIC and Machine language. See Program.

**Code Breaker\*** Includes three games involving scrambled words and sentences which strengthen basic skills in word usage. For ages 10 to adult. Cassette. Program Design, Inc.

**Code Number/Alphabetic File\*** This is a filing and sorting system with up to 225 categories that will sort by name or number. Cassette. Requires TI Extended BASIC Command Module. Western Properties Investment Company.

**Codec** COder-DECoder. A chip providing the essential translation of analog to digital conversion.

**COINC** XBASIC Subprogram. CALL COINC is used to detect a coincidence between two sprites, or between a sprite and a location on the screen. The format is:

CALL COINC (#<sprite a>,#<sprite B>,<T>,<X>

or

CALL COINC (#<sprite>,<DR>,<DC>,<T>,<X>)

or

CALL COINC (ALL,<X>)

<sprite> is the number of a sprite defined earlier in the program.

<DR> and <DC> are the dot row and dot column, respectively, of a location on the screen.

<T> is the tolerance, a number that indicates to the computer how close the sprites have to be to form a "coincidence". A sprite's screen address corres-

ponds to the location of its upper left hand corner. This address is used to check tolerance, which cannot be specified when using (ALL). In this case, if any sprites partially (or fully) overlap, their coincidence is reported.

<X> is the variable that is assigned to the “report” of CALL COINC. If a coincidence is found, <X> is set equal to -1. If no coincidence is found, <X> is set equal to 0.

Remember that if sprites are moving fast, CALL COINC may not detect a coincidence. Also, if a coincidence occurs while the computer is executing some other statement, the coincidence will not be detected.

**Colon (:) XBASIC.** Used for Multiple Statements on One Line. You can put a double colon (::) at the end of one statement and continue entering another statement on the same line, without a new line number. The line number at left refers to all statements on the line. An exclamation point allows a comment to be added after a statement. See BASIC Statements—Multiple on one line.

**COLOR BASIC Subprogram.** CALL COLOR allows you to define colors for characters displayed on the screen. The format is:

CALL COLOR(<character set>,  
<foreground color>,<background color>[, .. ])  
<character set> is a number (1-16 in TI BASIC, 0-14 in XBASIC). The character you are color-defining is part of this set.

The Character Sets are determined using the following chart:

Set Number	Includes ASCII Code Numbers
1	32-39
2	40-47
3	48-55
4	56-63
5	64-71
6	72-79
7	80-87
8	88-95
9	96-103
10	104-111
11	112-119
12	120-127
13	128-135
14	136-143
15	144-151
16	152-159

Remember that in Extended BASIC, character sets 15 and 16 are not available for redefinition by CALL CHAR.

(Foreground Color) is the number (1-16) of the color you want the actual character to be.

(Background Color) is the number (1-16) of the color that makes up the balance of the screen position.

The foreground and background colors are determined by these color codes:

CODES			
NUMBER	COLOR	NUMBER	COLOR
1	Transparent	9	Medium Red
2	Black	10	Light Red
3	Medium Green	11	Dark Yellow
4	Light Green	12	Light Yellow
5	Dark Blue	13	Dark Green
6	Light Blue	14	Magenta
7	Dark Red	15	Gray
8	Cyan	16	White

Until a CALL COLOR statement is encountered in a program, the standard foreground color is black (Code 2) and the standard background color is transparent (Code 1).

**COLOR XBASIC Subprogram** Extended BASIC also allows you to use CALL COLOR to define sprite (q.v.) colors. The format is:

CALL COLOR (#X<x>,<foreground color>  
[, Color>[,I II ])

This statement is used to change the color of the existing sprite.

<x> is the number of the sprite.

<foreground color> is the number (1-16) of the color you want the sprite to become. (See Above for a list of colors and their corresponding numbers.) A sprite's background color is always transparent (Code 1), allowing other characters and the screen color to show through.

**Color Codes** Color Codes are used in the COLOR, SCREEN, and SPRITE subprograms. See table under COLOR.

**Combinational Logic** A circuit with Boolean logic functions and no memory.

**Command** Directs a computer to carry out a specific action. The difference between a command and an instruction is that a command directs a specific action, while many instructions are combined to create a useful program. Commands are acted upon immediately by the computer, while instruc-

tions are saved for later execution in a program. Commands are acted upon by the BASIC operating system of a computer, while instructions must be processed by programs such as the BASIC interpreter or FORTRAN or Pascal compilers.

**Command Cartridge** Preprogrammed "Firmware"; software in ROM. Many of these cartridges are available from TI and third party vendors. The cartridge inserts into the slot in the front of the console, simplifying program operation for the user. Also called Command Modules.

**Command Processor** A program which accepts a command (usually from the keyboard) and causes it to be carried out. Some command processors contain the programming required for all commands they process. Others do not carry out any commands directly. Instead, they examine the command, determine what other program, if any, can carry it out, locate the required program, and start it running. Still another type of command processor carries out some commands directly (internal commands), but locates and runs other programs for some commands (external commands).

**Comment Field** A field within an instruction containing explanations or remarks that are ignored by the interpreter, the compiler, or the assembler.

**Comments in BASIC Programs—REM** Also in Extended BASIC. Use REM as a way of including remarks or explanatory comments in a program. The exclamation point (!) is synonym for REM and can be used interchangeably with REM. The exclamation point can be used without a double colon to indicate that the rest of the line is a remark. For example:

```
100 REM Just a comment
110 ' Just a comment
120 LET X = 1:: REM Just a comment
130 LET X = 1::! Just a comment
140 LET X = 1:! Just a comment
```

The double colon (::) allows multiple BASIC statements on one line.

**Companion\*** A menu-driven text processing program written in Assembly language. Includes a full-screen editor, seven cursor movement keys, automatic centering, accelerating auto-repeat, 18,000 character memory capacity, rapid correction, insertion and deletion, complete printer mode control, text embedded formatting control, suppressed or automatic page numbering, and full error recovery. Requires Extended BASIC and memory expansion; disk. Intelpro.

**Compatible, Upward (Versions of Programs)** Upward compatible means that programs developed for one version of a programming language, operating system, application software package, or computer, will work without alterations on an expanded, more powerful version of the same language, system, or package. For example, a program written in console BASIC will run in Extended BASIC, with 3 exceptions: 1) If, in the console BASIC program, CALL CHAR statement uses codes from character sets 15 and 16, Extended BASIC stops program execution and displays an error message ("\*Bad Value"); 2) There is an additional list of reserved words in Extended BASIC which used in a console BASIC program, would cause a break and error message in Extended BASIC; 3) There are 864 fewer bytes of unexpanded program space available in Extended BASIC, so very large console BASIC programs could produce a "Memory Full" error message.

In hardware, upward compatibility refers to the possibility of building up to more powerful models without reprogramming. The TI-99 fits this definition to a large extent, because of its capacity to handle additional memory, disk drives, and other peripherals.

**Compiler** Converts relatively few high-level instructions into many binary instructions for direct processor execution. Any high-level language, such as BASIC or COBOL, requires a compiler or an interpreter.

An interpreter translates each statement of the program whenever the statement is executed, while as a compiler translates the complete program once (producing object codes that can be executed repeatedly). Any change in the program requires recompilation. The code produced by compilers may be longer and/or slower than the code generated from Assembly language source code.

**Compile Time** The point in the processing of a program when it is being translated from source code to object code by a transistor (compiler or Assembler).

**Complementing** The action of changing each 1 to a 0, and each 0 to a 1.

**Complex Mathematics\*** A series of subroutines which add, subtract, and divide complex numbers; evaluates complex trigonometric functions and polynomials. Requires disk drive or cassette recorder and cable. Eastbench Software.

**Compound Interest Business Package\*** A series of menu-driven business programs that include amount

of interest paid, interest rate, and future value. Requires Extended BASIC cartridge; disk. Data Systems.

**Compound Words\*** Involves working with words made up of two smaller words. Requires the Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Compressed Print** To enter the mode for this small type size enter BASIC statement:

```
PRINT #<n>: CHR$(143)
```

This gives 132 characters per 8 inch line, or about 16 characters per inch. To return to normal size print, enter:

```
PRINT #<n> CHR$(146)
```

See Type Formats.

**Compu.sette Cassette Tapes\*** Cassettes available in C-05, C-10, C-20, and C-30 sizes and guaranteed to be 100% error free. Micro-80, Inc.

**Compu.sette Diskettes\*** 5¼ inch single-sided, double-density diskettes that come in packs of five or ten and are guaranteed to be 100% error-free. Micro-80, Inc.

**Computer** A general purpose computing system incorporating a central processing unit, memory, I/O facilities, power supply, and cabinet.

**Computer Accessories** See Supplies.

**Computer Cassettes\*** C-10 length cassettes with a five screw shell and a lifetime guarantee. Parallel Systems.

**Computer Math Games II\*** Five progressively more challenging math games. Features color graphics and music. For children in grades one through nine. Up to three players. Cartridge. Texas Instruments/Addison-Wesley.

**Computer Math Games VI\*** Four basic math skill games for one or two players, grades two through nine. Cartridge. Texas Instruments/Addison-Wesley.

**Computer Memory** Storage in Bytes. Byte is a storage label for one character (letter, digit, etc.) in internal or external memory. Abbreviated as B, or in thousands as KB, or simply K (1K = 1024 bytes, an even power of 2). The unexpanded 99/4A has 16K of internal memory or 16,000 bytes (16K=16 x 1024=16384 bytes).

**Computer Music Box\*** Three-part music can be entered, played, edited, and saved with this music composition system, which includes an automatic chord creation feature. Designed for ages 10 and up. Disk or cassette. Texas Instruments.

**Computerized Crayola\*** If you can imagine it, you can probably draw it with this computer graphics program for young and old. Fox Valley Software.

**Computer System** A complete system including the MPU, keyboard, CRT, and other peripherals, such as printers, disks, tapes, etc. Often used to also include programs.

**ComRiter CR-II\*** This daisy wheel printer produces 12 characters per second and features a 5K buffer used to store documents up to three pages long in the printer's memory for producing single or multiple copies. You can use the ComRiter in for word processing mode by selecting the Diablo 630 protocol, available in most software for word processing. Printer features sub- and superscripts, boldface, backspace, underline, and double-strike. Available with RS232C serial or Centronics parallel interface. Printing is bi-directional and logic seeking. Optional features include color print ribbons, tractor and cut sheet feeders, and interchangeable print wheels. Comrex International, Inc.

**Concatenation of Data or Programs** Adding one item to the end of another to produce one longer data or program item.

**Concentration\*** Ten pairs of three-letter words are hidden behind numbered squares for a child to match. Requires speech synthesizer and editor. Cartridge is optional. Cassette. Anthistle Systems & Programming.

**Connect Four\*** Players move their markers in different directions in this strategy game developed by Milton Bradley Company. Texas Instruments.

**Conquest in Space\*** Destroy your opponents' space station to gain control of the galaxy. Requires Extended BASIC. Pegasus Software.

**Console** The terminal that has the most control in a system. For a microcomputer, the keyboard or the front panel is the console.

**Consonant Blend Bullseye 1\*** Vowel-consonant pattern drills with moving color graphics and sound for the elementary school student. Other versions include Consonant Blend Bullseye 2 & 3. Disk or Cassette. Computer-Ed.

**Constant** An explicit value in a program instruction or statement rather than a symbolic value. The value is fixed throughout a program.

**Context Switch** TI 9900 Assembly language. Establishes a new next instruction address and a new value for the workspace pointer register. This establishes a new set of 16 RAM located workspace



## Constant • Control keys

registers, duplicating the register set for every sub-routine, rather than using a selective stack approach.

**Constant** An explicit value in a program instruction or statement rather than a symbolic value. The value is fixed throughout a program.

**Context Switch** TI 9900 Assembly language. Establishes a new next instruction address and a new value for the workspace pointer register. This establishes a new set of 16 RAM located workspace registers, duplicating the register set for every sub-routine, rather than using a selective stack approach.

**Continue** BASIC Command. Typing CON and pressing ENTER will restart a program after a BREAK (q.v.) has occurred and the program has stopped running.

CON cannot be used if, after BREAK, you edited any program lines. When a BREAK occurs, the standard character set and colors are restored. (In XBASIC, sprites are erased.) The CONTINUE command does not restore standard characters, colors, or sprites. Otherwise, the program continues as if no BREAK had occurred.

**Contractions\*** Identify and work with contractions. Requires Extended BASIC cartridge; disk or cassette. Micro-Ed, Inc.

**Control Bus** The set of control lines that carry the necessary synchronization and control information throughout the system. Examples of signals carried

on these lines are: Read or Write, Interrupt, Hold, and Acknowledge.

**Control Characters** Characters having specific system-dependent meanings.

**Control Characters** To set the TI Impact or Epson MX-80 printer's print size, strike method, or number of lines per inch down the page, you must send control codes to the printer.

To reverse the non-standard type size in effect and return to the default, normal 10 character per inch print size and 6 lines per inch, use the ASCII codes in the following table:

Type Format	Turn On	Turn Off
Compressed Print	143	146
Double Width	142	148
Emphasized	155,197	155,198
Double Strike	155,199	155,200
8 Lines/Inch	155,48	155,50
6 Lines/Inch*	155,50	155,50
72/n Lines/Inch#	155,193, n,155,50	155,193,12, 155,50

\* Standard 12 dots per line ( $72/12 = 6$  Lines/Inch). Set when printer is initialized or powered on. Not effective after use of 155,193,n to redefine result.

# This resets the definition of "Standard." See Type Formats for a full explanation and examples of type formats and line spacings.

**Control Keys** Most of the control keys on the keyboard are defined by the program currently executing, rather than by the 99/4A's hardware. CALL KEY is used with the control keys in TI BASIC and XBASIC to return different values to the pro-

gram. The control keys may also be used in various ways by different applications programs. The following is a list of control key codes and related information.

CONTROL KEY CODES				
Codes			Press	Comments
BASIC Mode	Pascal Mode	Mnemonic Code		
129	1	SOH	CONTROL A	Start of heading
130	2	STX	CONTROL B	Start of text
131	3	ETX	CONTROL C	End of text
132	4	EOT	CONTROL D	End of transmission
133	5	ENQ	CONTROL E	Enquiry
134	6	ACK	CONTROL F	Acknowledge
135	7	BEL	CONTROL G	Bell
136	8	BS	CONTROL H	Backspace

Codes			Press	Comments
BASIC Mode	Pascal Mode	Mnemonic Code		
137	9	HT	CONTROL I	Horizontal tabulation
138	10	LF	CONTROL J	Line feed
139	11	VT	CONTROL K	Vertical tabulation
140	12	FF	CONTROL L	Form feed
141	13	CR	CONTROL M	Carriage return
142	14	SO	CONTROL N	Shift out
143	15	SI	CONTROL O	Shift in
144	16	DLE	CONTROL P	Data link escape
145	17	DC1	CONTROL Q	Device control 1(X-ON)
146	18	DC2	CONTROL R	Device control 2
147	19	DC3	CONTROL S	Device control 3(X-OFF)
148	20	DC4	CONTROL T	Device control 4
149	21	NAK	CONTROL U	Negative acknowledge
150	22	SYN	CONTROL V	Synchronous idle
151	23	ETB	CONTROL W	End of transmission block
152	24	CAN	CONTROL X	Cancel
153	25	EM	CONTROL Y	End of medium
154	26	SUB	CONTROL Z	Substitute
155	27	ESC	CONTROL .	Escape
156	28	FS	CONTROL ;	File separator
157	29	GS	CONTROL =	Group separator
158	30	RS	CONTROL 8	Record separator
159	31	US	CONTROL 9	Unit separator

**Control Unit** The module which fetches and decodes instructions. The CU generates control signals and manages the control bus. Requires instruction register and a program counter.

**Controller** A circuit board or boards with complex circuitry that interface a peripheral and the computer to maintain device control.

**Convert Number to String** BASIC. See STR\$.

**Copy—Backup Diskettes** See Backup Copy of a Diskette.

**Corner Bound\*** Direct long, thin snakes into certain points on the screen. Disk or cassette. Micro-computers Corporation.

**COS** BASIC Function. COS returns the trigonometric cosine function of x. The format is:

<variable> = COS<x>

<x> is the angle whose cosine is to be calculated. The value of x must be in radians. To convert degrees to radians, multiply the degrees by pi/180, where pi = 3.141593. The calculation of COS(x) is performed in single precision.

**Count Adventure Database\*** Wake up in Transylvania without knowing who you are or how you got there. Requires the Adventure cartridge; disk or cassette. Texas Instruments.

**Count'Em\*** Teach your child to count by watching the rabbits. Disk or cassette. Micro-Ed.

**Counter** Binary counter.

**Counting With Coins\*** Use this program to teach children the values of U.S., Canadian, or Mexican currency. For children aged 4-7. Cassette. Maple Leaf Micro Ware.

**Country Roads\*** Go for a wild ride in the country. Requires joystick. Graphic Software.

**Course Designer Authoring System\*** A series of programs for non-programming trainers which use Extended BASIC to develop interactive video lessons. Includes prompts and interactive menus to guide the training specialist through the computer system. These programs make it easy to enter text and questions, describe branching instructions, and define video segments. Texas Instruments.

**Course Manager\*** For teachers to track students' progress in specific programs and correlate goals for third through eighth grades. For use with the Scott, Foresman mathematics program. Requires dual disk drive, RS-232 interface, and printer. Scott, Foresman and Co.

**Cow/Calf Enterprise Analysis\*** An analysis report is created for net profit by keeping records of various costs that are calculated. Disk. Computech Distributing.

**CP/M** Control Program for Microcomputers. Single-user operating system created by Digital Research for 8080, Z80, and 8085-based microcomputers. A huge selection of software is available for CP/M. However, CP/M is not available for the TI-99/4 and /4A.

**CPS** Characters Per Second or Cycles Per Second.

**CPU** Central Processing Unit. The computer device that fetches, decodes, and executes instructions; contains a control unit, an ALU, and other related facilities with registers, clocks, or drivers. The TI-99/4 and /4A use the TMS 9900 CPU chip.

**CR** Carriage Return. 13 decimal or OD base 16; or Command Register; or Card Reader.

**Craps\*** Play blackjack and keep players betting while the stakes are high. Extended BASIC cartridge. Cassette. Hall Software.

**Crash** When the system becomes inoperative due to a hardware or software malfunction. A head crash is an accidental impact of the read/write head upon the diskette surface.

**CRC** Cyclic Redundancy Check. A binary polynomial used to check information on blocks of data. Single-bit errors are detected when used with a Longitudinal Redundancy Check (LRC), all two-bit errors are detected and all one-bit errors cor-

rected. The two check sums (CRC and LRC) are calculated based on the data and appended to it. When the data is received or reread, the CRC and LRC are recalculated and compared to the earlier CRC and LRC. Any difference indicates that a bit has changed. The CRC and LRC act like parity bits, except that they work on a whole block of data rather than one byte.

**Creative Computing** Computer Magazine. A number of popular magazines contain useful information concerning the TI-99 /4A and available hardware and software. Most computer stores and larger bookstores carry a good assortment of such magazines.

Creative Computing

P. O. Box 789-M

Morristown, NJ 07960

U. S. = 1 year \$20/12 issues

**Cribbage\*** The computer is your opponent and scrupulously honest scorekeeper in this highly graphic game. Cassette. Sunshine Software.

**Cribbage\*** An advanced version of this famous 2 player card game. Includes fine graphics and documentation. Disk or cassette. Prometheus Software.

**Crime and Punishment\*** You're the judge in over 1,000 unique cases involving murder, robbery, embezzlement, burglary, and more. Decide on a sentence and then compare it to actual sentences handed down in real cases by real judges. Decision-Making Systems Ltd.

**CROM** Control Read Only Memory.

**Cross Country Car Rally\*** A fast action road race game by Norton Software.

**Crosses\*** Capture cross shaped sections of the game board by placing your marker on the center piece of the cross. The chain reactions generated are similar to those in Othello. For two players. Requires cassette. Not-Polyoptics.

**Crosstalk** Two signals interfering with one another.

**Crossums\*** Teaches addition and multiplication. Requires Extended BASIC cartridge. Disk or cassette. Oak Tree Systems.

**Crossword Challenge\*** A word game based on crossword puzzles, with color graphics and automatic scorekeeping. Cassette. PRP Computergraphics.

**CRT** Cathode Ray Tube. Some terminals use a CRT to display characters or pictures. Also called a monitor, screen, terminal, etc.

**CRTC** CRT Controller. A chip or circuit which provides necessary control signals to interface a CRT to the I/O bus of an MPU.

**CRU** Communications register unit. 4K bits (512 bytes) of bit-addressed memory used to control or monitor I/O devices. Has own address space, (ranging from 0-4K, addressed by bits rather than bytes),

totally separate from the normal 0-64K, byte-addressed RAM/ROM memory of the TI-99. The CRU memory is mapped into I/O devices as follows:

<b>CRU Address</b>	<b>Pin</b>	<b>Function</b>
>0000	—	Control
>0002	17	External
>0004	18	VDP vertical synchronization
>0006	9	Clock interrupt, keyboard enter line, and joystick fire
>0008	8	Keyboard 1 line and joystick left
>000A	7	Keyboard p line and joystick right
>000C	6	Keyboard 0 line and joystick down
>000E	34	Keyboard shift line and joystick up
>0010	33	Keyboard space line
>0012	32	Keyboard q line
>0014	31	Keyboard l line
>0016	30	Not used
>0018	29	Reserved
>001A—>001E	28,27,23	Not used
>0020	38	Reserved
>0022	37	Reserved
>0024	26	Bit 2 of keyboard select
>0026	22	Bit 1 of keyboard select
>0028	21	Bit 0 of keyboard select
>002A	20	Alpha lock on the TI-99/4A
>002C	19	Cassette control 1
>002E	23	Cassette control 2
>0030	27	Audio gate
>0032	28	Magnetic tape output
>0036	30	Magnetic tape input
>0038—>003E	31—34	Not used

<b>CRU Addresses</b>	<b>A3</b>	<b>A4</b>	<b>A5</b>	<b>A6</b>	<b>A7</b>	<b>Use (Peripheral)</b>	<b>Device Number</b>
>003F—>0FFE	0	X	X	X	X	Internal use	-
>1000—>10FE	1	0	0	0	0	Reserved	0
>1100—>11FE	1	0	0	0	1	Disk controller	1
>1200—>12FE	1	0	0	1	0	Reserved	2
>1300—>13FE	1	0	0	1	1	RS-232, ports 1 and 2	3
>1400—>14FE	1	0	1	0	0	Reserved	4
>1500—>15FE	1	0	1	0	1	RS-232, port 3 and 4	5
>1600—>16FE	1	0	1	1	0	Reserved	6
>1700—>17FE	1	1	0	0	0	Reserved	7
>1800—>18FE	1	1	0	0	0	Thermal Printer	8
>1900—>19FE	1	1	0	0	1	Future expansion	9
>1A00—>1AFE	1	1	0	1	0	Future expansion	10
>1B00—>1BFE	1	1	0	1	1	Future expansion	11
>1C00—>1CFE	1	1	1	0	0	Future expansion	12
>1D00—>1DFE	1	1	1	1	0	Future expansion	13
>1E00—>1EFE	1	1	1	1	0	Future expansion	14
>1F00—>1FFE	1	1	1	1	1	P-Code peripheral	15

## CRU • Cycle Stealing

2K of RAM from >4000 to >6000 is mapped to each peripheral device's service routine ROMs. This 2K is shared by all devices on a one-at-a-time bank switch basis controlled by the CRU bits for each device. Selected devices are also memory mapped in RAM from >8000 to >9C02 as follows:

Addresses	Use
8000	Internal RAM (8300-83FF)
8400	Sound
8800	VDP Read Data
8802	VDP Read Status
8C00	VDP Write Data
8C02	VDP Write Address
9000	Speech Read
9400	Speech Write
9800	CROM Read Data
9802	CROM Read Address
9C00	CROM Write Data
9C02	CROM Write Address

**CRU** Communications Register Unit. The TI 9900's bit addressable I/O interface. It accepts commands from the TI 9900 or ROM located in peripherals and is I/O mapped to the in and out ports of the peripherals.

**Cryptogrammer, The\*** A word code game for learning words and logic. Disk. Requires Extended BASIC cartridge; Prometheus Software.

**Crystal** Quartz crystal that issues piezoelectric vibrations of extremely accurate frequency for clock timing.

**CS** Chip Select or Code Segment.

**CT 160 Color Monitor\*** A composite, dual mode, 10" color monitor. Operates as a full-color display for graphics and video games, or as a monochrome display for data. Panasonic.

**CTS** Clear to Send. Control signal from the modem to the terminal stating the data may be sent because the carrier is present. RS-232C is the standard carrier.

**Cube, The\*** Full-color video version of the Rubik's Cube. The program stores up to 30 moves in memory or on tape. Features automatic cube scrambling, viewing of the reverse, invisible side of the cube on call, and full documentation. Linear Aesthetics Systems.

**Cursor** The cursor is the flashing block or square which appears on the screen that tells you where you are on the screen. The cursor moves to the right as you type and backs to the left when you press Left Arrow (FCTNS)(99/4-SHIFTS). Left Arrow does not erase the characters from the screen as the cursor moves left.

The cursor's location on the screen is also controlled by some programs by the following commands: Home, End, Right Arrow, Up Arrow, Down Arrow, and other keys. In many situations, you must first place the cursor at the correct location and then enter certain characters for the desired outcome. Example: To change a line of a BASIC program, move the cursor to where the change is required. Retype, delete, or insert as needed. Press Enter to insert the changed line into the program.

**Cursor, Move Left One Space** Press FCTN S (99/4-SHIFT S). This only moves the cursor, it does not erase data on the screen.

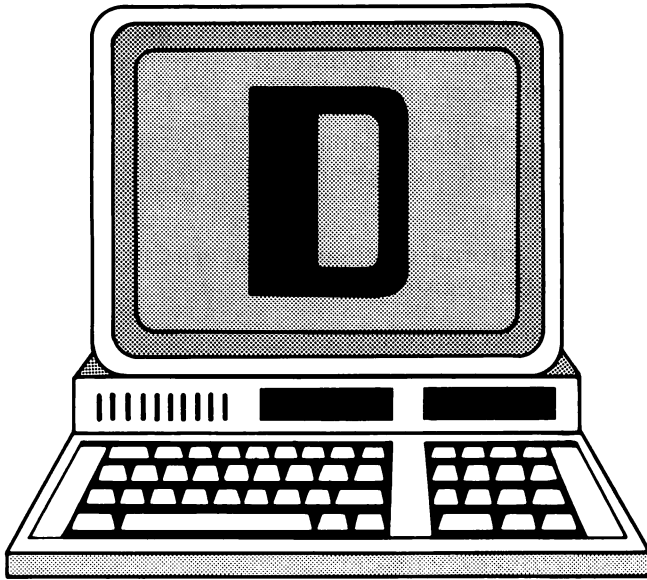
**Cursor, Move Right One Space** Press FCTN S (99/4-SHIFT-S). This only moves the cursor, it does not erase data on the screen.

**Curve Fitter\*** Contains subroutines that fit smooth curves to experimental data expressed as independent variables (straight line, power, logarithmic, exponential, and polynomial curves). Disk or cassette. Eastbench Software.

**Custom IC** Integrated Circuit built to the customer's specifications.

**Cycle Time** The time it takes for a device to complete one internal cycle before becoming available again. The TI has a bus cycle time of four 210 nanosecond clocks = 810 ns. The I/O cycle time is 5 clocks or 105 ns.

**Cycle-Stealing** Another processor gains access to a microprocessor bus for one cycle. The second processor may be an internal subsidiary processor as in DMA.



**D** Codes. ASCII 68, Hex 44. d-ASCII 100, Hex 64.

**D** Data line, or the hexadecimal symbol for the decimal number 13: D base 16 = 13 base 10 = 15 base 8 = 1101 base 2.

**D Flip-Flop** A flip-flop circuit with a delayed reaction. The output is determined by previous input.

**D/A** Digital to Analog. Conversion from the digital readout to the analog signals used to drive speakers, motors, etc.

**DAA** Data Access Arrangement.

**DAC** Digital to Analog Converter. Converts digital signals (such as a computer's I/O bus) to analog signals which could control an external device through differing voltage levels.

**Dairy Program\*** Calculate due dates, birth dates, breeding records, information records, and inventories. Includes ten farm management practices. Requires printer and Extended BASIC cartridge; disk. Computech Distributing.

**Daisy Chain** A method for establishing priorities for interrupts. Units capable of interrupting the system can transfer control of a processor, and acknowledge or block a signal. The highest priority is given to the unit electrically closest to the processor.

**Daisy-Wheel Printer** An impact printer with a radially-spoked wheel that produces letter-quality type. See Printers.

**Dan's Van (Short "A")\*** The first in a series for teaching vowel sounds, spelling, and comprehen-

sion skills. Features music, sound, and graphics. Disk or cassette. Computer-Ed.

**Darker Printing** Double Strike Printing causes the dot matrix printer to reprint every character with a slight shift down on the page. The reprinted dots fill in the vertical spaces between the original dots creating a darker, more solid character.

To turn on double strike, enter BASIC statement:

```
PRINT #<n> CHR$(155);CHR$(199)
```

To turn off this mode and return to normal, single strike printing, enter BASIC statement:

```
PRINT #<n> CHR$(155);CHR$(200)
```

See also Type Formats.

**DAS** Data Acquisition System.

**DATA** BASIC Statement. DATA is a nonexecutable statement used in conjunction with the READ statement. It stores the numeric and string constants that are accessed by the program's READ statement(s). The format is:

```
DATA <constant>[,constant]...
```

<constant> is a numeric or string constant. String constants in DATA statements need not be surrounded by quotation marks, unless the string contains commas, colons, or leading or trailing blanks. If you want to enclose a string constant in quotes, use two sets of quotes in the data statement. (Each pair of quotes (") will appear on screen as one quote (') mark.) For example:

```
100 DATA " " "This will have quotes on screen." " "
```

will appear as

```
"This will have quotes on screen."
```

DATA statements are nonexecutable. They can be placed anywhere in a program. A DATA statement may contain as many constants as will fit on a line, and any number of DATA statements may be used in a program. The READ statements access the DATA statements in line number order. The information in a group of DATA statements can be thought of as one continuous list of items, regardless of the number of items on one line.

If the variable type is defined in the READ statement as numeric, the corresponding constant in the DATA statement must be numeric as well. If the variable type in the READ statement is defined as string, the corresponding constant in the DATA statement must be string. See READ.

DATA statements can be "reread" by using the RESTORE statement. See RESTORE.

**Data Acquisition** The collection of data from external sensors, usually in analog form.

**Data Analyzer\*** Helps school administrators analyze data for several organizational levels. Dual disk drive and printer required. Scott, Foresman and Co.

**Data Communications Multiplexer** Allows several communications processes (or “conversations”) to operate concurrently over a single channel (such as one phone line). This can work through time-division multiplexing, which oscillates the channel rapidly from one conversation to another, and frequency-division multiplexing, which uses shifts around two different frequencies to simultaneously transmit two different conversations.

**Data File** A data file contains information that some programs use to solve a particular information processing problem. Different from program file, which contains program instructions specifying how data is to be processed.

**Data Link Escape** An escape character used to introduce control information in a data system.

**Data Rescue\*** A space game with special effects and multiple screens. Extended BASIC and joysticks. Kuhl Software.

**Data Security** Insuring that data (or programs) cannot be altered improperly. In an accounts receivable system, for example, steps must be taken to insure that clients cannot alter their invoices. Data security guarantees data integrity and data secrecy or privacy.

**Data Separator** A circuit in the disk drive that separates the data from the carrier in the signals read from the diskette surface.

**Data Set** A file or group of related data elements.

**Data Types** A specific interpretation applied to binary data, such as integer, real, character, etc.

**Database** A systematic organization of data files for central access, retrieval, and update.

**Database Management Software** See Business Data Base, Name-it.

**Databits** TI BASIC allows the setting of databits in the OPEN statement. The format is:

OPEN #<n>: “RS-232.DA=8”

<n> is the file number.

The default value for the number of databits is 7. The optional value is 8.

**Data-Transfer Rate** The rate of data-transfer from one place to another, such as from disk to memory or from memory to memory.

**DAV** Data AVailable. One of the 5 status bits of a standard UART. It becomes true when a character has been received. See PE, OR, TBMT.

**DBMS** DataBase Management System. Provides for systematic storage and retrieval of data from a database.

**D-Bus** Internal destination bus in a CPU, from the ALU to the registers.

**DC** Direct Current.

**DC Motor** Designed to operate with a direct current power source, often used in variable speed applications.

**DCE** Data Communications Equipment. Equipment used to interface with a data communications network; usually, a modem.

**DCM** Data Communication Multiplexer. A device which allows several communications processors (or “conversations”) to operate concurrently over a single channel (such as one phone line). This can work through: 1) time-division multiplexing, which oscillates the channel rapidly from one conversation to another; 2) frequency-division multiplexing, which uses shifts around two different frequencies to simultaneously transmit two different conversations; or 3) other, more complex, methods.

**DCO** Digitally Controlled Oscillator. An oscillator using a digital circuit to control frequency, rather than the analog circuit used by normal oscillators.

**Deadlock** When two processes wait indefinitely for each other.

**Death Drones\*** Alien drones are attacking the nuclear reactors of your city. Stop them before they reduce the city to rubble. Moonbeam Software.

**Debouncing** Eliminating the signal fluctuations accompanying a change of state in mechanical switches. Mechanical springs bounce repeatedly until the contact is finally opened or closed. Typical debounce time is 5 to 10 milliseconds for stable contact. Debouncing may be performed by hardware (latch) or software (delay).

**Debug or Test a Program** A programmer must insure that a program correctly processes all types of data for which it is intended. Data samples are prepared and the program is executed. The program's outputs are then verified per specifications. An error in the processing logic of a program is called a “bug,” hence the terms “debug” and “bug-free.”



**Debugging** Troubleshooting and eliminating mistakes or errors in a program.

**DEC** Digital Equipment Corporation. Manufacturers of the PDP family of computers.

**Decade Counter** A counter which advances in increments of ten.

**Decimals\*** A learning aid for practice in decimal usage. For grades 5 through 8. Cartridge. Texas Instruments/Milliken Publishing Co.

**Decimals 1\*** Provides practice exercises for adding and subtracting with decimals. For grades 3 through 5. Features sound and color graphics. Cartridge. Scott, Foresman and Co.

**Decimals 2\*** Learn to multiply decimals. For grades 5 through 7. Cartridge. Scott, Foresman and Co.

**Decode\*** Reads display-formatted disk files that have been saved with the Terminal Emulator II cartridge. If lower case characters are saved on the file, they are displayed on the screen. Extended BASIC required. Disk or cassette. Eastbench Software.

**Decode Cycle** The second cycle of the fetch-decode-execute sequence of instruction execution. The instruction, contained in the IR (Instruction Register), decoded into a sequence of control signals to all the required elements of the system, such as the register gates, ALU functions, or external devices.

**Decoder\*** Using this decoder program, view the original Assembler on which your Machine Code is based. C.A. Root.

**Decoder** A logical unit which decodes two, three, four, or more inputs into mutually exclusive outputs. A 3-bit decoder will have 8 outputs because a 3-bit number can have 8 possible values.

**De-Cypher\*** As you try to decipher one of fifty built-in messages, the corresponding letters are changed to reflect each guess. Includes a help feature. Extended Software Company.

**Dedicated Register** A register used exclusively to contain a specific item.

**DEF** BASIC Statement. Defines and names a numeric expression or equation. The format is:

DEF <name>[<arg>]=<expression>

<name> is the name of the function.

<arg> is an argument. It represents a variable name in the function definition that will be replaced with a value when the function is called.

<expression> is the return value of the function, in

numeric or string value, but must match the type that was declared by the <name>.

The function definition is limited to one statement. Arguments <arg> that appear in the function definition only define the function; they do not affect program variables that have the same name. A variable name used in the <expression> does not have to appear in the list of arguments. If it does, the value of the argument is supplied when the function is called. Otherwise, the current value of the variable is used.

The function type determines whether the function returns a numeric or string value. The type of function is declared by <name>, in the same way as variables are declared. If the type of <expression> does not match the function type, a string-number error is displayed.

**Default** See Default Value.

**Default Parameters** The parameter values supplied by a system when no explicit values are provided by a program or a programmer.

**Default Value** A value for a variable or parameter to be supplied by a program in case the value is not specified.

**Defend the Cities II\*** Pilot an airship to protect the cities below from an orbiting alien bomber. Blow up the bombs as they fall and ultimately destroy the bomber. 360 degree rotation, acceleration, and firepower capabilities. Arcade-style color graphics and sound. Intersoft.

**Del** Pronounced "dell." DELETE character. In ASCII a 7F base 16.

**DELETE** BASIC Command. Erases a file or program from a diskette. The format is:

DELETE "<dvc>.<filename>"

or

DELETE "<dvc>.<program name>"

<dvc> is an external device, such as "DSK1," "DSK2," etc. DELETE cannot be used with cassettes.

<filename> is the name of the data file you want erased.

<program name> is the name of the program you want erased.

Data files can also be deleted when using the CLOSE statement. See CLOSE.

**Delete Character** BASIC. Pressing FCNT 1 (99/4—SHIFT F) will delete the character above the cursor.

**Delimiter** A character which indicates the end of a sequence of characters. A space is the common delimiter in English to indicate the end of a word.

**DELSPRITE** XBASIC Subprogram. CALL DELSPRITE erases sprites from the screen and the computer's memory. The format is:

CALL DELSPRITE (#<x>[,#...])

or

CALL DELSPRITE (ALL)

<x> is the number or numbers of the sprites you want to erase.

(ALL) erases every sprite defined up to that point in the program.

The only way to recreate a sprite after using CALL DELSPRITE is to redefine it using CALL SPRITE.

**Demand Paging** A dynamic memory management technique which loads disk-resident pages into memory in response to "page faults," i.e., references by programs already in memory to data or instructions contained in those pages.

**Demolition Division\*** This educational cartridge provides practice with division problems for the numbers 0 through 9. Your only ammunition against the enemy is the correct answers to the division problem provided. A fast, exciting, and colorful way to strengthen division skills. Texas Instruments.

**Demonstration\*** Familiarize yourself with the TI-99. An easy demonstration of its many uses for the home or office. Texas Instruments.

**Demultiplexer** A logical circuit for routing digital signals from one source to multiple destinations.

**Depreciation\*** An easy way to figure the depreciation of items. Printer recommended; disk. Data Systems.

**Depreciation Schedule\*** Calculate monthly depreciation, using straight-line, double declining balance, sum of the years digits, and 50 percent declining balance. Features automatic switch to singleline from double declining balance. Requires printer and Extended BASIC Cartridge; disk or cassette. Joe D. Fain.

**Derivation of a Function\*** Computes the derivative of an inputted polynomial function. Disk or cassette. Data Systems.

**Descenders** The parts of printed or displayed characters that extend below the baseline—the line the print rests on.

**Destination Earth\*** Command a starship out to prevent aliens from spying on earth. Requires Extended BASIC Cartridge; cassette. Western Properties Investment Company.

**Development System** A system with the capabilities required for efficient hardware and software application development for a given microprocessor. Such a system typically includes a microcomputer, monitor, printer, mass-storage (often diskettes or hard disk), PROM programmer, and an in-circuit emulator. Software is often developed on a system totally different from the system it will run on, either because the target system does not have enough memory or other resources to support development, or because the system is not yet available. See Pascal Development System.

**Development Tools** Hardware and software aids used in developing programs and/or hardware systems.

**Device Names** Names which may be used in place of a file name in many DOS or BASIC commands to specify that data is to come from or go to a device (keyboard, CRT, printer, etc.), rather than a diskette or cassette file.

**Devices and Ports** A port is an address providing a connection between the computer's internal processor and an external device. Ports are used to attach input and output devices. The TI has 4K bits (512 bytes) of bit-addressable CRU (Communications Register Unit) memory into which the I/O units are mapped. The CRU has its own bit-oriented address space, totally separate from the register RAM/ROM 64K address space. See CRU.

**Devil Craze\*** A game apt to confuse even the most advanced players. Requires Extended BASIC Cartridge; cassette. Maple Leaf Micro Ware.

**Diablo** A Xerox-owned company, manufacturer of computer peripherals and computer systems. A supplier of daisy wheel printers.

**Diagnostics** A set of routines used to diagnose system malfunctions and/or run standard performance tests.

**Dictionary Guide Words** A six lesson dictionary simulation program using the guide words that appear at the top of each dictionary page. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Die/Dice** Circuit elements built of small rectangular pieces of silicon on a wafer. Each wafer has several dozen to hundreds of rectangles—dice. Once mounted in a package, they are called a chip.

**Differential Equation Solver\*** Solves first and second order differential equations. Disk or cassette. East-bench Software.

**Digital** Having discrete states. Digital logic may have from two to sixteen states. Most logic is binary logic, with two states, on or off.

**Digital Analyzers** Troubleshooting tools which allow the user to locate timing or logic errors.

**Digitizer** Converts analog information to its digital equivalent. Often used for obtaining input from a plotting surface and providing coordinates as output, such as a graphics tablet.

**DIM** BASIC Statement. DIM is used to reserve space in computer memory for numeric and string arrays. The format is:

DIM name (<int a>[,<int b>][,<int c>])

<name> is the array name. It can be any variable name.

<int> is a number that tells the computer how much space to reserve for each dimension of an array. The number of integers, separated by commas, tells the computer how many dimensions the array will have. TI BASIC allows up to three dimensional arrays.

More than one array may be placed on a DIM statement line, although an array can be created without the DIM statement, the maximum value for a subscript not defined in a DIM statement is 10. Because 0 is a usable, subscript number, this would reserve 11 spaces in the computer's memory.

Here are some examples of the DIM statement:

100 DIM X(50)  
100 DIM X\$(2,13),Y\$(3,15)  
100 DIM WO\$(5,5,5)

Extended BASIC allows up to seven dimensional arrays.

See also OPTION BASE.

**Diode** Allows current to flow in only one direction.

**DIP** Pronounced "dip." Dual In-line Package. A standard IC (Integrated Circuit) package with two rows of pins 0.1 inch apart.

**Dip Switches** A collection of small switches on a DIP, used to select options on a circuit board without modifying the hardware.

**Direct Addressing** Or short addressing. Allows short instructions with the address field limited to 8 rather than 16 bits.

**Direct Writer II\*** Features: "live" editing; auto-centering; right justify and left margin; displayed and storable tab markers; and underlining. Also allows for mixed text sizes on many dot matrix printers. Dynamic Data & Devices.

**Direction And Distance\*** Distance relationships and the points on a compass are taught in this game-structured drill. Disk or cassette. Micro-Ed.

**Directory** The table of contents of a file system which allows convenient access to specific files.

**Discrete Distributions Package\*** Calculates the distributions, binomial and Poisson, of a function. Disk. Data Systems.

**Disk** A flat, circular, magnetic storage medium that rotates while in use.

**Disk Controller Card** A printed circuit board that interfaces disk storage drives to the CPU of a computer.

**Disk Drive\*** This single-sided dual-density disk drive inserts directly into your Peripheral Expansion Box and you're ready to store. Texas Instruments.

**Disk Drive Controller Card\*** Up to three TI Disk Drives can be connected to your Home Computer with this card. Just plug it into the Peripheral Expansion Box and you're to store. Texas Instruments.

**Disk File** A file on a disk. Also refers to the complete disk drive.

**Disk Master\*** A software utility that catalogues your disks. Eastbench Software Products.

**Disk Memory System\*** Consists of the TI Disk Controller Card, the Disk Manager Cartridge, and from 1 to 3 Disk Drives. This system can store up to 90,000 information characters. Disk utilities and file maintenance commands are supplied with the Disk Manager Cartridge. Texas Instruments.

**Disk Operating System** DOS. Provides a method of operation for one or more disk drives with the TI 99/4 and /4A computers. The programming that makes up DOS is located in ROM in three places: 1) resident in the console (such commands as OLD and SAVE); 2) in the Disk Manager Cartridge (commands that allow diskette initialization, renaming of files, naming of diskettes, backup of diskettes, etc.), and 3) in Extended BASIC (additional commands including MERGE, RUN " ", PROTECTED etc.)

For more information on specific commands or processes, refer to individual listings elsewhere in this encyclopedia.

**Diskette** Or floppy disk. A flat circular sheet of mylar substrate coated with a magnetic oxide, rotating inside a protective jacket which continuously cleans the surface.

**Diskette Drive** The machine attached to the computer which turns the diskette, transferring data from the diskette to the computer and vice versa. The diskette is the removable media, about the size of a square greeting card.

**Diskette Formats** TI disk drives are single-sided, single-density, and soft sector. Each disk holds 96K of formatted data. Later model disk controller cards and the Disk Manager 2 Cartridge support the use of double-sided, single-density drives, holding 192K of formatted data. Third party manufacturers make double-sided drives that fit into the peripheral expansion box. TI does not market a double-sided drive.

**Diskette, Backup** The Disk Manager Cartridge command. BACKUP DISK makes an exact BACKUP copy of a diskette. The copy can be selective, allowing transfer of only certain files on the diskette; or non-selective, transferring all files to another diskette. Insert the Disk Manager (or Disk Manager 2) Cartridge and if you have dual-drives, choose:

2 DISK MANAGER

If you have only one disk drive, choose:

4 SET ALL COMMANDS FOR SINGLE DISK  
PROCESSING

and press ENTER. The message:

SINGLE DISK PROCESSING HAS BEEN INITIALIZED  
will appear on the screen. Now choose:

2 DISK COMMANDS

and press ENTER. Then choose

2 BACKUP DISK

and press ENTER. The message

SELECTIVE (Y/N)?

will appear. To make a complete copy of the entire diskette, simply press ENTER. (N is the default.) If you need backup copies of only certain files from the source diskette, type in a "Y" and press ENTER. In either case, instructions will appear at the bottom of the screen:

LOAD COPY DISK

PRESS: PROC'D, REDO BEGIN, or BACK

Load the disk that will hold the backup, and press FCTN 6 (PROC'D)(99/4 —SHIFT V). You will then be asked if you need the copy disk to be initialized. Make your choice and press ENTER. Follow the directions for initialization. The next instruction that appears is:

LOAD MASTER DISK

Remove the copy disk, insert the master disk, and press FCTN 6 (PROC'D).

Put an adhesive tab over the write-protect notch in

the source (master) disk. This insures against loss of your valuable data. (The rest of the instructions will apply to a non-selective copy.)

A file is loaded into the computer from the master diskette. The instruction:

LOAD COPY DISK

appears. From here on, it's a matter of trading diskettes in the disk drive, and pressing FCTN 6 (PROC'D). After all the files have been backed up to the copy diskette, the messages:

COMMAND COMPLETE

PRESS: PROC'D, REDO, BEGIN, OR BACK

appear on the screen. This signals that the complete diskette (or selected files) has been duplicated.

**Diskette, Data** Used primarily to store data rather than programs. A program diskette primarily stores programs used to process data. Often, a diskette will contain both data and the programs needed to process that data.

**Diskette, Load from** BASIC. Any program that was SAVED on diskette or cassette can be LOADED back into the computer's memory to be modified or run.

For a program named "SAMPLE," enter:

OLD DSK1.SAMPLE

All OLD instructions erase any program lines you have in memory before the OLD. If you want to combine a SAVED program with the one you are writing, use MERGE.

Extended BASIC allows the use of RUN in place of OLD. To automatically begin program execution, enter:

RUN "DSK1.SAMPLE"

(note quotation marks) and the program will LOAD and RUN.

**Diskette, Number of Files on** On each diskette DOS maintains an index of all files. The available space in the directory limits the number of files on a diskette. The maximum number of files allowable on a diskette is 128.

**Diskette, Program** Used primarily to store programs for processing data. A data diskette primarily stores data rather than programs. Often a diskette will contain both data and the programs needed to process that data.

**Diskette, SAVE on** BASIC. To save a program named "SAMPLE" on diskette, enter

SAVE DSK1.SAMPLE

To run the program later on, use the OLD command to copy it from the diskette you saved it on,

back into the TI's memory. See OLD.

The SAVE instruction does not alter your program in memory. If you write a BASIC program, it will be erased unless you SAVE it before you turn off your computer or use the BYE or NEW commands.

**Diskette, Source** The diskette from which information/data is coming. The target diskette is the diskette to which information/data is going.

**Diskette, Target** The diskette to which information/data is going is the target diskette. The source diskette is the diskette from which information/data is coming.

**Diskette, Write-Protected** A diskette is write-protected if it does not have a write-protect notch one inch down on the right side. The notch could be covered with an adhesive tab or missing altogether. This blocks a small spring-loaded switch or a light beam inside the disk drive and is sensed by the disk operating system. You'll get an error message whenever you attempt to alter a file on a write-protected diskette.

You are allowed to use, load, or copy, but you may not change or delete files on a write-protected diskette. These limitations are intended to prevent accidental loss of the only copy of programs or data. In most cases, the procedure is to copy the write-protected diskette onto a notched diskette, then modify the notched diskette. In some cases you may want to remove the adhesive tab from the write-protect notch and change the diskette.

You should put an adhesive tab (supplied with boxes of diskettes) over the write-protect notch of any important diskette you will backup. Then if you accidentally ask for the backup in the wrong direction (from the old diskette to your important diskette), you will get a second chance to make the backup rather than lose your data.

**Diskettes by C. R. C., Wholesale** Mini diskettes offered by the seller of seven major manufacturers of diskettes.

**DISPLAY** X BASIC Statement. DISPLAY is a more flexible version of PRINT. The format is:

```
DISPLAY [[AT(<row>,<column>)]
[BEEP][ERASE ALL][SIZE(<x>)]:<x or z$>[...]
```

AT(<row>,<column>) allows placement of the display field anywhere on the screen. Rows are numbered 1-24, and columns 1-28. Be aware that column 1 corresponds to column 3 in subprograms CALL HCHAR, CALL VCHAR, and CALL GCHAR. BEEP beeps through the monitor's speaker as the data is displayed.

ERASE ALL clears the screen before displaying data. SIZE (<x>) clears the screen for (x) number of characters starting at (row, column). If you don't use the SIZE option, the row is blanked from (row, column) to the end of that row.

All of the options (AT, BEEP, etc.) can be used as necessary in any combination and any order.

<z or z\$>[...] is the variable or variables that you're DISPLAYing.

DISPLAY is also available in TI BASIC using the "Programming Aids I" cassette or diskette. See Programming Aids I.

**Display** An output device which displays graphics and/or alphanumeric characters, such as a CRT or a seven-segment LED.

**DISPLAY...USING** X BASIC Statement. DISPLAY...USING gives you all the options of the DISPLAY statement, with the ability to format the data being DISPLAYed with the USING clause. The format is:  
DISPLAY <options>: USING <x\$> <z or z\$>[...]  
or

DISPLAY <options>: USING <line> <z or z\$>[...]  
<options> are the group of clauses used in the DISPLAY statement (AT, BEEP, SIZE(x), etc.).

<x\$> is a string expression that defines the data's format on the screen. See IMAGE for information about format options.

<line> is the line number in your program containing an IMAGE statement.

<z or z\$> is the variable that you're DISPLAYing and formatting.

DISPLAY...USING is, among other things, very helpful in lining up decimal points in numeric columns, and in rounding to a given decimal.

**DISTANCE** X BASIC Subprogram. CALL DISTANCE is a subprogram built in to Extended BASIC that gives the square of the distance between two sprites, or between a sprite and a pixel location. The format is:

```
CALL DISTANCE (#<sprite A>,<sprite B>,<x>)
or
```

```
CALL DISTANCE
(#<sprite>,<pixel row>,<pixel column>,<X>)
<SPRITE> is the sprite number(s) on which the computer will make a distance calculation. The position of each sprite is considered to be its upper left hand corner.
```

<pixel row>,<pixel column> refers to the row and column of a specific location on the screen. <pixel row> and <pixel column> can be a number from 1 to 256.

<x> is the variable that is assigned to the distance computation.

The distance is computed by finding and squaring the difference between the pixel rows of the sprites. Then the difference between the pixel columns of the sprites (or the sprite and location) is found and squared. If the sum of the two squares is larger than 32767, the computer returns 32767. The distance between sprites (or sprite and location) is the square root of the value.

**District Level System\*** A system for school district administrators including School Mailer\*, Payroll Assistant\*, Personnel Data Recorder\*, Activity Accountant\*, Accounting Assistant\*, Salary Planner\*, and Property Manager\*. Scott, Foresman and Co.

**Division\*** Helps teach division to young students. Disk or cassette. Microcomputers Corporation.

**Division\*** Third through eighth grade students can practice division with multiple skill levels. Cartridge. Milliken Publishing Co. Texas Instruments.

**Division\*** Math exercises that automatically adapt to the user's level of difficulty. Requires the Extended BASIC Cartridge; disk or cassette. W. R. Wilson, Inc.

**Division 1\*** Basic division lessons with color graphics for students in grades three through five. Speech synthesizer is optional. Cartridge. Texas Instruments/Scott, Foresman & Co.

**Division 1\*** Teaches the concept of division while providing division practice. Features animation, color, and graphics. Extra help is provided when performance is low. Designed for children ages eight through ten. Scott, Foresman & Co./Texas Instruments.

**Diyad\*** This do-it-yourself adventure kit helps you create your own adventure games. The package includes an adventure compiling program, a game playing program, and a demonstration desert island game. An optional randomizer makes the games interesting, even to you, their inventor. Welcome Software.

**DLC** Data Link Control. Control characters in data transfer used to initiate and terminate communications as well as for error checking.

**DLE** Data Link Escape. Communications control characters in a data link are distinguished from data characters by the escape character that precedes them.

**DMA** Direct Memory Access. Provides high-speed data transfers between a peripheral and the main

memory. Data is exchanged at maximum memory speed. Several means for accessing the memory are possible. Disconnection of the MPU from the busses requires using a HOLD signal, as well as tristate data and address busses. DMA is performed under the control of a DMAC. The TI-99/4A has multiple bases and address spaces instead of DMA. See CRU.

**DMAC** Direct Memory Access Controller. A device available as a single chip, used to automate DMA transfers. A DMAC is a specialized block-transfer processor which can take bus control away from the MPU and transfer one or more memory words. A typical DMAC can connect to four or eight devices.

**DMM** Digital Multi-Meter. A volt/Ohm meter with digital readout instead of the older needle meter.

**DPM** Digital Panel Meter.

**DO-Loop** A high-level language feature which allows a segment of a program to be executed repeatedly, or until a certain logical or arithmetic condition is fulfilled.

**Doomacastle\*** Explore the rooms of a spooky castle to find valuable treasures. Protect yourself from the castle's evil inhabitants. Disk or cassette. Sunshine Software.

**Doomcastle\*** Bargain for potions and weapons with Cahmi the Magician and then use them to recover the Royal sapphires. Requires Extended BASIC Cartridge. Ehninger Associates.

**Doryt Paraprint 18A\*** This unit eliminates the need for the TI Peripheral Expansion Box and the RS-232 Interface Card. Interfaces between the TI-99/4A and any Parallel Printer, plugging directly into your computer console. Also provides for daisy chained connections to other TI peripherals. Doryt Systems, Inc.

**Doryt 32K Memory\*** Plugs directly into the TI-99/4A, eliminating the need for a TI Peripheral Expansion Box. Fully compatible with all TI software, it allows you to access other peripheral units with daisy chained connections. Doryt Systems, Inc.

**DOS** Pronounced D-O-S or "doss". Disk Operating System. Functions as an operating system with disk as its main secondary storage medium. Usually supplies symbolic files, automatic space allocation, dynamic memory allocation, program relocation and loading, utilities, etc.

**Dot Matrix** A method of forming characters by using small dots, usually in patterns of 5 by 7, or 7 by 9, and, for high-quality characters, patterns of 11 by 13 dots. Applies to displays, printers, and other output devices.

**Dot Matrix Impact Printer\*** Has 80 columns and a parallel interface. Memory Devices.

**Double Precision Arithmetic** Arithmetic operations which double the precision by using twice as many bits to represent numbers.

**Double Strike Type Format** Printer. To set the Printer in double strike mode, enter the BASIC statement:

```
PRINT #<n>: CHR$(155);CHR$(199)
```

To return to normal strike printing, enter the BASIC statement:

```
PRINT #<n>: CHR$(155);CHR$(200)
```

**Double Width Type Format** Printer. To set the printer in double-width mode, enter the BASIC statement:

```
PRINT #<n>:CHR$(142)
```

To return to normal printing, enter the BASIC statement:

```
PRINT #<n>:CHR$(148)
```

**Double-Density** The techniques used to store twice as much data on a magnetic storage medium.

**Double-Density Diskette Format** Tracks that are twice as close together on the diskette. Double-density format is not supported on the TI-99/4 and /4A.

**Double-Sided Disk or Diskette** A disk with both sides used for data storage.

**Dow Editor/Assembler\*** Use TI's Mini Memory Module to learn Assembler, and use the full editing capabilities of this program to work on your programs with all your remarks and symbols visible on screen. Edit, run, change, and re-run programs just as you would in BASIC. John T. Dow.

**Dow-4 Gazelle\*** A real time simulation flight of a 4-place, single-engine, high-performance aircraft. The screen displays will show you the plane's instrument panel as you pilot with your joystick, using the keyboard to control flaps, fuel, etc. Written by an experienced pilot. Includes an extensive instruction manual. John T. Dow.

**Down Arrow** (↓) FCTN X (99/4—Shift X). The down arrow key is used for editing in BASIC. Type in the line number to be edited, and press FCTN X (99/4—Shift X). The line will be displayed on the

screen to be edited. Pressing FCTN X again causes the next lowest line number to be displayed.

**DP** Data Processing.

**D PDT** Double Pole Double Throw switch. A two-polarity switch with two different "on" positions.

**DPSK** Digital Phase Shift Keying. Encoding digital data with phase differences on a carrier. See Phase.

**DPST** Double Pole Single Throw switch.

**Dr. Eliza\*** An artificial intelligence program improved by a psychiatrist to help you express and pinpoint your troubles. Sof-Tex.

**Dr. Nuttier\*** The answer man is here to give you hours of entertainment. Disk. Futura Software.

**Drac Man\*** Evade the ghosts and search for the center of the maze where you can consume the vials of blood hidden there. Then it's Drac Man's turn to chase the ghosts. Fantasia '99 Software.

**Dragon Mix\*** Help the dragon defend your city. Your correct answers to multiplication and division problems enables the dragon to fight the city's enemies. Texas Instruments.

**Draw Poker\*** 5,000 dollars are at stake in this one-player card game that pits you against the computer. Requires Extended BASIC Cartridge. Texas Instruments.

**Draw Shapes\*** Create designs and color schemes by moving a drawing box around the screen. Cassette. Anthistle Systems & Programming, Ltd.

**Drive** Operates a tape transport or a floppy disk, and may include several motors for rotation, head positioning, position sensors, control circuits, lights, and switches.

**Drive, Diskette** A diskette (or disk) drive is the machine attached to the TI-99/4 or /4A which turns the diskette, transferring data from the diskette to the computer and vice versa. The diskette is the removable media, about the size of a square greeting card.

**Drive, Source** The diskette drive from which information/data is coming. The target drive is the diskette drive to which information/data is going.

**Drive, Target** The diskette drive to which information/data is going. The source drive is the diskette drive from which information or data is coming.

**Driver** An amplifier circuit required to reshape the signals on a bus when more than one TTL load is in use.



## Drives • Dynamic Memory Allocation

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**Drives** See Disk Memory System, HEX-BUS Wafer-tape Digital Tape Drive, Shugart, and Winchester.

**Dropping the Final E\*** Practice adding “ing” or “ed” suffixes to beginning words. Disk or cassette. Requires Extended BASIC Cartridge. Micro-Ed, Inc.

**Drum** Rotating magnetic memory similar to disk but using the surface of a cylinder.

**DS** Data Strobe. Enters data into a holding register.

**DSR** Data-Set Ready (RS-232C standard). A line on a modem indicating to the data terminal that the received carrier is normal. See RS-232C, CTS.

**DTE** Data Terminal Equipment. Equipment which receives or originates data, as opposed to Data Communications Equipment, which merely transmits data from one device to another.

**DTR** Data Terminal Ready (RS-232C standard). A line on a terminal indicating to the modem that it is ready to send data. See RS-232C, DSR, CTS.

**Dumb Terminal** A low-cost data terminal, ordinarily a CRT, which does not have editing keys or local processing features.

**Dummy Input Statement** To freeze the screen until the operator is finished, put in a dummy input statement and instruct the operator to press Enter to proceed. The input variable need not be used in your program:

```
1000 INPUT "Press Enter to continue";A$C$
```

To freeze the screen briefly while the operator using your program reads a message, write a delay loop after you print the message:

```
10 FOR Y = 1 TO 2000  
20 NEXT Y
```

**Dummy Variable** A symbol to be replaced later by the actual variable name or literal value.

**Dump** Transfer the contents of one memory device to another. Internal registers may be dumped to memory; memory can be dumped to disk, printer, or screen, etc.

**Duplex** Bi-directional communication method allowing simultaneous data transfers in both directions. May use separate lines or multiplex a single line.

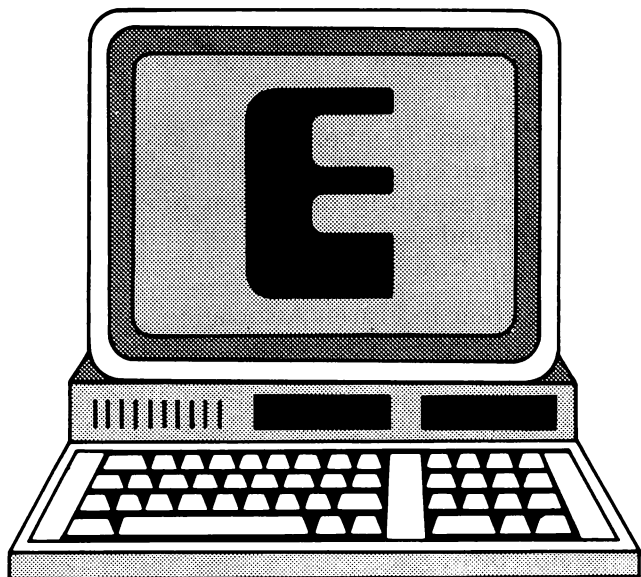
**DUT** Device Under Test

**Dyadic** An operation with two operands, such as addition or multiplication. Differs from monadic operation with one operand, such as negation.

**Dynamic** Usually volatile circuitry which stores information as charges on MOS capacitors. Requires periodic refreshing.

**Dynamic Memory** MOS RAM memory using dynamic circuits. Every bit is stored as a charge on a single MOS transistor, allowing for very high density (only one transistor is used per bit). Since the stored charge leaks, a typical dynamic memory must be refreshed every 2 milliseconds by rewriting its entire contents. This does not slow down the system, but does require additional memory refresh logic. Dynamic memory chips are cheaper than static ones, and are usually preferred for memory sizes over 16K. The TI's RAM memory is dynamic. Dynamic memory is also volatile—the stored data is lost when power is interrupted.

**Dynamic Memory Allocation** Varying allocation of memory to multiple concurrent programs according to their needs. Also a strategy for optimizing performance.



**E** Codes. ASCII 69, HEX 45. e—ASCII 101, HEX 65.

**E** Enable. Also: The hexadecimal symbol for the decimal number 14: E base 16 = 14 base 10 = 16 base 8 = 1110 base 2.

**e** Powers of in BASIC—Natural logarithms. See EXP.

**E-Beams** Electron beams.

**EA** Electronic Arrays.

**Early Learning Fun\*** Teaches children shapes, numbers and letters, and provides an introduction to computer operation. For children ages 3 through 6. Cartridge. Texas Instruments.

**Early Reading\*** Helps teach composition of words. Large letter graphics, sound, and music are used in typing each word. Cassette. Anthistle Systems & Programming, Ltd.

**Early Reading\*** Use color graphics and sound to develop and practice basic reading skills. For pre-school and first grade children. Requires speech synthesizer. Cartridge. Texas Instruments.

**Easydata\*** Sort, select, update, print your records, and create, define, dump, and delete your files. Ayers Computer Products.

**ECHO** Hardware Testing. A loop-back or “Echo” technique is used to test the circuits for an input/output device by “looping” output back into the computer as if it were input. The circuits inside the computer are thereby tested in isolation from the circuits in the external device to help determine where a fault lies.

**Echo** Keyboard to screen. ECHO describes the process of sending characters to the screen for a visual confirmation of what has been typed. There are no hardware connections between the keyboard and the screen. The keyboard simply enters characters into memory. The ROM programs of the TI-99 console DSR further copy the characters from memory to the screen, creating a duplication or “echo” of what was keyed.

**ECL** Emitter Coupled Logic. This is a bipolar transistor-transistor logic (TTL) device using variations in the current, rather than voltage levels, to control bit and gate switching. While as much as ten times faster than other TTL or MOS circuits, ECL-TTL circuits consume more energy and produce more heat.

**ECM** Electronic Counter Measures. Using electronic devices to jam or evade an opponent’s electronic equipment. Used in military and espionage situations.

**Edge Card Conductor** An edge of a printed circuit board which has exposed conductors (“ways”) to form an electrical connection with another board through a slot.

**EDIT** BASIC Command. Used to display a specified line in a program. The format is:

EDIT <line>

<line> is the line number of a line in a program that you want to edit. If the line doesn’t exist, an “Undefined line number” error is displayed.

When the EDIT command is used, the cursor is positioned over the first character of the statement in the line number specified. Changes or corrections may then be made to the line.

**Editor** Simplifies the entry and maintenance of text in a computer system. Typical operations include: insert word/line, delete word/line, append, search for “string,” and substitute. An Editor allows for creation and modification of data. BASIC and other word processors provide editing capability for any line displayed on the screen (full screen editors). Their basic function is to create and change text data such as letters, reports, programs, or books.

**Editor, Text** Specializes in text files, and manipulates ASCII letters and punctuation marks. The BASIC editor and word processing programs are text editors. Their basic function is to create and revise letters, reports, programs or books. See Editor, EDIT.

**Editor Assembler\*** Allows you to program in TMS 9900 Assembly language and utilize the 16-bit microprocessor's rapid processing capability. The Assembly language programs can run alone, or be called as a subroutine by an Extended BASIC program. Direct access is available to all the other functions. Includes two disks and extensive documentation.

**EDP** Electronic Data Processing. Processing data with electronic machines such as adding machines, calculators, and computers.

**Educational Programs\*** Classroom-tested programs for levels K through 6. Subjects include Reading, Language Arts, and Math. Includes follow up games and worksheets. Computer-Ed.

**Educational Reporting/Aids Software** See Advocate Course Authoring System, Building Level System, Class Data Recorder, Classroom Level System, Course Manager, Data Analyzer, District Level System, Educational Programs, Mark Reporter, Micro Grade, Scheduling Assistant, Student Data Recorder, Teachers Tool Box, and Test Scorer.

**Educational Software, Primary Level** See Addition, Addition/Subtraction 1,2,3, Alien Addition, Arithmetic Tutor, Bar Graph, Barnyard Fun, Barrier, Beginning Grammar, Bev the Vet, Big Sid's Ribs, Bullseye Addition-Division-Multiplication-Subtraction, Clock, Compound Words, Computer Math Games, Computer Music Box, Concentration, Contractions, Count'Em, Counting with Coins, Crossums, Dan's Van, Decimals, Demolition Division, Division, Dropping the Final E, Early Learning Fun, Early Reading, Equations, Exploring, Final Consonant Bingo, Grade 1 Math, Gus' Tug, Guess That Word, Happy Math, Hard and Soft C, Hard and Soft G, Higher, Same, Lower, Identifying Complete Sentences, Match 'Em, Mathematics, Metric and Counting, Multiplication, Number, PLATO, Punctuation Series, Reading, Scholastic Spelling, Speak & Math, Speak & Spell, Subtraction, Target Math, Teach, Tod's Cod, Verb, and Word Beginnings.

**Educational Software, Secondary Level** See America, Analogies, Antonym Machine, Arithmetex, Astronomy, Chemtutor, Dictionary Guide Words, Elementary Economics, Elementary Math and Science, Fractional Numbers, Fractions, Haiku Poetry Generator, Higher Math Made Easy, Homonym Machine, Laws of Arithmetic, Learn to Fly, Making an Outline, Matrix Mathematics, MECC Series, More Prefixes, More Suffixes, Morse Code, Natural Science, Plato, Scholastic Spelling, Social Science, Target Math, Trigonometry, Verb, and Word Family Bingo.

**EFL** Emitter-Follower Logic. A transistor circuit in which the base element is common to the output and input circuits.

**Eggbert\*** Bounce Eggbert over the three-D cubes to change their color. Change all the cubes before Eggbert gets caught by his leaping enemies. Features sound and graphics, and is written in Assembly language. C.A. Root.

**EIA** Electronic Industries Association.

**EIA-RS-232C** The EIA standard for serial data transmission interfaces for asynchronous communications. Data is sent in 10-or 11-bit serial bundles. The first bit is called the start bit and signals the beginning of the data. The data bits follow, from least to most significant. Following the last data bit is the stop bit.

**EIA-RS-232C Interface\*** This stand alone card does not require a Peripheral Expansion Box and is guaranteed to be fully compatible with all existing TI hardware and software. This interface supports more software functions than TI's own card, and it has been designed with a "switch selectable device address." The card is "soft coded" to be compatible with all future programming languages and software. A.J. International.

**Electrical Engineering Library\*** A collection of tools for electrical engineers. Includes Smith chart, phase-locked loop, root locus, and filter design. Texas Instruments.

**Electrical Wiring Design, Part II\*** For those who must perform calculations on wiring requirements. Includes voltage drop, current, horsepower, and multiple circuits. Technical Advancement Associates.

**Electron** The primary unit of negative electrical charge, often conceived as a particle circling the nucleus of an atom. The flow of electrons is an electrical current.

**Electron-Beam** A collimated beam (rendered to parallel paths) of electrons used in manufacturing of ICs and in CRT display systems.

**Electronic Disk** Same as RAM Disk (q.v.).

**Elementary Economics\*** Provides business models on managerial economics for third to eighth grade students. Requires Extended BASIC Cartridge: disk. Texas Instruments/Minn. Educational Computing Consortium (MECC).

**Elementary Math and Science\*** A 4-program set that includes math exercises and demonstrations

using food-chain examples. For second through sixth grade students. Requires Extended BASIC Cartridge; disk. Texas instruments/Minn. Educational Computing Consortium (MECC).

**Elephant Floppies\*** A 5 ¼ inch floppy diskette, single-sided, soft sector with hub ring certified 100% error free. Leading Edge Products, Inc.

**ELINT** ELectronic INTelligence.

**Eliza\*** A non-directive psychotherapist which examines statements as they are typed and responds with its own questions or comments. Created at MIT in 1966, Eliza is designed to run on a large mainframe, but, up to this time, has not been available to personal computer users except in stripped-down versions lacking the sophistication of the original program. This new microcomputer version possesses the same range of expression as the original. Artificial Intelligence Data Systems.

**EMI** Electro-Magnetic Interference. Caused by the electrical fields produced by capacitive coupling; by magnetic fields produced by mutual inductance; or by electro-magnetic fields (radio waves).

**Emulation** Simulation in real time. One computer emulates another by executing an emulator program that makes it interpret the same instructions.

**Enable** To make a device ready or available to function. Opposite of disable.

**END** Statement marking the end of a program in several programming languages.

**END** BASIC Statement. Used to terminate program execution and return to command level. The format is:

END

An END statement at the end of a program is not imperative.

**Energy and Security Management\*** This system is designed to help control energy usage involving heat, water heating, and lighting for highest efficiency. Requires dual disk drive and Extended BASIC Cartridge; 32K. RCL Computer.

**Energy Conservation—Residential Housing\*** A money saving cost-study program. Dynamic Data Devices.

**Engineering—Mechanical and Scientific Software**  
See Acceleration, AC Circuit Analysis Library, Active Solar Heating, Complex Mathematics, Derivation of a Function, Differential Equation Solver, Discrete Distributions Package, Electrical Engineer-

ing Library, Electrical Wiring Design, Energy and Security Management, Energy Conservation, Factorial, Fast Fourier Transform, Freefall, Home Brewed Antennas, Hydrocarbon Combustion, Hyperbolic Functions, LOG, Measurement Formulas, Polar to Rectangular Conversion, SMU Electrical Engineering Library, Star Finder, Statistics, Structural Engineering Library, and X-BASIC.

**ENQ** ENQuiry control character.

**Enter Key** Pressing Enter ends the current line, gives the line to the requesting program, and positions the cursor at the start of the next line.

**Environment** The state of all registers, memory and other specific locations in a system. Also used to refer to a software environment such as DOS.

**EOB** End Of Block.

**EOC** End Of Character. Also End Of Conversion for an ADC.

**EOF** BASIC Function. EOF function indicates an End Of File condition. The format is:

<variable> = EOF (<filenum>)

<filenum> is the number specified in the OPEN statement.

The EOF function cannot be used with cassettes, but can be used to tell if the end of a specified file has been reached, and to avoid an error message to be printed. EOF returns 1 (true) if end of file has been reached on the specified file. 0 (zero) is returned if end of file has not been reached. If the diskette is full, -1 is returned indicating that you are at the end of the file, and there is no more room for data.

**EOR** Exclusive OR (XOR). Also Electro-Optical Reconnaissance. Gathering information through electrical and optical surveillance. Used in scientific studies, military, and espionage applications.

**EOT** End Of Transmission.

**EPROM** Pronounced "ee-prom." Erasable Programmable Read-Only Memory. Typically, a PROM which can be erased several times by exposing it for several seconds to hard ultraviolet light. It is then reprogrammed with a special PROM programmer, and will retain its contents for years. A UV-erasable EPROM may be recognized by the quartz window over the chip. Other EPROMs are electrically erasable.

**Epson FX-80\*** A dot matrix impact printer that prints 160 characters-per-second (CPS), each one

within a 9x9 matrix. With 163 user-selectable type styles and seven different graphics modes, it can program-select from 72 dots-per-inch (DPI) to 640 DPI. The available print styles are expanded even further by designing up to 256 new characters defined in a 9x11 matrix and stored in the printer's integral 2K RAM. If you have not designed and stored such characters, you may use this RAM as a 2K data input buffer. Other features of the FX-80 include bidirectional logic seeking printing, a disposable print-head, and optional reverse paper feed. Paper can be friction or tractor fed, with an adjustable pin platen. You can use roll, fan-fold, or sheet paper with this machine. If you are printing forms, there is a function that lets you tear off paper one inch from the last print position. Epson America, Inc.

**Epson Printer** Control Characters with BASIC. To set the TI Impact or Epson MX-80 printer's print size, strike method, or number of lines per inch down the page; the non-standard type format you want must be turned on by sending control codes to the printer. This is an example of printing in a non-standard format: normal size, emphasized, double strike, 6 lines-per-inch.

To return to the default, normal, 10 character-per-inch print size and 6 lines-per-inch, the non-standard type size currently in effect must be reversed. To do this use the ASCII codes in the following table:

Type Format	Turn On	Turn Off
Compressed	143	146
Double Width	142	148
Emphasized	155,197	155,198
Double Strike	155,199	155,200
72/7 Lines/Inch	155,49	155,50
8 Lines/Inch	155,48	155,50
6 Lines/Inch*	155,50	155,50
72/n Lines/Inch#	155,193, n,155,50	155,193,12, 155,50

\* Standard 12 dots-per-line (72/12 = 6 Lines-per-Inch) set when printer is turned on. Not effective after use of 155,193, to redefine result. See below.

# This resets the definition of "Standard."

See Type Formats for full explanation and examples of type formats and line spacings.

**Equation Solver\*** Finds a solution to  $f(x)=0$  in operator specified interval. Disk or cassette. East-bench Software.

**Equations\*** Addition, subtraction, multiplication, and division drills. Twenty-six levels of difficulty for sixth through eighth grade students. Color gra-

phics and sound included. Texas Instruments and the Milliken Publishing Company.

**Erase All Program Lines** BASIC. To start a new program, enter:

NEW

This completely erases all lines in BASIC's memory. If you want to keep them and haven't already stored them on cassette or diskette, SAVE them first. If you don't erase the program in memory before starting another, you'll probably wind up with an unusable combination of mixed lines from your old and new programs.

**Erase Current Line** FCTN 3(Erase)(99/4—Shift) deletes the current line.

**Erase Screen** See CLEAR.

**Erase SPRITES** See DELSPRITE.

**ERR** XBASIC Subprogram. CALL ERR assigns value to the most recent uncleared error. The format is:

CALL ERR (<ec> <et>[,<es> <line>])

<ec> is the variable the computer will assign to the error code.

<et> is the variable the computer will assign to the error type.

<es>,<line> are the optional variables the computer will assign to the error severity and the line number where the error occurred.

For a complete explanation of CALL ERR, refer to Page 86 of the *TI Extended BASIC Manual*, and Appendix N.

**Error** See Error Message.

**Error-Code Number of Last Error** BASIC. See ERR.

**Error Correcting Code** A data storage or transmission code using extra bits to automatically detect and correct single- or multiple-bit errors.

**Error Correction** Methods used to correct erroneous data produced by defective or unreliable data storage and transmission systems.

**Error Message** A statement or code printed out or displayed on the screen by a program to indicate what is happening. Error messages tell you something about what went wrong.

**ESC** ESCape. A character that causes the terminal and/or processor to interpret subsequent characters differently. Escape codes are used to indicate a sequence of control messages in ASCII. For example ASCII 27 is an escape code to the TI/EPSON dot matrix printer to interpret one or more following

bytes as control information rather than data to be printed.

**Escape** Enter ASCII 27 (escape) for printer control in PRINT #<n> statements to set lines per inch, page length, and print size. See Type Formats.

**E.T., The Extra Terrestrial\*** Adventure game inspired by the popular movie of the same name. Reese's pieces not included. Texas Instruments.

**ETB** End of Transmission Block.

**Ethernet** A standard for inter-computer communications networks developed by Xerox Corporation.

**ETX** End of TeXt.

**EUROMICRO** European Association for Micro-processing and Microprogramming.

**Even Parity** A parity bit added to a byte or word that makes the total number of 1 bits even.

**Ewe/Lamb Enterprise Analysis\*** Fixed and variable costs are calculated to produce an Analysis Report to be saved for recall. Disk. Computech Distributing.

**Excess** A variation of BCD which uses binary values of 3 through 12 to represent the decimal integers 0 through 9.

**Execute** To start (run) a program. For a program in memory, Enter:

RUN

Extended BASIC looks for a program on DSK1 named LOAD when XBASIC is first chosen. If found, XBASIC automatically loads it into memory and RUNS it.

**Execute BASIC Program** See RUN, and OLD.

**Execute Cycle** The third of three cycles for program execution, during which the actual operation is performed. See Fetch Cycle, Decode Cycle.

**Execution Time** The time required to execute an instruction, including fetch-decode-execute. Also refers to the point when a program is given control of the CPU, as contrasted with compile time, link time, and load time.

**Exerciser** A test system designed to detect malfunctions in memory, disk, tape, or other devices, prior to shipping to customers, or during a maintenance operation.

**EXP** BASIC Function. EXP (<x>) function calculates the exponential function and returns the mathematical number "e" raised to the x power.

("e" is the base for natural logarithms.) If <x> is greater than 230, an overflow occurs.

**Expense Records\*** A month by month accounting record that produces monthly and annual charts and an accounting review. Cassette. Western Properties Investment Co.

**Exploring\*** Simulates the opening of historical frontiers with emphasis on map reading. Areas covered: Fur Trading, 1770; Traveling the Oregon Trail, 1800's; Governing Ancient Sumeria; Fur Trapping in the 1800's; and Map Reading. For students in grades three through eight. Requires Extended BASIC Cartridge; disk. Texas Instruments and the Minnesota Educational Computing Consortium (MECC).

**Exponential** BASIC. See EXP.

**Extended Baseball\*** Use the joystick to control the pitcher and batter. The batting algorithm is specifically affected by your choice of individual batting averages. Includes multi-base and multi-runner plays. Extended Software Company.

**Extended BASIC\*** A language used for programming with TI-99/4 BASIC that features direct screen accessing, output formatting with "using" clause, IF-THEN-ELSE statements, BASIC sub-programs with arguments, easy control of up to 28 sprites from BASIC, merging of code, protected programs, "ON ERROR" statements, and BOOLEAN functions. Texas Instruments.

**Extended Hangman\*** This version of the classic word game includes 180 words of four to nine letters on three levels of difficulty. Features music, sound, color graphics, and optional speech. Extended Software Company.

**External Device** Port Connections. An address providing a connection between the computer's internal processor and an external device (port). Ports are used to attach input and output devices. See Devices and Ports, CRU.

**External Memory** Any device capable of storing information and allowing it to be retrieved when needed. The TI-99 relies primarily on random access memory (RAM), read-only memory (ROM), diskettes, and cassettes. Memory, by itself, is usually a reference to RAM. This is the erasable and reusable memory located inside the 99/4 and /4A, and optional Memory Expansion.

ROM contains fixed data, such as the BASIC ROMs and ROM BIOS (BASIC Input/Output System). The ROM BIOS contains the Machine language programs to run the various devices attached to the TI

## **External Memory**

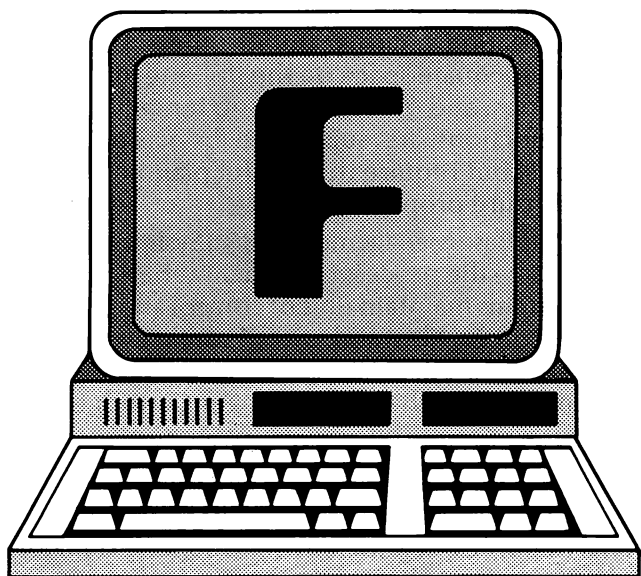
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such as monitor, printer, diskettes, cassettes, etc. ROM and RAM together make up the internal or main memory of the TI, or any other computer.

Contrast this with external memory such as cassette, diskette, and hard disk, which involve mechanical motion to retrieve data and are hundreds or thousands of times slower than internal memory. Data in internal memory is immediately available to programs for processing. Data in external memory must be copied into internal memory (READ or INPUT), processed, then copied back out to external memory (WRITE or OUTPUT).

Data that has been created can be written out to external memory without a READ first. If data read in from external memory has not been modified, there is no need to write it back out since the original copy is still there.

While external memory is very slow compared to internal memory, it also has advantages. External Memory is much cheaper per character. Also, the ability to store external memory data off-line (such as on diskettes or cassettes) allows for unlimited storage of data.



**F** Codes. ASCII 70, HEX 46. f—ASCII 102, HEX 66.

**F** Flag; also Finish in BNPF code; or the hexadecimal symbol for decimal 15—the largest hexadecimal digit: F base 16 = 15 base 10 = 17 base 8 = 1111 base 2.

**Factorial\*** When an integer is entered, the factorial value is displayed. Disk or cassette. Data Systems.

**Fairchild** Major semiconductor manufacturer—the oldest in Silicon Valley (between San Francisco and San Jose, California).

**Fan-Fold Paper** Continuous sheets of paper joined along perforations and folded in a zigzag fashion. Often used with printers because it can be continuously fed and folded without operator assistance.

**Fan-In** An electrical load presented to an output by an input.

**Fan-Out** The electrical load that an output is capable of driving. Usually expressed as the number of inputs that can be driven from a given output signal.

**Farad** The unit of electrical capacitance. A 1-volt-per-second change in voltage across a 1 farad capacitor will require 1 ampere of current flow.

**Fast Fourier Transform\*** Simplifies the calculation of fourier transformation of real or complex data. The results are in complex pairs and in magnitude/angle form. Eastbench Software.

**Fast Fourier Transform** Application of the Cooley-Tukey algorithm to Fourier transforms. Allows faster computation of Fourier transforms with increased storage requirements.

**Fatal Error** A condition occurring during the execution of a program which requires termination of the program.

**Fault-Tolerant** A program or system capable of correct operation even when one or more of its components have failed. Also called error-tolerant or fail-soft.

**FCC** Federal Communications Commission.

**FD** Floppy Disk.

**FDC** Floppy Disk Controller.

**FDM** Frequency Division Multiplexing.

**FE** Framing Error. One of the five status bits of a standard UART. Occurs if the incoming character lacks a valid stop bit. See PE, OR, DAV, TBMT.

**Federal Tax\*** Prepares your Form 1040s and includes schedules. Requires P-code; 32K disk or cassette. Eastbench Software.

**Feedback** One or more outputs of a system, also used as an input in a control loop.

**FET** Pronounced “fett.” Field Effect Transistor. A transistor with an n-type silicon bar for the main conduction path and depletion layering for control.

**Fetch Cycle** The first cycle in the fetch-decode-execute sequence of instruction execution. During the fetch cycle, the contents of the program counter are placed on the address bus, a Read signal is generated, and the Instruction Pointer is incremented. The data bytes arriving from the memory will be gated into the Instruction Register of the Control Unit.

**Fetch-Ahead** See Carry Look Ahead.

**FF** Flip-Flop. Also Form Feed. A control character used with printers to advance the paper so the top of the next sheet of paper is in position for printing.

**FFFF** The hexadecimal representation of the maximum simple address value on 8-bit microcomputers: FFFF base 16 = 65535 base 10 = 177777 base 8 = 1111111111111111 base 2.

**FFT** Fast Fourier Transform. A fast computational algorithm for determining the Fourier curve fit to a collection of data points.

**Field** A logical grouping of data. Could be a group of related characters in a record, a work area in memory, or in the CPU zone within an instruction, such as op code, address, or comment.



**FIFO** Pronounced “fife-oh.” First-In-First-Out structure. Data is added at one end and removed from the other. A FIFO buffer is used to connect two devices operating asynchronously at different speeds. Each device is connected to one end of the FIFO buffer.

**File** A logical grouping of information with an identifying name, and considered as a unit by the user. A file may be divided into records, blocks, or other units as required by the memory.

**File, Data** A file which contains data to be processed by a program. In general, a program file contains some type of program instructions specifying how to process data.

**File, Delete** See DELETE

**File, Erase** BASIC. See DELETE.

**File, Fragmented** See Fragmentation.

**File, Object** A file containing the 9900 Machine language version of a program. The object file is usually a translation of a source program.

**File, Program** A program file contains program instructions specifying how data is to be processed. See Programs; Object Programs; Execute; Command; and BASIC Interpreter.

**File, Program, Protected** Extended BASIC allows a program to be SAVED using the PROTECTED option. The saved program cannot then be LISTed, SAVED, EDITed, or PROTECTED. It is wise to always keep an unprotected backup copy on hand in case the original needs to be altered. The PROTECTED option is available for cassette and disk See SAVE.

**File, Text** A file containing character data, letters, numbers, or special characters.

**File Book\*** Stores up to 120 records, with six items per file, performs complete numerical and alphabetical sorts, and allows you to search and review files, and insert or delete characters as needed. You are also protected from memory errors. Rapid cassette storage; incoming files are visible on the screen as they load. Western Properties Investment Company.

**File Control Block** An area of memory used by a Disk Operating System to keep track of a file's status, including such information as I/O status, current record, physical sector numbers, etc.

**File List\*** Lets you store, maintain and review information in up to 150 categories. For home or office use. Cassette Western Properties Investment Company.

**File Management** Record keeping on disks includes creating records, finding them by name, insuring adequate space on the diskette, maintaining backups, and deleting files no longer needed. These functions are supported by various DOS functions, but require thoughtful planning by the user to insure proper results.

Some Data Base Management (DBM) Systems attempt to automate the process of file maintenance. Some DBM systems maintain files of control and tracking data on other files and disks, and may provide alternatives to DOS functions. DOS functions are implemented by the Disk Manager Cartridge.

**File Management** See Automatic Filer, Code Number/Alphabetic File, EasyData, File-Book, File-List, Filing, Name-It, Personal Record Keeping, Personal Report Generator, Sort, and Super Cataloger.

**File Management System** Designed to format and manage files in a transparent way. The system allows symbolic names and attributes, and manages the physical allocation of storage. Usually part of the Operating System, as in the TI.

**File Separator** A special pattern of bits or frequency which separates one file from another on magnetic media such as tape or disk.

**File Specification** Or Filespec. The complete specification of a file, including file name, drive identifier, and extension.

**File Translator\*** Will read BASIC or LOGO program files and output them to a printer. Requires thermal printer, and P-Code; 32K; Disk or cassette. Eastbench Software.

**Files—Listing Files or Programs on Diskette** See BASIC—Listing of Files or Programs on Diskette.

**Files—Rename** Use the Disk Manager Cartridge to change a file name on the disk. The Disk Manager Cartridge is menu driven, and easy to use. Insert the Disk Manager Cartridge into the console, choose Disk Manager, and when the Main Menu appears choose:

#### 1 FILE COMMANDS

and follow directions displayed on the screen.

When the SCREEN IS COMPLETE statement appears on the screen, press FCTN 6(PROC'D)(99/4—Shift V) to carry out the command.

**Filing\*** An easily adaptable filing system for home or business use. Includes sort and search functions. Prompts and verification are shown on the screen. Printer is recommended; disk. Professional Micro-ware.

**Filing Systems for Diskettes\*** Library cases for disks, flip files, etc. Cases hold 100 disks and filing enclosures for tapes and magazines. C.R.C. Wholesale.

**Final Consonant Bingo 1\*** Combines basic word patterns with the game of bingo. Features music and graphics. Other versions include Final Consonant Bingo 2, Final Consonant Bingo 3, Final Consonant Bingo 4, and Final Consonant Bingo 5. For elementary students. Disk or cassette. Computer-Ed.

**Financial Package\*** Helps the development of loan amortization schedules and planning of retirement account funds and annuities. Cassette. Anthistle Systems and Programming, Ltd.

**Financial Partner\*** For small businesses and home owners for keeping track of cash receipts, accounts payable, and general ledger. Requires 32K; P-Code; disk. The Denver Software Company.

**Financial Planning Software** See Accounting Assistant, Accounting Ledger, Bookkeeper, Budgie, Cash Flow, Charting With Income & Expense Records, Checkbook Manager, Expense Records, Financial Partner, Financial Software, Home Budget, Home Financial Decisions, Home Budget Management, Income and Expense Records, Individual Retirement Account Analysis, MicroSoft Multiplan, Monthly Budget \$ Master, Personal Finance, Personal Income, Salary Planner, and Statement Analysis.

**Financial Record Keeping\*** Keeps a current record of credits, debits, loans, commodities, and adjusted sales values. The net worth statements are automatically updated, including the subtraction of expenses. Designed for those in the farming industry. Requires printer and Extended BASIC Cartridge; disk or cassette. Computech Distributing.

**Financial Software\*** Includes Non-Profit Income and Expense Report, Personal Income and Expense Report, a Financial Statement Analysis, and Home Budget versions II through IV. Eastbench Software Products.

**Financial Statements\*** Simple statement listing, invoices and balances. Requires thermal printer; cassette. Soft-Sell.

**Find The City\*** Find the cities of the U.S. Includes two U.S. maps, graphics, and sound. Speech synthesizer and joysticks are optional; cassette. The Micro House.

**Finding Programs or Files** See BASIC—Listing of Files or Programs on Diskette.

**Firmware** A program stored in a ROM. Originally, firmware was only used for microprograms inside the CPU. In microprocessors, many kinds of programs reside in ROM, and firmware designates any ROM implemented program. The TI contains BASIC and DOS (ROM BIOS) in ROM. ROM for the TI computer is also in the Solid State Software Cartridges inserted in the front of the console.

**Fish\*** Animated graphics spice up this simulated fishing game. Kuhl Software.

**Fixed Media for Recording Information.** The physical devices for recording information are called media. The main media for the 99/4 and 99/4A are cassette and diskette, as well as hard disk, RAM, ROM and other devices. Media are often classified as:

a) removable media—such as diskettes, cassettes and some hard disks.

b) fixed media—such as most hard disks, which are not removable from the device that drives them, with no ability to store additional data or backup copies off-line (outside the computing system) for insertion when needed. See Memory.

**Fixed Point** Integer representation with the decimal point assumed to be in a fixed position. Contrast with Floating-Point.

**Fixed-Head Disk** A disk system with a head over each track. Eliminating head positioning delay time provides rapid access, but at higher cost.

**Flag** A status indicator for a special condition. A flag is normally stored in a flip-flop or a register. Typically, a microprocessor provides the following status flags: carry, zero, sign, overflow, and half-carry or auxiliary-carry. The TI provides all of these plus interrupts, and 4K of I/O flags in the form of bit addressed CRU memory.

**Flip Checkers\*** Compete against another player or the computer to flip all the checkers to your opponent's color. Extended Software Company.

**Flip-Flop** FF. A circuit used to store one bit of information. A FF is bistable with two stable states (0 and 1). Registers are generally assembled out of flip-flops. The circuit remains in one state until a new signal is received.

**Flippy** Another name for a mini-floppy. Also used to describe a single-sided diskette turned over to record data on the back side.

**Floating Gate** A technique used for UV-erasable EPROMs. A silicon gate is isolated inside the silicon dioxide.

**Floating Point-Package** FPP. A set of necessary software routines or hardware features for floating-point arithmetic: addition, subtraction, multiplication, and normalization. To assure proper precision, the design of an FPP requires careful analysis of error propagation phenomena.

**Floating-Point Representation** Representation of numbers in a fixed length format, such as 24 or 32 bits. The number N is normalized and encoded as a mantissa field M and an exponent field. The name reflects that the representation remains fixed as the decimal point floats, i.e., the changes in magnitude are reflected by adjustment of the exponent field with renormalization of the mantissa field. The precision of the representation is limited by the number of bits allocated to the mantissa field. Contrast with Fixed-Point.

**Floppy Disk** A mass-storage device using a flexible (floppy) mylar disk (diskette) to record information. The diskette is sealed in a square plastic jacket lined with a soft material which cleans the diskette as it rotates. A cut-out slot provides access for the moving head which must come in contact with the diskette surface in order to function. Other holes in the jacket provide access to sector index holes in the diskette. Diskettes are hard-sectored if the sector start points are marked by holes in the diskette. Soft-sectored diskettes have only one (or a few) holes to mark the start of the track. The sector start marks are placed on the soft-sectored diskette under software control in a process called formatting the diskette. The TI-99/4 and /4A use soft sectored 5 1/4 inch diskettes in their standard drives. Diskettes are classified as single- or double-sided and single- and double-density.

**Floppy Mini** A smaller floppy that is 5 1/4 inches square compared to 8 inches for the original floppy. This is the standard size for the TI-99/4 and /4A.

**Flowchart** A symbolic representation of a process. Boxes represent commands or computations. Diamonds represent tests and decisions (branches). A flowchart is a useful step between process specification and program writing. Facilitates understanding and debugging the program by segmenting it into logical, sequential steps.

**Fly Snuffer\*** Use your joystick to position the spray can and let those flies and other pesky beasts have it! Three levels of difficulty. Requires Extended BASIC Cartridge. Erninger Associates.

**Flyback** The time delay while the spot on a CRT comes back to the beginning of a frame.

**Flyer\*** A compatible program with the Black Book that addresses promotional materials for distribution. Requires printer; cassette. Denali Data Design.

**FMS** File Management System.

**Football\*** A football simulation game for one or two players based on professional football statistics. Texas Instruments.

**FOR and NEXT—BASIC Statements.** The FOR statement used in conjunction with the NEXT statement performs a series of instructions in a loop a given number of times. The format is:

```
FOR <variable> = <x> to <y> [STEP <z>]
NEXT <variable>[, <variable>]...
```

<variable> is an integer or single precision variable to be used as a counter.

<x> is a numeric expression which is the initial value of the counter.

<y> is a numeric expression which is the final value of the counter.

<z> is a numeric expression to be used as an increment.

Within a single FOR...NEXT loop, all lines following the FOR statement are executed until the NEXT statement is encountered. Then the counter <x> is incremented by the amount specified by the STEP value <z>. If you don't specify a value for <z>, the increment is set to 1 (one). A check is then done to see if the value of the counter is now greater than the final value <y>. If it is not greater, BASIC goes back to the statement after the FOR statement and the process is repeated. If it is greater, the first statement following the NEXT statement is executed.

If the value of <z> is negative, the check is reversed. The counter is decremented each time the loop is executed and execution continues until the counter <x> is less than the final value <y>.

The statements within the FOR...NEXT loop are not executed if <x> is already greater than <y> when the STEP value is positive, or if <x> is less than the <y> when the STEP value is negative. If <z> is zero, a BAD VALUE error message will be displayed.

Nested loops is the name given to a situation where one or more FOR...NEXT loops are placed inside a FOR...NEXT loop. Whenever FOR...NEXT loops are nested, each loop must have a unique variable name as its counter. The NEXT statement for the inner loop must appear in a statement before the NEXT statement for the outside loop. When using FOR...NEXT loops, you must include the variable or variables on all the NEXT statements.

When a NEXT statement is encountered before its corresponding FOR statement, a "NEXT without FOR" error is displayed.

Some examples are:

```
100 M=2:K=10
110 FOR I=M TO K STEP 2
120 PRINT I;
130 NEXT I
RUN
2
4
6
8
10
DONE
```

**Foreground Program** A higher priority program in a multi-programming environment. Also: a program for interfacing with a user or a process. See Background Program.

**Form Feed** To Advance to the Top of the page enter the BASIC statement:

```
LPRINT CHR$(12)
```

Or use the "top of form" or "form feed" manual control button (FF) on the printer. You may then need to adjust the paper in the printer so it is at the top of a page as defined by the perforations.

In a program, you may want to provide instructions to the operator and a pause (q.v.) to allow adjustment of the paper.

**FORMAT** See Initialize a Diskette.

**Formatter** A circuit or program which writes the file marks, track marks, address marks, pre-amble, post-amble, and check characters for floppy disks, disks, or tape drives. See Initialize a Diskette.

**FORTH** A programming language and operating system. FORTH is characterized by threaded code and postfix, or reverse Polish notation. FORTH is an extensible language. You can create new commands, defined in terms of the existing commands or in Machine language code. Your new commands then become part of the FORTH language, allowing you to build the commands you would request if you were designing a language especially for a particular application. FORTH is also transportable from one microcomputer to another—more so than BASIC and most other languages. FORTH runs fast—closer to Machine Code than to higher level languages like BASIC. FORTH may be a more difficult language than BASIC, but it offers many advantages. FORTH for the TI is available from Wycove Systems Limited and Texas Instruments.

Wycove Systems Limited  
P.O. Box 499  
Dartmouth, Nova Scotia  
Canada B2Y 3Y8

**FORTRAN** FORMula TRANslator. FORTRAN was one of the first high-level languages. It is still widely used, especially by scientists and engineers. BASIC is largely based on FORTRAN, using statement numbers and a similar set of commands. The differences are slight, mostly dealing with I/O statements. FORTRAN includes the FORMAT statement for printed output. It is rich in mathematical functions and supports an extended precision calculations mode for scientific problems.

FORTRAN is a compiled language, not interpreted like BASIC. A program is edited in a file, then submitted to a compiler for translation into executable object code. This is later executed. FORTRAN and BASIC are so similar that BASIC could be called an interpreted dialect of FORTRAN. Here is a sample FORTRAN program to sum the first 100 integers:

```
20 FOR I = 1 TO 100
30 J = J + I
40 NEXT I
50 END
```

FORTRAN is not yet available for the TI-99/4 and /4A computers.

**Fourier Transform** The mathematical analysis of a complex wave-form into harmonic components.

**Fowl Play\*** Help the chicken cross a highway filled with speeding cars. Includes graphics designed by Ron Binkowski. Requires Extended BASIC Cartridge; cassette. Futura Software.

**FPGA** Field Programmable Gate Array. A device containing an array of AND and OR gates which can be reconnected (programmed) in the field (i.e. without return to factory).

**FPLA** Field Programmable Logic Array. A PLA which can be programmed by the user. FPLAs are used to implement the control section of bit-slice processors.

**FPLS** Field Programmable Logic Sequence.

**FPP** Floating Point Package.

**Fractional Numbers\*** Solve problems of varying levels of difficulty. Color graphics and sound. For students in grades five through eight. Cartridge. Texas Instruments/Milliken Publishing Co.

**Fractions 1\*** Demonstrate fractions and mixed numbers. Teacher's guide and worksheets are

## Fractions 2\* • Function keys

included with optional speech synthesizer. Cartridge. Scott, Foresman and Co.

**Fractions 2\*** Practice adding and subtracting fractions. Features animation and instant feedback. For students in grades four and five. Speech synthesizer optional. Cartridge. Scott, Foresman and Co.

**Fragmentation** When mass memory (diskette, hard disk, etc.) has been allocated with many unallocated areas (fragments) that are too small to allow optimum performance.

**Frame** The necessary underlying structure for a record, file, or other data item. The frame creates an organization within which the data takes its place.

**Freefall\*** Simulates falling objects by calculating speeds and distance. The earth's gravity is the default, but can be changed as well as any friction on the object. Disk or cassette. Data Systems.

**Freeways\*** Simulates five freeways at rush hour. Can your chicken cross the road? Requires Extended BASIC Cartridge and joystick. Best Software.

**Freeze Screen Display** To freeze the screen briefly while the operator using your program reads a message, just write a delay loop after you print the message:

```
1000 FOR Y = 1 TO 2000
1010 NEXT Y
```

To freeze the screen until the operator is finished, input a dummy statement, and instruct the operator to press ENTER and proceed. The input variable (A\$) need not be used in your program:

```
1000 INPUT "Press ENTER to continue";A$
```

**Frequencies, Note** For a table of note frequencies, refer to your *TI BASIC Reference Manual* under Musical Tone Frequencies.

**Frequency** The number of cycles per second.  $F=1/T$  where T is the period in seconds over which cycles are counted.

**Frog Legs\*** Why does the frog cross the road? For a kiss. Requires Extended BASIC Cartridge. Disk or cassette. Prometheus Software.

**Frogger\*** Play against time on one of ten skill levels as you try to jump your frog safely home. Requires Extended BASIC and a joystick. Best Software.

**Froggy\*** Jump the froggy across ten lanes of traffic and over six floating logs to get home. Extended Software Company.

**Front Panel** A panel with lights and switches to display information and allow direct control or access to memory or registers. A front panel requires a specific interface and a monitor program. Many microcomputers have no front panel. All access is then performed from a keyboard and screen.

**Front-End Processor** A processor which acts as an interface with a user or a process. The front-end may perform pre-processing translations or file handling, while the main processor performs interpretation, execution, or other processing.

**Frozen Keyboard** If a "System Lockup" occurs and the keyboard fails to respond, the only way to unlock the system is to turn the console off, then back on. You will lose whatever you were working on.

**FS** File Selector.

**FSC** Full Scale range.

**FSK** Frequency Shift Keying. A 0 is represented by one frequency, and a 1 is given a different frequency. These two tones are then transmitted over telephone or radio links and converted back to digital signals upon reception. See Modem.

**Full Duplex** Allows data to be transmitted and received simultaneously.

**Fully Decoded Selection** A method of selecting memory locations or input/output devices through a full n-bit address (typically  $n=16$ ). This requires the use of decoders, but allows full utilization of 64K possible addresses. Most of the TI-99's I/O devices are partially decoded, responding to a whole range of addresses rather than a unique address.

**Fun & Games 1\*** Become a bomber pilot or a hockey player. Requires Extended BASIC Cartridge; cassette. Lowe Software Company.

**Fun House\*** Increase your skill level in BASIC and Extended BASIC through the development of games. Requires Extended BASIC Cartridge for certain programs; disk. Microcomputers Corporation.

**Function Keys** The following is a list of codes returned by pressing Function Keys. The Functions returned depend on the applications program. The codes returned depend on the key unit value specified in CALL KEY.

TI-99/4 & BASIC Modes	Pascal Mode	Function Name	Function Key
1	129	AID	FCTN 7
2	130	CLEAR	FCTN 4

TI-99/4 & BASIC Modes	Pascal Mode	Function Name	Function Key
3	131	DELeTe	FCTN 1
4	132	INSert	FCTN 2
5	133	QUIT	FCTN =
6	134	REDO	FCTN 8
7	135	ERASE	FCTN 3
8	136	LEFT arrow	FCTN S
9	137	RIGHT arrow	FCTN D
10	138	DOWN arrow	FCTN X
11	139	UP arrow	FCTN E
12	140	PROD'D	FCTN 6
13	141	ENTER	ENTER
14	142	BEGIN	FCTN 5
15	143	BACK	FCTN 9

**Function Keys** BASIC. See KEY.

**Functions** Choose from menu. A menu is a screen display listing a number of options and asking the user to select one by keying in an identifying letter or number. This may require a branch or subroutine call to the code for the selection, or else the program to carry out this function may be loaded into memory and executed.

Many application packages use a system of multiple menus. A Master Menu lists the major functions allowed. Selection of an option on the Master Menu causes another menu to be displayed, indicating more detailed options for the selected function. This can be followed by even more detailed menus, and so on. Often, completion of a function will cause redisplay of the Master Menu. Such a system is called menu driven.

**Fundamental** The base or carrier signal on which a data signal will be superimposed. It is usually a pure sine wave with no distortion.

**Futura Accounts Payable\*** Allows user to alphabetize and modify up to 350 vendor accounts. Compatible with Futura General Ledger. Requires two disk drives, Extended BASIC Cartridge and printer; 32K. Futura Software.

**Futura Accounts Receivable\*** Provides a listing of up to 350 customer accounts, in alphabetical or numerical order, with records of all outstanding debts plus a shorter listing of account balances. Compatible with the Futura General Ledger\*. Requires two disk drives, printer, and Extended BASIC Cartridge; 32K. Futura Software.

**Futura General Ledger\*** Random access of account numbers allows for maintenance of accounts in this production of a general ledger. Compatible with other Futura programs. 1200 entries are allowed per accounting month resulting in a system

of 200 accounts. Requires Extended BASIC Cartridge and printer; disk. Futura Software.

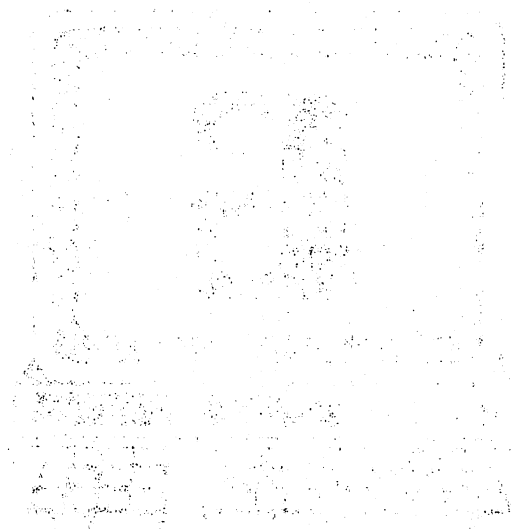
**Futura Inventory Management\*** Keeps a running total of description, quantity available, and price of up to 1400 different items. Various reports are organized with given data. Compatible with the Futura Accounts Receivable and General Ledger. Requires two disk drives, printer, and Extended BASIC Cartridge; 32K. Futura Software.

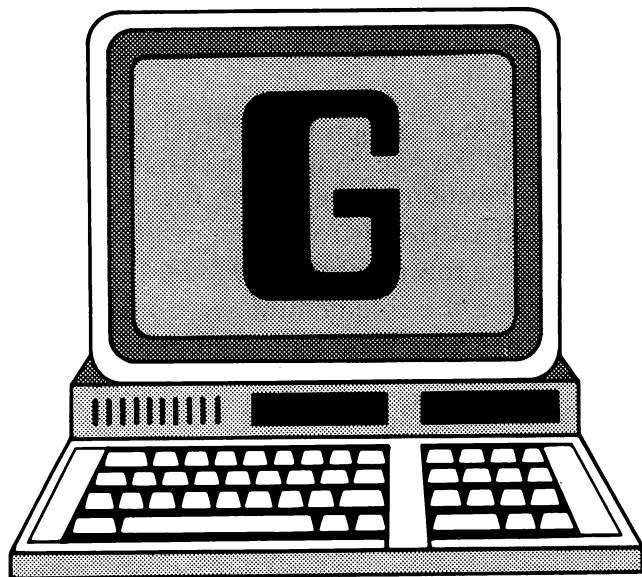
**Futura Payroll\*** Record standard deductions, earnings, taxes, and labor distribution for personnel and pay data files. Requires two disk drives, printer, and Extended BASIC Cartridge; 32K. Futura Software.

**Futura Word Processing\*** You can edit, store, and retrieve text; when printing, specifications may be made regarding print features desired. Compatible with Futura Mailing List. Requires two disk drives, printer, and Extended BASIC Cartridge; 32K. Futura Software.

**F/V** Frequency to Voltage converter.

**F-8** Fairchild's 8-bit microcomputer.





**G** Codes. ASCII 71, HEX 47. g—ASCII 103, HEX 67.

**G** Ground. Also: Generate signal. The output from an adder connected to a carry look-ahead circuit. It requires a propagate signal.

**Gain** The output to input amplification ratio.

**Galactic War\*** You're pitted against alien airships. Requires Extended BASIC Cartridge; cassette. Futura Software.

**Galactic Warrior\*** During your tour of space you encounter many obstacles. Includes sound and graphics. Requires Extended BASIC Cartridge; cassette. Western Properties Investment Company.

**Game Controllers\*** Fast action games will be enhanced when you maneuver objects on the screen with these "joysticks" which feature an eight-position remote control with an action button. Texas Instruments.

## Games

A Day at the Races	Advance
Adventure	Adventureland Adventure Database
Adventures Int. Series	Aeronaut
AirMail Pilot	Alligator Mix
All Star Baseball	All Star Bowling
Alpiner	A-Maze-Ing
American Baccarat	Andromeda
Ant Wars	Arcade Monopoly
Aron's Revenge	Anthropod
Artillery	Assault Forces
Assortment Package	Asteroid Defender in Quest of Gold
Asteroid Miner	Astromania
Asteroids	ASW Tactics
Astro Mouse	

Atlantic City	Attack
Backgammon	Balloon Voyage
Baseball Statistician	Battle Over Titan
Berzerkie	Biorhythm
Black Beard's Treasure	Black Bomber
Blackjack	Black Market
Blade Runner 2020	Blasto
Bomb Squad	Bouncer
Box Lines	Brain Games
Bridge Bidding	Burger Builder
Cape Cod Golf	Cars and Carcasses
Car Wars	Casino Blackjack
Casino Pack	Castle Nova
Caterpillar	Cavern Quest
Challenge Poker	Challenge I & II
Checkers	Chisholm Trail
Chopper Ace	Chutes & Sharks
CIA Adventure	Cobra Command
Cockroach Races	Code Breaker
Connect Four	Conquest in Space
Corner Bound	Count Adventure Database
Country Roads	Craps
Cribbage	Crime and Punishment
Cross Country Car Rally	Crosses
Crossword Challenge	Data Rescue
Death Drones	De-Cypher
Defend the Cities II	Destination Earth
Devil Craze	Direction and Distance
Doom Castle	Dow—4 Gazelle
Drac Man	Dragon Mix
Draw Poker	Eggbert
E.T., The Extra Terrestrial	Extended Baseball
Extended Hangman	Fish
Flip Checkers	FLY SNUFFER
Football	Fowl Play
Freeways	Frogger
Froggy	Fun & Games 1
Fun House	Galactic War
Game Controllers	Garbage Belly
Gopher	Gorfia Pestulitis
Go-To-Monker	Hang Glider Pilot
Hat In the Ring	Hobbyist Game Pac I
Hunt the Wumpus	Hustle
Ice Caverns of Xen	Indoor Soccer
Jellybeans	Jotto
Kemp Games I	KONG
Krazy Kong	Land on Mars
Laser Battle	Laser Shields
Laser War	London Blitz
Lunar Lander	Lunar Lander
Martian Lander	Match Wits
Mean Streets	Medieval World
Meteor Shower	Mind Challengers
Minigolf I & II	Minus Mission
Moonbeam Express	Moonduster



## Gap • Global Variable

MoonVasion	Mr. Frog
Neutral Zone	North Seas Battle
Obstacle Course	Oldies But Goodies Games I & II
Othello	Peg Jump
Poker	Pulsar
Quadcube	Quadrant Command
Quest for the Sword	Quibiq
Racing	Ring Destroyer
Ringwraith's Lair I,II,III	Robotron
Roll Five	Sam Defense
Saturday Night Bingo	Scepter of Kzirlga
Scribble	Sector Command
Siege	Sengoku Jidai
Ships	Shuttle Command
Ski	Sky-Diver
Slot Machine	Smash
South Pacific	Space Games
Space Salvo	Square
Starship Concord	Starship Pegasus
Star Trek 2	Strike Forces
Super Frogger	Supertrek
Tank	TEECH
Texas Light Shooter	The Grande Adventure
The Hustler	The Mad Monopolist
The Pharoahs Tomb	Ti-Asteroids
TickWorld	Tic-Tac-Toe
TI Nuclear Power Plant	TI Toad
TI-Trek	Trail West
Treasure Trap	Tri-Light
Tunnels of Doom	Video Chess
Video Games I	Vid-O-Thello
Waldoball	Walls and Bridges
Wari	War of the Worms
Wildcatting	Wizards Dominion
Word Family Bingo	World Defender
Wrap	Xorkle
Yahtzee	ZeroZap
Zombie Mambo	Zygon
3-D Startrek	99' vaders

**Gap** The space between two records on a magnetic media. A gap is usually set to a predetermined value, allowing blocks of data to be rewritten in an expanded or reduced format, due to speed variations of the drive.

**Garbage Belly\*** Garbage Belly is free in a field of garbage pails and it's your job to help him eat the ripe garbage and keep him away from the raw garbage that could kill him. Moonbeam Software.

**Garbage Collection** Collecting unavailable space in a mass memory and making it available for reuse.

**Gate** A single logic function, such as NAND, NOR, AND, OR, XOR, and NOT functions.

**Gauss** A unit of flux density (1 Maxwell per square cm.), named for German mathematician Karl F. Gauss.

**GCHAR** BASIC Subprogram. CALL GCHAR is used to find the ASCII value of a character from a particular location on the screen. The format is:

CALL GCHAR (<row, column>,<x>)

<row> is the row number, from 1-24, 1 at the top. <column> is the column number, from 1-32, 1 at the left.

<x> is the variable assigned to the ASCII value in <row>,<column>.

**GCR** Group Coded Recording.

**GE** Greater than or Equal to (represented by  $\geq$  or  $\Rightarrow$ ).

**Gemini-10 Printer\*** This printer uses standard typewriter ribbons for easy replacement. Features buffers, additional fonts, and adjustable, removable tractor feeds. Star Microtronics.

**Gemini-15 Printer\*** This low-priced daisy wheel printer uses standard typewriter ribbons for easy replacement. Features large built-in buffers, additional fonts, and adjustable, removable tractor feeds. Star Microtronics.

**General Will\*** Helps you to create your own legal will. Requires printer; disk. Data Systems.

**Generate BASIC Line Numbers** In TI BASIC, NUM or NUMBER will generate automatic line numbers in increments of 10 starting at 100, unless otherwise specified. See NUMBER.

**Ghost Town Adventure Database\*** Locate treasures throughout the ghost town, but beware of the ghosts. Disk or cassette. Texas Instruments.

**Ghost Writer\*** From a few key words, this program will create four totally different stories. Even if you repeat key words you will never get a repeat story. All stories may be saved. Vid-Com.

**Gibson Mix** A statistically balanced mix of instructions representative of general data processing applications. One of many similar variations used for benchmark testing.

**Glitch** A pulse or burst of noise. A small pulse of noise is called a snivitz. The word glitch is usually reserved for the more dangerous pulses which cause system failures.

**Global Variable** A variable with name and value accessible throughout the program. Contrast with Local Variable, accessible only within the programming block where it is defined.

**GND** GrouND.

**Golden Voyage Adventure Database\*** Search for the “fountain of youth” with limited resources. Disk or cassette. Texas Instruments.

**Gopher\*** Help the gopher move through an ever-changing maze while collecting points. For one or two players. Joystick recommended. Titan Software.

**Gorfia Pestulitis\*** Shoot down invading Gorfians using joystick control of space mines and laser sights. Extended Software Company.

**GOSUB and RETURN—BASIC Statements.** GOSUB and RETURN are used to branch to and return from subroutines. The format is:

```
GOSUB<line>
```

```
.  
.<line>
```

```
.  
RETURN
```

<line> is the line number of the first line of the subroutine.

You may call a subroutine using GOSUB repeatedly in a program, and a subroutine may be called from within another subroutine.

The RETURN statement causes BASIC to branch back to the statement following the GOSUB statement from where it exited. In order to return from different points in the subroutine, subroutine may contain more than one RETURN statement. You may place subroutines anywhere in a program.

To keep your program from entering a subroutine that should not be executed, you may need to use a STOP, END, or GOTO statement to direct program control around it.

Refer also to ON GOSUB and ON GOTO.

**GOTO** BASIC Statement. GOTO is used to exit from the normal program sequence to a specified line number. The format is:

```
GOTO <line>
```

The <line> specified after GOTO will be executed if it is an executable statement. If <line> is a non-executable statement, such as DATA or REM, the program will continue until it finds the next executable line.

Refer also to ON...GOSUB and ON...GOTO.

**GOTO** Or GO TO. A branch instruction in a high level language.

**Go-To-Monker\*** A board game with a famous past. Disk or cassette. Prometheus Software.

**GP** General Purpose.

**GPB** General Purpose Interface Bus. The IEEE 488-1975 interface bus standard. Also called ANSI Standard MC 1.1-1975, or the IEC Bus in Europe.

**Grade 1 Math\*** For basic concepts and practice drills in math. Cassette. Anthistle Systems & Programming, Ltd.

**Grande Adventure, The\*** Has you traveling to unusual places in search of the evil wizard. Requires Extended BASIC cartridge; disk. Prometheus Software.

**Graphical Adventures\*** Maneuver an adventurer inside a window by using verb-noun commands. As the adventurer exits one window, a new one quickly forms. All adventures include instructions and clue sheets. Some let you save the game to continue later. Includes Medieval Adventure, an Egyptian Adventure, and a two-part World War II game. Walter J. Dollard.

**Graphics\*** Bar graphs of up to thirteen categories can be displayed on the screen. Legends depict the values of the bars as percents of a total sum. Cassette. Hall Software.

**Graphics** BASIC and X BASIC. See CHAR, COLOR, HCHAR, SCREEN, SPRITE, and VCHAR.

**Graphics Package\*** This high-resolution graphics package enables the creation of intricate detail with the control of just a few keys. Includes four levels of detail ranging from 768 to 49,152 accessible points. Automatic features: lines, circles, parabolas, ellipses, and more. All the information you use to create your graphics can be saved for later use in your programs. The Extended BASIC Cartridge and 32K memory expansion is recommended for cassette and required for disk; printer is optional. Norton Software.

**Graphics Software** See Character Definition Graphics Form, Computerized Crayola, Draw Shapes, Graphics, Graphics Package, Graphing Package, HIPAD Digitizer, Poor Man's Plotter, Screen Graphics, Spiral-Graphics, Video Graphs, Video Titles, and X-BASIC Color Bars.

**Graphing Package\*** Easy to use plotting routines include scatter plot (with curve fitting), Cartesian plots, polar plots, and XYZ plots. Texas Instruments.

**Graphing Programs\*** Two graphing programs written in TI BASIC that scale automatically. Includes the Point-Plot Program, which graphs data or equations with a 160 by 60 resolution; and the Bar-Plot Program, which graphs distribution of direct data with a 160 by 30 resolution. Micro Concepts.

## **Grid to Design Pictures\* • Gus' Tug (Short "U")\***

---

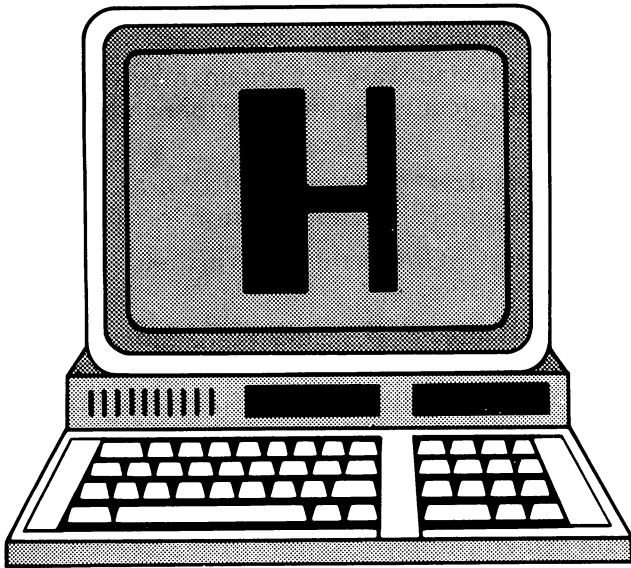
**Grid To Design Pictures\*** Learn design code by drawing pictures and displaying the results. Disk or cassette. Microcomputers Corporation.

**Ground** The point of reference in an electrical circuit (not necessarily the physical ground). The ground point is considered at nominal zero potential, and all other potentials in the circuit are compared with it.

**GT** Greater Than (also represented by >).

**Guess That Word\*** Create your own spelling lessons with the words of your choice. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Gus' Tug (Short "U")\*** Introduces the beginning reader to vowel sounds, spelling, and comprehension skills. Features music, sound, and graphics. Disk or cassette. Computer-Ed.



**H** Codes. ASCII 72, HEX 48. h—ASCII 104, HEX 68.

**H** Hexadecimal. Used as a suffix to denote hexadecimal numbers in Intel format. In TI-99 literature, the leading > denotes hexadecimal numbers: >FF9A.

**Haiku Poetry Generator\*** An educational software program. Eastbench Software Products.

**Half-Carry** The carry from bit 3 into bit 4 required to add packed BCD numbers correctly, where two BCD digits reside in one 8-bit byte.

**Half-Duplex** Communication mode in which data may be transmitted in only one direction at a time.

**Halt** When a computer stops all activity.

**Halt System Operation** Pressing FCTN 4(CLEAR) (99/4—Shift C) stops program execution and displays a “Breakpoint in <line>” message. Enter:  
CON

to continue. See BREAK and CON.

**Hamming Code** A 7-bit error-correcting code named after its inventor.

**Handler** A program used to control or communicate with an external device such as a diskette drive.

**Handshaking** A basic communications synchronizing technique using two signals: ready ?; yes/no acknowledgment. The handshaking procedure takes place when establishing a connection between two data communication devices before any data transfer. For example, a CPU will ask an I/O: is input buffer 1 empty? If yes, it can be reloaded. If no, the CPU must wait.

**Hang-Glider Pilot\*** Hang-gliding simulation program, complete with weather elements. Requires

Extended BASIC Cartridge; cassette. Maple Leaf Micro Ware.

**Hangman\*** Guess the mystery word and avoid the gallows. Developed by Milton Bradley Company. Texas Instruments.

**Happy Math\*** Learn and practice addition and subtraction. For children aged four to six. Cassette. Maple Leaf Micro Ware.

**Hard and Soft C\*** Students can learn to distinguish between the hard and soft “c” sounds. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Hard and Soft G\*** Learn to identify the different sounds represented by the letter “g.” Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Hard Copy** Computer output printed on paper.

**Hard Disk** A disk composed of a magnetic coating applied to a rigid substrate such as aluminum or ceramic. The term is generally used to contrast with “soft” (floppy), flexible disks. Floppy disks are slower and have less storage capacity.

**Hard-Sectored** Disk with the recording surface divided into sectors using non-alterable methods, such as a ring of holes in the disk itself. Contrast with soft sectoring as used on the 99/4A, where the Disk Manager module creates sectors by writing information on the diskette.

**Hardware** The boards, chips, wires, etc. of a system. Contrast with Software (Programs). See Boards/Cards, Drives, Media, Memory, Monitors, Peripherals, and Printers.

**Hardware vs Software** Computer programs are called software. The actual chips, wires, and boards making up the computer are called hardware. A special case is read-only memory (ROM), hardware that contains a permanent copy of software. “A BASIC ROM” means a ROM (hardware) containing a copy of a BASIC interpreter program (software). Such ROMs are often called firmware to distinguish them from non-program hardware and from software in changeable media (RAM, diskette, cassette, etc.).

**Harmonic** An integer multiple of a fundamental frequency.

**Harmonic Distortion** Distortion caused by the signal’s non-linear characteristics, resulting in output which includes harmonics of a harmonic-free sine input.

## Hat In The Ring\* • Homonym Machine\*

**Hat In The Ring\*** Two players are introduced to presidential politics by running their own campaigns against each other. Disk or cassette. Micro-Ed.

**HayesStack Smartmodem** An RS-232C auto-answer, auto-dial data communications system compatible with most personal computers. Standard features are touch-tone or pulse dialing and direct connection to single or multiline telephones. The system can be controlled by any language through ASCII character strings. Operating parameters are changed with ease by a series of unique "Set" commands and eight configuration switches. Smartmodem's operating level is full- or half-duplex up to 1200 baud. Seven LED indicators on the front panel provide a visual check of system status, and you can monitor the progress of calls with an audio speaker. The system features automatic baud rate, parity sense, and word size detection. The system is covered by a two-year limited warranty.

**HCHAR** BASIC Subprogram. CALL HCHAR displays a character anywhere on the monitor screen, and can be repeated horizontally. (For vertical repetition, see VCHAR.) The format is:

CALL HCHAR (<row>,<column>,<x>[,<r>])  
<row> is the row number, from 1-24, 1 at the top.  
<column> is the column number, from 1-32, 1 at the left.  
<x> is the ASCII value of the character that will be displayed.  
<r> is the number of times <x> will be repeated horizontally, starting at <row>,<column> and moving from left to right. The range here is 2-768.

**Hexadecimal to Decimal Conversion** See HEX\$.

**HEX-BUS Printer/Plotter (#HX 1000)\*** This four color printer plotter prints on paper 2.5 inches wide. Requires interface. Texas Instruments.

**HEX-BUS Wafertape Digital Tape Drive (HX 2000)\*** This high speed, "stringy floppy," data storage tape drive holds 48K and operates at 8000 BAUD. Requires interface. Texas Instruments.

**HEX\$** BASIC Function. HEX\$ function returns a string which represents the hexadecimal value of the decimal argument. The format is:

(string value)=HEX\$(n)

(n) is a numeric expression in the range of 0 to 65535.

**Hidden Numbers\*** Use your recall to pick out the hidden numbers. Cassette. Hall Software.

**Higher, Same, Lower\*** Tone perception is tested when two notes are played and the student must

decide if the second tone is higher, the same, or lower. Disk or cassette. Micro-Ed.

**Higher Math Made Easy\*** Contains matrices, functions, and calculus routines. Eastbench Software Systems.

**HIPAD Digitizer\*** Use a pen to "draw" digital input into your computer. Houston Instrument.

**Hit and Run\*** Outfox the Mafia in their own territory. N S Y Software.

**Hobbyist Game Pac I\*** Eleven card games including Acey Ducey, Snack Man, Command Fighter, Maze Game, Memory Chips, Space Station XIII, Alien Invasion, Bells Lemons and Diamonds, Beginner's Double Oh Hell, Memory Fun, and Knock Out. Features color graphics and sound. Microworld.

**Hold Screen Display** To freeze the screen briefly while the operator using your program reads a message, write a delay loop after you print the message:

```
1000 FOR Y = 1 TO 2000
1010 NEXT Y
```

To freeze the screen until the operator is finished, input a dummy statement and have the operator press ENTER to proceed. The input variable (A\$) need not be used in your program:

```
1000 INPUT "Press ENTER to continue";A$
```

See also KEY.

**Holding Register** A register that temporarily holds data to bridge a speed or timing gap between two devices.

**Home Brewed Antennas\*** A program for short-wave radio enthusiasts. Subjects include dipoles, quads, quagis, and long wires, as well as how much to prune from the first s.w.r. curve. Fox Valley Software.

**Home Budget\*** Holds 12 months and year-to-date data on projected and actual expenses, using projected month, projected vs. actual month, and projected vs. actual year-to-date screens. Income, total expense, and net difference categories are supplied, and you may define seventeen specific expense categories. Easy to use prompts guide you through the program. B & B Graphics.

**Home Financial Decisions\*** A personal finance guide to everyday decisions about loans, major purchases, leases, or savings. Cartridge. Texas Instruments.

**Homonym Machine\*** Lessons covering word pairs that sound the same but have different meanings. Disk or cassette. Micro-Ed.

**Household Budget Management\*** Organize, monitor and plan your budget by month and category. Identify budget problems with graphic displays and table. Requires Extended BASIC Cartridge; disk or cassette. Instruments.

**Human Engineering** Friendly programs for the Operator (User). For programs you write, the operator will often be you. But, if others ever use your program, you need to give some clear prompts (q.v.) for every item of input data. You should freeze the screen (q.v) long enough for them to act on the information displayed, and provide clear error messages. This is often referred to as “human engineering”—making the program easy to use as well as technically correct. Another term for this is making the program “user friendly.”

Also, if a series of data entries has been typed in but some turn out to be invalid, the user should be able to re-enter only the bad items. Error messages should indicate not only that an entry is invalid, but also why it is invalid, and, if at all possible, how to correct it.

**Hunt the Wumpus\*** Make your way through perilous tunnels to locate the Wumpus. Texas Instruments.

**Hustle\*** Direct a snake-like object at targets while avoiding hazards. Developed by Milton Bradley Company. Texas Instruments.

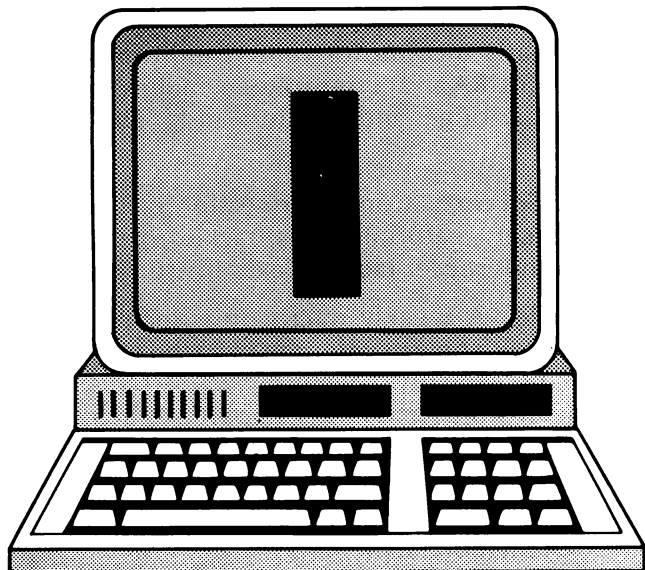
**Hustler, The\*** A billiards game with multiple skill levels. Requires Extended BASIC cartridge and wired remote controllers; Futura Software.

**Hydrocarbon Combustion\*** Given a combustion, the end products will be outputted, including combustion and air/fuel ratios when the formula of the hydrocarbon and air percentage is given at the start. Disk or cassette. Data Systems.

**Hyperbolic Functions\*** Enter a value to the program to calculate the hyperbolic function or its inverse. Disk or cassette. Data Systems.

**Hyperbolic Functions\*** Computes the hyperbolic functions (SINH, COSH, and TANH) and the factorial function. Disk or cassette. Eastbench Software.





**I** Codes. ASCII 73, HEX 49. i—ASCII 105, HEX 69.

**IC** See Integrated Circuit.

**Ice Caverns of Xen\*** Crack the cryptic clues to recover the magical diamond. Should keep you going for weeks.

**ICS 1000 32K Memory Card\*** Fits into the TI peripheral expansion box. Intellec Computer Systems.

**ICS 2000 32K Memory Add On\*** Attaches to the right side of the TI99/4A console and has a port on its own right side for the addition of other peripherals, such as the Peripheral Expansion Box, the hex bus adapter, and speech synthesizer. Intellec Computer Systems.

**Identifying Complete Sentences\*** This drill and lesson program tests a student's understanding of sentence structure by presenting a group of words to be identified as complete or not. Disk or cassette. Micro-Ed.

**IF...THEN...ELSE** BASIC Statement. IF...THEN makes a decision regarding program flow based on the result of an expression. The format is:

IF<expression> THEN<line> [ELSE<line>]

<expression> is any relational or numeric expression. If <expression> is a numeric expression, it will be true IF not equal to zero.

<line> is the number of the line to execute if <expression> is true.

Optionally, ELSE can be used to direct a program to another <line> if <expression> is not true.

IF...THEN...ELSE may not contain the statements DATA, DEF, DIM, FOR, NEXT, or OPTION BASE.

**IF...THEN...ELSE** XBASIC Statement. Extended BASIC allows added flexibility in the IF...THEN...ELSE statement. The additional format is:

IF<expression> THEN<clause> [ELSE<clause>]

<clause> is a statement or group of statements separated by the statement separator (::), and may be any statement valid in Extended BASIC (with exceptions noted below).

IF...THEN...ELSE statements may not contain the statements DATA, DEF, DIM, FOR, NEXT, OPTION, BASE, SUB, or SUBEND.

**IMAGE** XBASIC Statement. Allows you to specify the format of data displayed on the screen when used with the PRINT...USING and DISPLAY...USING BASIC statements. The format is:

IMAGE <x\$>

<x\$> may contain up to 254 characters. You may use any characters. The following specific rules apply to IMAGE: Use a pound sign (#) for each character or digit to be displayed on the screen. Put a decimal point in the IMAGE statement to separate the whole and fractional portions of numbers. The decimal point is displayed on the screen where it appears in the IMAGE statement.

If you don't allow enough space (pound signs) to print the number or character string, the computer will print an asterisk (\*) on the screen for each pound sign to indicate the overflow.

Regarding the fractional portions of numbers, you can use the IMAGE statement to round to the nearest decimal (tenth, hundredth, etc.). Place a pound sign (#) after the decimal point in the IMAGE statement for each decimal place. The computer will automatically round the number to fit, or place a zero in place of the pound sign.

If you want to IMAGE for scientific notation, carets (^) must be given for the E and power numbers. There must be four or five carets, and ten or fewer characters (minus sign, pound signs, and decimal point) when using the E format.

Any other numbers, characters, or letters will be printed just as they appear in the IMAGE statement. Enclose <x\$> in quotation marks if there are leading or trailing spaces, and if <x\$> is to be used in DISPLAY...USING or PRINT...USING statements.

<x\$> may be used directly in a DISPLAY...USING or PRINT...USING statement by placing <x\$> immediately after USING. All the above rules apply. It is most efficient to refer to an IMAGE statement if it will be used often in a program.

The IMAGE statement must be the only statement on a program line.



## Immediate Response • Initialize A Diskette

Many images will fit in one IMAGE statement. Separate each image with any character except a decimal point. If the DISPLAY...USING and PRINT...USING statement has more values than there are images in the IMAGE statement, the images are reused, starting at the beginning of the statement.

**Immediate Response to One-Character Answers** BASIC. To hasten machine reaction to a one-character response (Y or N, drive letter, etc.), use INKEY\$ to input that response. The program can then proceed to process the request. For example:

```
10 PRINT "Make another copy Y/N?"
20 LET A$ = INKEY$
25 IF A$ = "" THEN GOTO 20
30 IF A$ = "Y" THEN GOTO 1000
40 IF A$ = "N" THEN GOTO 2000
50 GOTO 10
```

This technique can be used with a numeric response by using the VAL function:

```
10 LET A$ = INKEY$
20 IF A$ = "" THEN GOTO 10
30 IF A$ < "1" OR A$ > "2" THEN GOTO 10
40 GOTO 100*VAL A$
100 PRINT "LINE 100"
110 GOTO 10
200 PRINT "LINE 200"
210 GOTO 10
```

**Income and Expense Records\*** Name the two income and twenty-eight categories in this month-by-month, category-by-category accounting record that produces monthly and annual charts, and accounting reviews. Rapid cassette storage. Western Properties Investment Co.

**Income and Expense Report for Non-Profit Organizations\*** Use the fund accounting method to manage income and expense records for non-profit organizations. Up to ten funds with up to 100 income and expense categories. Eastbench Software Products.

**Income Tax Planner\*** Forecast your upcoming tax bill to avoid over or under withholding. Revise and resave your data as your circumstances change. SA2 Software.

**Income Tax Preparer\*** Itemize deductions, compute Form 1040 entries, and check for excess FICA payment. Cassette. The Computer Consultants.

**Indexed Sequential Access Method** A program or package that supports files organized with one or more indexes. Records may be retrieved from the file either sequentially or randomly by the key used in the index.

**Individual Retirement Account Analysis\*** Computes yearly income for retired individuals after estimates of IRA and current rates. Requires Extended BASIC Cartridge and printer; disk. The Micro House.

**Indoor Soccer\*** Computer version of five-on-a-side soccer, featuring saves, tackles, passes, and many other soccer tactics. Texas Instruments.

**Infoworld** A weekly microcomputer magazine. Keep up with new developments in the microcomputer industry on a week-by-week basis. Most computer stores and larger bookstores carry Infoworld and a good assortment of other computer magazines. Infoworld's address is:

InfoWorld  
Circulation Dept.  
Box 837  
Framingham, MA 01701

**INIT** XBASIC Subprogram. CALL INIT is used in combination with other XBASIC subprograms to access Assembly language subroutines and programs. CALL INIT insures that memory expansion is available, sets up the computer to run Assembly language programs, and loads a special set of supportive routines into memory expansion.

CALL INIT must be used before CALL LOAD or CALL LINK, to clear any previously loaded subprograms from memory expansion.

CALL INIT lasts until memory expansion is turned off. There's no need to RECALL from each program using the Assembly language subprogram involved. If memory expansion is not detected by CALL INIT, the \*SYNTAX ERROR message is displayed on the screen.

**Initialize A Diskette** All diskettes start out blank, and must be formatted to run properly on the 99/4 and /4A. This process is called initialization. Here is how to initialize a diskette:

Insert the Disk Manager Cartridge into the console. Choose:

2 DISK MANAGER

When the Main Menu appears, choose:

2 DISK COMMANDS

and press ENTER. You will be asked the number of the disk drive, Make your choice and press ENTER. You then will be asked for the disk name, which may be up to ten characters long, and may not include lowercase letters or spaces. Make your choice, then press ENTER.

Next, choose the number of tracks per side, based on the number your disk drive will support. Most TI

drives support forty tracks. Press ENTER. With Disk Manager (1.0) you will now get a

SCREEN IS COMPLETE  
PRESS PROC'D REDO,  
BEGIN, OR BACK

message. Press FCTN 6 (PROC'D)(99/4—SHIFT V) to carry out the command.

If you have Disk Manager 2 (2.0), the next choice to make will be

SINGLE SIDED (Y/N)?

Make your choice and press ENTER. Most likely, you have a single-sided disk drive. When you press Enter, the command is carried out. It takes about a minute to initialize a disk. When you purchase blank disks, you should initialize them right away, so that you always have a disk ready to use.

**Initial Program Load (IPL)** See LOAD.

**INPUT** BASIC Statement. INPUT statement receives input from the keyboard during program execution. The format is:

INPUT ["<prompt>";]<variable>[,<variable>]...  
<prompt> is a string constant which will be used to prompt for the desired input.

<variable> is the name of the numeric or string variable or array element which will receive the input.

When the program encounters an INPUT statement, it displays a question mark (?) on the screen to indicate that data must be typed in. When a "prompt" is included, this string is displayed in place of the question mark.

The entered data is assigned in the variables declared in the variable list. Each typed-in data item must be separated by commas, and the number of data items must match the number of variables. The type of data items you enter must also agree with the type specified by the variable name. Strings entered in response to an INPUT statement need not be surrounded by quotation marks, unless they contain commas or leading or trailing blanks.

If you respond to INPUT with too many or too few items, or with the wrong type of value, BASIC will display an "INPUT ERROR" message. If a single variable is requested, you may just press ENTER to indicate the default values of 0 for numeric input or null for string input. If more than one variable is requested, pressing ENTER will create an INPUT ERROR message. No input values will be assigned to any variables until an acceptable response is given.

**Input** See READ, INPUT #.

**INPUT#** BASIC Statement. INPUT# reads data items from a device or file and assigns them to program variables. The format is:

INPUT #<filenum>[,REC<recnum>]:  
<variable>[<variable>]...

<filenum> is the number used when the file was opened for input.

<recnum> is the record number. It can only be used with files open with relative file organization. <recnum> allows you to specify a record to be read. The first record of a file is zero.

<variable> is the name of a variable that will have an item in the file assigned to it. It can be a string or numeric variable, or an array element.

The file may be located on diskette or cassette, and may be a sequential data stream from a communications adapter, or may be the (#0). The type of data filed must agree with the type specified by the variable name. No question mark is displayed with INPUT# (unlike the INPUT statement). The data items in the file must appear just as they would if the data was being typed in as responses to an INPUT statement. Numeric values, leading spaces, carriage returns, and line feeds are ignored. The first character that is not a space, carriage return, or line feed is presumed to be the start of the number. The number ends with a space, carriage return, line feed, or comma.

If BASIC is scanning the data for a string item, leading spaces, carriage returns, and line feeds are also ignored. The first character that is not a space, carriage return, or line feed is assumed to be the start of the string item. If the first character is a quotation mark ("), the string item will consist of all characters between the first and the next quotation marks. If the first character is not a quotation mark, the string is an unquoted string, and will end with a comma, carriage return, or line feed, or after 255 characters have been read.

**INPUT Statement, Dummy** To freeze the screen while the operator using your program reads a message, write a delay loop after you print the message:

```
1000 FOR Y = 1 TO 2000
1010 NEXT Y
```

To freeze the screen until the operator is finished, input a dummy statement and have the operator press ENTER to proceed. The input variable (A\$ in the example below) need not be used in your program:

```
1000 INPUT "Press ENTER to continue";A$
```

**Input/Output** See Input, and Output.

## Insert • Inventory\*

---

**Insert BASIC.** Pressing FCTN 2 (INSERT)(99/4—SHIFT G) will insert the next character entered on the line where the cursor is.

**Insert Characters** The term for inserting characters into a line. This could be an omitted letter in a word, or an omitted word in a line.

**Insert Line** The term for inserting a line between two existing lines. The insert line could also go at the very top or bottom of a file.

**Instructions** A statement causing a computer to carry out a specific action. A command is usually a complete specification of an action, while instructions are often combined by the hundreds to make a useful program. Commands are usually acted upon immediately, while instructions are saved for later execution in a program. Commands are acted upon by the basic operating system of the computer, while instructions must be processed by a particular program such as the BASIC interpreter, a FORTRAN or Pascal compiler, etc. See Command Processor and Disk Operating System.

**INT BASIC Function.** INT function returns the largest integer less than or equal to (x). The format is:

<variable> = INT(<x>)

<x> is any numeric expression.

For example:

PRINT INT(57.97) returns 57.

or

PRINT INT(-4.53) returns -5.

**Integers\*** Students can perform basic arithmetic problems with integers. Cartridge. Texas Instruments/Milliken Publishing Co.

**Integrated Circuit** A complete electronic circuit with multiple components (transistors, diodes, resistors, capacitors, etc.) all constructed on a single small silicon chip.

**Integrity of Data** Insurance that data cannot be improperly altered. Data security consists of guaranteeing both data integrity and data secrecy.

**Interface** The point at which two systems make contact. Most microcomputers have multiple interfaces or "ports," such as a serial port to connect serial devices, a parallel port, and possibly TV or monitor ports, power port, joystick ports, etc. Interface is also used to refer to the type of interconnection, with respect to its size or shape (sub-miniature 25-pin D connector), its mode of function (serial, parallel, etc.), or its electrical characteristics.

**Internal Memory** Memory can store information and allow it to be retrieved when needed. The TI-99 relies on random access memory (RAM), read-only memory (ROM), and external memory (diskettes and cassettes). Memory, by itself, is usually a reference to RAM. This is the general purpose, erasable, and reusable memory located inside the console, and optional Memory Expansion.

ROM contains fixed data, usually such programs as the BASIC ROMs and ROM BIOS (BASIC Input/Output System). The ROM BIOS contains the Machine language programs to run the various devices attached to the console, such as monitor, printer, diskettes, or cassettes. ROM and RAM together make up the internal or main memory of the TI, or any other computer.

**Interpreter** Any programs that run directly on the TI are Machine language programs, in the actual numeric instruction code of the TI 9900 microcomputer chip. Most were originally written by a programmer as text files known as source programs, containing fairly readable statements in BASIC.

Regular BASIC is a program (in Machine language) which uses your BASIC program as a guide. Regular BASIC is an interpreter, processing each line of your source program and determining what should be done. Since it must re-interpret your source program each time you run it, interpreted BASIC can be as much as 100 times slower than compiled BASIC.

When you write a BASIC program, you have produced a source program in text form. The BASIC interpreter, itself a Machine language program, uses your source program as a source of instructions or commands to control its execution.

**Interrupt** A signal to an MPU that an event has occurred which requires attention. The MPU will save enough information to resume the task it is currently working on, then execute code from an interrupt servicing program. There may be multiple interrupt lines or other ways of distinguishing interrupts, in which case the MPU can tell, by which interrupt signal it receives, what kind of event has occurred.

**Inventory\*** Can sustain, generate, and update more than 350 inventory items per SS disk. May interact with other programs. Requires Extended BASIC Cartridge and printer; disk. Ycan Systems, Inc.

**Inventory\*** Additions, deletions, updates, and sales may be applied to partial or entire inventory. Requires Extended BASIC Cartridge; disk. W.R. Wilson, Inc.

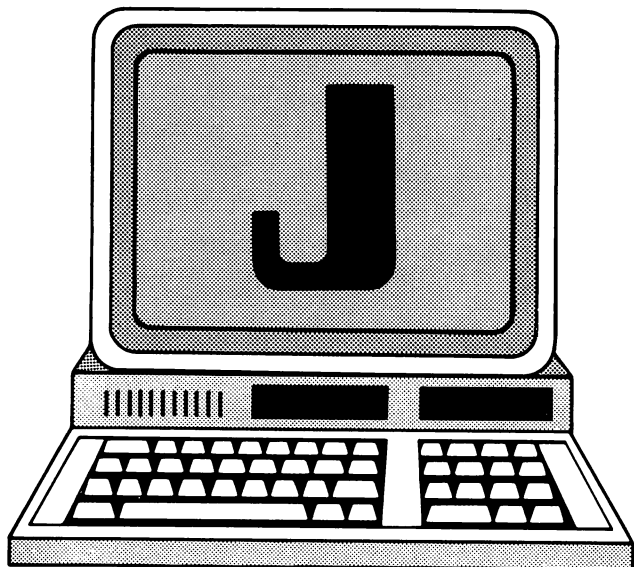
**Inventory Control\*** Six previously defined categories per record: item cost, total cost, name, quantity, reference quantity, and note. Each category appears as a column on the screen and the total number of allowable records is 1000; each of which may be named by the user. Memory Devices.

**I/O** See Input/Output.

**IR** Instruction Register. In most MPU's the IR contains the address of the next instruction to be executed. Branches are implemented by loading a new value into the IR.

**ISAM** See Indexed Sequential Access Method.





**J** Codes. ASCII 74, HEX 4A. j—ASCII 106, HEX 6A.

**Jellybeans\*** The jelly beans are falling through the holes on the conveyer belt and only you can stop them. Northern Lights Software.

**Jotto\*** Increase word power and develop problem-solving abilities. Disk or cassette. Microcomputers Corporation.

**Joyprint\*** A low cost RS-232 interface that connects a printer to the joystick port of your computer console. Needs a mini text editor and a mini memory expansion module. Model Masters.

**JOYST** BASIC Subprogram. CALL JOYST is used to accept data into a program from the wired remote controllers (Joysticks). The format is:

CALL JOYST (<k>,<x>,<y>)

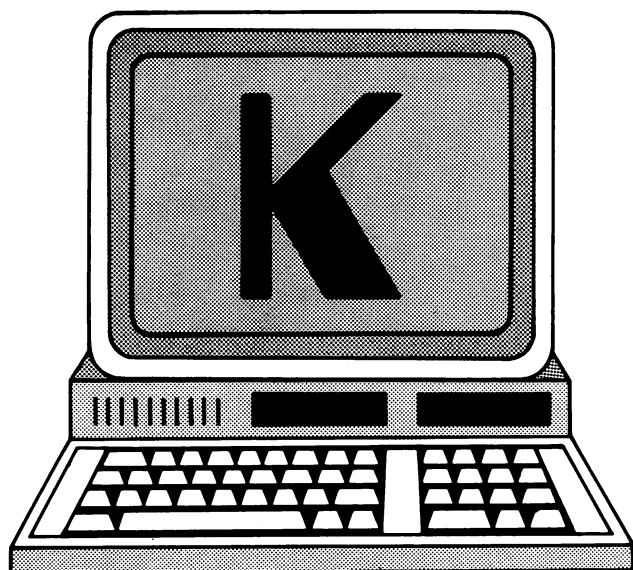
<k> refers to the joystick number (1 or 2). <x> and <y> are values determined by the joystick's position. The values are shown below. The first value listed is assigned to <x> and the second value to <y>.

These values can be entered to affect motion of characters on the screen. For a chart depicting these values, refer to your TI Extended BASIC manual.

The fire button on the Joystick can be used in a program with the CALL KEY Subprogram. The return variable for the fire button is 18. See KEY.

**Justify** To make the right edges of a text file line up straight. Right justification is usually present only in text that has been typeset or processed by a word processor or special typewriter to insert a variable amount of space between words or letters (proportional spacing). This book is printed with a justified right margin.





**K** Codes. ASCII 75, HEX 4B. k—ASCII 107, HEX 6B.

**K** Measurement of bytes of storage in computer memory. Byte is a label for storage of one character (letter, digit, etc.) in internal or external computer memory, and is abbreviated as B, or in thousands KB, or simply K. 1K = 1024 bytes, because this is an even power of 2. The TI99/4 and 4/A computers have 16K bytes of console memory, or 16,000 bytes (to be precise 16K = 16 x 1024 = 16,384 bytes).

**KB** Measurement of bytes in thousands. See K.

**Kemp Games I\*** A series of three games that include sound, color, and graphics. Cassette. Kemp Software.

**KEY** BASIC Subprogram. The CALL KEY subprogram reads a character value from the keyboard. The format is:

CALL KEY (<k>,<x>,<s>)

<k> is the KEY Unit. The Key unit is a number (0-2 for the 99/4, 0-2 for Extended BASIC version 100, 0-5 for the 99/4A and for Extended BASIC version 110) that sets up the keyboard (or joysticks) to read particular numbers into a program when certain keys are pressed.

The keyboard “Maps” for the different values of <k> in CALL KEY can be found in the *Programmer’s Reference Guide* to your computer.

<x> is the return variable.

The computer assigns <k> to the number of the key being pressed.

<s> is the status variable.

The CALL KEY subprogram is usually set up in a program as a part of a “loop” (q.v.). By using the status variable <s>, you can instruct the computer

to stay in the CALL KEY loop or to jump out to the next (or some other) program line. Here are the values assigned to the status variable <s>: +1 is assigned to <s> if a new key has been pressed; -1 is assigned to <s> if the same key that was pressed last time CALL KEY was performed is still being performed; and 0 is assigned to <s> if no key was pressed.

Here’s an example and line-by-line explanation of a short CALL KEY program loop:

```
100 CALL KEY (3,X,S)
110 IF S=0 THEN 100
120 IF S=1 THEN 100
130 PRINT X
140 GOTO 100
```

Here’s what the program is telling the computer to do:

100 “Check to see if a key is being pressed. If not, let S=0 and go on to the next program statement. If a key is being pressed, let S=+1 and use “Map” #3 to find the number to assign to (K). Let K=that number, and go on to the next program statement. If the same key is being pressed, let S=-1 and go on to the next program statement.”

110 “If no key was pressed (if S=0), then go back to line 100.”

120 “If the key is being pressed, (if S=1), then go back to line 100”

130 “Print the value assigned to (X) (in line 100) on the screen.”

140 “Go back to line 100.”

**Key Master\*** A touch-typing course specifically designed for the TI-99/4A computer. Features colors, sound effects, practice exercises, and a space game. Cassette. 99’er Ware (TM).

**Key Search Package\*** A program that can be used to find data within large files with numeric keys and rapid table look-up. Cassette. Anthistle Systems & Programming, Ltd.

**Keyboard** ECHO Function. ECHO means to send characters keyed from the keyboard to the screen. There is no hard-wired connection between the keyboard and the screen. The keyboard simply enters characters into memory. The ROM BIOS programs of the TI-99 then copy the characters from memory to the screen, creating a duplication or “echo” of what was keyed.

**Keyboard** BASIC. See KEY.

**Keyboard, Read Data from** BASIC. See INPUT.



## **Keyword • Krazy Kong\***

---

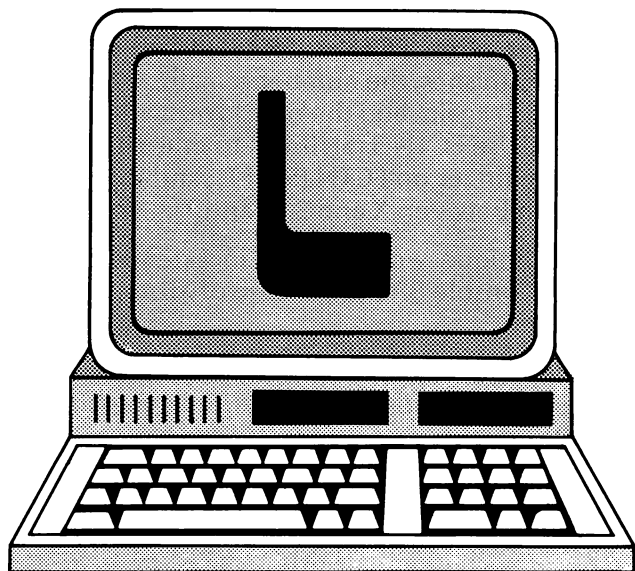
**Keyword** A word with special significance to a program. If misspelled or used for other purposes, erroneous results may occur.

**King Tut's Tomb\*** A three-dimensional color maze game with seven full chambers, hidden pitfalls, bonus coffins, and Tut's ghost. Contains four levels of difficulty. Northern Light Software.

**KLEEN-LINE REGULATOR KLR-500\*** The KLEEN-LINE provides 500 watts of regulated AC current for top equipment performance. The voltage ranges from 90 to 140 volts. KLEEN-LINE systems provide line-noise isolation and lightning-spike protection. Other models include 1000, 1500, and 2000 watt units. An integral ISOLATOR option is available for all models. Electronic Specialists, Inc.

**KONG\*** The villainous Igor tries to bomb Roxanne while Kong, avoiding rolling barrels and trapdoors along the way, climbs to the top of the warehouse to save her. Has six game screens. Requires joysticks: disk or cassette. Extended Software Company.

**Krazy Kong\*** Home version of the arcade game. Has three screens. Joystick is optional. N S Y Software.



**L** Codes. ASCII 76, HEX 4C. I—ASCII 108, HEX 6C.

**Land on Mars\*** Land a spacecraft on alien soil amid dangerous obstacles. Disk or cassette. American Software Design & Distribution Company.

**Largest Line Number** BASIC. The largest possible line number for a BASIC program is 32767.

**Laser Battle\*** Compete against another player or the computer in a war in space. Asteroids can protect or destroy your ships. Developed by William Hoffman. Extended BASIC Cartridge; cassette. Futura Software.

**Laser Shield\*** You must defend your laser base from attacking enemy missiles. Are your reflexes quick enough to protect yourself and four cities from destruction? Disk or cassette. American Software Design & Distribution Company.

**Laser Wars\*** Keep the kids entertained with color and graphics. Cassette. Kemp Software.

**Laws of Arithmetic\*** Teaches commutative, associative, distributive and identity laws. Nineteen different problem levels for students in grades four through eight. Color graphics and sound effects for correct responses. Milliken Publishing Company, Texas Instruments.

**Lazer Tank\*** Lightning quick duels between lazer equipped vehicles. Allows for maveuvering, chasing, and engaging the enemy on the battle field. Not -Polyoptics.

**Learn to Fly: Dow-4 Gazelle** A flight simulation program with sound effects and instrument panel displays. Cassette; joysticks. John T. Dow.

**Learning Drill Program\*** Create a drill table, conduct the drill, and score your answers. Question and answer pairs can be up to fourteen characters long and the disk version allows you to save the table you create; disk or cassette. James Harvey.

**Learning Fractions\*** Solve any type of fraction problem and show each stage of process to the student. Extended BASIC Cartridge; cassette. Hall Software.

**Learning TI BASIC\*** A tutorial on TI BASIC. Cassette. Soft-Sell.

**Ledger Package\*** Maintain current financial records and analyze all types of related data. Includes techniques for organizing information. Disk. RS-232 Interface and printer are recommended. Professional Microware.

**Left Cursor** BASIC. Pressing FCTN S(LEFT ARROW) (99/4—SHIFT S) spaces to the left with the character remaining.

**Leggs\*** A stand for Epson MX-80 and TI Impact printer, consisting of four clear acrylic legs installed into existing holes in the printer. This raises the printer so that a three inch pad of paper can be slid underneath. No tools or drilling are needed. Paper is accessible from all four sides. Argus, Inc.

**LEN** BASIC Function. LEN returns the number of characters in <x\$>. The format is:

<variable> = LEN(<x\$>)

<x\$> is any string expression.

The count returned includes blanks and unprintable characters.

**Length of Line** To set your printer to 60 characters per line, enter BASIC statement:

PRINT #<n>:CHR\$(155);CHR\$(81);CHR\$(60)

**Length of String** BASIC. See LEN(<x\$>).

**LET** BASIC Statement. Assigns the value of an expression to a variable. The format is:

[LET] <variable>=<expression>

<variable> is the name of the variable or array element to receive a value. May be a string or numeric variable or array element.

<expression> is the expression whose value will be assigned to <variable>. The type of expression (string or numeric) must match the type of the variable, or a "String Number Mismatch" error will be displayed.

The word LET is not necessary in BASIC programs

## Letter Writer\* • Line Per Inch (8)

when assigning values to variables. You may simply use the format:

`<variable> = <expression>`

**Letter Writer\*** Select a format for the heading, address, body, and closing of a letter. Input and edit the letter text on the screen, and store the finished letter or output it to the printer. Memory Devices.

**Level A Second Grade\*** Words and their definitions are introduced in seven programs to expand a student's vocabulary. Other versions include Level A Third Grade, Level A Fourth Grade, and Level A Fifth Grade. Disk or cassette. Micro-Ed.

**Life Cycle Costs of Electrical Motors\*** Assists engineers in developing standards for electric motors. Makes the necessary calculations, comparisons, and is a real time saver. Disk or cassette. Technical Advancement Associates.

**Life Expectancy\*** Asks you personal questions requiring yes or no answers. You are then told about your life expectancy. Disk or cassette. Data Systems.

**Line, Blank** A `PRINT #<n>`: statement with no other specifications will print a blank line (or, feed the paper up one line and return to left margin) to format your printout neatly.

**Line, End Current** Press ENTER to end the current line, send the line to the requesting program, and put the cursor at the start of the next line.

**Line Feed** Printer. To advance one line on the printer (space up) without carriage return, enter BASIC statement:

`PRINT #<n>: CHR$(10)`

or use "line feed" button (LF) on printer.

Entering `PRINT #<n>`: gives a line feed—both space up one line (line feed) and return to left margin (carriage return).

**Line Length** To set to 60-characters-per-line (for example) enter BASIC statement:

`PRINT #<n>: CHR$(155);CHR$(81);CHR$(60)`

**Line Number** Largest in BASIC. The largest possible line number for a BASIC program is 32767.

**Line Number Where Error Occurred** XBASIC. See ERR.

**Line Numbers** BASIC. Automatically generating line numbers. See NUMBER.

**Lines, Deleting** BASIC. Type the number of the first line you want deleted. Press FCTN X (DOWN

ARROW)(99/4—SHIFT X). The line comes up on the screen. Press FCTN 3 (ERASE)(99/4—SHIFT T). The line vanishes, the number remains. Press FCTN X (SHIFT X) again, and the next lowest line number appears. Use FCTN 3 (SHIFT T) to erase it. You can hold one finger on FCTN (SHIFT), and toggle back and forth between X and 3 (X and T).

This technique works better in Extended BASIC than in Console BASIC because of XBASIC'S faster edit time.

Another way to delete program lines is with the "Programming Aids III" diskette. See Programming Aids III.

**Lines, List** BASIC. To display all the lines of the program in memory, enter:

`LIST`

To display program lines from start up to line 100 enter:

`LIST -100`

To display program lines from line 100 to end, enter:

`LIST 100-`

To display program lines from line 100 to line 200 enter:

`LIST 100-200`

To display program line 100 only enter:

`LIST 100`

In Extended BASIC, to freeze the list during its display so you can read it, press the space bar and hold it until the list freezes. Press again to restart the listing.

**Lines, Program** To erase old program lines before starting a New program,

`NEW`

This completely erases all lines now in BASIC's memory. If it's something you want to keep and haven't already stored on diskette, SAVE it first. If you don't erase the program in memory before starting on another, you will probably wind up with an unusable combination of lines from your old and new programs.

**Lines Per Inch (6)** To set your printer for this line spacing, enter BASIC statement:

`PRINT #<n>: CHR$(155);"2"`

See Type Formats.

**Lines Per Inch (8)** To set your printer for this line spacing, enter BASIC statement:

`PRINT #<n>: CHR$(155);"0"`

See Type Format.

**Lines Per Inch (72/7)** To set your printer for this line spacing, enter BASIC statement:

```
PRINT #<n>:CHR$(155);"1"
```

or

```
PRINT #<n>:CHR$(155);CHR$(49)
```

This is a good setting for spacing with compressed print. See Type Format.

**Lines Per Page** To set your printer page length to 55 lines (for example), enter BASIC statement:

```
PRINT #<n>:CHR$(155);"C";"55"
```

**LINK** XBASIC Subprogram. CALL LINK is used to access Assembly language subprograms. Used in conjunction with subprograms CALL INIT, CALL LOAD, and CALL PEEK. The format is:

```
CALL LINK (<subname>[,<x or x$ >][,...])
```

<subname> is the name of the Assembly language subprogram you want to CALL.

<x or x\$ > is the variable, expression, or group of variables and/or expressions that the Assembly language subprogram <subname> needs in order to run.

CALL LINK transfers control to an Assembly language subprogram from an Extended BASIC program. The Assembly language program named in CALL LINK must be loaded into memory expansion first using CALL LOAD (as a statement or as a command.)

**Link Time** The point in the processing of a program with a language translator (Compiler or Assembler) when the program is tailored for a specific memory location. This occurs after compiling (compile time) but before execution (execution time). Some small systems do not require linking.

**LINPUT** XBASIC Statement. LINPUT reads an entire line of up to 254 characters from the keyboard into a string variable, ignoring delimiters. The format is:

```
LINPUT ["<prompt>":]<x$ >
```

<"prompt"> is a message displayed before input is accepted. A question mark is not printed unless you include it with the prompt string.

<x\$ > is the string variable assigned to the data input from the keyboard.

**LINPUT#** XBASIC Statement. LINPUT# reads an entire line from a file into a string variable, ignoring delimiters. The format is:

```
LINPUT# <filenum>[,REC<recnum>]:<x$ >
```

<filenum> is the number of a file opened earlier in the program.

<recnum> is the number of a specific record.

[REC<recnum>] may only be used with files set up

with RELATIVE file organization.

<x\$ > is the string variable that will be assigned to the data input from <filenum>.

LINPUT# may only be used with DISPLAY type files.

**LISP** A programming language oriented toward symbols rather than numbers, best at handling data structures unspecified in advance. LISP permits you to build and discard intermediate structures without needing to find and reuse the necessary space. The natural method of building programs in LISP by function composition encourages good programming style, and simplifies modular programming. LISP is not available for the 99/4 and /4A at this time.

**LIST** BASIC Command. LIST command displays the program currently in computer memory. The format is:

```
LIST["<dvc>"][:<linea>][-<lineb>]
```

or

```
LIST [<linea>][-<lineb>]
```

(dvc) is a device name, such as "TP" (Thermal Printer), "RS232," etc. If <dvc> is not specified, the listing will be printed on the screen.

<linea> <lineb> are valid line numbers in the range 0 to 32767. <linea> is the first line to be listed and <lineb> is the last.

When using console BASIC, listings displayed on the screen may be stopped at any time by pressing FCTN CLEAR (FCTN 4).

When using Extended BASIC, press the space bar to interrupt the listing. You can list an entire program simply by entering LIST.

Three options are available when using the hyphen (-):

1. If you declare only <line>- that line and all higher numbered lines will be listed.
2. If you declare only -<line>, all lines from the beginning of the program through <line> are listed.
3. If you declare both line numbers, <linea> <lineb>, all lines from <linea> through <lineb>, inclusive, are listed.

For example:

```
LIST 100
```

will list line 100 on the screen.

```
LIST "RS232";-100
```

will list lines through 100 on a device (such as a printer) connected to the RS232 port.

```
LIST 100-
```

will list lines 100 and all subsequent lines of the program.

## List All Files on A Diskette • Lunar Lander\*

### LIST 200-300

will list lines 200 through 300, inclusive, on the screen.

**List All Files on A Diskette** See BASIC—Listing of files or Programs on Diskette.

**LOAD** X BASIC Subprogram. CALL LOAD loads an Assembly language subprogram into memory expansion to be executed using the CALL LINK statement. This is done in one of two ways:

1) Load an object file containing the Machine Code from a file named <access name> into memory at >A000. The format is:

```
CALL LOAD (<access name>[,<access name>]...)
```

The second and subsequent files, when included, are loaded immediately after the preceding files.

2) Poke data specified as a list of constants—<value>... starting at <memory address>. This format is:

```
CALL LOAD (<memory address>,  
           <value>[,<value>]...)
```

Multiple poke addresses may be specified, separated by the null string:

```
CALL LOAD (<memory address>,<value>  
           [,<value>]...," "<memory address 2>,  
           <value>[,<value>]...)
```

**Load Module** A file containing object code ready to load into memory.

**Load Time** The point in the processing of a program when all translation and linking are completed and the program is loaded from disk or tape into memory for execution.

**LOCATE** X BASIC Subprogram. CALL LOCATE changes the location of sprites in the screen. The format is:

```
CALL LOCATE (#<sprite>,<pr>,<pc>)
```

<sprite> refers to a sprite defined earlier in a program.

<pr> <pc> are the numbers of the pixel row and column, that define the new location of the sprite. Pixel rows are numbered 1-256, with numbers 193-256 at the bottom of the screen. Pixel columns are numbered 1-256. The upper left hand corner of the sprite is placed at the position defined by (<pr>, <pc>).

**Locked-Up-Keyboard** See Frozen Keyboard.

**Log\*** Calculate the log value of any number with the log base and starting number. Disk or cassette. Data Systems.

**LOG** BASIC Function. LOG function returns the natural logarithm of (x) (log to the base (e)). The format is:

<variable> = LOG(<x>)

<x> must be a numeric expression which is greater than zero.

**London Blitz\*** Man the guns and keep enemy aircraft in check. A game based on the World War II bombings of London. Created by Ron Binkowski. Cassette. Requires Extended BASIC Cartridge and joysticks. Futura Software.

**Loop** BASIC. See FOR and NEXT.

**Loop, Delay** BASIC. To freeze the screen while the operator reads a display message, write a delay loop after you print the message:

```
1000 FOR Y = 1 TO 2000  
1010 NEXT Y
```

To freeze the screen until the operator is finished, input a dummy statement instructing the operator to press ENTER and proceed. The input variable (A\$) need not be used in your program:

```
1000 INPUT "Press ENTER to continue";A$
```

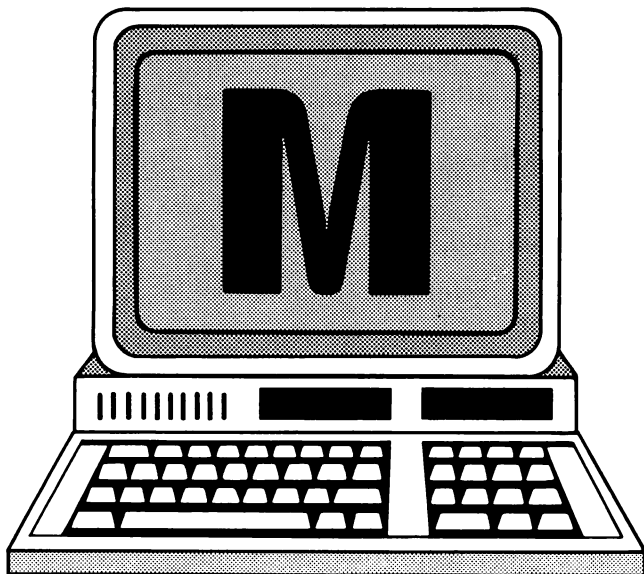
**Loop-back** Synonym for ECHO. Loop-back or ECHO is used to test the circuits for an input/output device by "looping" whatever is output back into the computer as if it were input. In this way, the circuits inside the computer are tested independently from the circuits of the external device to help determine the exact location of the problem.

**Lotus 1-2-3** A second generation spreadsheet and first generation database. As a spreadsheet, it is 2048 rows by 256 columns, and offers fifteen operators, forty-one functions and sixty-six commands. Add to this the graphing and database functions, and the total number of commands is 110. Lotus 1-2-3 is not available for the TI99/4 or 4/A.

**LRC** Logitudinal Redundancy Check. See CRC.

**LSB** Least Significant Bit.

**Lunar Lander\*** Crash land on your favorite planet. Multiple levels of play. Norton Software.



**M** Codes. ASCII 77, HEX 4D. m—ASCII 109, HEX 6D.

**Machine Language Program** All programs that run directly on the TI are Machine language programs (in the actual numeric instruction code of the TI's 9900 microcomputer chip), and were originally written as source programs, containing readable statements in such languages as FORTRAN or COBOL, then translated by a compiler program, to produce an object program.

The object program contains the Machine language instructions for the TI's 9900 which corresponds to the instructions of the original source program. BASIC programs work in this way with a BASIC compiler. (Not available for TI-99/4 or /4A at this time).

Regular BASIC works in a slightly different way. Regular BASIC is a program which uses your BASIC program as a guide to what it should do. It is therefore an interpreter, processing each line of your source program and interpreting what should be done. Since it must re-interpret your source program each time you run it, interpreted BASIC can be as much as 100 times slower than compiled BASIC.

When you write a BASIC program, you have produced a source program in text form. The BASIC interpreter, itself a Machine language program, uses your source program as data—a source of instructions or commands to control its execution.

**Machine Language Program** Load with BASIC. See LOAD.

**Machine Language Program** XBASIC Subroutine. See LINK.

**Mad Monopolist, The\*** A computerized version of Monopoly. Buy and sell your way to riches or bankruptcy. Requires Extended BASIC Cartridge; disk or cassette. Prometheus Software.

**Magazines** There are a number of popular, computer-oriented magazines which contain useful information. Most computer stores and larger bookstores carry a good assortment of these magazines. *BYTE* is an excellent source for general information on microcomputers. *Infoworld* is a weekly newspaper about microcomputers.

*99'er Home Computer Magazine* is totally devoted to TI-99 and a must for the 99 user. *Enthusiast 99* is another source of information published by the International 99/4 Users' Group. *Compute!* also has significant coverage of the TI99.

If you want to subscribe or write for information, here are the addresses:

**BYTE**

Subscription Dept.  
P.O. Box 590  
Martinsville, NJ 08836  
U.S. = 1 year \$19 12 issues

**Compute!**

P.O. Box 5406  
Greensboro, NC 27403  
U.S. = 1 year \$20 12 issues

**Creative Computing**

P.O.Box 789-M  
Morristown, NJ 07960  
U.S. = 1 year \$20 12 issues

**Enthusiast 99**

International 99/4 User Group Newsletter  
P.O. Box 67  
Bethany, OK 73008

**InfoWorld**

Circulation Dept. Box 837 Framingham, MA 01701  
U.S. = 1 year \$25 52 issues

**99'er Home Computer Magazine**

P.O. Box 5537  
Eugene, OR 97405

**MAGNIFY** XBASIC Subprogram. CALL MAGNIFY specifies the size of sprites and the number of characters in each sprite. The format is:

CALL MAGNIFY (<factor>)

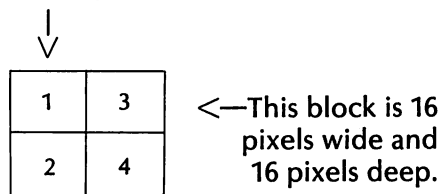
<factor> is the magnification factor: 1, 2, 3, or 4. CALL MAGNIFY affects the size of all sprites. If you do not input a CALL MAGNIFY statement, the default magnification factor is 1.

<factor>=1 sets all sprites at single size, unmagnified. Each sprite takes up one character position on the screen.

<factor>=2 sets all sprites at single size, magnified, making the sprite twice as wide and twice as tall, but still defines it with a sixteen hex digit pattern identifier. The sprite takes up four character positions on the screen.

<factor>=3 sets all sprites a double size, unmagnified, making a sprite the same size as with magnification 2. However, because each sprite is being defined by four ASCII characters, the sprite can be given more detail. With this factor, the computer needs a sixty-four hex digit pattern identifier in the CALL CHAR statements. See CALL CHAR for a more detailed explanation. Also, the character code in the CALL SPRITE statement should be divisible by 4, or unpredictable results will occur. The sprite is laid out on the screen as shown below:

This is the block specified in sprite.



If you were specifying a sprite number with a character code of 128, using the above diagram,

ASCII character number	Would become a string defining position
128	1
129	2
130	3
131	4

<factor>=4 sets all sprites at double size, magnified. This creates a sprite of 64 x 64 pixels on the screen. All the rules for magnification 3 are the same, but the sprite takes up sixteen character positions on the screen. With magnifications 2 and 4, the sprite is enlarged to the right (the upper left pixel remains in the same position).

**Mail List\*** Automatically updates from the order entry program, sorts whenever desired on any field, and allows for printing on numerous types of output. Requires RS-232 interface, printer, and the Extended BASIC Cartridge; disk. Ycan Systems, Inc.

**Mailing List\*** Keeps mailing list information current for easy reference. Search, sort, and alphabetize names, addresses, telephone numbers, and other information. Texas Instruments.

**Mail-Out\*** Keep up to 1000 records of names, addresses, and L phone numbers. You can search the file for specific names, and print mailing labels. Memory Devices, Inc.

**Main Memory** See Memory.

**Making An Outline\*** After an article is displayed to the student, he/she must complete a partial outline on the subjects covered in the text. Disk or cassette. Micro-Ed.

**Manual** A process done by hand, not automated or programmed.

**Manual** A reference book, booklet, or other document.

**Many Mini's\*** Figure out your life expectancy and blood alcohol content. Fox Valley Software.

**Maps and Globes\*** This program should be used in conjunction with the booklet "Skills for Understanding Maps and Globes." Contact the manufacturer for more information. Requires Extended BASIC Cartridge; disk and cassette. Micro-Ed.

**Mark Reporter\*** Produce and maintain academic records, progress reports, and summaries for several classes. Requires dual disk drives, RS-232 interface, and compatible printer; disk. Scott, Foresman and Co.

**Market Simulation\*** Two contestants are placed in head-on business competition. The players choose the amount of advertising, how many units to produce, and watch the results. Built-in economic changes make this game even more realistic. Disk or cassette. Texas Instruments.

**Martian Lander\*** Pilot a spaceship running dangerously low on fuel. You must land the ship before crashing it. Your ship is controlled by joystick and keyboard. Requires Extended BASIC Cartridge; cassette. Galactic Software.

**Master Catalog\*** Creates an alphabetical master index of 100 programs per disk. Look-up time is under one minute from a cold start, and fifteen to twenty seconds from a running program. Extended Software Company.

**Master Menu** A screen display listing a number of possible options. When a selection is made, the selected function is performed.

Many application packages use a multiple menu system. A Master Menu lists the major functions allowed. Selecting an option on the Master Menu displays another menu, indicating more detailed options for the selected function. This can be followed by even more detailed menus, and so on. Often, completion of a function will cause re-display of the Master Menu. Such a system is called menu-driven.

**Match Wits\*** Take turns trying to match pairs of hidden colored pictures until a pair is chosen. Matching your own pairs is worth one point, matching your opponent's pairs is worth two points. Pewterware.

**Match'Em I\*** Preschool lessons on counting and numeral and letter recognition. Disk or cassette. Microcomputer Corporation.

**Match'Em II\*** Provides lessons on small letters and Roman numerals for the young student. Disk or cassette. Microcomputers Corporation.

**Math Practice\*** Lets students practice a variety of math concepts. Areas covered: equations, geometry, factoring, logic, addition, subtraction, multiplication, and division. For grades two through twelve. Requires Extended BASIC Cartridge; disk. Texas Instruments and the Minnesota Educational Computing Consortium (MECC).

**Math Routines Library\*** Performs base conversions, prime factorizations, function analyses, Fourier series calculations, hyperbolic functions, and simultaneous equation calculations. Texas Instruments.

**Mathematics Action Game Series Module A\*** Learn basic math by playing these games that feature sound, color and animated graphics. For grades K-3. Includes teacher's guide and forms. Cartridge. Scott, Foresman and Co.

**Mathematics Action Game Series Module B\*** Motivate students to practice multiplication and division. For grades three through six. Includes a teacher's guide and assessment forms. Cartridge. Scott, Foresman and Co.

**Mathematics Action Game Series Module C\*** Practice using decimals and fractions. A two-game set for sixth to eight grade students. Cartridge. Scott, Foresman and Co.

**Matrix Mathematics\*** Contains subroutines for multiplying and inverting matrices, solving simultaneous equations, finding determinants, performing cross and dot product operations, row and column interchange, transpose, and pivot operations. Disk or cassette. Eastbench Software.

**MAX** XBASIC Function. With the MAX function, the computer determines which of two numbers is larger, and returns that number's value. The format is:

MAX (<x>,<y>)

<x> and <y> are the two numbers you want the computer to compare. If <x>><y>, the computer returns their value.

**Maximum Assembler\*** Create large programs in high-speed Assembly language. Works with your Mini Memory Module. M.K. Eckhaus.

**MC** Machine Code. Actual Machine language instructions, whether written directly in MC or resulting from translation of a source program.

**Mean Streets\*** Control a ten member SWAT team in its attempt to capture bank robbers on the run in a large city. Alpha Software.

**Measurement Formulas\*** Twenty-six levels of practice for area and volume of squares, rectangles, and cubes. Grades six through eight. Includes color graphics and sound. Texas Instruments and the Miliken Publishing Company.

**MECC Series\*** Contains eleven science and math programs for Junior and Senior High School students. Programs include Astronomy, Exploring, Elementary Economics, Natural Science, and others. Requires Extended BASIC Cartridge. Texas Instruments and the Minnesota Educational Computing Consortium.

**Mechanical Software** See Engineering—Mechanical and Scientific Software.

**Med Alert\*** A guide to first aid and accident prevention, developed by Duane Fisher. Requires Extended BASIC Cartridge; disk. Futura Software.

**Media** Modes of recording and storing information. The main medium for the TI-99/4 or /4A is cassette, but RAM, ROM, disk and other devices are also used. Media are often classified as:

a) removable media, such as diskettes, cassettes and some hard disks, or

b) fixed, such as most hard disks. Fixed media are not removable from the device that drives them, so there is no ability to store additional data or backup copies off-line (outside the computing system) for insertion when needed. See Memory.

**Media** See BASF, Cassettes, Compu.sette Cassettes/Diskettes, Computer Cassettes, Mini Disks.

**Medieval World\*** You are a Duke aspiring to be the King. To reach this goal you must first build up your supplies of grain and gold. Requires Extended BASIC Cartridge; cassette. Galactic Software.

**Memory** Any device which stores information and allows it to be retrieved when needed. The TI-99/4 and /4A computers rely primarily on random access memory (RAM), read-only memory (ROM), cassettes, and diskettes. Memory, by itself, is usually a reference to RAM. This is the erasable and reusable memory located inside either the



Console, or in the optional Memory Expansion. ROM (read-only) memory contains fixed data, usually programs such as the 99's BASIC ROMs and its ROM BIOS (BASIC Input/Output System). The ROM BIOS contains the fundamental Machine language programs to run the various devices attached to the console, such as monitor, printer, diskettes, or cassettes. ROM and RAM make up the internal or main memory of the TI, or any other computer.

Contrast this with external memory such as cassette and diskette, which involve mechanical motion to retrieve data and are hundreds or thousands of times slower than internal memory. Data in internal memory is immediately available to programs for processing. Data in external memory must be copied into internal memory (READ or INPUT), processed, then copied back to external memory (WRITE or OUTPUT).

Data that has been created can be written to external memory without a READ first. And, if data read from external memory has not been modified, there is no need to write it out since the original copy is still there.

While external memory is very slow compared to internal memory, it also has advantages. It is much cheaper per character of data stored on-line (available for processing without manual intervention). Also, the ability to store external memory data off-line allows unlimited storage of data. This requires the insertion of the diskette/cassette before the data can be loaded into the internal memory for processing.

**Memory** See Disk Memory System, Doryt 32K Memory, ICS 1000 32K Memory Card, ICS 2000 32K Memory Add-on, Memory Expansion Card, Mini-Memory, 32K Memory Card, 128K Memory Card.

**Memory—Amount Free** BASIC. To find the amount of memory available in BASIC, enter the following program:

```
>1 X=X+8
>2 GOSUB 1
>RUN
```

The computer will RUN, and the extra memory (what's not occupied by your program) will fill up. The message

MEMORY FILL IN 1

will be displayed. Then enter

```
PRINT X
```

The number printed is the amount of available space in memory.

(Don't forget to erase lines 1 and 2 after you are finished.)

**Memory, Amount Free** XBASIC. See SIZE.

**Memory, Reading Bytes From** XBASIC. See PEEK.

**Memory, Storage in Bytes** Byte is a label for storage of one character (letter, digit, etc.) in internal or external memory. Abbreviated as B, or in thousands, as KB or simply K (actually, 1K = 1024 bytes, an even power of 2).

The TI-99/4 and /4A has 16K (or 16KB) of internal memory, or approximately 16,000 (to be precise, 16K = 16 x 1024 = 16,384 bytes).

**Memory Address** A number or variable designating a location in memory. See Address.

**Memory Card** A card containing RAM or ROM memory to expand or enhance the computer's main memory.

**Memory Expansion Card\*** Adds 32K bytes of RAM (Random Access Memory) to your Home Computer. Just plug the card into the Peripheral Expansion box and you are ready to go. Texas Instruments.

**Memory Segment** A continuous block of memory addresses, such as 0 to 16K.

**Menu** Screen display listing a number of possible options from which the user may select one or more. When a selection is made by keying in an identifying number or letter, (or positioning the cursor beside the desired item), the selected function is performed. This may require a branch or subroutine call to the code for the function, or the program to carry out this function may be loaded into memory and executed.

Many application packages use a system of multiple menus. A Master Menu lists the major functions allowed. Selection of an option on the Master Menu will display another menu, indicating more detailed options for the selected function. This can be followed by even more detailed menus, and so on. Often completion of a function will cause re-display of the Master Menu. Such a system is called menu-driven.

**Menu-Driven** See Menu.

**MERGE** XBASIC Command, MERGE allows you to put additional lines into a program that's currently in (RAM) memory. It can only be used with diskettes. The format is:

```
MERGE ["]DSK<n>. <program name>["]
```

<n> is the disk drive number (1-3) where the program to be MERGED is located. <program name> is the name of a program previously SAVED using the MERGE keyword. See SAVE.

When a program is MERGED into the computer's memory, the computer checks all old and new line numbers. If a line number duplication is found, the computer deletes the old line and replaces it with the line from the MERGE program. All other lines are put in line number order.

**Message** A statement or code printed out or displayed on the screen by a program to let you know what is happening. Examples include prompts, when the program expects you to input something; error messages which tell you something about what went wrong; and informational messages, such as Command.

**Meteor Multiplication\*** Quick action and multiplication skills are required to survive a dangerous threat from space. Texas Instruments.

**Meteor Shower\*** Throws you into the midst of a meteor shower. The longer you can evade the meteors the faster they will fly at you. Disk or cassette. American Software Design & Distribution Company.

**Meteor Storm\*** You are headed into the heart of a meteor storm. The longer you survive, the thicker the storm gets. Disk or Cassette. Requires Extended BASIC Cartridge; disk or cassette. Intersoft.

**Metric and Counting\*** Includes several programs for practice with metrics, basic math, and computer skills. For students in grades two through six. Disk. Requires Extended BASIC Cartridge; disk. Texas Instruments/Minn. Educational Computing Consortium.

**MICROCOMPUTING\*** A monthly computer magazine geared for the novice computer user. Microcomputing Magazine/Wayne Green, Inc.

**MicroFazer\*** An inexpensive universal printer buffer (8K to 64K available). Attaches directly to the input port of Epson, and other printers. MicroFazer is available in five versions: parallel-to-parallel, parallel-to-serial, serial-to-serial, and serial-to-parallel. Quadram Corporation.

**Micrograde\*** Create an easily accessible and maintained electronic grade book for class rosters and reports on cumulative performance. Requires Extended BASIC Cartridge; 32K RS-232 interface, and printer are recommended; disk. Charles Morreale.

**Microprism\*** A low cost printer with seventy-five CPS operation, pin and friction feed, and data printing at 110 CPS. Contains both RS-232 and parallel interfaces, and features data plot graphics. Integral Data Systems, Inc.

**Microsoft Multiplan\*** See Multiplan.

**Milliken Math Series\*** Provides basic math practice and drills for children ages four through thirteen. Includes sound effects and color graphics. Developed by the Milliken Publishing Company. Texas Instruments.

**MIN** XBASIC Function. With the MIN function, the computer determines which of two numbers is smaller, and returns that number's value. The format is:

MIN(<x>,<z>)

<x> and <z> are the two numbers you want the computer to compare. If <x><z> the computer returns their value.

**Mind Challengers\*** Includes two different games: an echo sequence of notes, and a game using shapes and colors in code-breaking. Texas Instruments.

**Mind Masters\*** A program that uses the computer to decipher answers in logic problems. For one or many players. Cassette. Image Computer Products.

**Mini Disks\*** 5¼ inch mini disks are available in two models for use on Shugart or the TI. The MD-1 is single-density, single-sided, and designed for use on mini floppy disk drives. Maxell.

**Mini Memory Solid State Software Cartridge\*** 6K of Graphics Read Only Memory, 4K of Read Only Memory, and 4K of RAM (Random Access Memory), which is retained even after the computer is turned off, or the cartridge is removed, makes a total of 14K bytes of memory contained in this cartridge. Programming tools included. Texas Instruments.

**Minigolf\*** No two consecutive holes or games are the same in this miniature golf game for one or two players. Each game is eighteen holes, with sixteen different possible greens in the program. BeeJay Funware.

**Minigolf II\*** The same as Minigolf 1, except you can play this version over the telephone with a friend. BeeJay Funware.

**Miniprint\*** For use with the Joyprint interface but can also be used with a printer connected to the Peripheral Box. It loads from cassette into the Mini Memory where it executes to print files, programs, diskette catalogues, etc. Model Masters.

**Minus Mission\*** Strengthen subtraction skills while the robot fights to defend its territory from the "creeping slime" above it. Help the robot fight by providing the correct answers. Subtraction problems for numbers 0 to 9 are used. Texas Instruments.

**Misplaced or Dangling Modifiers\*** Correct the given sentences if needed. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Mission Impossible Adventure Database\*** “Your mission, should you decide to accept it...” is to save the doomed nuclear reactor. Requires Adventure cassette; disk or cassette. Texas Instruments.

**Mixed Program Lines** BASIC. Erasing BASIC Memory. To start a new program type:

NEW

This completely erases all lines now in BASIC’s memory, so if it’s something you want to keep, SAVE it first. If you don’t erase the program in memory before starting on another, you will usually wind up with an unusable combination of mixed lines from your old and new programs.

**MMM Edit Assembler\*** A combination editor-assembler with several features not found in line-by-line assemblers. Assembler directives like DEF and TEXT and a symbol table of all the addresses for MMM ROM routines are included. With the easy-to-learn editor you can save and restore your source codes from two or more cassette drives and modify them using over twenty edit commands. You can also merge all or part of separate programs. A special bonus program is included which decodes ROM routines and their programs. C.A. Root.

**Mnemonic** A name or abbreviation which is intended to remind you of what it stands for, such as LAX for load accumulator into X register.

**Modem** MODulator DEModulator. A device to convert the digital voltage level signals of the computer to modulated (frequency or tune) signals for transmission over phone lines. Required at both ends of a phone line for telecommunications.

**Monitors** See CT 160 Color Monitor, TR120, Video Monitor.

**Monthly Budget\$ Master\*** Provides a built-in format for creating up to thirty different budget accounts. You may save and retrieve data files, with rapid data entry and editing. Output can be routed to a printer or to the screen. SA2 Software.

**Moonbeam Express\*** You are on a supply mission to deep space and must defend your cargo ship against enemy attackers. Moonbeam Software.

**Moonduster\*** You must land your space capsule on prearranged landing areas before your fuel runs out. Designed by Neil Weinstock. Cassette. Futura Software.

**MoonVasion\*** It’s your moonbase squadron against attacking alien starfighters. Fire your Moon Launch before you are destroyed. Moonbeam Software.

**More Prefixes\*** Choose the correct prefix to attach to a given word. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc. See Prefixes.

**More Suffixes\*** Choose the correct suffix to complete the given word. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc. See Suffixes.

**Morse Code\*** Two programs for easy and effective study of morse code: Learning Morse Code and Programmable Morse Code Practice. Dynamic Data Devices.

**Mortgage and Loan Amortization Schedule\*** Figures monthly payment, interest, principal, and balance for the term of your loan. Fox Valley Software.

**Mortgage Amortization Schedule\*** Calculate fully amortized loan payment amounts, and extract interest and principal amounts for any given period of up to 12 months. Cassette PRP Computergraphics.

**MOS** Metal Oxide Semiconductor. A technology used for fabricating high-density IC’s, so named for the three successive layers of materials used. Most LSI devices such as microprocessors are based on MOS technology.

**Motherboard** The main printed circuit board in an electronic device, usually the largest, with “slots” for smaller boards to plug into. See Board.

**MOTION** X BASIC subprogram. CALL MOTION is used to change the speed and/or direction of sprites on the screen. The format is:

CALL MOTION ((#<sprite>,<vr>,<vc>))

<sprite> refers to a sprite defined earlier in a program.

(<vr>,<vc>) are the numbers of the row velocity and column velocity that define the sprite’s speed and/or direction.

Here are the rules governing <vr> and <vc>.

- 1) <vr,>vc> can be from 128 to 127.
- 2) If <vr>≥0, the sprite is not moving up and down.
- 3) If <vc>≥0, the sprite is not moving from side to side.
- 4) If <vr> and <vc>≥0, the sprite is stationary.
- 5) If <vr> is a positive value, the sprite moves down; if <vr> is a negative value, the sprite moves up. if <vc> is a positive value, the sprite moves to the right, If <vc> is a negative value,

the sprite moves to the left. Values far from zero move the sprite faster. Values close to zero move the sprite slower.

6) If <vr> and <vc> are both not zero, the sprite moves smoothly at an angle, with speed and "heading" defined by <vr> and <vc>.

If a sprite comes to the edge of the screen, it "wraps"; that is, or disappears and reappears in the corresponding row or column on the other side of the screen.

**Moving the Cursor** The cursor is the flashing block (or in some programs a different symbol such as a square) which appears on the screen to let you know where an action (such as typing in a character, deleting, inserting, etc.) will take place. The cursor moves to the right as you type, backs up to the left when you press FCTN S(LEFT arrow)(99/4—SHIFT S). LEFT arrow does not erase the characters from the screen as the cursor moves left.

It is often necessary to first position the cursor to the correct location, then enter certain characters there for the desired outcome. To change a line of a BASIC program listed on the screen, move the cursor to where the change is required, using FCTN D(RIGHT arrow)(99/4—Shift D). Retype, delete, or insert as needed; then press ENTER (to send the changed line into BASIC).

**MPU** MicroProcessor Unit. The actual chip containing the processor. The TI-99/4 and 4/A use the 9900 CPU chip.

**Mr. Frog\*** Learn to recognize letters and to count as you try to win a race. Features graphics and music. Requires Extended BASIC Cartridge; disk or cassette. American Software Design & Distribution Company.

**MSB** Most Significant Bit.

**Multiplan\*** After VisiCalc's 1978 release and subsequent success, the microcomputer was perceived as a viable tool for small businesses. Without requiring much programming experience, the electronic spreadsheet was recognized as an easily mastered program that could still provide sophisticated results for daily bookkeeping and financial planning. With a booming new software market, new brands of electronic spreadsheets were rushed onto the market. With each VisiClone trying to be a little better than its predecessor, Multiplan is one of the latest and more successful attempts to go "VisiCalc" one better.

While one look-alike, SuperCalc, tried to outdistance the original in processing speed, Multiplan's main appeal is in its ease of use. VisiCalc,

using a command line of a single row of letters spread across the top of the screen, is perhaps too cryptic for inexperienced users. Multiplan has simplified the user interface (the screen as the user sees it) to make use of the spreadsheet easier.

Multiplan divides the computer screen into a grid of rectangular cells. A row of numbers stretches across the top, and another down the side of the screen giving the coordinates for each cell. Unlike VisiCalc, Multiplan uses numbers for both row and column coordinates. The first cell in the upper left corner is referenced as R1C1, for Row 1 Column 1, rather than the A1 of VisiCalc. Multiplan's numbering scheme simplifies moving about the spreadsheet by using coordinates that are easy to remember.

The Multiplan command line has two rows of command words at the bottom of the screen, replacing VisiCalc's line of single letters. Spelled out on screen, the commands are easier to understand and work with. The Multiplan screen also features information such as the current cursor position, amount of memory remaining, a message line, and the name of the worksheet.

Multiplan's commands, such as Blank, Delete, Copy, Move, and Format, closely parallel VisiCalc's. Multiplan also has seven new commands, which are not found in VisiCalc, including Lock, Sort, and Name. Multiplan provides the same functions used in creating formulas of a spreadsheet, and adds twelve more of its own. Other features, such as multiple windows, make Multiplan a powerful analytical tool.

Creating a spreadsheet involves placing numeric values in the different cells and then relating them to other cells with mathematical formulas. The cells R1C1, R1C2, and R1C3 each represent a value and might be added together in the formula R1C1+R1C2+R1C3. The total of this formula appears in a fourth cell somewhere on the spreadsheet. One feature of Multiplan is the ability to give individual cells meaningful names. The value in R1C1 can be given the name SALES if the value the cell holds is a sales statistic. The value in another cell can be named COSTS. Multiplan allows the use of cell names in your math so that you can create a formula of SALES-COSTS, and have the new value appear in a cell named PROFITS. The ability to name cells and use them in spreadsheet mathematics simplifies the logic required to create complicated spreadsheets. This feature represents a significant improvement over Multiplan's predecessors.

Multiplan is one part of an integrated software package, dubbed "Multitools", which Microsoft is

## Multiple Choice Questions • Mystery Melody\*

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developing. Requires Multiplan Cartridge: disk. Texas Instruments/Microsoft Corporation.

**Multiple Choice Questions\*** Design a series of questions to be used with a selection of possible answers. Disk or cassette. Microcomputers Corporation.

**Multiple Statements on One Line** XBASIC. Extended BASIC allows you to put a double colon (::) at the end of one statement and continue entering another statement on the same line, without giving a new line number. The line number at the left refers to all statements on the line. An exclamation point (!) allows a tail remark to be added after a statement, with or without a separating double colon.

**Multiplex** Use the same component for several distinct functions, either sequentially or simultaneously. The address lines of an MPU are often used as the data lines at another point in time—an example of multiplexing.

**Multiplication\*** Multiplication aid for young students. Disk or cassette. Microcomputers Corporation.

**Multiplication\*** Teaches the basics of multiplication. Featuring sound and color displays. For students in grades three to eight. Cartridge. Texas Instruments/Milliken Publishing Co.

**Multiplication\*** Monitors your answers and automatically adjusts the level of difficulty to your proficiency level. Requires Extended BASIC Cartridge; disk or cassette. W.R. Wilson, Inc.

**Multiplication 1\*** A math tutorial program that teaches the basics of multiplication to children in grades three and four. Texas Instruments.

**Multiplication 2\*** Multiplication practice with emphasis on one-digit multipliers for grades three to four. Speech synthesizer optional. Cartridge. Scott, Foresman and Co.

**Multi-Tasking** Running two or more tasks concurrently on a single computer. The MPU actually works on only one task at a time, but it switches back and forth rapidly, creating the illusion that all tasks are being processed concurrently.

**Munch Man\*** An exciting arcade-style maze game. Texas Instruments.

**Music** BASIC. See SOUND.

**Music Analysis-Synthesis\*** For creating and studying various types of music. 32K memory expansion and Extended BASIC Cartridge are recommended; disk or cassette. Eastbench Software.

**Music Editor\*** Generates sound definition data. The screen is formatted with a bass and treble staff on which musical notes are placed to be immediately heard and/or edited. The “call sound” output is used in Extended BASIC; and the “byte” output is used in assembly programs. Requires Extended BASIC Cartridge; 32K, disk. Law Associated.

**Music From Numbers\*** Create your own music by entering numbers that represent notes. Cassette. Anthistle Systems & Programming, Ltd.

**Music Maker\*** Create musical compositions by arranging notes on an electronic musical staff. Even a novice composer can create computer music with this easy-to-use package. Texas Instruments.

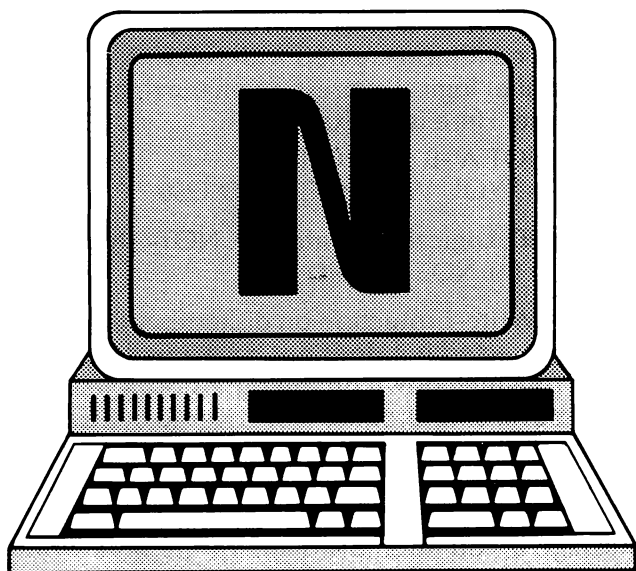
**Music Maker Demonstration\*** Five music files with songs ranging from Christmas and children’s songs to classical, are included in this demonstration disk to show the kinds of musical composition possible with the Music Maker Solid State Cartridge. Texas Instruments.

**Music Skills Trainer\*** Four drills that test musical ability and improve musical skills. Includes pitch guess, interval recognition, phrase recall, and chord recognition. For beginning musicians ten years and up. Disk or cassette. Texas Instruments.

**Music Synthesizer\*** Produce music by keying in notes from sheet music and hearing it played back. Extended BASIC Cartridge is optional; 32K; disk or cassette. Norton Software.

**Mystery Fun House Adventure Database\*** Figure out how to enter the old house, then the fun really begins. Requires Adventure cartridge; disk or cassette; Texas Instruments.

**Mystery Melody\*** Musical game in which one or two players score points by recognizing titles of particular songs. Texas Instruments.



**N** Codes. ASCII 78, HEX 4E. n—ASCII 110, HEX 6E.

**NAK** Negative Acknowledge. A signal used in telecommunications to indicate the rejection of a block of data by the receiving terminal.

**Name Subprograms** See CALL.

**Name-It\*** A Database management system for mailing lists, labels, and files. Records up to nine 28-character items per record, and 250 records per diskette. Functions include pre-set, search, print labels and lists, a rapid 250-record sort, and a form letter program that uses Name-It data in typewriter-generated form letters. Extended Software Company.

**Names, Variable** The rules for naming BASIC variables are:

- a) they must start with a letter, an at sign (@), a left or right bracket ([ ]), a back slash (\), or a hyphen (-).
- b) they can have up to fifteen characters (including the dollar sign for string variables).
- c) they may be made up of letters, numbers, the at sign (@), and the hyphen (-).
- d) they cannot be a reserved word such as IF, ON, THEN, GOTO, etc.

Also, the default value for the type of variable is numeric, so any variable name not ending in \$ is automatically a numeric variable.

**NAND** Not-AND Logical. A combination of Logical NOT and AND gates. It takes two logical inputs and produces one output. If both input values are 1 or "true" it produces an output of 0. Otherwise it produces an output of 1.

**NAND Gate** Hardware device which implements the NOT-AND logical function.

**Native Code** Machine-dependent language synonym such as Assembly language.

**Native Compiler** Compiler for the processor on which it runs.

**Natural Logarithm** BASIC. See LOG.

**Natural Science\*** Natural Science topics for grades five through eight. Includes circulatory system, minerals, and earthquakes. Requires Extended BASIC Cartridge; disk. Texas Instruments and the Minnesota Educational Computing Consortium (MECC).

**NBS** National Bureau of Standards.

**NC** No Connection. In telecommunications, this signal indicates the failure to establish a line to transmit data.

**NDAC** Not Data ACcepted.

**NE** Not Equal. The sign for not equal is  $\neq$ .

**Negative Logic** Normally, true state voltage in the computer system represents a logically false state. A normally false state voltage in the computer system represents a logically true state.

**NEQ** Not EQual to. The sign for NEQ is  $\neq$ .

**Nested subroutine** A subroutine called from within another subroutine. The inner subroutine (nested) is completed first, then the outer subroutine is completed after the nested subroutine has finished.

**Network** Computers can be connected together to form a system which is interconnected—a network.

**Neutral Zone\*** An outerspace battle between you and the alien enemy. Your ship is faster, but the aliens have a secret superweapon. Disk or cassette. Data Systems.

**NEW** BASIC Command. NEW deletes the program currently in memory and clears all variables. The format is:

NEW

NEW is generally used to clear all memory before entering a new program. BASIC will always return to command level after NEW is executed. NEW causes all files to be closed and turns trace off if it was on.

NEW erases all lines now in BASIC's memory. If it's something you want to keep, SAVE it first. If you don't erase the program in memory before starting another, you'll wind up with an unusable combination of lines from your old and new programs.

**New File** There are several ways to make a new file on diskette, as opposed to modifying an existing file. See Backup Copy of a Disk.

**Newspaper Route\*** Can also be used for newspaper rates or other small home businesses such as cosmetic sales. Maintains a list of all customers, and the amount due from each. Software for the Home.

**Newton's Revenge\*** Position the baskets and attempt to catch the falling apples. Lose a basket for each apple you miss. The cassette version requires Mini Mem, and the disk versions require Mini Mem or 32K and Extended BASIC or Editor Assembler. Ehninger Associates, Inc.

**NEXT** End of FOR...NEXT loop in BASIC. See FOR...NEXT.

**Nibble** Half a byte or 4 bits.

**Nim\*** Challenge the computer in skill and decision-making. Cassette. Hall Software.

**Noise** Interference on a system communications line or random unknown signals.

**Non-Destructive Read-Out** The memory contents are not erased or displaced when other data is read.

**Non-Profit Organization Income and Expense Report\*** Uses a fund accounting system to organize up to ten funds of up to one hundred records each. Can also keep track of ten different bank accounts and produces reports on each, showing year-to-date, month-to-date, and ending balances. Ehninger Associates, Inc.

**NOP or NOOP** No OPeration. An instruction forcing a delay of an instruction cycle without changing the contents of the registers or status flags.

**NOR** Condition of being NOT-OR.

**Normal Size Print** Printer. To return to normal ten character-per-inch print size, you must turn off all non-standard print options. See Type Format.

**North Seas Battle\*** Ships and submarines locked in combat. Requires Extended BASIC Cartridge and joysticks; cassette. Western Properties Investment Company.

**NOT** Negative operation which changes every "1" in a byte to "0" and every "0" in a byte to "1." Also used as a logical operator to reverse the outcome of a conditional test in many languages (IF x NOT = 1).

**NOT** XBASIC. Use with IF...THEN...ELSE. Extended BASIC allows the use of NOT as a logical

operator in the IF...THEN...ELSE statement. The complex condition created with NOT will be true, if the smaller logical expression on the right of NOT is not true. Here is an example:

```
IF NOT A -B + C = Q THEN  
B$ = "YOU WIN" :: GOSUB 1250
```

**NOT-AND Logical Operator** A NOT-AND B is a synonym for NOT (A AND B).

**Notch** Write-protection on diskette. A diskette is write-protected if it does not have a write-protect notch one inch down on the right side. The notch could be missing altogether or covered by an adhesive tab. This blocks a small spring-loaded switch or light beam inside the diskette and is sensed by the DOS diskette driver programs. You will get an error message if you attempt to alter a file on a write-protected diskette. You may not format, change, delete, or copy a file onto the write-protected diskette.

You may use, load, or copy files from the write-protected diskette. The purpose of these limitations is to prevent accidental loss of the only copy of programs or data. The procedure is to copy the write-protected diskette onto a notched diskette, put away the write-protected diskette as a permanent copy, then modify the notched diskette. In some cases you may decide to remove the adhesive tab from the write-protect notch and change the diskette.

You should put an adhesive tab (supplied with boxes of diskettes) over the write-protect notch of any important diskette you will backup. Then if you accidentally ask for the backup in the wrong direction (from the old diskette to your important diskette), you will get a second chance to make the backup rather than lose your data.

**Note Whiz\*** Improve your music skills and learn to read notes in four clefs. Features color graphics and built-in rewards for good scores. Three levels of complexity. Extended BASIC. Meca, Inc.

**Notes, Computer Generated** See SOUND.

**NSEC** Stands for NanoSECond. One nanosecond is equal to one billionth of a second.

**Null Detector** Circuit that registers when current is not flowing or when voltage is not present.

**Null String or File** An empty string or file.

**NUMBER** BASIC Command. The computer will automatically generate sequenced line numbers for programming purposes. The format is:

```
NUM <line>,<i>
```

<line> is the initial line of the program to be written. If no value is given the initial line is 100.

<i> specifies the line increment. If no value is given the increment is 10.

If a line number already exists in memory, it will be displayed. You can ERASE (FCTN-3) it and type in a new line, alter it using all of the edit commands (99/4-SHIFT), or confirm the line by pressing ENTER.

There are two ways to leave the NUMber mode. When a line number is displayed with no instructions or statements next to it, you can press CLEAR, (99/4-SHIFT), or ENTER.

**Number, Convert from String** BASIC. See VAL.

**Number, Convert to String** BASIC. See STR\$.

**Number** Largest Line Number in BASIC. The largest possible line number for a BASIC program is 32767.

**Number Crunching** The performance of complex arithmetic operations and computations.

**Number Magic\*** Covers basic mathematics with drills and practice problems. Features full-color displays and sound. For children ages six and up. Texas Instruments.

**Number Readiness\*** Object sets and missing numbers in sequences. Sixteen level package that features color graphics and sound. For students in grades K through one. Texas Instruments and the Milliken Publishing Company.

**Numeration 1\*** Counting, number comparison, and place value identification. Features color and graphics for grades one and two. Cartridge. Scott, Foresman and Co.

**Numeration 2\*** Practice comparing and rounding numbers through the millions. For third and fourth grade students. Speech synthesizer optional; cartridge. Scott, Foresman and Co.

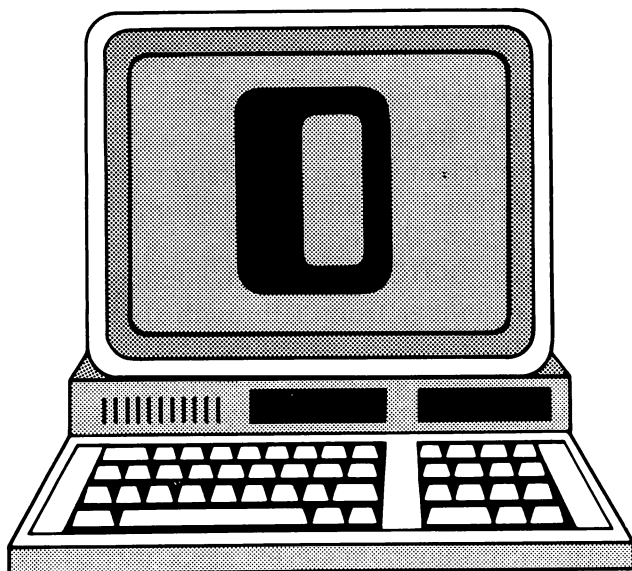
**Numeric Value of String** BASIC. See VAL(x\$).

**Numeric Variable** Rules for Names in BASIC. See Names, Variable.

**Numerical Integration\*** Contains subroutines for trapezoidal, Simpson, and Gaussian integration over evenly spaced points. Disk or cassette. East-bench Software.







**O** Codes. ASCII 79, HEX 4F. o—ASCII 111, HEX 6F.

**O** Output or Overflow.

**O—Printer** How to set 9 Lines Per Inch. To set for the line spacing of nine lines per inch, enter BASIC statement:

PRINT #<n> CHR\$(27);"O"

See Type Formats for more information and examples.

**Object Code** The code produced by a compiler or Assembler program. The object code is either directly executed by the computer or needs further translation through a linkage before execution. The TI editor assembler produces object code from your Assembly language files.

**Object Program** Machine language program resulting from translation of a source program.

**Obstacle Course\*** Compounds the challenge of a maze with hidden obstacles. Deduce the logic behind the obstacle locations to avoid them. Cassette. Sunshine Software.

**Odd Parity** The parity bit is added to a word so the total number of one bits becomes odd. Contrasted with even parity, where the total number of bits becomes even. See Parity.

**Off-Line** Off-line means that a device or medium is outside of or disconnected from the computer system. Contrasted with On-line, which describes a device or medium which is inside or connected.

A cassette or diskette is off-line when it is in a box, and on-line when it is in a working cassette player or diskette drive. A printer is on-line if it is attached, powered on, and ready to print. The printer is off-line if it is disconnected, powered off, or switched

to its "off-line" state by an on-line/off-line switch. See also Memory.

**Offset Address** The smaller part of a base register/offset pair. The data to be processed is located at: <effective address>=<contents of base register> + >offset>

**OLD** BASIC Command. The OLD command is used to load programs from a storage device (cassette, diskette, etc.) into the computer's memory. The format is:

OLD <dvc><.filename>

<dvc> is the storage device. If the program you want to load is on cassette, type in OLD CS1 and follow the directions displayed on the screen. No file name needs to be entered when using cassette storage on the 99/4 and /4A.

<program name> is the name of the program you want to load from diskette. With a diskette based system, type in OLD DSK1.BALANCE to load a program named BALANCE from a diskette in drive 1. The computer can search for a particular disk name. Type in OLD DSK.GAME DISK.FISHY to load a program named FISHY located on the diskette named GAMEDISK.

BASIC programs may also be stored on mini memory. To load a BASIC program from mini memory, type in OLD MINIMEM.

Before it loads the specified program into memory, the OLD command closes all open files and erases any program currently in memory.

**Oldies But Goodies—Games I\*** Five different games are included for one or two players, including Biorhythm, Number Scramble, Tic-Tac-Toe, Word Scramble, and Factor Foe. Texas Instruments.

**Oldies But Goodies—Games II\*** This is another series of games including Hidden Parts, Peg Jump, 3D Tic-Tac-Toe, and Word Safari. Texas Instruments.

**Olive-I\*** A microprocessor based serial RS-232 interface that can turn your Olivetti Praxis 30 or 35 daisy wheel typewriter into a letter quality computer printer. The Olive Branch Association, Ltd.

**Omega Fource\*** Simulates a "new training technique" to combat the super race of Carsinians who are trying to eliminate the human race with their own deadly and unorthodox battle techniques. Requires joysticks and Extended BASIC cartridge. Graphic Software.

**ONBREAK** XBASIC Statement. ONBREAK changes the action taken when a BREAK (line NUM) state-

## ON ERROR • One Line

ment is encountered in program execution. The format is:

ON BREAK NEXT

or

ON BREAK STOP

When you use ON BREAK NEXT in a program, you are telling the computer "Every time you encounter a BREAK statement with a line number (or numbers) listed after it, ignore the BREAK statement and go to the next program line." If a BREAK statement is encountered without a line number listed after it, ON BREAK NEXT has no effect.

If you want to have the computer accept BREAK statements after a certain point in a program, you can enter ON BREAK STOP as a statement. This disables the ON BREAK NEXT statement and BREAKs are executed as usual.

When ON BREAK NEXT is in use in a program, FCTN 4 (CLEAR) is disabled. Only FCTN = (QUIT) (99/4-SHIFT) will stop program execution, but this is a drastic measure that erases the program from memory and returns you to the title screen.

**ON ERROR** X BASIC Statement. ON ERROR can be used to change the action taken when an error occurs in a program. The format is:

ON ERROR <linenum>

<linenum> is the number of the line to execute in case an error occurs. It must be the beginning line in a subroutine similar to that called by a GOSUB statement. The subroutine should end by the execution of RETURN. See RETURN-ON ERROR.

Once ON ERROR has transferred control to <linenum>, error handling returns to normal action (stops program and displays error message). If you want new errors to be handled differently, ON ERROR must be executed again.

**On Gaming\*** This package includes a powerful graphics editor and a comprehensive manual revealing the tricks of the gaming trade. C. A. Root.

**ONGOSUB** BASIC Statement. ONGOSUB branches to subroutines based on numeric input from the operator or program. The format is:

ON<x> GOSUB <linenum1,linenum2...>

<x> is a number from 1 through the count in <linenum...>.

<linenum...> is a group of line numbers that begin subroutines.

Here is what ON GOSUB instructs the computer to do:

"Based on the value of <x>, execute one of these subroutines:

If <x>=1, execute the subroutine that is first in line in <linenum...>. If <x>=2, execute the subroutine that is second in <linenum...>, etc."

**ON GOTO** BASIC Statement. ON GOTO provides an efficient way of branching to other program lines based on numeric input from the operator or program. The format is:

ON <x> GOTO <linenum 1, linenum 2...>

<x> is a number from 1 through the count in <linenum...>.

<linenum...> is a group of line numbers to GOTO. Here's what ON GOTO instructs the computer to do:

"Based on the value of <x>, go to one of these program lines: If <x>=1, go to the first program line listed in <linenum...>, etc. If <x>=2 go to the second program line listed in <linenum...>, etc."

**On-Line** Describes a device or medium that is inside or connected. Contrasted with off-line, which describes a device or medium outside of or disconnected from the computer system.

A cassette or diskette is off-line when it is in a box, and on-line when it is in a working cassette player or diskette drive. A printer is on-line if it is attached, powered on, and ready to print. The printer is off-line if it is disconnected, powered off, or switched to its "off-line" state by an on-line/off-line switch. See Memory.

**ON WARNING** X BASIC Statement. Used to change the action taken when a warning occurs during program execution. The formats are:

ON WARNING PRINT

or

ON WARNING STOP

or

ON WARNING NEXT

ON WARNING PRINT causes a warning message to be printed and program execution to continue.

ON WARNING STOP causes a warning message to be printed and the program to halt.

ON WARNING NEXT causes program execution to continue with no warning message printed.

Putting an ON WARNING statement in a program changes the subsequent response to a warning during program execution. Other ON WARNING statements may be put in the program to further modify ON WARNING action.

**One Line** To advance one line on the printer (space up) without carriage return, enter BASIC statement:

PRINT #<n>:CHR\$(10)

or use the “line feed” button (LF) on printer.

Entering just:

PRINT #<n>:

gives a line feed—both a space up one line (line feed) and a return to the left margin (carriage return).

**One Line, Multiple BASIC Statements On.** You can put a double colon (::) at the end of one statement and continue entering another statement on the same line, without giving it a new line number. The number at left refers to all statements on the line. An exclamation point (!) allows a comment or remark to be added after a statement with or without a separating double colon.

**OPEN** BASIC Statement. The OPEN statement sets up I/O to a data file on cassette or diskette. The format is:

```
OPEN #<filenum>:“<dvc>[.<filename>]”  
[,<fileorg>][,<type>][,<mode>][,<rectype>]
```

<filenum> is a number from 0 to 255. 0 is the file number of the keyboard and screen. It is always open and may not be used for other files.

<dvc> is the name of the device where the file is/will be located.

<filename> is included when the device is a diskette drive and cannot be used with cassettes.

<fileorg> indicates the file organization: sequential or relative (random). If not specified, the default is sequential. Cassette-based files can only be OPENed with sequential organization. Diskette based files may be OPENed with sequential or relative organization. Specifying the number of records on a file may be accomplished by placing a number after sequential or relative in the OPEN statement.

<type> indicates the file type. Two file types are available: display and internal. If not specified, the default is display. Display type files are written to <dvc> using the ASCII code system. Internal files are written to <dvc> using binary code, the 99's native Machine language. The display file type is indicated if the information on file is displayed on the screen or on the printer. Internal type files are indicated when the computer will be doing “number crunching” or when large amounts of data must be contained on cassette or diskette. Internal files are more compact than display files.

<mode> refers to the file's OPEN mode. Four modes are available: update, input, output, or append. If not specified, the file is OPENed in the update mode. Update allows data to be read from and written to the file. Input allows data to be read

only from the file. Output allows data to be written only to the file. Append allows data to be added only to the file, and may only be used when variable length records are specified.

<rectype> is the record type. Two record types are available: variable and fixed. Variable length records are just as long as they need be to store the data, plus a little (1 byte) for “housekeeping.” Fixed length records are a set length, padding data with zeros or truncating to fit. A maximum record length may be specified following variable or fixed. Here are the default values associated with <rectype>:

Fixed length records must be used with relative file organization.

Variable or fixed records may be used with sequential file organization. The default record type with sequential file is variable length.

Here are the default values for maximum record length:

If <dvc> is diskette, default is 80. If <dvc> is cassette, default is 64. If <dvc> is RS-232, default is 80. If <dvc> is thermal printer, default is 32.

**OPEN** In order for a program to be run, the files with necessary data must first be OPENed so that the data they contain is available to the running program.

**Operand** Operations are performed upon entities called operands. For example, LET A=B+C specifies that the operation of addition be performed on the operands B and C.

**Operating System** The software which manages the hardware and logical reasoning of the computer. The Operating System includes file management, scheduling of the process requested, and the handling of any connected devices.

**Operation** Action of a program resulting in an instruction being executed and carried out.

**Operation Code** Part of the Assembly or Machine language program which specifies the operation to be performed.

**Operator** Person using a program or user. For programs you write, the operator will often be you.

**Operator** Symbols within a program—such as \* for multiply, - for subtract, or + for add—which specify what operation is to be performed.

**Optimization** Changing either the software or the hardware of a computer system so that it operates faster or more efficiently.

## OPTION BASE • Over-Voltage Protection

**OPTION BASE** BASIC Statement. OPTION BASE is used to set the lowest allowable subscript of arrays to zero or one. Zero is the default value. The format is:

OPTION BASE 0  
OPTION BASE 1

OPTION BASE must be placed in a line number lower than the line numbers of any DIM statements, or references to any arrays. OPTION BASE may only be used once in a program. It cannot be used in an IF...THEN...ELSE statement.

**Options** A menu is a screen display listing a number of possible options and asking the user to select one. When a selection is made by keying in an identifying number or letter, the selected function is performed. This may require a branch or subroutine call to the code for the function, or the program to carry out this function may be loaded into memory and executed.

Many application packages use a system of multiple menus. A master menu lists the major functions allowed. Selection of an option on the master menu causes another menu to be displayed, indicating more detailed options for the selected function. This can be followed by even more detailed menus, and so on. Often completion of a function will cause re-display of the master menu. Such a system is called menu-driven.

**OR** OverRun. The status flag of the Universal Synchronous/ Asynchronous Receiver/Transmitter (UART) goes to "1" if a new character is written on top of an old one.

**OR** XBASIC. Use with IF...THEN...ELSE. Extended BASIC allows the use of OR as a logical operator in the IF...THEN...ELSE statement. The complex condition created with OR will be true if either of the two smaller logical expressions (one on the right and one on the left of OR) are true. Here is an example:

```
IF X + 3 = 14 OR Y < 32 OR C$ = "HI" THEN  
  B$ = "YOU WIN" :: GOSUB 1250
```

**Order Entry\*** Specification records for order processing are sustained. Includes billing, shipping, COD information, and is correlated with other programs. Requires Extended BASIC Cartridge and printer; disk. Ycan Systems, Inc.

**OS** Operating System.

**Othello\*** Capture as many disks as you can to outflank your opponent. Anticipate the computer's strategy and get your revenge. Texas Instruments.

**Output** Information coming out of a program, going to a screen, printer, disk, or speaker.

**Output, From Memory** Memory is any device able to store information and allow it to be retrieved. The TI-99/4 and /4A rely primarily on random access memory (RAM), read-only memory (ROM), cassettes and diskettes. ROM and RAM together make up the internal memory or main memory of the TI, or any other computer.

Contrasted with external memory, such as cassette and diskette, which involves mechanical motion to retrieve data and are thus hundreds or thousands of times slower than internal memory. Data in internal memory is immediately available to programs for processing. Data in external memory must be copied into internal memory (read or input), processed, then copied back out to external memory (write or output).

Data that has been created can be written out to external memory without a READ first. Data read in from external memory that has not been modified need not be written back out since the original copy still exists.

**OV** Overflow. When the number of digits resulting from a mathematical operation exceeds the number of registers in memory available to hold the result.

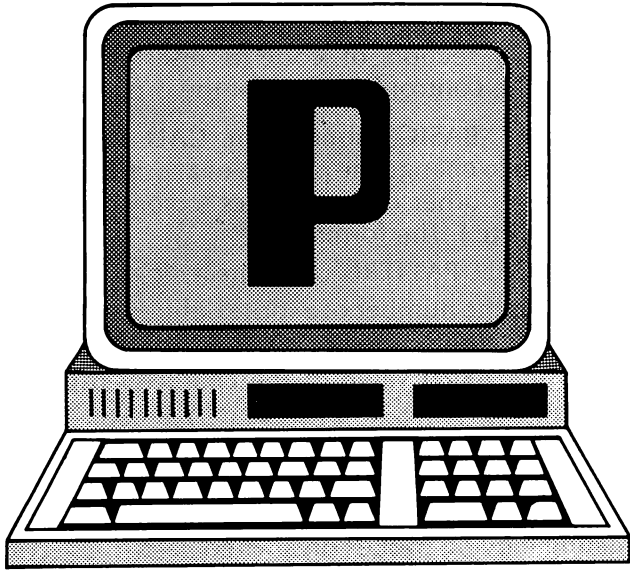
**Overflow** The sign bit is filled from the next lower bit, and a status flag is set. When the result of the arithmetic operation is too large for the register specified, an overflow condition results.

**Overlay** Different routines within a program that occupy the same memory location. They are loaded, as needed, during the operation of a program. Conflict may occur if two routines with different overlays try to use the same location at the same time.

**Over-Run Error** The previous character in a register hasn't been completely read when a new character is loaded into the register.

**Over-Striking** The printer returns to the position of a previous character and strikes a new character on top of it, producing a combination character. Also called boldfacing.

**Over-Voltage Protection** The computer's circuitry is protected from undesirable increases in the AC power line voltage.



**P** Codes. ASCII 80, HEX 50. p—ASCII 112, HEX 70.

**P** Parity.

**Package, Software** A software package is a group of computer programs, possibly including data files and documentation, which perform a function or group of related functions on the computer. These are called applications software when the programs are operated by the user, such as a word processing package or an accounting package. These programs are called systems software packages when they facilitate the use of the machinery, such as a database management package, a disk operating system, or a program development package.

**Packed Decimal** Two or more binary coded decimal digits are present in every byte. The ten decimal digits 0 through 9 are stored in a 4-bit representation. 1 is coded as 0001, 9 as 1001, etc.

**Packet** A short set of data of a prefixed length that fits into a particular location. The set is then transferred through a network of devices.

**Pad** The rectangular base where the wire of a computer chip is connected.

**Pad** To fill a data field with blanks.

**Page Length** To set your printer's page length to fifty-five lines per page(for example), enter BASIC statement:

```
PRINT #<n>:CHR$(27);"C"; CHR$(55).
```

See Type Formats.

**Paging** A feature often found in word processing programs that allows you to switch backward or forward from one screen of information to another.

In memory, a page is a logical set of storage used for the management of memory; in a paging system, the memory location is designated by a page number or address within the page.

**Parallel** Simultaneous handling of processes, transmissions, or storage of data. In most microcomputers, parallel I/O connections have 8 wires to carry 8 bits of a byte simultaneously, or in parallel. Contrast with a serial interface, where only one data wire is available. The 8 bits of a byte are transmitted one after another, serially. The I/O device must collect all 8 bits back into one 8-bit byte.

**Parameter** A definable variable in a program or system which can be used to send information to and from a subroutine or procedure. A parameter may take on various values which are used in subsequent processing by a program.

**Parity** Error detection technique that uses a one-bit indicator at the end of a word. Odd parity sets the parity bit to make the total number of 1 bits odd. Even parity sets the parity bit to make or command an even number of 1 bits.

**Parsec (Speech)\*** Guide your spaceship through alien attacks, refueling tunnels, and asteroid belts. Texas Instruments.

**Parser** Analyzes a program instruction to set up its tree structure according to the programming language's syntax.

**Pascal** A structured computer language, descending from ALGOL 60, with new features such as "records" (data structure definition), and "sets." Its well-defined standard is the Report portion of the book, *Pascal: User Manual and Report*, by Kathleen Jensen and Niklaus Wirth. Pascal is a versatile language, suitable for various types of programming, from systems to application. It is easy for experienced and inexperienced users alike to understand the function of a Pascal program.

Pascal is structured, representing a major improvement for programmers who want to more easily predict the behavior of a program. It is easier to understand the function of an IF...THEN...ELSE structure than to trace GOTOs and statement labels to remote, unpredictable places in a program. Pascal has most of the structures necessary to write a completely structured program (without GOTOs). Some of the dialects of Pascal implement all the necessary structures. In any case, it allows for more complete structuring than even FORTRAN 77 or COBOL.

Pascal is strongly typed. The "type" (floating-point, integer, set, record) of a variable is traced even

through procedure calls, where a language like FORTRAN only checks the type through the current local routine, helping to point out a major class of programming errors. Pascal, like other recent languages, requires the explicit definition of all variables as a guard against introducing a misspelled variable, that is otherwise difficult to spot.

The Pascal standard includes an input/output package, which is important for a language intended to be used in textbooks, but fixes the style of I/O that can be done from Pascal.

Pointers and records give the high-level language programmer access to powerful techniques for handling complicated data structures, such as linked lists and trees, previously available only to Assembly language programmers. These structures can be handled explicitly in Pascal. In a language like FORTRAN, these structures would have to be "simulated" inside an array with the structure diagrammed only in documentation or the inside of the programmer's head.

Currently, there are many implementations of Pascal. There are several stand alone compilers that run under various operating systems. There is also an operating system written primarily in Pascal, called the p-System, which is available on a wide range of computers, contributing to the portability of programs written in Pascal. See UCSD p-System.

**Pascal Development System\*** This package lets you use the Pascal language on your TI99/4A. Includes the UCSD p-System Editor, Filer, and Utilities, the p-Code card, the UCSD p-System Assembler/Linker, and the UCSD Pascal Compiler. Requires a Peripheral Expansion System; 32K; disk. Texas Instruments.

**Pascal Tutor** An opportunity for the novice programmer to work with Pascal language. Requires P-Code; 32K; disk. The Denver Software Company.

**Pass** To make information from one process or program available to another process or program. Similar to a football pass, except that one or more bytes of data replaces the football (and the receiver is a program). The sender may be a program or a person typing the data onto a command line to be "passed" to a program. One common example is a BASIC program passing variables to a subroutine.

**Password** Used for identification and security purposes on a computer system. Each user is assigned a specific set of alphanumeric characters to gain entrance to all or part of the computer system.

**Patch** For debugging or alteration of a software program, a section of code is inserted which changes the control functions of the program.

**PATTERN** XBASIC Subprogram. CALL PATTERN allows you to change the pattern of a sprite without changing its other characteristics (color, position, direction, etc.). The format is:

CALL PATTERN (#<sprite>,<c>)

<sprite> is the number of a sprite defined earlier in a program.

<c> is the ASCII value of the character used to redefine the sprite, and can be any integer from 32-143. See CHAR for information on defining characters.

This program is very useful for doing things like creating moving spokes on a wheel, etc.

**Pattern Identifier** See CHAR.

**Pause** To freeze the screen while the operator using your program reads a message, write a delay loop after you print the message:

```
1000 FOR Y = 1 TO 2000
1010 NEXT Y
```

To freeze the screen until the operator is finished, put in a dummy input statement and instruct the operator to press ENTER to proceed. The input variable (A\$) need not be used in your program:

```
1000 INPUT "Press ENTER to continue";A$
```

See KEY.

**Payroll Assistant\*** School administrators can generate payroll records and summarize district withholding and FICA information. Requires dual disk drives and printer. Scott, Foresman and Co.

**Payroll 1\*** Allows for accurate accounting of employees' income tax, disability insurance, union dues, and health insurance. The disk-based system contains the latest tax tables and Social Security Formulas.

**PC** Program Counter, Printed Circuit, Personal Computer.

**P-Code Card\*** Plug this card into your Peripheral Expansion box to program in UCSD-p Pascal. Disk. Texas Instruments.

**PCS** Personal Computing System.

**PE** Parity Error. If the parity status bit goes to 1 in odd parity or 0 in even parity, an error is produced, a flag set, and a message is displayed.

**PEEK** XBASIC Subprogram. Peek assigns the contents of the specified <memory address> as a value to the specified <numeric variable>. Subsequent

<numeric variables> are assigned as values to the contents of the bytes immediately following <memory address>. The format is:

CALL PEEK(<memory address>,  
<numeric variable>[,<numeric variable>...])  
For example, if memory contains:

Address	Contents(ASCII)
8237	15
8238	127
8239	92

After the statement

CALL PEEK (8237,X,Y,Z)

X will be 15

Y will be 127

Z will be 92

This can be used for several purposes:

a) retrieve the value of system parameters that are stored at fixed, known locations for processing by the BASIC program;

b) to retrieve the results of computations performed by a Machine language subroutine for further use in one BASIC machine program. One way to make a value available to a Machine language program is to poke into a fixed memory location with CALL LOAD. A CALL LINK then executes the Machine language program based on the data BASIC has poked into memory. The Machine language routine then leaves the result in a fixed address. The BASIC program, after the Machine language routine returns control, can retrieve the result left in memory by the Machine language routine, by a CALL PEEK, to the address where result is left.

**Peg Jump\*** Jump rapidly around the board in order to win. Cassette. Hall Software.

**Percentage Comparisons\*** Calculates percentage changes and sorts entries on the basis of given historical investment data. Generates a bar chart of all entries. Cassette. Anthistle Systems and Programming, Ltd.

**Percents\*** Offers practice in percent/decimal conversions and other problems. Includes color graphics and sound. Cartridge. Texas Instruments/-Milliken Publishing Co.

**PerfectData Head Cleaning Kit\*** Removes contamination from the recording heads of 8 inch or 5¼ inch flexible disk drives. The user dispenses the cleaning solution onto the lint-free cleaning disk through the cutout in the diskette and activates the

drive. The cleaning solution quickly and safely loosens head contamination, and the non-abrasive disk gently buffs the head dry. Each kit provides a cleaning capability for one drive for up to six months (twenty-six cleanings). Innovative Computer Products.

**PerfectData Micro Maintenance Kit\*** A general purpose microcomputer care kit that provides the necessary cleaning supplies for the small business or personal computer. Intended for maintenance and cleaning of flexible disk drives, tape drives, CRT screens, printers, and keyboards. Includes flexible disk drive head-cleaning diskette and special cleaning products for magnetic peripheral devices. Each kit contains ICP's proprietary cleaning solution, dispenser cap, lint-free cloths, and specially constructed cleaning wands. Innovative Computer Products.

**PerfectData Type Element Cleaning Kit\*** A simple, practical, and low-cost way to clean print-wheel type elements found on the majority of today's information-processing printers. Innovative Computer Products.

**PerfectData Video Display Cleaning Kit\*** For cleaning terminal screens and keyboards. Contains two 4-ounce bottles of video display cleaning solution, a pump spray dispenser, and fifty cleaning cloths. The solution contains a static neutralizing agent which prevents build-up of electro-static charges that attract dust and dirt. The cleaning cloths are specially designed to eliminate foreign particles and contaminants without scratching plastic surfaces. Innovative Computer Products.

**Peripheral** Any external device connected to and controlled by a computer.

**Peripheral Expansion System\*** Expand your computer to allow for optional peripheral capabilities. This compact expansion box can accommodate up to seven plug-in peripheral cards and one disk drive without cables. Texas Instruments.

**Peripherals** See Doryt Paraprint 18A, Peripheral Expansion Box, RS-232, Sat 4511 Bus Extender, Sat 4513 Prototype Kit, Signalman Modem, Spike Spiker, Telephone Coupler, Terminal Emulator, Texas Light Shooter, and Tex-Sette Adapter.

**Personal Computer** Generally, an inexpensive single user computer system which can fit on a desktop.

**Personal Finance Aids\*** Develop home financial statements, perform depreciation computations,



mortgage analyses, and create loan amortization schedules. Texas Instruments.

**Personal Finance Programs\*** The two versions of this program are: The Personal Ledger in TI BASIC and The Personal Register in Extended BASIC. Both versions allow you to store an entire year's financial file on one cassette covering utilities and charge accounts, and both use charts and graphs to illustrate changes in cost and consumption. Tyte.

**Personal Income and Expense Record-Keeping\*** Maintains records on up to ten expense accounts and sources of income, as well as fifty credit card accounts. Each expense account may include as many as twenty expense categories. It keeps track of electronic fund transfers between charge and bank accounts and produces current, monthly, and year-to-date balances on call. Ehninger Associates.

**Personal Planning Software\*** See Calender, General Will, Physical Fitness, and Weight Control & Nutrition.

**Personal Real Estate\*** Compares and evaluates various property investment alternatives. Disk or cassette. Texas Instruments.

**Personal Record Keeping\*** Allows you to create your own electronic filing system for everything from storage of insurance information to remembering important dates. Cartridge. Texas Instruments.

**Personal Report Generator\*** Allows you to create customized reports from information organized within other files. The program saves and loads report formats, prints reports, modifies report formats for correction or update, and tests formats before printing. Includes a Report Management function which operates on existing files. You can use the Data File Management to add items to already defined files, combine two compatible files, and delete items from a defined file. Requires printer and RS-232 Interface. Texas Instruments.

**Personal Tax Plan\*** Use this program to make detailed tax planning calculations. If you specify income and expenses, the tax effects of these items will be shown. Tax plans can be stored on diskettes. Requires p-code; 32K; disk. Texas Instruments/Aardvark Software, Inc.

**Personality Analyzer\*** This program lets you measure yourself, your spouse, your friends, your date, relatives, and co-workers for compatibility, behavior tendencies, values, and career potential. Find out with whom you will work best and have the most fun with. Software International.

**Personnel Data Recorder** With the help of this program, school administrators can store and main-

tain up-to-date employee information. Requires dual disk drives and printer. Scott, Foresman and Co.

**Pharaoh's Tomb, The\*** Enter the tomb to find riches or horrors in this game with several levels of difficulty. Requires Extended BASIC cartridge; disk or cassette. Millers Graphics.

**Phase** Measured in degrees, the phase is the difference between the 0 crossing point of a reference waveform and that of the measured waveform.

**Phase Locked Oscillator** PLO A circuit which is phase locked to recover data in a floppy diskette drive controller. The PLO steadies the separate data and clock bits.

**Physical Fitness\*** Design your personal health and exercise plan. Includes five levels of exercises and separate programs for men and women. You can evaluate and monitor your physical condition as you progress. Cartridge. Texas Instruments.

**PI** XBASIC Function. PI can be used as a number in Extended BASIC. The computer sets pi equal to 3.14159265359.

**Piano Song\*** Adds original or old piano favorites to your programs. Disk or cassette. Microcomputers Corporation.

**PIC** Priority Interrupt Controller. A chip which manages interrupts and gives vectored interrupt capability to an MPU which does not have this feature built in.

**Pin-Compatible** Computer systems having integrated circuits, with leads or pins having identical functions.

**Pipelining** A method of increasing the speed of the processor by setting the next program instruction before finishing the last instruction.

**Pixel** A dot on a video display comprising part of the picture seen. The 99/4 and /4A provide a resolution of 192 x 256 pixels.

**Planes\*** Count, add, and subtract planes as they zoom onto the runway. For children in preschool to second grade. Graphic Software.

**PLATO—Basic Skills 3-8—Grammar\*** Courses that provide instruction in parts of speech, building and using sentences, spelling, word usage, capital letters, punctuation, and writing letters. For children in grades three to eight. Texas Instruments.

**PLATO—Basic Skills 3-8—Mathematics\*** Courses that provide instruction in basic number ideas, addition, subtraction, multiplication, division, frac-

tions, decimals, ratio, proportion, percentages, geometry and measurement. For children in grades three to eight. Texas Instruments.

**PLATO—Basic Skills 3-8—Reading\*** Courses that provide instruction in vocabulary and reading comprehension. For children in grades 3-8. Texas Instruments.

**PLATO—High School Skills 9-12—Mathematics\*** Courses that provide instruction in basic number ideas, math sentences in one and two variables, geometry, measurement, and other special topics. For students in grades 9-12 and adults. Texas Instruments.

**PLATO—High School Skills 9-12—Reading\*** Courses that provide instruction in reading, prose literature, poetry, and drama. For students in grades 9-12 and adults. Texas Instruments.

**PLATO—High School Skills 9-12—Science\*** Courses that provide instruction in physics, chemistry, earth science, and biology. For students in grades 9-12 and adults. Texas Instruments.

**PLATO—High School Skills 9-12—Social Studies\*** Courses that provide instruction in geography, economics, behavioral science, political science, and history. For students in grades 9-12 and adults. Texas Instruments.

**PLATO—High School Skills 9-12—Writing\*** Courses that provide instruction in spelling, punctuation, grammar, diction, sentence structure, logic, and organization. For students in grades 9-12 and adults. Texas Instruments.

**Plotter** A computer controlled mechanical device that draws images on a screen or printer.

**Plug-Compatible** Devices or components that use the same plugs and can be used interchangeably without modification within the computer system.

**Point of Sale\*** Keeps thorough customer records and invoices to be processed and recorded for future use. Calculations include freight charges. Requires Extended BASIC Cartridge, RS-232 interface, 80 column printer; 32K; disk. The Micro House.

**Pointer** A data item whose contents is the address of another data item.

**Poker\*** Your computer opponent is very hard to beat. Optional speech synthesizer. Requires Extended BASIC Cartridge; disk or cassette. W.R. Wilson, Inc.

**Polar to Rectangular Conversion\*** Translates coordinates from polar to rectangular form. Disk or cassette. Data Systems.

**Polling** A technique in which an inquiry into the status of each device is done according to a schedule.

**Poor Man's Plotter\*** Forty-eight predefined patterns make drawing and plotting with this program easy. 16K; Extended BASIC Cartridge. Computertronics.

**POP** A programming instruction in which the last word is removed from the top of a stack.

**Port** A physical I/O connection. An address providing a connection between the computer's internal processor and an external device. Ports are used to attach input and output devices.

**POS** BASIC Function. With this function, the computer will search a character group to find occurrences of another character group. The format is:

`<x>POS (<a$ >,<b$ >,<z>)`

`<x>` is the variable assigned to the answer that POS returns.

`<a$ >` is the character group (string) being searched.

`<b$ >` is the character group (string) that the computer is searching for in `<a$ >`.

`<z>` is the number of the character in `<a$ >` at which the computer should begin the search.

Here's what the POS function tells the computer to do: "Look at the group of characters called `<a$ >`; count over `<z>` number of characters and then start looking for the occurrence of `<b$ >`; assign `<x>` to that number; if you don't find `<b$ >` in `<a$ >` starting at `<z>`, assign `<x>` to zero."

**POSITION** XBASIC Subprogram. CALL POSITION tells the computer where a specified sprite is located on the screen. The format is:

`CALL POSITION (#<sprite>,<pr>,<pc>)`

`<sprite>` is the number of a sprite defined earlier in a program.

`<pr>` and `<pc>` are the pixel row and pixel column, where the upper left corner of the sprite is located. The computer assigns numbers from 1-256 to these two variables.

The CALL POSITION subprogram assigns the values to `<pr>` and `<pc>` in the split-second that CALL POSITION is being executed. It does not affect their motion so that movement must be allowed for when programming.

**Position the Cursor** See Moving the Cursor.

**Positive Logic** Voltage level most positive in the computer system is the true level, and the false level is the voltage level closest to zero.

**Postfix** Notation system in which the operator follows the manipulation symbols used in the program.

**Power Down** The steps a computer may take to preserve the state of and prevent damage to the processor connected peripherals when the power fails or is shut off.

**Power On** Turn the power switch to the ON position or otherwise supply electric current to a device.

**Power Supply** The unit that converts the voltage from the electrical supply to the voltages the computer elements use.

**Power Up** The steps taken by a computer processor when the power is restored after a power failure. The processor and peripherals are initialized so that program execution may be started.

**Power-Fail Restart** A device that detects a drop in the voltage, and signals the processor. The processor still has several milliseconds to preserve the registers in a battery backup memory, allowing automatic resumption of processing when the power is restored.

**Powwow\*** Test your skill with numbers. Guess the correct answer in the least number of turns. Disk or cassette. Microcomputers Corporation.

**Prefixes\*** Provides a list of incomplete words and possible prefixes from which to choose. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Pre-Processor** A program or mechanical device that prepares data for further processing.

**Preschool IQ Builder\*** Drills children (ages 3-6) in matching and differentiating between shapes and letters. Cassette. Program Design, Inc.

**Pretty Print\*** A software utility program that formats your program listings. Eastbench Software Products.

**Prevent Accidental Loss of Programs or Data** A diskette is write-protected if it does not have a write-protect notch one inch down on the side. The notch could be missing altogether or covered over with an adhesive tab. See Write-Protected Diskette.

**Prime\*** Specify a number and this program will hand identify it as a prime number, or, if it isn't, find its factors. Disk or cassette. Data Systems.

**PRINT** BASIC Statement. PRINT displays data on the screen. The format is:

PRINT <list of expressions>

<list of expressions> is a list of numeric and/or string expressions, separated by commas, semicolons, colons, or the ampersand (&). These punctuation symbols act as print separators and place the data in different locations on the screen. The screen is divided into two print zones of fourteen spaces each. A comma after an item in the <list of expressions> will cause the next item to be printed starting in the first space of the next print zone, jumping to the next line down if necessary. If a semicolon is used, the next value will be printed immediately after the last value at the beginning of the next line. When multiple colons are used, the item just displayed on the screen scrolls up. (Note: When using multiple colons with Extended BASIC, a single space must be placed between them, or the computer regards them as multiple statement separators.) The ampersand (&) may be used in place of the semicolon if the values on either side of & are strings.

The TAB function is another method of formatting data on the screen. See TAB for more information.

A PRINT statement alone will display a blank line.

If a comma or semicolon ends the list of expressions, the following PRINT statement begins printing on the same line, spacing accordingly. If the list of expressions ends without a comma or semicolon, a carriage return is entered at the end of the line and the cursor is moved to the beginning of the next line.

Positive numbers are preceded by a space and negative numbers are preceded by a minus sign. Numbers can be represented with 10 or fewer digits in fixed-point format no less accurately than they can be represented in the floating-point format, and output using fixed-point or integer format. For example, 10—(-7) is output as .0000001 and 10—(-11) is output as 1E-11.

**PRINT#** BASIC Statement. PRINT# is used to write data to an accessory device. The format is:

PRINT# <filenum>[,REC<recnum>]  
[:<list of expression>]

<filenum> is the number of a file opened earlier in the program.

<recnum> is the number or numeric expression that specifies the record number to which the data

will be written [REC<recnum>] may only be used with relative file organization. See OPEN.

<list of expressions> is the group of values you want to transfer to <filenum>. If <filenum> was opened in display format, commas, semicolons, and other print separators will control spacing as explained in PRINT. A file opened in internal format sees the comma and semicolon the same way and prints values in the <list of expressions> adjacent to each other on the device opened in <filenum>.

**PRINT—Blank Line on Printer** A PRINT#<n>: statement with no other specifications will print a blank line (that is, feed the paper up one line and return to the left margin) so that you can space your printout format neatly.

**Print BASIC Program Line on Printer** See LIST.

**Print Lines** Spacing in BASIC. To get one or more spaces between fields printed by your BASIC programs, use a literal of spaces like: " ". To get several spaces between the printed values of <a\$ > and <b\$ > use BASIC statement:

```
PRINT#<n>: A$ ;" "B$
```

See also Print Zones.

**Print Zone, How to Skip Over A** To leave space on the print line between items, put an extra comma (,) in the print listing. Enter BASIC statement:

```
PRINT#<n>: A,,B
```

This would print A in print zone 1, nothing in print zone 2, and put B in print zone 3 (col 29). See also Print Zones.

**Print Zones** Each group of 14 spaces across the print line is called a print zone. A comma (,) in a PRINT #<n>: list of items to be printed means "start printing the following item at the start of the next print zone." Contrasted with the semi-colon (;), which means the next item is to print immediately after this one, without even a single space between. The print zones begin in columns 1, 15, 29, 44, 58, and 72. See also Print Line.

**PRINT...USING** XBASIC Statement. PRINT...USING gives you all the options of the PRINT statement, with the added ability to format the data being PRINTed. The format is:

```
PRINT [#<filenum>[,REC<recnum>],] USING  
    <x$ >:<z or z$ >
```

or

```
PRINT [#<filenum>[,REC<recnum>],] USING  
    <line>:<z or z$ >
```

<filenum> is the number of a file opened earlier in

a program. See OPEN. If it is not used, or 0 is not entered, the data will be displayed on the screen.

<recnum> is the record number. It is used in conjunction with #<filenum>, and only with relative files. See OPEN.

<x\$ > is a string expression that defines the data's format where it is printed. See IMAGE for information about format options.

<line> is the number of a line in your program containing an IMAGE statement.

<z or z\$ > is the variable or variables that you're PRINTing and formatting. When using the PRINT ...USING statement to print data on the screen, all data is displayed at the bottom of the screen. The data scrolls up as new data is PRINTed. See DISPLAY and DISPLAY...USING.

**Printer, Compressed Print With** For this small type size, enter BASIC statement:

```
PRINT#<n>:CHR$(15)
```

This gives 132 characters on the eight inch line, or about sixteen-characters-per-inch. To turn off, enter:

```
PRINT#<n>:CHR$(18)
```

See Type Formats for more information and examples.

**Printer, Space Up One Line On.** To advance one line on the printer (space up) without a carriage return, enter BASIC statement:

```
PRINT#<n>: CHR$(10)
```

or use "line feed" button (LF) on printer. Entering just

```
PRINT#<n>:
```

gives a line feed—both a space up one line (line feed) and a return to left margin (carriage return).

**Printer—Blank Line** A PRINT#<n>: statement with no other specifications will print a blank line (feed the paper up one line and return to left margin) so you can space your print-out format neatly.

**Printer—Line Length** To set to 80-characters-per-line, enter BASIC statement:

```
PRINT#<n>: CHR$(155);CHR$(65);CHR$(60)
```

**Printer—Normal Print Size** To return to normal ten-character-per-inch print size, turn off all non-standard print options. See Type Formats for more information and examples.

**Printer—Page Length** To set page length to 55 lines, enter BASIC statement:

```
PRINT#<n>:CHR$(155);"C";CHR$(55)
```

**Printer—Top of Page** To form feed or advance to top of page, enter BASIC statement:

```
PRINT#<n>:CHR$(12)
```

Or use the “top of form” or “form feed” manual control button (FF) on the printer. You may need to adjust the paper in the printer so it’s at the top of a page as defined by the perforations. In a program, you may want to provide these instructions to the operator and a pause to allow for adjustment of the paper.

**Printer—Type Formats** BASIC. To set the TI Impact Printer or Epson MX-80 printer’s print size, strike method, or number of lines-per-inch down the page, the non-standard type format you want must be turned on by sending control codes to the printer. See Type Formats.

**Printer—6-Lines-per-Inch** To set for this line-spacing, enter BASIC statement:

```
PRINT#<n>:CHR$(155):“2”
```

See Type Formats for more information and examples.

**Printer—8 Lines per Inch.** To set for this line-spacing, enter BASIC statement:

```
PRINT#<n>:CHR$(155):“0”
```

See Type Format for more information and examples.

**Printer—72/7 Lines per Inch.** To set for this line spacing, enter BASIC statements:

```
PRINT#<n>:CHR$(155):“1”
```

or

```
PRINT#<n>:CHR$(155):CHR$(49)
```

This is a good setting for spacing with compressed print. See Type Formats for more information and examples.

**Printers** See C. Itoh Prowriter, Comriter CR-II, Dot Matrix Impact Printer, Epson FX-80, Gemini 10/15, Hex Bus Printer/Plotter, Miniprint, Olive-I, Smith-Corona, STX-80 Printer, and TI-Impact Printer.

**Probe** An electrical device which, when touching a circuit point, will allow a test meter to check the circuit’s connection and power.

**Procedure** Part of a program which helps structure the program, for readability and reliability. A procedure is a separate function of the program and could be incorporated into a subroutine.

**Processor-Bound** The speed of the processor limits the processing speed of the program.

**Professional Billing/Receivables\*** Allows you to maintain a variety of client records and other information for a twelve month period. Also includes analysis, billing, and correspondence capabilities. RS-232 Interface and compatible printer are recommended; disk. Professional Microware.

**Profit & Loss Statement\*** Produce totals under categories listed by day, month, or year. A comparison is made of overall income for evaluation of cost. Requires Extended BASIC Cartridge; disk. Creative Expressions, Inc.

**Program** A sequence of instructions that specify a process for manipulating data. Programs can be written in many languages which have level ratings according to how much additional work the processor must do before the program can be executed. BASIC is a high level language which requires that all programs be run through a compiler or interpreter. A mid-range language is Assembly language which is closer to the binary code of the computer, but still needs some processing through an Assembler before executing. The lowest level are programs written in binary or hexadecimal code directly executable by the microprocessor. Before Assembly language, programs were written in binary code—a time-consuming task.

**Program—User Oriented** For programs you write, the operator will often be you. But if others use your program, you should provide clear prompts for every item of input data, and freeze the screen long enough for them to read or act on the information displayed. Prompts should include clear error messages if anything should go wrong. This is often called “human engineering”—making the program easy to use as well as technically correct. Another term for this aspect of programming is making the program “user friendly.”

If a complex series of data items has been typed in, but some entries turn out to be invalid, the user should be able to re-enter only the bad items. Error messages should indicate not only that an entry is invalid, but why it is invalid, and if possible, how to correct it.

**Program, Load** Putting a BASIC program that was SAVED on diskette or cassette back into the TI’s memory to run or modify it. See OLD.

**Program, Object** See Object Program. The Machine language instructions which result from translation of a source program by a compiler or Assembler.

**Program, Run or Execute a** See RUN and OLD.

**Program, SAVE** BASIC. See SAVE.

**Program, Start a** See RUN and OLD.

**Program, Version or Release of** See BASIC Releases.

**Program, Write-Protected** Extended BASIC allows a program to be SAVED using the PROTECTED option. Once this is done, the saved program can-

not be listed, saved, edited, or unprotected. You should always keep an unprotected backup copy in case any changes need to be made to the original. The PROTECTED option is available for cassettes and diskettes. See SAVE.

**Program Concatenation** Adding one item at the end of others to produce one longer data or program item.

**Program Counter** A register which holds the address in memory for the next instruction to be executed. The counter is incremented each time an instruction is executed. The counter can be modified through subroutines or calls, so that the next instruction executed is different from that which follows directly in the program.

**Program Diskette** Primarily used to store programs which process data. On the other hand, data diskettes are used primarily to store data rather than programs. Often, a diskette will contain both data and the programs needed to process the data.

**Program File** A program file contains program instructions specifying how data is to be processed. Contrast this with data files, which provide some programs with information (variables, etc.) needed to solve a particular information processing problem.

**Program Integrity** Insuring that programs (or data) cannot be altered improperly. Data security consists of guaranteeing both data integrity and data security or privacy.

**Program Lines, Display** To display all program lines, enter:

LIST

To display program lines from start up to line 100 enter:

LIST-100

To display program lines from line 100 to end enter:

LIST 100-

To display program lines from line 100 to line 200 enter:

LIST 100-200

To display program line 100 only enter:

LIST 100

Extended BASIC allows you to press the space bar to freeze a list being displayed on the screen.

**Program Lines, Erasing** To start a new program, type:

NEW

This completely erases all lines now in BASIC's memory. If it's something you want to keep, SAVE it first. If you don't erase the program in memory

before starting on another, you will probably wind up with an unusable combination of lines from your old and new programs.

**Program Recorder\*** This cassette recorder is specially made for the home computer as a low cost memory storage device. An interface cable is included to hook up the recorder to your computer. Loading, saving, and retrieval of data is controlled by the computer to ensure reliability. Texas Instruments.

**Programming Aids** See America, Bedrock BASIC, Beginner's BASIC Tutor, Diyad, Dow Editor/Assembler, Editor Assembler, Extended BASIC, Factorial, Grid to Design Pictures, Master Catalog, Pascal Development Aids, Pascal Tutor, Programming Aids, Simple Sprite Procedures, Simple Turtle Procedures, Sprite Editor, and Teach Yourself BASIC.

**Programming Aids I\*** Provides assistance with Display at, Accept at, Screen Print, Lower Case Letters, Second ASCII Set Subroutines, and User-defined Characters. Texas Instruments.

**Programming Aids II\*** Provides the experienced user with the ability to organize information for reporting and processing purposes. Performs either alphabetic or numeric sorting and includes File Dump and Merge Programs, as well as Disk and RAM Sorts. Texas Instruments.

**Programming Aids III\*** Use this package to cross-reference a list of line number references, functions, keywords, arrays, and variables. With this information, the programmer can locate where subroutines are called, where certain variables are used, and which lines need changing to make a program compatible with another version of BASIC. Designed for the experienced programmer. Requires Extended BASIC Cartridge. Texas Instruments.

**Programming Language** A set of rules specifying a language that can be translated into Machine language and cause the computer to carry out functions.

**Programming Languages** See Assembly, BASIC, C, COBOL, FORTRAN, and Pascal.

**Programming Utilities** See BASIC Disk Utility, Bitmanipulator, Decode, Decoder, Disk Master, File Translator, Maximum Assembler, MMM Edit Assembler, Print Pretty, Screen Dump, TI Advanced Assembler Debugger, TI-Forth, TI-Logo, TI-Pilot, UCSD-P, and Utilities.

**Programs for Livestock Enterprise Analysis\*** Calculates expenses such as total cost and cost per pound of grain, and recalls profit data to produce

analysis reports for livestock enterprises. Disk. Computech Distributing.

**Project Planning\*** Includes budgeting, bid cost, estimation completion costs, and project time. For the engineer, contractor, or consultant. Creative Discount Software.

**PROM** Programmable Read-Only Memory. A ROM which can be modified by the user.

**PROM Programmer** An external device or module used to write user-modified ROMs. The programmer may input data through a hex keyboard, binary paper tape, or directly through the microprocessing unit.

**Prompt** A prompt is a visual signal from a program that tells the operator what to do. Hopefully, the prompt gives some clue as to what the program requires (or allows) the operator to do in response to the prompt.

> is the prompt from BASIC or X BASIC, indicating that you can now enter a BASIC command or statement.

? is the prompt from a running BASIC language program requesting you to type in data to answer a question. In this case, in the program, you should include a descriptive prompt such as "Enter check amount 9999.99" so you or the operator will know exactly what should be entered in response to the ? prompt. An example of how to do this:

```
100 INPUT "ENTER CHECK AMOUNT 9999.99"  
      ,CHECKAMOUNT
```

This will give the operator using the program this prompt on the screen:

```
ENTER CHECK AMOUNT 9999.99
```

**Propagate** To go from one component in the computer system to another.

**Propagation Delay** The time needed for the processor to pass a signal through one device on the system to another.

**Property Manager\*** Keep track of the equipment inventory for an entire organization, or just one of its programs. Requires dual disk drives, RS-232 interface, and printer; disk. Scott, Foresman and Co.

**Proportional Spacing** The type of printing in which the amount of a character's horizontal spacing is dependent on the allocation of space to the width of the character. Proportional spacing is more readable than fixed-width type and appears to be typeset.

**Protected Diskette** A diskette is write-protected if it does not have a write-protect notch about one inch down on the right side. The notch could be missing or covered with an adhesive tab which blocks a small spring-loaded switch or light beam inside the diskette that is sensed by diskette driver programs. An error message will appear whenever you try to alter a write-protected diskette by changing, deleting, copying, or formatting the diskette.

You may, however, use, load, or copy files from the write-protected diskette. The purpose of these limitations is to prevent accidental loss of the only copy of programs or data. The usual procedure is to copy the write-protected diskette onto a notched diskette, put away the write-protected diskette as a permanent copy, then modify the notched diskette. In some cases, you may decide to remove the adhesive tab from the write-protect notch, and change the diskette.

You should put an adhesive tab, (supplied with boxes of diskettes) over the write-protect notch of any important diskette you will backup, so that if you accidentally ask for the backup in the wrong direction (from the old diskette to your important diskette), you will get a second chance to make the backup, rather than lose your data.

**Protected Field** On some data entry screens, certain areas are reserved and cannot be changed by the user with keyboard entry.

**Protected Format** Extended BASIC allows saving of programs using the protected option. See SAVE.

**Protected Program** Extended BASIC allows a program to be SAVED using the PROTECTED option, after which, the saved program cannot be listed, saved, edited, or unprotected. You should always keep an unprotected backup copy on hand in case any changes need to be made to the original. The PROTECTED option is available for cassettes and diskettes. See SAVE.

**Protocol** The rules governing the exchange of information between two computer systems.

**Pseudo-Instruction** A user-defined directive interpreted by the Assembler as one or more instructions.

**Pseudo-Operation** An operation code recognized by an Assembler but not corresponding to any Machine language instruction. Examples are ORG, which specifies where a program will reside in memory, and SKIP, which specifies a new page in the listing of the program.

**PSW** Program Status Word contains the zero flag, carry flag, and other information relevant to the processor.

**Psychometrics\*** A series of questionnaires that can allow you to get to know yourself better. Cassette. Pablo Diablo.

**Pulse** A square or gaussian shaped voltage or current of short duration.

**Pulser** A circuit being tested that delivers a high current signal of short duration.

**Pulsar\*** Avoid the pulsars and mine ore in this deep space game. C. A. Root.

**Punctuation Series\*** You are given sentences that may or may not need punctuation corrections. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**PUSH** An Assembler instruction used to put a word on the top of a stack.

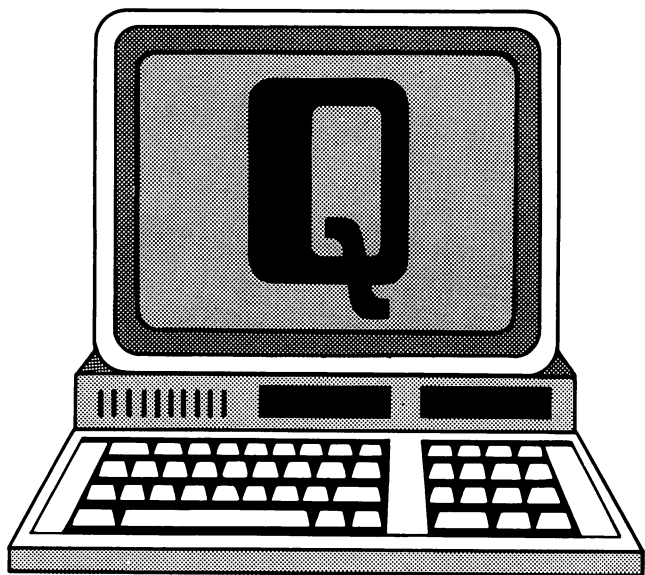
**Pushdown List** Another name for a stack.

**Puzzle 15\*** Alphabetize the single letter squares A to O by moving the squares one at a time into the one available open slot. The number of moves it takes to solve the puzzle are recorded and may be compared against previous scores. Extended Software Company.

**Pyramid Of Doom Adventure Database\*** Enter the partially buried pyramid, collect the treasures, and escape. Requires the Adventure cartridge; disk or cassette. Texas Instruments.







**Q** Codes. ASCII 81, HEX 51. q—ASCII 113, HEX 71.

**Q** Half-width of the power spectrum of bandpass filter response in hertz, divided into the center frequency in hertz. Also, a register used as an accumulator extension, necessary for efficient multiply-divide operations. Q was not generally provided in earlier 8-bit CPUs. Newer 8-bit and 16-bit CPUs usually have a larger set of general purpose registers than the older 8-bit CPUs having an A register/Q register combination.

**Q Bus** The internal system bus of the DEC LSI-11 computer.

**QA** Quality Assurance.

**QC** Quality Control.

**QPL** Qualified Products List. Military qualified products list for high reliability applications.

**QTAM** Queued Teleprocessing Access Method (IBM mainframe term).

**Quad** Involving four entities, or a multiple of four.

**Quadcube\*** More difficult than Rubik's cube, with 16 color squares per cube face. Stores thirty moves in memory or on tape, and automatically scrambles the cube for you. Cassette. Linear Aesthetic Systems.

**Quadrant Command\*** Defend the Alpha Quadrant against enemy attack by Vanian Deathstars. Features color, 3-D graphics, and sound. Alpha Software.

**Quadratic Equation\*** Solves the Quadratic equation with given input variables. Disk or cassette. Data Systems.

**Quest For the Sword\*** Find the lost sword of Aron. Pegasus Software.

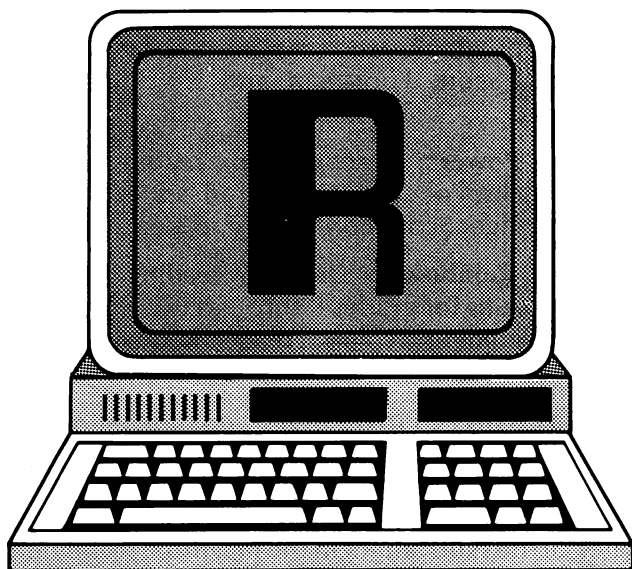
**Queue** A data structure which contains data or tasks waiting to be processed.

**Quibiq\*** Graphically represents a puzzle that the computer scrambles and the player unscrambles. Cassette. Sunshine Software.

**QUIP** QUad-In-line Package. An IC package with two rows of pins on each side which is much smaller than a comparable DIP.

**Qwerty** The traditional typewriter keyboard layout, in which the keys for those six letters appear in that order.





**R** Codes. ASCII 82, HEX 52. r—ASCII 114, HEX 72.

**R** Reset. Also Register, Request, Ring indicator.

**Racing\*** See what life in the fast lane is really all about. Includes color and graphics. Cassette. Kemp Software.

**Racing Letters\*** Fast paced number and alphabet lessons for students aged 5-7. Disk or cassette. Microcomputer Corporation.

**Rack Mountable** Equipment packaged for installation in a metal cabinet called a rack.

**Radiation Hardening** A quality assurance process used in the production of ICs to select circuits better suited to withstand radiation.

**Ragged Margin** Not justified. See Justify.

**RALU** Register-equipped ALU. A bit-slice ancestor (National Semiconductor).

**RAM** Random Access Memory. See Memory.

**RAM Disk** A block of RAM memory used by a program to simulate a diskette drive. The program must modify or intercept all I/O to the “fictitious” drive and redirect it to the RAM memory. The RAM disk will have its own drive letter and appear in every way like a real diskette, except that it is much faster.

**RAM Memory card** A card containing RAM memory to expand the computer’s main memory.

**RAM Pack** A package containing expansion RAM to mount on the outside of the computer. If mounted inside the computer housing, it would be called a RAM card.

**Random Access** An access method where each data item can be retrieved directly by an address computed from the data.

**Random Number** BASIC. See RND.

**RANDOMIZE** BASIC Statement. RANDOMIZE is used to reseed the random number generator. The format is:

RANDOMIZE [<seed>]

<seed> is a number or numeric expression. The RND function generates pseudo-random numbers. If RANDOMIZE is not used, the set of numbers that RND generates is the same every time the program using RND is run. When RANDOMIZE is inserted in the program before RND is executed, the sequence becomes different each time the program is run. If <seed> is specified, the sequence of numbers will be different for each <seed> value, and will be the same every time a given <seed> value is used in a program.

**RAS** Row Address Strobe. A signal used in dynamic RAMs to reduce the pin count by multiplexing the address.

**Raster Scan** TV display technique where an image is built from aggregates of dots of varying brightness.

**RATFOR** RATional FORtran. A structured dialect of FORTRAN compiled into standard FORTRAN by a preprocessor.

**R-C** Resistor-Capacitor. A circuit connected to an oscillator to define its oscillating frequency. For stable frequencies, a crystal is required.

**RD** Received Data (RS-232C standard).

**RDE** Received Data Enable. A status flag in a UART.

**RDOS** Real-time Disk-Operating System. See DOS.

**RDY** A control signal used with slow memory or devices to indicate that valid data is available.

**Read** Input Data into Memory. Data in internal RAM is immediately available to programs for processing. Data in external memory must be copied into internal memory (READ or INPUT), processed, then copied back out to external memory (WRITE or OUTPUT).

Data that has been created can be written out to external memory without a READ first. And, since the original copy still exists, data that has not been modified can be read in from external memory without being written back out.

**READ BASIC Statement.** Reads values from a DATA statement and assigns them to variables. The format is:

READ <variable>[,<variable>]...

<variable> is a numeric or string variable or an array element which is to receive the value read from the DATA table.

A READ statement must always be used with a DATA statement. The READ statement will take values read from the data statement and assign them to READ variables on a one-to-one basis. The variable types must agree with the data being stored in them or a "Syntax error" will occur.

One READ statement may access several data statements, or several read statements may access the same data statement. If the amount of data available is less than the number of variables allocated for the data, an "Out of data" error occurs. If the number of variables in the READ statement is less than the amount of data items, subsequent READ statements may be used and reading will begin at the first unread element. If there are no subsequent READ statements, the extra data is ignored. Data can be reread using the RESTORE statement. See RESTORE.

**Read Character from Keyboard BASIC.** See KEY, INPUT.

**Read Data from File BASIC.** See INPUT#.

**Reading Adventures (3B)\*** One of twelve reading education aids to enhance comprehension skills. Includes teacher's manual and full-color reader. Cartridge. Scott, Foresman and Co.

**Reading Cheers (2B)\*** Exercises for developing word identification and reading skills. Part of a series of twelve modules. Includes teacher's guide and full-color reader. For students in grades one through three. Cartridge. Scott, Foresman and Co.

**Reading Flight\*** Three stories that teach how to classify and summarize information and approaches to outlining that information. A fourth story incorporates all the skills learned in the three previous stories. For sixth graders. Cartridge. Texas Instruments.

**Reading Fun\*** Learn more about the world and practice basic reading skills. The four-part program includes three stories and accompanying drills. All the skills taught in the first three stories are incorporated into a final story, making up the fourth part. For second grade students. Scott, Foresman and Co., Texas Instruments.

**Reading On\*** Teaches skills required to understand maps, graphs, and schedules. For third grade students. Scott, Foresman and Co., Texas Instruments.

**Reading Power\*** Practice using reading and research skills. For students in grades four through six. Cartridge. Scott, Foresman and Co.

**Reading Rainbows\*** Develop reading comprehension skills for grades K through two. Includes a teacher's guide and colorful reader. Requires speech synthesizer. Scott, Foresman and Co.

**Reading Rally\*** Provides basic reading skills practice for fifth grade students. Includes: "Fact and Opinion," "Author's Purpose," and "Bias and Connotation of Words." A fourth story incorporates all the skills taught in the first three stories into a review lesson. Texas Instruments.

**Reading Roundup\*** A four-part learning skills program that provides learning opportunities for students in the fourth grade. Includes: "Figures of Speech," "Word Meanings," and "Idioms." A fourth part incorporates all the skills into a final story. Texas Instruments.

**Reading Trail (4B)\*** Offers practice in reading comprehension and appreciation, with teacher's guide and colorful reader. For grades three through five. Cartridge. Scott, Foresman and Co.

**Reading Wonders (6B)\*** Practice in reading comprehension and appreciation for students in grades five through seven. Includes teacher's manual and student reader. Cartridge. Scott, Foresman and Co.

**Read-Only Memory** See Memory.

**Read/Write** Describes the nature of an operation, i.e., the direction of data flow.

**Real-Time** An action or system capable of action at a speed that keeps pace with the occurrence of an actual process.

**Real-Time Operating System** An operating system capable of real-time task management, including event scheduling, interrupt management, and real-time event counters.

**Reasonableness Test** A test of a variable's value falling within a bracket defined as reasonable. Used to detect and filter noisy inputs or erroneous outputs.

**REC** X BASIC Function. The REC function tells you where the internal record "Pointer" is located within a file. The format is:

REC(<filenum>)

**<filenum>** is the number of a file OPENed earlier in a program. The file must have been opened in RELATIVE mode, with INTERNAL format in order for the REC function to be usable.

Upon being instructed to PRINT REC(3), the computer will tell you what the number of the next record to be read on a file opened as #3.

**Record** A unit of information, either read, written, or stored, such as a punched card, disk sector, or a line of characters.

**Recursive** Refers to a function, routine, or procedure which calls itself.

**Redundancy** The use of more than one of the same item to increase reliability or performance.

**Reentrant** Programs or routines written in reentrant code. This code can be used by several tasks concurrently.

**Reentrant Code** A single segment of code and data which is not modified during execution, so that it may be called by multiple programs.

**Refresh** The logic necessary to periodically rewrite the contents of the dynamic RAM, typically every one millisecond.

**Refresh Circuitry** Electronic circuitry which periodically rewrite the contents of the dynamic memory to prevent loss of data. See Dynamic Memory.

**Register** One word of memory, usually implemented in fast flip-flops, directly accessible to a processor. Most CPUs include a set of internal registers which can be accessed much faster than the main memory. TI's 9900 has three registers—the program counter (PC), the workspace pointer (WP), and the status register (ST). RAM addresses can be notated as registers in TI-99 Assembly language used as if they were registers, but at slower RAM speed rather than fast internal processor speed. See Workspace Registers, Context Switch, Base Register, and CRU.

**Register Select** One or more lines used to select one register out of a given number within a device. Register select pins are normally connected to the address bus.

**Relative Addressing** A method of memory addressing by which the desired information is located by adding a displacement to a pointer. Addresses are expressed relative to some base address or pointer.

**Release** Program or Software. See BASIC.

**Relocatable** The load module or object form of a program or routine which does not contain fixed

addresses or is structured to be “relocated” and executed anywhere in the memory.

**Rem** A unit of radiation.

**REM** BASIC Statement. REM is used to insert remarks in programs. The format is:

REM <remark>

<remark> is any string of characters.

REM statements are nonexecutable, but are output exactly as entered when the program is listed. They do, however, take up extra memory space and slow execution time. REM statements may be branched into by using GOTO or GOSUB statements. Execution continues with the first executable statement after the REM statement.

Extended BASIC allows the use of tail remarks separated from the statement with an exclamation point (!).

**Removable Media for Recording Information** See Media.

**Rename a File** Use the Disk Manager Cartridge to change a file name on diskette. The Disk Manager Cartridge is menu-driven and “User Friendly.” Insert the Disk Manager Cartridge in the console, choose Disk Manager and when the Main Menu appears choose:

#### 1 FILE COMMANDS

and follow directions displayed on the screen.

Note: When the “SCREEN IS COMPLETE” statement appears on the screen, press FCTN 6 (PROC'D) (99/4—SHIFT V) to carry out the command.

**Rental Property Accounting\*** Compute your monthly and yearly taxable profits, total expenses, and print out accounting information. Track your real estate investments and tax status. Cassette. Requires printer. The Computer Consultants.

**Rental Property Inventory Management\*** Lists your properties by location or cost and provides a sum of your assets. Cassette. Requires printer. The Computer Consultants.

**Repeat a Character** XBASIC. See RPT\$.

**Repeat Program Lines** BASIC. See FOR...NEXT.

**RES** RESet signal.

**Reserved Word or Name** A specific value which serves a special purpose and may not be used for other purposes. See Names, Variable.

**Reserved Words** BASIC. See BASIC—Reserved Words.

## Reset • Ring Destroyer\*

**Reset** To return to zero, or to a selected beginning point. Powering on the TI-99 or pressing FCTN=(Quit)(99/4-SHIFT Q) or entering BYE performs a reset.

**Reside** To record in. A program may reside on a diskette, or in memory (RAM or ROM).

**Resident Program** A program residing in the main memory of the system. See Memory.

**RESequence** BASIC Command. RESequence is used to change the line numbers of a program in the computer's memory. The format is:

RES [<line>][<inc>]

<line> is the new beginning line number in your program. If <line> is not specified, the computer assumes that the beginning line will be 100.

<inc> is the increment. If <inc> is not specified, the computer assumes that the increment will be 10.

Not only are the line numbers changed, line number references (in statements like GOTO, GOSUB, RESTORE, etc.) are changed to match the new line numbers.

**RESTORE#** BASIC Statement. RESTORE# resets the record number used by a PRINT, INPUT, or LINPUT statement. The format is:

RESTORE# <filenum>[,REC<recnum>]

<filnum> is the number of a file opened earlier in the program.

<recnum> is a number or numeric expression.

REC <recnum> specifies a particular record number to use with PRINT, INPUT, and LINPUT. If REC <recnum> is not used, the computer is directed to the beginning file record. If REC <recnum> is used, the computer is directed to the file number indicated by <recnum>.

The REC <recnum> option may only be used with RELATIVE files.

**RESTORE** BASIC Statement. Lets you reread DATA statements from specified lines. The format is:

RESTORE<line>

<line> is the line number of a DATA statement in the program.

Following the execution of the RESTORE statement, the next READ statement reads the first item in the program's first DATA statement. If <line> is specified, the READ statement will read the first item in the DATA statement line specified.

**Retrofit** To improve or change software or hardware by making additions.

**RETURN** BASIC Statement. Will return you from a subroutine. It is used in conjunction with the GOSUB statement. Refer to GOSUB and RETURN—BASIC Statements. The format is:

RETURN

**RETURN, With ON ERROR** XBASIC Statement. This version of RETURN allows you to direct the program to either a new line number or the next program line. The format is:

RETURN <line>

or

RETURN <next>

<line> is the line number the computer will execute after the current subroutine has been executed.

<next> directs the computer to the next program statement after the one that caused the error.

RETURN is used with ON ERROR to change the action taken when an error occurs. See ON ERROR for more information.

**Reverse Video** The ability of some CRT terminals to display dark characters on a light background as opposed to the standard light on dark. Also called Inverse Video. The TI-99/4 and /4A's Standard Display Mode is Reverse Video.

**RF Modulator** A device that encodes a composite video signal, required for most monitors, into a radio frequency signal for display on a standard television set. TI users who use a standard television set, must connect it to the console through an RF Modulator.

**RFI** Radio-Frequency Interference.

**RFP** Request For Proposals.

**RFQ** Request For Quotes.

**RI** Right In. The right input to a shifter. This is the pin-in for the incoming bit to fill the vacancy left by shifting all other bits in the word to the right.

**RIGHT Arrow** Pressing FCTN D (99/4—SHIFT D) moves the flashing cursor over one space to the right. The right arrow may also be used in other ways in various applications programs.

**RIGHT Cursor** BASIC. FCTND (RIGHT Arrow) (99/4—shift D). Moves the cursor one space to the right with the character remaining in BASIC.

**Right Justify** See Justify.

**Ring Destroyer\*** An outer space game that is written in Extended BASIC but converts automatically

to arcade fast Assembler when you add Expansion RAM to your computer. Republic Software.

**Ring Indicator** In telephone-based applications, such as telecommunications via modem, Ring Indicator is the signal or line which causes the bell to ring.

**Ringwraith's Lair\*** Venture into the unknown in search of treasure and a missing maiden. Requires Extended BASIC Cartridge; 32K; disk. Fantasy Computing.

**Ringwraith's Lair, Scenario II\*** Create new effects for the first version of this game. Requires Extended BASIC Cartridge; 32K; disk. Fantasy Computing.

**Ringwraith's Lair, Scenario III\*** Gives you more thrills when combined with I and II. Requires Extended BASIC Cartridge; 32K; disk. Fantasy Computing.

**Ripple-Carry** An addition technique in which the carry coming out of an adder is propagated to the next adder. A faster method is to use carry look-ahead.

**Rise Time** The time required to complete the low-to-high transition of a pulse.

**RND** BASIC Function. Returns a RaNDom number between 0 and 1. RND is used like a number in an equation.

To generate random numbers in the range zero through (n), use the formula:

$$\text{INT}(\text{RND} * (n+1))$$

The same sequence of random numbers is generated each time the program is run unless the random number generator is reseeded by using the RANDOMIZE statement. See RANDOMIZE.

**RO** Right Out. The right output from a shifter.

**Robotron\*** A robot chase game. Requires Extended BASIC and joystick. Best Software.

**Roll Five\*** Roll the dice and save the ones of your choice on each of three rolls. The one with the highest score on each round is the winner. Pewterware.

**Rollover** Depressing two or more keys on a keyboard simultaneously. A good keyboard controller will include debouncing and multiple-key rollover protection.

**ROM** Read-Only Memory. See Memory.

**ROMable** Code which will execute properly when placed in ROM memory. Segments of ROMable

code have no temporary data storage areas and do not use instruction modification techniques.

**Romeo\*** An eager Romeo must confront blazing desert dunes, alligators, and shark-infested waters before he can reach his just reward. Cassette or disk. Extended Software Company.

**Root Finder\*** Find the roots of polynomials (of degree 4 or less). Disk or cassette. Eastbench Software.

**ROTATE** An instruction that shifts the contents of a register or word to the left or right. The bit coming in one end of the rotating word is usually the one falling off the other end. Sometimes it is the old value of the carry bit (9-bit rotation).

**Round-Robin** A scheduling technique in which a task list is cycled from top to bottom and back again. In round-robin scheduling, each process or device corresponding to a task is guaranteed periodic service.

**Routine** A section of code written to perform an action, such as an input-character routine, or a disk-write routine.

**Row Scanning** Used in decoding which key of a keyboard was pressed. Each row is scanned in turn by outputting a 1. The output on the columns is examined, resulting in identification of the key.

**RPG** Report Program Generator. A business-oriented programming language using a highly structured system of preformatted commands.

**RPM** Rotations Per Minute.

**RPN** Reverse Polish Notation. See Postfix.

**RPROM** Reprogrammable Read-Only Memory. See PROM.

**RPT\$** X BASIC Function. Used to make a "Multiplied Version" of a string expression. The format is:

$$\text{RPT\$} (<\text{x\$}>, <\text{n}>)$$

<x\$> is the group (string) of characters to be repeated. <z> is the number of times you want <x\$> to be repeated.

One way to use RPT\$ is in CALL CHAR statements. Here's an example:

```
CALL CHAR (100,RPT$("18",8))
```

Redefines ASCII character 100 using the string "1818181818181818"

**RS** Register Select. A control signal determining which of several eligible registers will be used in an MPU operation.



## R-S Flip Flop • Run-On Sentences\*

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**R-S Flip Flop** A flip-flop using two cross-coupled NAND gates.

**RS-232C** The widely used standard for connecting computer system components, especially for serial communication of data between computers and serial input/output peripheral devices. RS-232C is an electrical standard for connecting data terminal equipment such as modems or network data concentrators. Allows substantial variation of signals to be passed. See EIA-RS232C.

**RS-232 Controller\*** The software contained by this integral ROM will support automatic insertion of line feeds; carriage returns; null characters; a programmable BAUD rate from 110 to 9600; data bits from 5 to 8; stop bits of 1, 1 ½, and 2; even, odd or no parity; TI BASIC functions OPEN, CLOSE, LIST, INPUT, PRINT, SAVE, and OLD; auto echo; a listing margin and Extended BASIC Listing Decompress feature. The hardware allows you to reverse pins for compatibility with all present and future controllers and peripherals, and has DIP switches for device address selection. It also has an AC power adapter and a buffered bus. EIA RS-232C levels are provided on a standard DB25S connector at the rear of the cabinet. A.J. International.

**RS-232 Interface\*** Two models of this low-cost interface are available, the HX 3000, and the HX 3000/P which includes a parallel port. Texas Instruments.

**RS-232 Interface Card\*** Plug this card into the Peripheral Expansion Box to transmit and receive data over phone lines, and hook up to a printer. Texas Instruments.

**RS-232/32K Memory Combination\*** This combination interface and memory add-on unit attaches to the right side of the TI-99/4A console and has a port on its own right side for additional peripherals. Inteltec Computer Systems.

**RTOS** Real Time Operating System. An operating system in which data input and computer response proceed at the same rate.

**RTS** Ready To Send (RS-232C standard signal).

**Rules For C and K\*** Teaches spelling rules for words using the letters C and K. For elementary grade students. Disk or cassette. Computer-Ed.

**Rules For G and J\*** Teaches spelling rules for words using the letters G and J. For the elementary school students. Disk or cassette. Computer-Ed.

**RUN** XBASIC Command. Extended BASIC allows you to load and execute a program using RUN as a

command or as a program statement. The format is:

RUN "<dvc>[.<programname>]"

<dvc> is the storage device (CS1,DSK1, etc.) where the program is located. You may also instruct the computer to look for a particular disk name on any disk drive by using DSK<diskname>. If this command/statement is used with (CS1), the standard Cassette-Load instruction set will be displayed on the screen, then the program will be executed from cassette.

<programname> is the name of the program on the diskette that you want to load and RUN.

Note: when using RUN as a command to load and execute a program, <dvc>:<programname> must be in quotes.

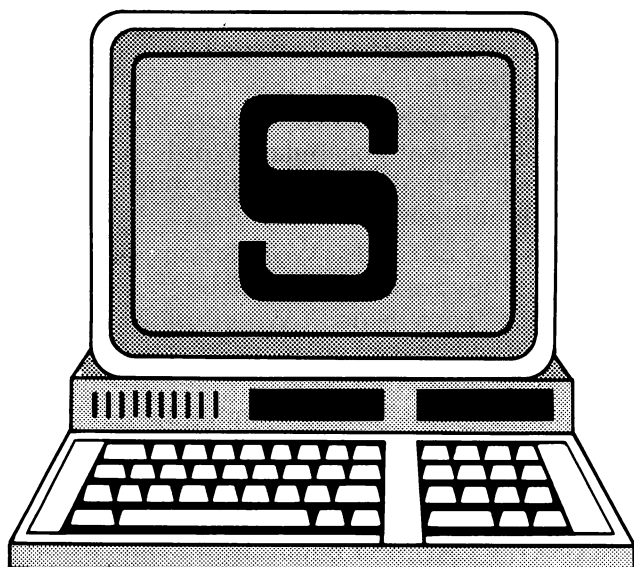
**RUN** BASIC Command. The RUN command causes a program to begin execution. The formats are:

RUN [<line>]

<line> is the line number of the program in memory where you wish execution to begin.

RUN executes the program currently in memory at the lowest line number. RUN <line> will begin to execute the program at the specified line number.

**Run-On Sentences\*** Learn to recognize long sentences that should be broken into smaller ones. Requires Extended BASIC Cartridge. Disk or cassette. Micro-Ed, Inc.



**S** Codes. ASCII 83, HEX 53. s—ASCII 115, HEX 73.

**S** Select or Strobe.

**S-100** An extremely widespread 100-line micro-computer system bus. It was originally developed as the bus for the first 8080-based system, Altair. It has since been standardized as the IEEE696 bus. In its latest form, it can be used with the newer 16-bit microprocessors.

**Salary Planner\*** A program to help school administrators coordinate salary schedules with budgets and produce a variety of reports. Helpful in collective bargaining situations. Requires printer; disk. Scott, Foresman and Co.

**Sales\*** Similar to the Order Entry program, except it was created to store and generate a point of sales and automatically update and interrelate with other programs. Requires Extended BASIC Cartridge and printer; disk. Ycan Systems, Inc.

**Sam Defense\*** A replica of real military equipment and operations involving missiles, aircraft, and radar. Cassette. Futura Software.

**Sample and Hold** An analog circuit to capture and retain a signal so that it may be converted by an A/D converter.

**Sampling** Measuring an input value at intervals.

**Santa Paravia and Fiumaccio\*** As the medieval head of a small Italian City-State, you direct the affairs of your kingdom. If you choose wisely in matters of taxation, public works, justice, and agriculture, your kingdom will flourish. If you choose poorly, your life may be in danger. Cassette. Instant Software, Inc.

**SAT 4511 Bus Extender\*** Check out and repair the cards in your peripheral expansion box using this bus extender. Space Age Technology.

**SAT 4512 Wire Wrap Prototype Board\*** For use with TI's peripheral expansion box. Supports as many as forty-eight 20-pin devices plus their regulators and associated capacitors. You may use varieties of 8, 14, 16, 18, 20, 24, 40, and 64 pin devices as well. Space Age Technology.

**SAT 4513 Prototype Kit\*** Contains one hundred pins and twenty decoupling capacitors, wire wrap i.d.'s, 15 three level wire wrap sockets, and +5 +12 regulators and associated capacitors. Space Age Technology.

**Satellite Processor** A computer subordinate to another computer, possibly communicating over large distances, performing specialized processing related to the master computer. The satellite may also be contained in the same device as the main processor, creating a multi-processor machine.

**Saturday Night Bingo\*** A computer-aided version of BINGO that can be set at different paces of play. Requires speech synthesizer. Texas Instruments.

**Savage Island I and II Adventure Database\*** This island has many surprises and quick reflexes are needed to avoid a quick death. Requires Adventure cartridge; disk or cassette. Texas Instruments.

**SAVE** BASIC Command. SAVE allows you to copy a program in memory on to cassette or diskette. The format is:

SAVE <dvc>[.<prgname>]

<dvc> is the storage device (CS1,DSK1,etc.) that the program will be SAVED to.

<prgname> with diskettes is the name of the program you are saving.

If you are saving to cassette, the computer will display instructions on the screen for you to follow. To RUN the program at a later time, use the OLD command to copy it, from the diskette/cassette you saved it on, back into the TI's memory. See OLD.

The SAVE instruction does not alter your program in memory. Remember that if you write a BASIC program, it will be erased unless you SAVE it before you turn off the console, or use the NEW, BYE, or FCTN=(quit) commands.

**SAVE** X BASIC Command. Extended BASIC allows two additional options to SAVE programs on cassette or diskette. The formats are:

SAVE <dvc>[.<prgname>],PROTECTED

or

SAVE <dvc>[<prgname>],MERGE

<dvc> is the storage device (CS1,DSK1,etc.) that the program will be SAVEd to.

<prgname> with diskettes is the name of the program you are saving.

PROTECTED is the keyword that “locks up” your program. Saving with the PROTECTED option means that the program can be loaded and run, but cannot be LISTed, SAVEd, EDITed (or unPROTECTED). PROTECTED will work with both cassettes and diskettes.

MERGE is the keyword that allows a program to be merged with another program in memory, using the MERGE command. See BASIC statements for information on the MERGE command. The MERGE keyword can only be used with diskettes.

Because this keyword is not reversible, be sure to keep an unprotected copy of your program.

**SAY** XBASIC Subprogram. CALL SAY allows the computer to use the Speech Synthesizer(PHP 1500) and to speak through the Monitor Speaker. The Speech Synthesiser (PHP 1500) is optional. The format is:

CALL SAY (“<wo\$ >”<x\$ >,...)

“<wo\$ >” is a word string and can be any of the Resident Vocabulary Words and must be enclosed in quotation marks.

<x\$ > is a Direct String and can be one of the Resident Vocabulary Words or modified to include Suffixes. See the TI Extended BASIC Manual, Appendix M, for Suffix Programs. See SPGET.

The syntax of CALL SAY is very important. Here are some rules to follow:

When using Word Strings, begin and end a sentence with quotation marks.

Speech Separator Characters are used to separate words. Here is a list of Speech Separator Characters and their corresponding time pauses:

Speech Separator Characters	
Symbol	Pause (seconds)
+	0
space	.1
-	.2
,	.3
;	.5
:	.8
.	1.0

The above characters may be used in multiples to further vary the pause time between words. (The Space Character is the only exception to the above rule; more than one space is ignored.)

Be sure the words you use are part of the Speech

Synthesizer’s Resident Vocabulary. Otherwise the non-vocabulary word will be spoken as a series of individual letters.

If CALL SAY is to have two or more Word Strings (Group of Resident Vocabulary Words enclosed in quotation marks), the Word Strings must be separated by double commas.

Numbers may be used as Word Strings, but will be spoken as they are listed. (49 will be spoken “Four Nine,” not “Forty Nine.”) When using numbers, the period will be spoken as “point.” in (“4.9” will be spoken “Four Point Nine”).

When using Direct Strings (defined by the SPGET Subprogram), extra commas are sometimes needed to help the computer keep words separated. Use double commas to separate two Direct Strings in a CALL SAY. If CALL SAY begins with a Direct String, the string must have a single comma in front of it. When alternating between Direct Strings and Word Strings, place a single comma between them.

Notice that some of the Resident Vocabulary Words are actually phrases such as “Ready to Start” and “That is Right.” These phrases must be entered using a pound sign (#) on either end. (Example: “I am a #Texas Instruments# Home Computer”).

Note also that some of the words have more than one pronunciation. These words (Homographs) are delinated with a Trailing number 1 (Example: The= (“Thee”) and The 1= (“Thuh”).)

Here are some examples of CALL SAY

200 CALL SAY (“HELLO. ARE YOU #READY TO START#”)

200 CALL SAY (,A\$, “ANSWER”, B\$, “5”)

200 CALL SAY (“THE”, A\$,, B\$, “TWELVE”, “THIRTY”

In these examples, the values of A\$ and B\$ have been defined earlier in the program with CALL SPGET—with A\$ = “TIME” for example.

There are over 300 Letters, Words, and Phrases Resident in the TI Speech Synthesizer. They are listed in Appendix L of the TI Extended BASIC Manual.

**SBC** Single Board Computer. A name applied to a line of board-level products built to Intel specifications and using a common system bus known as the multibus. This bus is standardized as the IEEE 796. National Semiconductor has a compatible board line designated by the letters BLC (Board-Level-Computer).

**SCCS** Southern California Computer Society.

**Scepter of Kzirgla\*** The popular graphics adventure originally designed for the TRS-80. Requires Extended Basic and joysticks. Kuhl Software.

**Scheduling** Allocating a non-sharable resource such as CPU time or an I/O device to a particular task for a period of time.

**Scheduling Assistant\*** Helps plan class and student schedules. Requires dual disk drive, RS-232 interface, and printer; disk. Scott, Foresman and Co.

**Scholastic Spelling—Level 3\*** Includes many spelling learning aids, games, and reviews. Requires speech synthesizer; cartridge. Texas Instruments/Scholastic, Inc.

**Scholastic Spelling—Level 4\*** A continuation of Scholastic Spelling—Level 3. Includes new games, practice, and review. Requires speech synthesizer; cartridge. Texas Instruments/Scholastic, Inc.

**Scholastic Spelling—Level 5\*** A continuation of Scholastic Spelling—Level 4. Requires speech synthesizer; cartridge. Texas Instruments/Scholastic, Inc.

**Scholastic Spelling—Level 6\*** Spelling and practice tools, including lessons, reviews, and games. Requires speech synthesizer; cartridge. Texas Instruments/Scholastic, Inc.

**School Mailer\*** Create easily accessible mailing lists and print labels. Requires dual disk drive and printer; cartridge. Scott, Foresman and Co.

**Schotky** A technology of high-speed circuits.

**Science Facts\*** Teaches the development of scientific principles of physics and biology: Object Collision, Diffusion, Radioactive Decay, Snell's Law, Membranes, and Pesticides. For students in grades nine through twelve. Requires Extended BASIC Cartridge; disk. Texas Instruments and Minnesota Educational Computing Consortium (MECC).

**Scientific Software** See Engineering—Mechanical and Scientific Software.

**SC/MP** Simple Cost-effective MicroProcessor. National Semiconductor's small 8-bit microprocessor.

**Scope** The scope of a variable or definition is that part of the program in which it may be accessed. Also, an abbreviation for oscilloscope.

**Scotch** A brand of magnetic recording media.

**SCR** Silicon Controlled Rectifier. A silicon cell which permits current flow in one direction only, thus effectively converting AC current to DC.

**Scrambled Letters Puzzle & Number & Alphabet Hi-Lo\*** Includes an adaptation of scrabble and a

number and letter guessing game. Cassette. Hall Software.

**Scratchpad** A group of general purpose registers without specific function that serve as a high speed workspace for some operations. Usually, an internal RAM faster than the main system RAM.

**Screen** The surface of a monitor or TV set on which characters are displayed.

**SCREEN** BASIC Subprogram. CALL SCREEN is used to change screen color. The format is:

CALL SCREEN(<x>)

<x> is the color number. There are sixteen colors available in TI BASIC and XBASIC. They are:

Number	Color	Number	Color
1	Transparent	9	Medium Red
2	Black	10	Light Red
3	Medium Green	11	Dark Yellow
4	Light Green	12	Light Yellow
5	Dark Blue	13	Dark Green
6	Light Blue	14	Magenta
7	Dark Red	15	Gray
8	Cyan	16	White

The standard screen color for TI BASIC is (8) Cyan in immediate mode, and (4) light green in the program execution mode. TI Extended BASIC remains the same color, (8) Cyan, in both modes.

**Screen Display, Freeze** To briefly freeze the screen display while the operator using your program reads a message, write a delay loop after you print the message:

```
1000 FOR Y = 1 TO 2000
1010 NEXT Y
```

To freeze the screen until the operator is finished, put in a dummy input statement instructing the operator to press ENTER to proceed. The input variable (A\$) need not be used in your program:

```
1000 INPUT "Press ENTER to continue";A$
See also KEY.
```

**Screen Dump\*** Does not require extra memory to dump the contents of your screen to a dot matrix printer. Available in both disk and cassette versions, but the cassette version will require some programming knowledge to use. Extended Software Company.

**Screen Dump\*** A utility program which can be merged with BASIC programs. Intended to print the screen in graphics style on an Epson printer with Grafrax, but can be modified for other printers with dot addressable graphics. Requires Extended BASIC Cartridge and printer with dot addressable graphics; disk. The Micro House.

**Screen Generator** Helps to define CRT screen forms, which are a particular pattern of symbols on a CRT screen for data entry and display. Screen forms are often displayed in protected fields and consist of prompts to guide the data entry operator.

**Screen Graphics\*** Creates multi-colored patterns. Requires Extended BASIC Cartridge; cassette. Western Properties Investment Co.

**Screen Size** The amount of information that a CRT screen can display. Screens may be measured diagonally, as TV sets are, or by the number of vertical and horizontal dots (pixel) or character positions.

**Scribble\*** A computer version of Scrabble which randomly provides the players with the letter blocks. The screen graphically represents the playing board, complete with double and triple value, squares, and automatic scoring. Cassette. PRP Computergraphics.

**Scrolling** Moving the contents of the CRT screen up or down by one or more lines. Smaller movements are performed by microscrolling, moving one dot at a time.

**SDLC** Synchronous Data Link Control. An IBM computer networking protocol, primarily used between mainframes.

**SE** Sign Extend. A technique used during multiply, divide and shift operations to insure that negative numbers remain negative when shifted right. The convention is that bits shifted into the high end of the register will be identical to the bit that was in the high order position when the shift began. Also: Systems Engineer, a software technician usually employed by a computer manufacturer.

**Second Source** The manufacturer of a device, other than the original one.

**Sector** A continuous section of a disk track. A block of data on a disk is addressed by its track and sector numbers. Typical disk sector sizes are 128, 256, or 512 bytes of data. Consecutively numbered sectors may or may not be physically adjacent within a track. The TI-99/4 and /4A use 256 byte sectors written 9 per track.

**Sector, Bad** A sector on the diskette which will not read/write data correctly, usually due to a minor physical flaw in the disk. The Disk Manager Cartridge has a selection for running Disk Tests. This checks the condition of the Disk, Disk Drive, and Controller.

**Sector Command\*** Travel to the far reaches of space and destroy the outlaw aliens. Cassette. Simul-Tech.

**Securities Analysis\*** This is a securities analysis package designed to assist brokers and investors with analyses, interest and annuities calculations, and more. Texas Instruments.

**Seek Time** The time needed to position the head of a disk over the specified track.

**SEG\$** BASIC Function. SEG\$ is used to get a portion of a group of characters. The format is:

SEG\$(**<x\$>**,**<p>**,**<l>**)

**<x\$>** is the group of characters (string) the computer will "read." **<p>** is the position in **<x\$>** where the computer is to begin reading. **<l>** is the number of characters the computer is to Read (beginning at l).

Here's an example of a program line, and an explanation:

100 NO\$=SEG\$(N\$,4,5)

This instruction is telling the computer:

"Count over 4 characters in the character group known as N\$. Starting at the 4th character, read 5 characters and assign the value of NO\$ to this new group."

**Segment** A continuous block of memory addresses, such as 0 to 64K.

**Select-A-Cart\*** A command module expansion unit holds up to 3 of your favorite cartridges and lets you switch from one to the other using a rotary switch. You can also reset the computer using only the reset button. Navarone, Ltd.

**Semi-Colon (;)** Each group of fourteen spaces across the print line is called a print zone. A comma (,) in a PRINT#<n>: <list of items to be printed>, means "start printing the following item at the start of the next print zone." A semi-colon (;), means the next item is to print immediately after this one, without a space between. The print zones begin in columns 1, 15, 29, 44, 58, and 72. See also Print Lines.

**Sending Line to Requesting Program** Upon pressing the ENTER key the displayed line is sent to the requesting program for processing.

**Sengoku Jidai\*** Capture Japanese castles and use their forces to keep from being overthrown. Cassette. Not-Polyoptics.

**Sensor** A device which translates a physical stimulus into an electronic signal which may, for example, be input into a computer.

**Sequencer** In a bit-slice system, the module in charge of providing the next microprogram address to the microprogram memory. It is essentially a complex multiplexer, but may include stack facilities and a loop counter.

**Sequential Access** An access method in which items may be accessed in a fixed order only. The standard example of a sequentially accessed medium is magnetic tape. In order to access a particular record, all records before it must be scanned first.

**Sequential File** A file with elements that may only be accessed in ascending order. In order to read an element of a sequential file, all of the preceding elements must be accessed.

**Serial** Simultaneous handling of processes, transmissions, or storage of data. In most microcomputers, parallel I/O connections have 8 wires to carry 8 bits of a byte simultaneously (or in parallel). Contrast this with a Serial interface, where only one data wire is available. The 8 bits of a byte are transmitted one after another (or serially). The I/O device must collect all 8 bits back into one 8-bit byte.

**Serial Data** Data transmitted sequentially, one bit at a time.

**Serial Port** An I/O port through which data is serially transmitted. Serial ports are often used for communicating with terminals or other computers. The RS-232 Interface Card has both Serial and Parallel Ports.

**Series** Circuit elements connected so that the output of one is the input of the next.

**Servo** Short form of servo-mechanism (q.v.).

**Servo-Mechanism** A device which converts electrical signals to mechanical or physical action. Servo-mechanisms range from simple relays to robots.

**Setup Time** The time required before a signal can be changed from its prior state or the time required for a program to mount the required disks and tapes, change printer forms and set up the other preliminary conditions to run.

**SGN** BASIC Function. SGN function gives the sign, positive or negative, of  $\langle x \rangle$ . The format is:

$$v = \text{SGN}(\langle x \rangle)$$

$\langle x \rangle$  is any numeric expression.

If  $\langle x \rangle$  is positive,  $\text{SGN}(x)$  will return 1.

If  $\langle x \rangle$  is zero,  $\text{SGN}(x)$  will return 0.

If  $\langle x \rangle$  is negative,  $\text{SGN}(x)$  will return -1.

**S/H** Sample and Hold.

**Shell** The name for the command interpreter running under the Unix operating system.

**Shenango Enterprises Adventure Games\*** In Agent 000 you search for Atlantis, outwit enemy agents, and escape a black hole; in Agent 000 Returns, the ghost is reunited with agent 000, who unravels a time paradox. Shenango Enterprises.

**Shift** Moving the contents of a register left or right by one or more bits. The bit falling out goes into the carry bit of the status register or is lost. The bit coming in is usually a 0, except in some special circumstances, such as Sign-Extend.

**Shift Register** A register whose contents can be moved left or right by one or more bit positions.

**Shifter** Hardware device which implements the shift instruction. It moves all bits in a register left or right one bit.

**Ships\*** Fight a battle at sea while in command of several large clipper ships. Cassette. Not-Poly-optics.

**Short Story Generator\*** An educational program produced by Eastbench Software Products.

**Shugart SA400 Mini Floppy Disk Drive\*** A compact unit that will operate in a single- or double-density capacity. Unformatted storage is 125/250 Bytes.

**Shuttle Command\*** Man your Space Shuttle command post to defend the Earth from attack satellites. Destroy them before they destroy you. FFF Software.

**SI** Serial Input.

**Side Effect** An accidental change to the value of a global variable by a function, procedure, or subroutine. Structured programming languages discourage side effects by limiting the scope of global variables.

**Siege\*** Two players are pitted against each other in a siege situation between defenders of a castle and attacking forces. Pegasus Software.

**Sigma Function\*** Answer given after upper and lower values, the increment, and the function are entered. Disk or cassette. Data Systems.

**Sign** Plus or minus. In two's complement notation, the sign can be determined by examining bit 7, the most significant bits (MSB).

**Sign Magnitude** A binary representation for integers where the MSB acts as the sign (0 for +, 1 for -)

and the rest of the bits contain the magnitude, or absolute value, of the number.

**Signalman Mark III Modem\*** This compact modem is designed for the use with your RS-232 Interface. Features an internal, long life, 9-volt battery and an audible carrier detect signal. Will transmit both voice and data, and automatically switch between answer and originate modes. Fully compatible with Bell 103 modems. Tex-Comp.

**Signed Binary** A binary representation of signed integer numbers which sets aside one bit, usually the high-order or leftmost bit, to indicate the sign of the number.

**Silicon-Gate** The MOS technology using silicon for the gate of the transistor. An alternative is aluminum-gate.

**Silicon Valley** The area around Sunnyvale, in the Santa Clara Valley south of San Francisco, California, where many semiconductor manufacturers are located. Contains the greatest concentration of electronics industries in the U.S. It is also called Silicon Gulch.

**Simple Sprite Procedures For TI Logo\*** Create your own Sprite procedure with the help of this package including easy-to-follow instructions. Requires TI Logo cartridge; 32K; disk or cassette. Microcomputers Corporation.

**Simple Turtle Procedures For TI Logo\*** Create your own Turtle procedure with the help of this package, including easy-to-follow instructions. Requires TI Logo cartridge; 32K; disk or cassette. Microcomputers Corporation.

**Simplex** Data transferred in one direction only.

**Simulator** A program with the same input/output behavior as the device it simulates, but generally slower. A simulated time counter allows the measurement of time. A CPU is easily simulated but I/O cannot be precisely simulated because of timing involved, so only the logic of a program can be tested with a simulator.

**SIN** BASIC Function. Calculates and returns the trigonometric sine function. The format is:

$$\langle v \rangle = \text{SIN}(\langle x \rangle)$$

$\langle x \rangle$  is the angle in radians.

$\langle v \rangle$  is the variable that will be assigned to the value returned by  $\text{SIN}(\langle x \rangle)$ .

To convert degrees to radians, multiply by  $\pi/180$ ;  $\pi=3.141593$ .

**Single Board Computer** A complete computer on one printed circuit board: CPU, ROM, RAM, and

interfaces. Single board computers are often used for industrial control applications.

**Single Density Diskette Format** The only density choice supported by the 99/4 and /4A.

**Single Precision Arithmetic** Regular Arithmetic. example, arithmetic on single-word integers, contrasted with double- or multi-precision arithmetic.

**Single Sided** A method of disk storage using only one side of the disk as used in the TI supplied 90K drives. Also, a printed-circuit board with printed-circuit wiring on only one side.

**Sink Current** A logic family's current drive capability. Sink current is 1.6 milliamperes for one standard TTL gate.

**SIP** Single In-line Package. A package for a chip which has a single row of pins, usually very few in number (2-8). Contrast with dual-in-line package, where up to 100 pins are often used.

**SIZE** XBASIC Command. When you type SIZE and press ENTER, the amount of unused memory is printed on the screen. If memory expansion is connected, the computer will give amounts of free space for both "STACK" and "PROGRAM SPACE". If memory expansion is not attached, the computer gives the amount of free memory space in the console. The amounts are expressed in bytes (characters).

Free space in memory is determined by subtracting programs, variables, strings, and character definitions from total available memory/stack space.

**Size Print** To set line spacing for 8 lines per inch, enter BASIC statement:

```
PRINT#<n>:CHR$(155);"0"
```

To set line spacing for 6 lines per inch, enter BASIC statement:

```
PRINT#<n>:CHR$(155);"2"
```

To set line spacing for 72 lines per 7 inches, enter BASIC statement:

```
PRINT#<n>:CHR$(155);"1"
```

or

```
PRINT#<n>:CHR$(155);CHR$(49)
```

See Type Formats.

**Size Type** Normal Size Print. To return to normal, ten character per inch print size, turn off all non-standard print options. See Type Formats.

**Size Type** Compressed Print. For compressed print (small type size) enter BASIC statement:

```
PRINT#<n>:CHR$(143)
```

in a program line where you want to start printing

in small type. This gives 132 characters on the 8 inch line, or about 16 characters per inch. To return to normal size print, enter:

PRINT#<n>:CHR\$(146)

See Type Formats.

**Ski\*** Ski hundreds of courses in a variety of ski conditions, trying to arrive at the finish with the best possible time. If you go too fast for the conditions on the course you will fall. Times for each player are visible on screen to determine the winner. American Software Design & Distribution Company.

**Skill Builder I\*** Bingo Duel and Number Hunt; two games that run from simple to complex. Cassette. Image Computer Products.

**Skip** An instruction, in Assembly or Machine language, to skip the following program instruction. A condition is usually specified, such as: "Skip If Z True".

**Skip to Top of Page** Form Feed on Printer. Enter BASIC statement:

PRINT#<n>:CHR\$(140)

Or use the "top of form" or "form feed" manual control button (FF) on the printer. You may then need to adjust the paper in the printer so it actually is at the top of a page as defined by the perforations. In a program, you may want to provide instructions to the operator and a pause (q.v.) to allow for adjustment of the paper.

**Sky-Diver\*** You are free-falling from an airplane and must score a direct landing for the maximum points. Requires Extended BASIC Cartridge; cassette. Maple Leaf Micro Ware.

**Slave** Any device under control of or imitating the operation of another device.

**Slew Rate** A fast signal response measured in volts per second. Used in operational amplifier specifications.

**Slice** See Bit-Slice.

**Slot Machine\*** The Las Vegas favorite with super graphics and sound. Cassette or disk. The Micro House.

**SLSI** Super Large Scale Integration. A technology which holds up to 100,000 transistors per chip.

**Small Business Accounts Payable\*** Create and maintain a list of accounts payable. Detailed information is stored for each account regarding vendor name and number, cost allocation number, discount percentage and expiration date, unpaid bal-

ance, date of last payment, invoice due date, and account status. Eastbench Software Products.

**Small Scale Integration** The technology which holds up to ten gates per device.

**Small Type Size** Compressed Print. To enter this mode, enter BASIC statement:

PRINT#<n>:CHR\$(143)

in a program line at the point you want to start printing in the small type. This gives 132 characters on the eight inch line, or about sixteen characters per inch. To return to normal size type enter:

PRINT#<n>:CHR\$(146)

See Type Formats.

**Smalltalk** Organized around two fundamental concepts: objects and messages. Smalltalk systems are characterized by a high degree of pictorial interaction. A language and software system developed by the Learning Research Group at the Xerox Palo Alto Research Center (PARC).

**Smash\*** Features merge and delete, the ability to save disk space, memory, and execution time. Requires Extended BASIC Cartridge; disk. Oak Tree Systems.

**SMI** Static Memory Interface.

**Smith-Corona TP-1 Letter Quality Electronic Text Printer\*** Produce fully formed executive quality printouts on this microprocessor controlled, daisy wheel printer, at a speed of 120 words per minute. You can change fonts by changing the daisy wheel and have the option of using high quality carbon film ribbon or economical nylon ribbon. Daisy wheel and ribbons are available from Smith-Corona dealers. The standard interface and print size are parallel and ten characters per inch respectively but a serial interface and/or twelve characters per inch are available at no extra charge. Smith-Corona.

**Smoke Test** Turning on the equipment for the first time to see if it will work.

**SMS** Scientific Micro Systems—a manufacturer.

**SMU Electrical Engineering Library\*** Helps engineering students to perform tedious calculations quickly. It teaches Kirchhoff's Voltage Laws, Kirchhoff's Current, and Ohm's. Developed by Southern Methodist University. Texas Instruments.

**SNOBOL** StriNg-Oriented symBOLic language. A character-string manipulating programming language.

**SNR** Signal to Noise Ratio.



**SO** Shift-Out bit. The bit lost (or stored in the carry status register) when a word is shifted left or right.

**SOB** Start-of-block.

**Social Science\*** Teaches geography and international relations; reviews countries and their capitals, and simulates negotiations between superpowers and between companies, and unions. Requires Extended Basic Cartridge; disk. Texas Instruments and the Minnesota Educational Computing Consortium (MECC).

**Socket** A mechanical electrical connector. The socket is also known as the female connector.

**Soft-Fail** Technique which preserves a degree of system operation despite failures.

**Soft-Sectored** A disk format where the beginning of every sector is detected by reading magnetic marks on the disk (used by the TI-99/4 and /4A). Compare this with hard-sectored, in which each sector's origin is marked by a physical hole.

**Software** Computer programs of all kinds are called software. Usually software is contrasted to hardware which is the actual chips, wires, boards, etc., which make up the computer. A special case is read-only memory (ROM) (q.v.), which is hardware that contains a permanent copy of software. Shorthand terminology here could be confusing—such as “a BASIC ROM,” which means a ROM (hardware) containing a copy of a BASIC interpreter program (software). Such ROMs are often called firmware to distinguish them from non-program hardware and from software in changeable media (RAM, diskette, cassette, etc.).

**Software (Applications)** A Software package is a group of computer programs, possibly including data files and documentation, to perform a function or group of related functions on the computer. These are called applications software when the programs are devoted to a user task. Examples would be a word processing package, an accounting package, etc. These programs are called systems software packages when they facilitate the use of the machinery, such as database management packages, disk operating systems, or program development packages.

**Software-Compatible** Describes CPUs which execute the same instructions (i.e., the same Machine language).

**Software Package** A pre-written group of commercially available programs designed to serve a

specific need, such as word processing, inventory control, database management, etc.

**Solid State Software** Preprogrammed “firmware”; software in ROM. Many of these cartridges are available from TI and third party vendors. The cartridge inserts into the slot in the front of the console, eliminating the need for the user to have programming experience.

**Sort\*** Sequential tables are sorted, then outputted. Used mainly for small files. Cassette. Anthistle Systems 7 Programming, Ltd.

**Sort** To arrange items according to defined criteria, such as alphabetical or numerical order.

**Sort Routines\*** You'll be able to sort alphabetic or alphanumeric data through the use of subroutines. Printer optional; disk or cassette. Eastbench Software.

**SOS** Silicon-On-Sapphire. Integrated circuit technology in which a sapphire substrate is used. Yields high speeds of operation.

**Sound** BASIC Subprogram. CALL SOUND enables the computer to generate tones and/or noise through the monitor speaker. The format is:

```
CALL SOUND(<dur.>, <freq. 1>
[...,<freq. 4>,<vol. 4>])
```

<dur.> is the duration (length of time) that the tone(s) and/or noise will be played. This is expressed as a number from 1 to 4250. The number indicates the length of time in milliseconds (thousandths of a second). A negative value may also be given (-1 to -4250). This causes the computer to ignore the actual length of time requested and execute the CALL SOUND statements as fast as the computer can process them. It also removes the characteristic “click” between CALL SOUNDS.

<freq. 1-freq. 4> are the tone frequencies, expressed in Hertz (cycles per second), or the noise type, expressed as -1 through -8. Notes may have a value of 110 through 44733, although above about 10,000 you will be out of the range of the average human's hearing. The actual tone frequency produced by the computer may vary by up to ten percent. See the TI Reference manual under “Musical Tone Frequencies” for a table of notes and corresponding frequency values. Noise produced by the computer is listed in the table below.

- 1 Periodic Noise Type 1 (aprox. value 466, A#)
- 2 Periodic Noise Type 2 (aprox. value 233, A#)
- 3 Periodic Noise Type 3 (aprox. value 117, A#)
- 4 Periodic Noise that varies with the frequency of the third tone specified.

- 5 White Noise Type 1
- 6 White Noise Type 2
- 7 White Noise Type 3
- 8 White Noise that varies with the frequency of the third tone specified.

<vol. 1-vol. 4> is the volume (loudness) of the tone(s) and/or noise expressed as 0 (loudest) through 30 (softest).

The computer will accept a CALL SOUND statement with up to three tones and one noise, all played simultaneously.

**Sound Processing Units Software** See Music Analysis-Synthesis, Music Edition, Music from Numbers, Music Maker, Music Synthesizer, Piano Song, Speech Synthesizer, and Text to Speech.

**Source** The emitter of a transistor.

**Source Code** A synonym for source program.

**Source Drive** The diskette drive from which information/data is coming. Target drive is the diskette drive to which information/data is going.

**Source Language** The original language used by the programmer, on which a translator program operates to produce a version in the language used by the machine.

**Source Program** A file which contains data to be processed by a language processor or interpreter. For example, if you write a BASIC program, this is a source program. If you RUN the program, the BASIC interpreter translates this source program into a Machine language the CPU understands. If you submit the source program to a BASIC interpreter to produce a fast object program, the BASIC interpreter will treat the program as its input data rather than as a program to be executed. The BASIC interpreter will produce an object file which contains a translation of your source program into Machine language.

**South Pacific\*** A south sea naval battle in which your ship is pitted against enemy submarines. Destroy as many subs as you can before going under. Graphic Software.

**Sow/Pig Enterprise Analysis\*** Create an Analysis Report with such data as various costs, expenses, profit, and pounds per sow. The program has recall, revision, and rerun capabilities. Computech Distributing.

**SP** Stack Pointer.

**Space** Binary 0 (zero). Defined in the RS-232C standard as negative voltage; in a current loop, no

circuit flow; and in modems, the lower frequency of the pair. Also, commonly used as a synonym for the blank character.

**Space Battle\*** This game pits you against marauding aliens bent on the destruction of your defenseless ships and a fueling station. You will find the enemy unpredictable as the computer generates random factors to vary his behavior every time you play. Disk or cassette. American Software Design & Distribution Company.

**Space Games\*** You are pitted against marauding aliens bent on the destruction of defenseless ships and a fueling station. The enemy is unpredictable because of the random factors introduced by the computer. Disk or cassette. American Software Design & Distribution Company.

**Space Games\*** In X-Wing Pilot, you must destroy the enemy with your air ship before you run out of fuel; in Alien Attack, you battle, your starship against the computer in a battle for territory. Disk or cassette. Software Exchange.

**Space Rescue 2.0\*** You must get fuel to the other ships in your squadron while avoiding the alien blockades. Requires Extended BASIC cartridge; cassette. PS Software Co.

**Space Salvo\*** Are you fast and accurate enough to intercept the attacking ships and save New York City? Jerseyware Microcomputer Systems.

**Space Up One Line** To advance one line on the printer (space up) without carriage return, enter BASIC statement:

PRINT#<n>:CHR\$(10)

or use "line feed" button (LF) on the printer.

**Spacing in BASIC Print Lines** To get one or more spaces between fields printed by your BASIC programs, use a literal of spaces like: " ". To get several spaces between the printed values of A\$ and B\$, enter BASIC statement:

PRINT#<n>:A\$;" ";B\$

See also Print Zones

**Spacing on Printer** #<n>: statement with no other specifications will print a blank line (feed the paper up one line and return to left margin) to neatly format your printout.

**Spanish Vocabulary—Part One\*** Take six different tests by giving the English equivalent of Spanish words. Cassette. Lowe Software Company.

**SPDT** Single Pole Double Throw. A type of switch.

**Speak & Math Program\*** Teaches children math and problem solving techniques. Includes Great-

er/Less, Write It, Number Stumper, Solve It and Mix It. Requires speech synthesizer and Terminal Emulator Cartridge. Texas Instruments.

**Speak and Math Program\*** Provides basic math practice like the stand-alone learning aid. Requires speech synthesizer and the Terminal Emulator II cartridge; disk or cassette. Texas Instruments.

**Speak & Spell Program\*** Offers children five activities for learning to spell. "Spell" has the child type in the correct spelling of a pronounced word; "Secret Code" codes a word until decoded by the computer; "Say It" has the child say the word then spell it; and "Mystery Word" has the child guess a word by trying to spell it correctly. Texas Instruments.

**Special Characters** Meanings in BASIC. The following characters have special meanings in TI BASIC and XBASIC. These characters cannot be used to have meanings other than what is stated below:

- blank
- = equal sign or assignment symbol
- + plus sign or concatenation symbol
- minus sign
- \ backslash
- / slash or division symbol
- \* asterisk or multiplication
- ^ caret or exponential symbol
- # number (or pound) sign
- % percent sign
- ! exclamation point or tail remark delimiter (XBASIC)
- \$ dollar sign or string type declaration character
- , comma
- & ampersand
- ' single quotation mark
- . period or decimal
- ' apostrophe
- ; semicolon
- : colon or statement separator (double colon) (XBASIC)
- \_ underline
- ? question mark
- " double quotation mark or string delimiter
- < less than
- > greater than
- ( left parenthesis
- ) right parenthesis

**Speech Editor\*** Learn pronunciation and usage by typing words, phrases, and sentences from the selected vocabulary which the computer then says. Requires speech synthesizer. Texas Instruments.

**Speech Synthesizer\*** Human speech is reproduced electronically, allowing children too young to read to work with the computer. A variety of inflections and pitches make it easy to understand. Unlimited text-to-speech capability is available with The Terminal Emulator II Cartridge or other speech cartridges. Texas Instruments.

**Speak and File\*** Makes the computer say any word that is typed into the keyboard. You control the pitch, primary and secondary stress, slope, and delay through the TE II module protocols. Create files for later use with your other BASIC programs. Requires speech synthesizer and Terminal Emulator II. Vid-Com.

**Spell Me\*** Helps students learn to spell words of the teacher's choosing or pre-programmed words. For students in grades 1-6. Color displays and sound. Disk or cassette. Creative Expressions, Inc.

**Spell Writer\*** Three Speak & Spell programs that use the Text-to-Speech system. Includes a program for word games, a file transfer program, and a program for designing specialized spelling lessons. Requires speech synthesizer and the Terminal Emulator II. Texas Instruments.

**Spelling of File Names** See BASIC—Listing of Files or Programs on Diskette.

**SPGET** XBASIC Subprogram. CALL SPGET is used to call the code pattern from the Speech Synthesizer for a Resident Word, and assign a variable to the code. The format is:

CALL SPGET (<wo\$ >,<x\$ >)

<wo\$ > is the string constant or string variable that represents a word or phrase from the Speech Synthesizer's Resident Vocabulary.

<x\$ > is the variable to be assigned to the code retrieved from the Speech Synthesizer.

SPGET can also be used to create new words by adding suffixes. See the TI Extended BASIC Manual, Appendix M, for programs and information.

**Spike Spiker\*** Protects your computer and peripherals from damage by absorbing transients. Also protects your software from mysterious memory loss. All models are 120V, 15 Amps, and the filter models attenuate conducted RF interference as well. Five models are available: Delux power console, a transient absorber with dual five stage filter, eight individually switched sockets, and main switch with light; Quad-II, a transient absorber with four sockets, light and dual, three-stage filter; Quad-I, a transient absorber with four sockets; Mini-II, a transient absorber with two sockets and three-stage

filter; and Mini-I, a transient absorber with two sockets. Kalglo.

**Spikes** Sharp, temporary increases in a signal or voltage.

**Spin.a.Fortune\*** Simulates the TV game Wheel of Fortune in which you spin the money wheel, and try to solve the letter puzzle. The game includes more than 300 puzzles and lets you invent your own. Sunrise Software.

**Spinwriter\*** A line of thimble printers manufactured by Nippon Electric Corporation (NEC).

**Spiral-Graphics\*** Create intricate spiral patterns on the screen. An unlimited number of different patterns are possible. Cassette. Sunshine Software.

**Split Screen** Division of a CRT screen into two or more separate areas, or windows, in which distinct information is displayed.

**Spool** Simultaneous Peripheral Operating On-Line. A method of increasing system output by allowing programs that use slow output devices to complete a rapid execution. Program output data is placed in queues on high speed mass storage devices, or a part of main memory dedicated to spooling for low-speed transmission concurrent with normal system operation.

**SPRITE** XBASIC Subprogram. CALL SPRITE is used to create sprites. The format is:

```
CALL SPRITE(#<sprite>,<char>,<col>,<pr>,<pc>,[<vr>,<vc>])
```

<sprite> is the sprite number. It can be a number from one through twenty-eight. If the number is used to define a sprite earlier in the program, the old sprite is deleted and the new one replaces it. If the deleted sprite had <vr> and/or <vc> values and no new values are given, the new sprite assumes the old direction and "heading." Sprites pass over fixed characters on the monitor screen. When the paths of two sprites intersect, the sprite with the lowest number passes in front of the other sprite.

<Char> is the number of the ASCII code that defines the shape of the sprite, and can be a number from 32 through 143. See CHAR for more on character definition. The sprite is defined using <char>, and in the case of double-sized sprites, the next three ASCII characters. See MAGNIFY for more information on sprite size options. The shape of a sprite can be redefined in a program through the use of the PATTERN subprogram.

<col> determines the foreground color of the

sprite, and is a number from 1 through 16. The background color is preset to (1), transparent, and cannot be changed. See SCREEN and COLOR for more information.

(pr) and (pc) are the Pixel Row and Pixel Column, where the upper left corner of the sprite is located when it first appears on the screen. (pr) and (pc) may be numbers from 1 through 256, with Pixel Rows 193 through 256 off the bottom of the screen. For information on sprite position, see the COINC, DISTANCE, and POSITION subprograms. To change the location of a sprite, see LOCATE. The COLOR subprogram changes a sprite color. Sprites may be erased using the DELSPRITE program.

<vr> and <vc> are the numbers that define the sprite's row, column, speed, and direction. These values are optional. If they are not specified, the sprite appears at <pr>,<pc> and is stationary. <vr>,<vc> may be a number from -128 through 127. For the rules governing the motion of a sprite, and changing a sprite's speed and/or direction, see the MOTION subprogram.

When the program stops due to a breakpoint, SPRITES are erased from the screen. The CON command does not cause them to reappear.

**Sprite Editor\*** Designed for TI BASIC, Extended BASIC or Assembler to generate complete character definition data. The bit pattern required to reproduce characters on a grid is composed in data statements for BASIC programs or byte statements for Assembly language programs. Standard or magnified character data can be generated in each mode and can be saved and reloaded for editing. The operation of Sprite is simplified by being menu-driven. Requires Extended BASIC Cartridge, printer recommended; 32K; disk. Law Associated.

**SPST** Single Pole Single Throw. A type of switch.

**SQR(<x>)** BASIC Statement. Returns the square root of x.

**Square\*** Adds a new twist to the Rubic's cube by only letting the player view one side of the cube at a time. Disk or cassette. Data Systems.

**Square Root** BASIC. See SQR(<x>).

**SR** Status Register. A register holding bits that indicate the type of results that were obtained by the last operation, such as positive or negative, error or overflow situations.

**SS** Solid State.

**SSDA** Synchronous Serial Data Adaptor. A synchronous serial interface.

**SSI** Small Scale Integration. A technology holding a few gates per element.

**SSR** Solid State Relay.

**Stack** A LIFO structure which preserves the chronological ordering of information and is necessary for subroutines and interrupt management. A stack is manipulated by two basic instructions, PUSH and POP.

**Stack Pointer** The register in the CPU which contains the address of the top of the stack in memory.

**Stand-Alone** A device which will operate by itself, requiring no other equipment.

**Star Finder\*** Find the position of a star by inputting the date, time, and observed location. Printer optional; disk or cassette. Eastbench Software.

**Star Sentinel\*** A deluxe four game package that includes two animated rules programs and a reset program. Features arcade style sound and graphics. Cassette. PS Software Co. and Starsaber Software Co.

**Star Trek 2\*** An improved version of the old classic. Requires joystick and Extended BASIC. Best Software.

**Starship Concord\*** Your mission in space could lead you into alien clutches. Graphics designed by Sam Pincus. Requires Extended BASIC Cartridge; cassette. Futura Software.

**Starship Pegasus\*** Command a starship and search for alien worlds to conquer. Cassette. Not-Polyoptics.

**Start or Execute** See RUN.

**Start-Bit** A bit indicating the beginning of asynchronous serial transmission. See Stop-Bit.

**Starting A New Program** BASIC. To start a new program type:

NEW

This completely erases all lines now in BASIC's memory. If it's something you want to keep, SAVE it first. If you don't erase the program in memory before starting on another, you're likely to end up with an unusable combination of lines from your old and new programs.

**State Table** A list of the logic circuit outputs based on the inputs and the previous outputs. Such a circuit has memory and cannot be described by a simple truth table. Also called state-transition table.

**Statement** A string of characters with a syntactically complete instruction for a high-level language translator.

**Statement Analysis\*** Accumulates and stores data from as many as sixteen corporate financial statements. This may then be referenced, modified, and analyzed. Will derive ratios and financial statistics and fit them to various trend curves. Eastbench Software Products.

**States and Capitals\*** Learn the states and their capitals. Cassette. Hall Software.

**Static Memory** MOS memory which uses a flip-flop as a storage element. It does not need to be refreshed, or require a clock. It also will not lose its contents as long as power is supplied.

**Static RAM** RAM memory circuits which retain their contents as long as power is supplied.

**Statistical Software** See Basic Statistical Package, Maxi Stat, and Microstat.

**Statistics\*** Performs statistical calculations on data, leaving more time for analysis. Can also be used with Personal Record Keeping module and includes linear regression analysis, correlation, and descriptive statistics. Texas Instruments.

**Status** The present condition of a device, usually indicated by flag flip-flops in special registers. See Flag.

**Status Bit Handshaking** The delegation of certain bits of a parallel I/O port to coordinate data transfer with a peripheral device. Status bits are used to indicate device read, buffer full, printer out of paper, etc.

**Status Register** A register used to hold status information inside a functional unit, such as an MPU, a PIC, a DMAC, or an FDC. A typical MPU status register provides carry, overflow, sign (negative), zero, interrupt, parity, enable, and mask.

**STD** STanDard.

**Stepper Motor** A mechanical device which rotates by a fixed amount each time it is pulsed. Often used in diskette drives.

**Stock Investments\*** Graphically displays the stock board at all times and maintains a record of all calculations and statistics. For up to ten players. Requires Extended BASIC. Graphic Software.

**Stock Market Software** See Securities Analysis, Stock Investments, and Stock Plot.

**Stock Plot\*** The computer files your data on the weekly high, low, and closing prices of your stocks,

and plots up to a fifty week price history for any given stock. Will also give the average hold time, rate of return, value, and cost of your portfolio. Software for the Home.

**STOP** BASIC Statement. STOP is used to terminate program execution. The format is:

STOP

Identical to the END statement, except that it cannot be placed after subprograms.

**Stop and Terminate Current Function** To end, terminate, or break current function, press FCTN 4(CLEAR)(99/4—SHIFT C) together.

**Stop BASIC Program** See STOP and END.

**Stop Bit** A bit indicating the end of asynchronous serial transmission.

**Stop Bits** TI BASIC allows you to set the number of Stop Bits in the OPEN statement. The default value is one stop bit. For two stop bits, the format is:

OPEN#<n>: "RS232.TW"

<n> is the number of the file you are opening.

**Storage** Synonym for Memory (q.v.).

**Story Problems in Addition and Subtraction\*** Imaginative story problems offer addition and subtraction practice. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**STR\$** BASIC Function. Returns a string representation of the numeric value in (x). The format is:

<variable\$> = STR\$(<x>)

<x> is any numeric expression.

**Strain Gauge** A sensor which produces a voltage or resistance change when a force is applied.

**Strange Odyssey Adventure Database\*** Your space ship is wrecked on a small planet. While searching for repair materials, you find an old civilization and possibly its treasures. Requires the Adventure cartridge; disk or cassette. Texas Instruments.

**Strategy and Brain Games\*** Two different games for a total workout. Disk. Creative Computing.

**Strategy Games\*** A series of games that require tactical ability and include such favorites as darts, checkers, and others. Cassette. Creative Computing.

**Strategy Pack I\*** Roman Checkers and another strategy game for ages 10 and up. Cassette. Image Computer Products.

**Strike Forces\*** Destroy the enemy ship in this 3-D action game. M.W. Ruth Co.

**String** An ordered sequence of data items. For example, the word "string" is a string of six characters. See Character String.

**String, Convert from Number** BASIC. See STR\$(<x>).

**String, Convert to Number** BASIC. See VAL(<x\$>).

**String, Length of** BASIC. See LEN(<x\$>).

**String, Numeric Value of** BASIC. See VAL(<x\$>).

**String Handling** A programming language's ability to operate on strings of characters.

**String Variable** See Names, Variable.

**Strobe** A selection signal that is active when data is correct on a bus.

**Structural Engineering Library\*** Assists structural engineers with complex calculations and evaluations. Texas Instruments.

**Structured Language** A computer language designed to aid or enforce structured programming. Control structures such as IF...THEN...ELSE, DO...WHILE, and REPEAT...UNTIL, together with provisions for declaring logically separate program modules such as procedures, and limiting the scope of variables all lend a modular structure to programs. Unconditional control transfer statements (GOTOs) are often left unimplemented. Popular structured languages are Pascal, ALGOL, and C.

**Structured Programming** A set of techniques designed to increase the reliability and coherency of programs by increasing programmer discipline. Structured programming involves precise problem specification, top-down or stepwise program design, and block-structured or modular programs.

**STTL** Standard Transistor-Transistor Logic.

**Student Data Recorder\*** Provides easy storage and access of student information such as names, addresses, and other data. Requires dual disk drive; plus RS-232 interface and compatible printer; disk. Scott, Foresman and Co.

**STX** Start of TeXt.

**STX-80 Printer\*** A thermal printer that prints eighty column lines at a rate of sixty characters per second. Graphics are block or dot addressable. The characters have true descenders and include foreign language symbols. It is quiet, too. Star Microtronics.

## SUB • Swine Record Keeping II\*

**SUB** XBASIC Statement. SUB is used as the first line in a user-defined subprogram. The format is:

SUB <name>[<x or x\$ >,...]

<name> is the user-defined subprogram name, and may be any name you choose, with the exception of those on the reserved words list. See BASIC—Reserved Words for more information.

<x or x\$ >,... refers to a variable list from the main program that you want used in SUB<name>. Variables defined in a subprogram are local to that subprogram, so all subprogram variables must be newly defined or transferred over using the list <x or x\$ >,...

The SUB <name> statement has control passed to it with the CALL <name> statement. SUB <name> is exited with either SUBEXIT or SUBEND. It must have SUBEND as its final statement.

A complicated set of rules exists for passing variable values to and from user-defined subprograms. They are explained in the TI Extended BASIC Manual, under SUB.

**SUBEND** XBASIC Statement. SUBEND must be used as the last statement in a user-defined subprogram. The format is:

SUBEND

After execution of SUBEND, program control is passed to the first statement after the one that called the subprogram. SUBEND may not be a part of an IF-THEN-ELSE statement. REM, END, and SUB <name> are the only statements that may follow SUBEND in a program.

**SUBEXIT** XBASIC Statement. SUBEXIT is used to pass control out of a user-defined subprogram before its end (marked with SUBEND). The format is:

SUBEXIT

After execution of SUBEXIT, program control is passed to the first statement after the one that called the subprogram.

**Sub-Harmonic** A fractional multiple of the fundamental frequency.

**Subprograms** See CALL.

**Subroutine** BASIC. See GOSUB<line>.

**Subroutine** Passing parameters (also called arguments or data) makes information from one process or program available to another process or program. Similar to a football pass, except that one or more bytes of data replaces the football. Also, the receiver is a program. The sender may be a program or a person typing the data onto a com-

mand line to be “passed” to a program. One common example would be a BASIC program passing variables to a subroutine.

**Subroutine, Machine language from BASIC** See INIT, LOAD, LINK, and PEEK.

**Subtraction\*** Subtraction aid for the elementary school student. Disk or cassette. Microcomputers Corporation.

**Subtraction\*** Learn and practice subtraction with many levels of problem difficulty. Includes color graphics and sound. For Kindergarten through eighth grade. Cartridge. Texas Instruments/Milliken Publishing Co.

**Subtraction\*** A math practice module that includes seven levels of difficulty and automatically adapts to the level of the user. Includes full documentation. For children and adults. Requires Extended BASIC Cartridge; disk or cassette. W. R. Wilson, Inc.

**Suffixes\*** Take an incomplete word and add the correct suffix from a list of choices. Requires Extended BASIC Cartridge; disk or cassette. MicroEd, Inc.

**Super Cataloger\*** Produces a sorted catalog on your printer of up to 550 file names on as many as sixty-three disks. Can sort 200 file names in six seconds. Requires extended memory and a printer; disk or cassette. J&HK Software.

**Super Frogger\*** Help your frog get across five lanes of traffic and over three logs in a piranha infested river, then avoid the alligators on the other side. Norton .

**Supertrek\*** Try to save the Federation. Includes color graphics and sound. Soft-Tex.

**Support Chips** All the components beyond the main device required for complete system operation.

**SUT** Socket Under Test.

**SW** Status Word.

**Swine Record Keeping I\*** Features totals and averages of up to 300 individual or group characteristics of sows and boars. May include the number born, living, and weaned per litter, plus wean weight. Requires RS-232 interface and 80 column printer; disk. Computech Distributing.

**Swine Record Keeping II\*** Has the ability to keep extensive breeding records, totals and averages of between 300 to 800 sows/boars. Requires dual disk

drive and 80 column printer. Computech Distributing.

**Switching Regulator** A power supply design that provides regulation by computing the amount of input voltage put into a filter circuit.

**SYBEX** A leading publisher of computer books.

**Symbol Table** A table constructed by an Assembler or compiler to associate symbolic names with actual addresses or values.

**Symbolic** Describes the use of characters or character strings in a defined syntax to stand for machine-related entities.

**SYNC** Abbreviation for SYNChronous or SYNChronizing.

**Synchronous** Operation controlled by a mutually sensed clock pulse.

**Synchronous System** One in which all events are synchronized with a common clock pulse.

**Syntax** The rules governing proper punctuation and construction of words and word groups in a language. For programs, the rules include spelling and placement of keywords, spelling and type of data names, and number, type, and order of arguments.

**Syntac Check** A check, performed by a program or person, to ensure that one or more statements in a programming language complies with all syntax rules of the language. A program may pass all syntax checks and still give an error message or erroneous results due to logic, data, or program flow problems.

**System** Any aggregate of two or more interconnected electronic components. Also used for "computer system." See Computer System.

**System** A group of programs that accomplishes some function (example: a Data Base Management System), or a group of interconnected devices, or both taken together (example: a total accounting system).

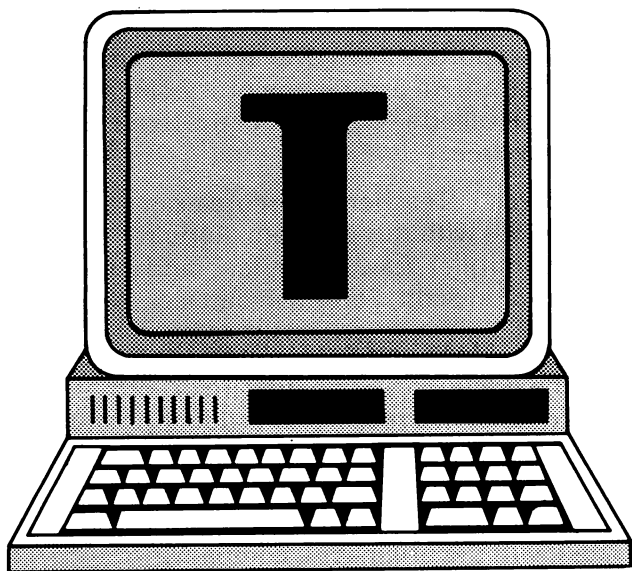
**System Reset** Press FCTN=(QUIT) (99/4—shift Q) to reset the system and return to the Title Screen. Upon resetting the system, any applications program will be stopped, and any unsaved current work will be erased from internal memory. See also BYE.

**Systems Software** A software package is a group of computer programs, sometimes including data files and documentation, that performs a function

or group of related functions. Systems software packages, such as database management packages, disk operating systems, or program development packages, simplify use of the machinery. Applications software programs, however, are for the operator's use, such as word processing or accounting packages.







**T** Codes. ASCII 84, HEX 54. t—ASCII 116, HEX 74.

**T** An electrical network shaped like the letter “T,” with one input, one output, and one ground lead. Used with resistors for attenuators and with capacitors and inductors for filters. Also, True—a logical 1.

**TAB** BASIC Function. TAB is used to “move over” a specified number of spaces before executing a PRINT (and in Extended BASIC, DISPLAY) statement. The format is:

TAB(<x>)

<x> is the screen or printer position at which you want to begin PRINTing (or DISPLAYing). If the current print position is past SPACE<x>, then TAB goes to position <x> on the next line. If the sum of the characters in the PRINT (or DISPLAY) statement plus <x> in the TAB function is more than the device allows (255 MAX cassette or diskette, 28 MAX. screen, 32 MAX. thermal printer, 80 or 132 MAX. for impact printer), then the items are printed in the first position on the following line.

**Tab, Adhesive** See Diskette—Write-Protected.

**Tabbing** A method of moving a CRT cursor or printer head to a predefined column on the screen or paper.

**Table Look-Up** A method of converting one variable to a corresponding value, or verifying its accuracy by searching a list or table of entries for the known keyword or value. The corresponding values may then be taken from corresponding positions in the table.

**Tachistoscope\*** Random groups of words are flashed on the screen, and the user tries to reproduce

## T • Teach Yourself Extended BASIC\*

the words as they appear. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**TAN** BASIC Function. TAN gives the trigonometric tangent of <x>. The format is:

<variable> = TAN(<x>)

<x> is the angle in radians. Multiply by pi/180 to convert degrees to radians. pi = 3.141593.

**Tank\*** Challenge the computer or another player in this war game. Norton Software.

**Tape, Magnetic** An inexpensive mass storage medium that requires sequential access. Convenient for large files or archival storage. Often the only external storage on very low priced systems, used as a backup for disk on larger systems.

**Target Drive** The diskette drive to which information/data is going. The source drive is the diskette drive from which information/data is coming.

**Target Math\*** Select the type of problem and level of difficulty. Moving graphic displays tell you if you answered correctly. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Task** A particular execution of a program.

**Tax Packages** See Federal Tax, Income Tax Planner, Personal Tax Plan, and Tax Investment Record Keeping.

**Tax/Investment Record Keeping\*** A tool for maintenance of tax related information. Provides an easy means of recording income, expenses, liabilities, assets, and keeping track of taxable and tax-exempt income. Disk. Texas Instruments.

**TBMT** Transmitter Buffer eMpTy. One of the five status bits of a standard UART; true when a buffer may be reloaded. See: PE, FE, OR, DAV.

**TCAM** TeleCommunications Access Method (IBM mainframe term).

**TD** Transmitted Data (RS-232C standard).

**TDM** Time-Division Multiple access. A networking, timesharing technique used for regulating signal flow between terminals.

**Teach Yourself BASIC\*** Learn BASIC with ten on-screen lessons that cover everything from simple commands to color graphics and sound. Wolfdata Corporation. Texas Instruments.

**Teach Yourself Extended BASIC\*** Teaches you what can be done with this advanced language. Includes tutorial lessons. Requires the Extended BASIC Cartridge. Texas Instruments.

**Teacher's Tool Box\*** Computer generated educational tools: mazes, word games, posters, crossword puzzles, test reviews, and tests from a suggested question list. Requires Extended BASIC Cartridge; RS-232 interface, and compatible printer, are optional; disk. Texas Instruments and the Minnesota Educational Computing Consortium (MECC).

**TED Version 1\*** This is an extended line-oriented and disk based BASIC text editor with full ASCII support, forty page manual, and limited document processing capabilities. Supports lower case, command files, limited speech, string searches, substitution, command files, device-independence, and printers. Copies tape to disk, disk to tape, or disk to disk. Limited support of terminals. Requires Extended BASIC Cartridge; RS-232 interface; compatible printer and 32K are recommended; disk. Kemp Software.

**TEECH\*** A mathematics teaching program with four skill levels. Rewards excellent performances with a special bonus. Graphic Software.

**Telephone Coupler\*** Send and receive messages over the telephone by placing your telephone receiver in the cradle of the coupler. Communicate with Dow Jones News/Retrieval Services, the SOURCE, Compuserve, and more. Requires Terminal Emulator II cartridge and the RS-232 Interface. Texas Instruments.

**Telephone Directory\*** A software utility developed by Eastbench Software Products.

**Teletype** One of the oldest and slowest methods of communicating with a computer, with the disadvantage of sending and receiving only 10 characters per second or 110 baud.

**Terminal Emulator II\*** A connection utility that allows access to subscription data services by using a telephone coupler and RS-232 Interface. Provides text-to-speech access with the addition of a speech synthesizer. Texas Instruments.

**Terminal Mode** A mode of operating a general purpose computer so that its CRT and/or printer can be used as a terminal for another computer. Also called terminal emulation.

**Terminate Current Function** To end, terminate, or break current function in any program at any time, press FCTN 4 (CLEAR) (99/4—shift C) together.

**Test Data, Test Run** For a programmer to insure that a program runs correctly, samples of the data are prepared (test data) and the program is exe-

cuted using this data (a test run). The program's outputs (reports, screen displays, files, etc.) should be as desired. An error in the processing logic of a program is called a "bug," hence the terms "debug" and "bug-free."

**Test Scorer\*** Teachers can score exams and compute grades with this program. Requires dual disk drive, controller, RS-232 interface, and compatible printer; disk. Scott, Foresman and Co.

**Test Sites, Alpha and Beta** A test site participates with the originators of a hardware or software product to test it in a real-world production situation. Alpha testing usually involves only a few companies or individuals who realize that the product is incomplete or flawed. Alpha testers are often associated with the originating company.

Beta test sites are more numerous. They expect the product to be complete and correct, and agree to use it in a real-world situation. If errors are discovered, the originators try to fix them quickly so the beta sites can stay "on the air" with the new product. If numerous or serious bugs are found, the product may have to go back to alpha testing until an improved version can be beta tested.

**Texas Light Shooter\*** Plug this photoreceptor gun into the joystick port of your computer and shoot at on-screen targets in the included shooting spree game on cassette. Instructions are included. Not-Polyoptics.

**Tex-Sette Adapter\*** Allows your computer to control your tape deck through the remote jack. 99'er Home Computer Magazine.

**Text Editor** A specialized editing program for text files. Manipulates ASCII characters such as numbers, letters, and punctuation marks. Word processing programs are text editors for creating and changing letters, reports, programs, or books.

**Text File** A file containing character data, letters, numbers, or special characters. Most data and programs you write will be in text files. See Data File.

**Textiger\*** A compact word processing program that automatically paginates, collects, formats, combines, and prints any mix of files. Also features editing and cataloging capabilities. Requires Extended BASIC Cartridge and printer. Textiger.

**Textiger I\*** This program has both word processing and text editing programs that allow for use of various formats and printing styles. Format and text files may be merged. Commands for single line and global edit are line and word oriented. Requires

RS-232 interface, compatible printer, and Extended BASIC Cartridge; disk or cassette. Patio Pacific, Inc.

**Textiger II** Created exclusively for the 99/4A, this program differs with its use of shift and shift lock keys for upper and lower case, and its ability to save and retrieve the list of auto-printed data on disk. Features numerous indentations and twenty tabs per line. Requires RS-232 interface, appropriate printer, and Extended BASIC Cartridge; disk or cassette. Patio Pacific, Inc.

**Text-to-Speech (English)\*** Gives the computer speech capabilities and specifically features word, phrase, sentence construction with appropriate pitch contour, inflection, and pause control, as well as other special additions. Requires speech synthesizer and Extended BASIC Cartridge; 32K; disk. Texas Instruments.

**Tex-Writer\*** A word processing program with full cursor control for text editing. Features variable margin and line length, automatic page numbering, upper and lower case, four print sizes, italics, underlining, and emphasized type. Requires Extended BASIC Cartridge and printer; disk. Sof-Tex.

**Thimble Printer** Prints fully-formed characters with a "thimble." The thimble is like a daisy-wheel type element with the type petals bent up ninety degrees to form a cup or thimble shape.

**TI Advanced Assembler Debugger\*** An interactive disk-based debugger. Features single-step trace, a memory dump utility, a disassembler, and a bit-mapped screen. Requires expanded memory and the editor/assembler module. Texas Instruments.

**TI Impact Printer\*** A printer that features eighty characters per second of bi-directional printing, four type sizes, four distinct printing densities, and long-life dot matrix print/head. Can reproduce text or graphic data with column widths of 40, 66, 80, and 132. Requires RS-232 Interface. Texas Instruments.

**TI Invaders\*** Destroy the multi-colored creatures that threaten the world. Texas Instruments.

**TI LOGO\*** Children can learn a computer language designed at MIT to develop math, logic, communication and computer skills. Disk, cassette, or cartridge; 32K. Texas Instruments.

**TI LOGO II\*** A continuation of TI Logo for children. Helps develop computer, math, and logic skills, using this specially designed computer language. Disk, cassette, or cartridge. 32K; Texas Instruments.

**TI Nuclear Power Plant\*** Introduces the player to the fundamental workings of a nuclear power plant. Requires Extended BASIC; cassette. Galactic Software.

**TI PILOT\*** A language designed for Computer Assisted Instruction. Allows for the running of existing programs developed in TI PILOT. You can also use it to implement TI UCSD p-System to develop your own practice and drill programs, develop testing programs which automatically score students, store a variety of information, and develop interactive instructional programs. Requires p-Code Card; 32K; disk. For program development with the UCSD p-System, an Editor/Filer/Utilities disk is also required. Texas Instruments.

**TI Toad\*** Help the TI Toad jump across four lanes of rush hour traffic, and then help him cross the river by jumping from log to log. Software Specialties, Inc.

**TI Writer\*** A word processor that offers many features at a reduced cost. Includes an automatic screen wrap on a forty column screen, justification, variable tabs, a mailing list option, error recovery, and headers and footers. Text processing functions include: find and replace string, insert or delete line, delete character, move text, word splitting, and more. Includes software module, diskette, reference card, and 172 page manual. Requires printer; disk. Texas Instruments.

**TI-Asteroids\*** Only your pulsar cannon, quick reflexes, and an occasional jump to hyperspace can help you avoid the asteroids hurtling at you from all directions. Disk or cassette. FFF Software.

**Tic Tac Toe Adding up to  $10 \times 11$ \*** Combines the strategy of a game while sharpening the student's addition skills. First in a series. Disk or cassette. Computer-Ed.

**Tic Tac Toe Adding up to  $12 \times 19$ \*** Combines the strategy of a game while sharpening the student's addition skills. Disk or cassette. Computer-Ed.

**Tic Tac Toe (Short, Long)\*** Combines the strategy of a game while sharpening the student's vowel sound and vocabulary skills. First in a series. Other versions include Tic Tac Toe (short, diagraph), (short, long diagraphs), (hard and soft C), (hard and soft G). Disk or cassette. Computer-Ed.

**TickWorld\*** You are pursued by giant insects that must be captured and contained in jails. Cassette. Not-Polyoptics.

## TI-Count Business Packages\* • Tree Structure

**TI-Count Business Packages\*** A series of professional business packages. All packages require the RS-232 interface, Extended BASIC Cartridge, and a printer. Available titles are Payroll, Inventory, Accounts Receivable, Accounts Payable, General Ledgers, and Mail List. Pike Creek Computer Company, Inc. Texas Instruments.

**Tic-Tac-Toe\*** Four levels of difficulty, featuring fast setup and decision making. Extended Software Company.

**Tic-Talk-Toe\*** A children's adventure game that features music, color graphics, and sound. Speech synthesizer is optional. Graphic Software.

**Tie Fighter\*** A picture of a tie fighter is shown at the top of the screen. Designed for user programs and games (not in Extended BASIC). Disk or cassette. Data Systems.

**TI-Forth\*** A sixty-four column language disk with bit-mapped editor, interrupt service routines, and high-resolution graphics. Requires expanded memory and the Editor/Assembler module. Texas Instruments.

**TI-Tester\*** Teaches proper word usage through the creation of a testing list. Disk or cassette. Microcomputers Corporation.

**TI-Tester (Hebrew Version)\*** A test for learning Hebrew symbols by creating a list from which the correct answers are deleted. Disk or cassette. Microcomputers Corporation.

**TI-Text Writer\*** Create, format, print and store text with this program using the features of the Epson printer. Also produce and maintain mailing labels. Requires Extended BASIC and Epson printer; 32K; disk or cassette. Microcomputers Corporation.

**TI-Trek (With Optional Speech)\*** Defend your galaxy with torpedoes and phasers. Added speech capability gives the game a new dimension. Speech synthesizer and editor are optional. Disk. Texas Instruments.

**Tlventures\*** Game programs that include Stone Age, Haunted House, Fun House, Aqua Base, Miner 49'er, and the Four Vedas. Requires Extended BASIC; cassette. American Software.

**TI-99/4A Home Computer Operations\*** For users that are unfamiliar with the TI99, this audiovisual presentation introduces the user to the basics of microcomputing. Filmstrip, slide set, or video. Requires either video recorder, sound filmstrip projector, or sound playback. RMI Media Productions, INC.

**Tod's Cod (Short "O")\*** Vowel sounds, spelling, and word comprehension are introduced to the beginning reader. Features music, sound, and graphics. Disk or cassette. ComputerEd.

**Tombstone City: 21st Century\*** Fight off the invading alien Morgs. Help save the 21st Century Western ghost town. A single player game that tests strategy and skill. Texas Instruments.

**Touch Typing Tutor\*** A learning program for touch-typing lessons covering letters, numbers, and symbols including a diagnostic section for word-per-minute timing. Also helps to improve speed and accuracy. Requires TI-99/4A keyboard; cartridge. Texas Instruments.

**Tournament Brick Bat\*** A skill game that can be played against companions or the computer. Cassette. Image Computer Products.

**TRACE** BASIC Command. TRACE instructs the computer to print the line numbers on the screen as a program is being executed. The format is:

TRACE

Also used as a debugging tool. The commands NEW or UNTRACE will "turn off" the TRACE command.

**Trail West\*** Travel to the gold fields of California 2000 miles away with a limited supply of food, clothes, and ammunition. Can you make your provisions last during your journey westward? Disk or cassette. Micro-Ed.

**Transistor** An electronic device which can use one electrical signal to influence another. The two main uses of transistors are as amplifiers and switches. As an amplifier, a transistor uses the changes in a small signal to make large changes in a large signal. As a switch, the transistor opens or closes a circuit, depending on the state of a controlling signal.

**Transistor-Transistor Logic** Or TTL. Logic circuits (AND, OR, NOT, etc.) use transistors as switching units. TTL is the standard for microcomputers, because of its combination of speed, signal-to-noise ratio, and low-power designation. There are other logic designs that are superior in any one of these characteristics, but none of them combine all three.

**Treasure Trap\*** Explore the myriad rooms on the Builder's planetoid in search of high-tech treasure. Not-Polyoptics.

**Tree Structure** A collection of data organized so that each item is linked to one or more other items,

creating a spreading network of linkage like the branches of a tree. Genealogical data provides the classic model—each person has exactly one mother, but may have zero or more daughters. An example of data organized in this way might be the parts list of an airplane. The main entry is for the entire airplane. It is linked to its major components, such as the wings, fuselage, and tail. Wings, in turn, are linked to their smaller components, such as flaps, engine supports, engines, etc. Each of these can be further linked to smaller and smaller subassemblies, until individual parts such as nuts and bolts are listed.

**Trigonometry\*** A tutorial program covering plane and spherical trigonometry, computing problems with input variables. RS-232 interface and compatible printer are optional; disk or cassette. Eastbench Software.

**Tri-Light\*** A computer board game for two to four players. You can choose from three different skill levels. Forty-nine playing pieces and a game board are included. Northern Light Software.

**Troublesome Pronouns\*** Helps to identify proper pronoun usage in a game format. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**Truth Table** A table showing the logical value (true or false) of a compound logical expression, based on the logical value of the simple components of the expression. Example:

A	B	A or B
T	T	T
T	F	T
F	T	T
F	F	F

This table reflects the definition of OR: A or B is true if and only if either A or B or both are true.

**TR120\*** A high-resolution monochrome monitor that measures 12" diagonally and displays 80 x 25 characters in a high resolution green P31 phosphor. Other features include built-in audio and optional monitor cables. Panasonic.

**TTL** See Transistor-Transistor Logic.

**Tunnels of Doom\*** You must save the king and collect the treasure, while fighting off monsters and other dangers. Texas Instruments.

**Two-Dimensional FFT\*** When you input a two dimensional array, the program will perform a Fourier. 32K; disk or cassette. Thermal printer is optional. Eastbench Software.

**Two-Pass** See Pass.

**Type Declaration Character** See Names, Variable.

**Type Formats** To set the TI Impact or Epson MX-80 printer's print size, strike method, or number of lines per inch, the non-standard type format you want must be turned on by sending control codes to the printer. To do this, use the ASCII codes in the following table:

Type Format	Turn On	Turn Off
Compressed	143	146
Double Width	142	148
Emphasized	155,197	155,198
Double Strike	155,199	155,200
72/7 Lines/Inch	155,49	155,50
8 Lines/Inch	155,48	155,50
6 Lines/Inch*	155,50	155,50
72/n Lines/155,193, Inch#	193,12, n,155,50	155,50

\* Standard 12 dots per line (72/12 = 6 Lines/Inch). Set when printer is initialized or powered on. Not effective after use of 155,193,n to redefine result. See below.

# This resets the definition of "Standard."

You'll have better luck if you use the alternate values given here (128 + original level character), since these are less likely to be interpreted as control characters by various editors.

Combinations of the three type sizes (normal, compressed, and double width) with four strike methods (single strike, double strike, emphasized, and emphasized with double strike) produce twelve different type formats. In addition, each type format can be printed in any of three standard spacings down the page (6 lines per inch, 8 lines per inch, or 72/7 = 10 lines per inch).

Finer control of line spacing is also available by using dot spacing. This also allows double and triple spacing. The TI/Epson printer prints 72 dots per inch down the page. Each dot thus uses 1/72 inch. The number of dots to be used as a print line can be specified. Twelve dots per line is the default, established when the printer is initialized or powered on. Twelve dots x 1/72 inch per dot = 12/72 inch, 1/6 inch per line, or 6 lines per inch.

The other two standard dot settings are 9 and 7 dots per line. 9 dots x 1/72 inch/dot = 9/72 inch, 1/8 inch, or 8 lines per inch; 7 dots per line x 1/72 inch/dot = 7/72 inch/line, or about 10 lines per inch.

Since 12 dots per line makes 6 single spaced lines per inch, 24 dots per line gives double spacing, 36

## Type Set—6 Lines Per Inch • Types of Variable Names

dots per line gives triple spacing, etc. The following table gives some common values to verify your procedure for calculating them:

LPI	Dots/Line	ASCII Control	Alternate
		Characters Required	
72/7	single 7	155,193,7,155,50	155,50
	double 14	155,193,14,155,50	None
	triple 21	155,193,21,155,50	None
8	single 9	155,193,9,155,50	155,48
	double 18	155,193,18,155,50	None
	triple 27	155,193,155,155,50	None
6	single 12	155,193,12,155,50	155,50
	double 24	155,193,24,155,50	None
	triple 36	155,193,36,155,50	None

Any number of dots per line, from 1 to 85, may be specified. Using the 155,193, in control character sequence, redefines the default dots per line, which was set at 12 when you turned on the printer. Any subsequent use of the 155,50 “return to default” option will return to this new default, not 12 (= 6 LPI). To re-establish the standard default of 12 dots/line, use 155,193,12,155,50. Entering 155,193,n does not change the line spacing—it only changes the stored default line spacing. The 155,50, then, moves the stored default line spacing into the current line spacing slot, making it immediately effective. Using 155,48 or 155,49 changes the current line spacing, but does not affect the stored default line setting. A 155,50 control sequence will return to either your last specified stored default line spacing, or to the 12 dots per line stored at power on, if you haven’t changed the line spacing.

If you want to set the printer for 8 lines per inch double spaced, the sequence of control characters (from the table above) is:

155,193,18,155,50.

To send these to the printer from BASIC enter:

```
PRINT#<n>:CHR$(155);CHR$(193);
CHR$(18);CHR$(155);CHR$(50)
```

You can always reset all of the printer’s characteristics to default values by turning it off and back on. So, if at any point you get confused, turn it off and on again to start over with default values.

Some programs do not allow full access to the printer’s capabilities. You can avoid this by setting up the printer the way you want it before executing the program. This, however, doesn’t allow you to vary the print formats used in a given document. Except for format changes implemented using control characters recognized by your word processor or other programs, this method completely determines how an entire document will be printed.

One other technique is to embed the control characters in the text. Some programs will pass these through to the printer, others won’t.

If you want to print large, very dark characters at 8 lines per inch for a title, use double width, emphasized, and double strike all together. This is done by the following three BASIC statements:

```
PRINT#<n>:CHR$(142) !Turn on double width
PRINT#<n>:CHR$(155);CHR$(197) !Turn on
emphasized
PRINT#<n>:CHR$(155);CHR$(199) !Turn on
double strike
PRINT#<n>:CHR$(155);CHR$(48) !8 Lines per
inch
```

Anything printed after these printer control LPRINTs will be in double width, emphasized, double strike characters. To return to standard printing, turn off each of the non-standard print options previously turned on, thus:

```
PRINT#<n>:CHR$(148) !Turn OFF double
width
PRINT#<n>:CHR$(155);CHR$(198) !Turn OFF
emphasized
PRINT#<n>:CHR$(155);CHR$(200) !Turn OFF
double strike
```

Of course, multiple printer control characters can be given in one PRINT #<n>:, so:

```
PRINT#<n>:CHR$(148);CHR$(155);
CHR$(198);CHR$(155);CHR$(200)
```

performs the same function as the three printer control statements listed above.

**Type Set—6 Lines Per Inch** To set for this line spacing, enter BASIC statement:

```
PRINT#<n>:CHR$(155);“2”
```

**Type Set—8 Lines Per Inch** To set for this line spacing, enter BASIC statement:

```
PRINT#<n>:CHR$(155);“0”
```

**Type Set—72/7 Lines Per Inch** To set for this line spacing, enter BASIC statement:

```
PRINT#<n>:CHR$(155);CHR$(49)
```

**Type Size—Compressed Print** To enter this mode, enter BASIC statement:

```
PRINT#<n>:CHR$(15)
```

This gives 132 characters on the 8 inch line, or about 16 characters per inch. To return to normal type size, enter:

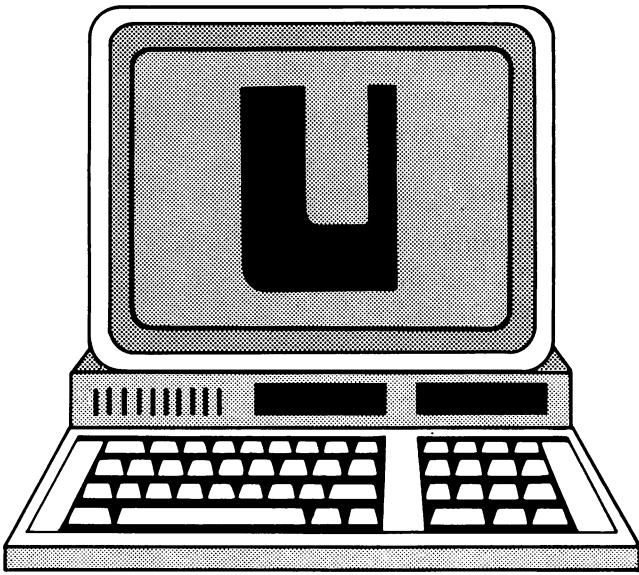
```
PRINT#<n>:CHR$(146)
```

**Types of Variable Names** See Names, Variable.

**Ty-Printer\*** Works with your existing printer, and Extended Basic module to do complete editing by cursor control. Includes line insert, delete, and page forward and backward. Features a variable number of characters per line (28 to 254), underlining, enhanced print, and formatting. You may stop printing without losing text, or you may set up a partial print. Extended Software Company.







**U** ASCII 85, HEX 55. **u**—ASCII 117, HEX 75.

**U** Underflow. Also: A lower case **u** is sometimes used to represent the Greek letter **mu** meaning micro.

**UART** Universal Asynchronous Receiver/Transmitter. A serial-to-parallel and parallel-to-serial converter. Usually a particular kind of IC used to interface a byte-parallel port to a bit-serial communications network or processor bus.

**UCSD Pascal Compiler\*** Allows you to compile programs written in Pascal into p-Code (pseudo-Code). The pseudo-machine interpreter then translates the p-Codes using the p-Code Card. Requires Code Card; 32K. Texas Instruments.

**UCSD p-System Assembler/Linker\*** Uses the p-System to create TMS9900 Assembly language programs. Requires p-Code Card; 32K. Texas Instruments.

**USSD p-System Editor/File/Utilities\*** Edit on screen and manage files for the p-System. Requires p-Code Card; 32K. Texas Instruments.

**UHF** Ultra High Frequencies.

**UNBREAK** BASIC Command. UNBREAK cancels breakpoints. The format is:

UNBREAK [<line>,...]

<line> is the line number (or numbers) of breakpoints to be removed. If <line> is not specified, all breakpoints placed in the program will be removed.

**Unibus** A mini-computer bus with more than one hundred signals invented by DEC for its PDP-11. Not used by the LSI-11. Digital Equipment Corp.

**Unix** A mini- and microcomputer operating system developed by Bell Labs. Features multiprogramming, a hierarchical file structure, and numerous useful utilities. See Xenix, C.

**Unstack** Same as POP. To remove from the top of a stack.

**UNTRACE** BASIC Command. UNTRACE cancels the TRACE command. The format is:

UNTRACE

**uP** MicroProcessor

**UP ARROW** FCTN E (99/4—SHIFT E) key usage. The up arrow key is used for editing in BASIC. Type in the line number to be edited and press FCTN E (99/4—SHIFT E). The line will be displayed on the screen and may be edited. Pressing FCTN E again causes the next lowest line number to be displayed for editing. The down arrow may also be used in other ways in various application programs.

**UPC** Universal Product Code.

**UPI** Universal Peripheral Interface.

**uS** Microsecond. One millionth of a second.

**USASCII-8** Same as ASCII.

**Usage Boners\*** Offers practice in correcting basic grammar mistakes. Requires Extended BASIC Cartridge; disk or cassette. Micro-Ed, Inc.

**USART** Universal Synchronous/Asynchronous Receiver/Transmitter. A chip that handles all the operations associated with synchronous data communications, such as bisync.

**USASCII** Same as ASCII.

**User** A User is a person who owns or uses a computer. Look in a mirror.

**User Friendly** Friendly programs for the operator (user). For programs you write, the operator will often be you. But if others use your program, you need to give clear prompts for every item of input data, freeze the screen long enough for them to read or act on the information displayed, and provide clear error messages if anything is entered incorrectly or error situations arise. Often called "human engineering," this makes the program easy to use as well as technically correct. Another term for this is making the program "user friendly". Several other guidelines exist for writing user friendly programs. If a complex series of data items has been typed in, but some entries turn out to be invalid, the user should be able to re-enter only the bad items. Error messages should indicate not only

invalid entries, but, also, why they are invalid and, if possible, how to correct them.

**User Group** A user group is a group or club focused on some aspect of computer use. Some clubs focus their attention on one particular computer; there are many TI-99 user's groups, some of which are listed at the back of this book. Other groups focus on a language (FORTH user's group, Pascal user's group, etc.), on an Operating System (CP/M, etc.), on an area of application (accounting, education, science, graphics) or other aspects of computing. Many magazines (q.v.) on computing carry lists of clubs/groups and report on their activities.

User groups provide outlets for giving and receiving advice on TI hardware, software, and applications. Often you can talk to someone who has used a product you are considering buying. User group newsletters may also offer useful information. If you need a programmer or consultant, you may meet or hear about a good one at a user group meeting.

### ALABAMA

Central Alabama 99/4 User's Group  
551 Larkwood Dr.  
Montgomery, AL 36109

Jasper 99/4A User's Group  
1F Northwood Townhomes  
Jasper, AL 35501

North Alabama 99 Computer Club  
4126 Cherokee Dr.  
Huntsville, AL 35801

TI Bug  
709 Nytor Cr.  
Birmingham, AL 35210

Wiregrass 99 User's Group  
106 Harwood Place  
Enterprise, AL 36330

### ARIZONA

Arizona 99'er Users' Group  
4328 E. LaPuente Ave.  
Phoenix, AZ 85044

Tuscon 99/4A Users' Group  
6816 E. Lurlene Dr.  
Tuscon, AZ 85730

Yuma 99'er Users' Group  
1573 East Kuns Ct.  
Yuma, AZ 85365

### ARKANSAS

Little Rock 99'er Users Group  
P.O. Box 55  
North Little Rock, AR 72115

### CALIFORNIA

Bechtel Employee's Computer Users  
50 Beale St. P.O. Box 3965  
San Francisco, CA 94119

Golden Gate Computer Users Group  
3617 Guerneville Rd.  
Santa Rosa, CA 95401

Highway 99'ers Computer Group  
1217 East Ave.  
Chico, CA 95926

Kings 99/4A Users' Group  
299 W Birch  
Hanford, CA 93230

L.A. 99'ers Computer Group  
P.O. Box 3547  
Gardena, CA 90247-7247

L.A./South Bay 99er Users' Group  
5128 Merrill St.  
Torrance, CA 90503

Orange County 99/4 Users' Group  
1673 Chateau  
Anaheim, CA 92802

Rancho Seco 99/4A HC Users Group  
11440 Hwy 104 Herald  
Rancho Seco, CA 95638

San Francisco 99ers  
P.O. Box 1255  
Novato, CA 94948

South Bay 99er Users' Group  
1680 E. LaChiquita  
Los Gatos, CA 95030

San Gabriel Valley 99/4 Users' Group  
1008 Dore St.  
West Covina, CA 91712

Southern California Computer Group  
1643 Coronado Ave.  
Spring Valley, CA 92071

### COLORADO

Boulder 99/4A Users' Group  
7129 Mt. Meeker Rd.  
Longmount, CO 80501

Colorado 99/4 Users' Group  
15177C East Louisiana Dr.  
Aurora, CO 80012

Colorado 99/4 Users' Group  
P.O. Box 3400  
Littleton, CO 80501

#### **DELAWARE**

Delaware Valley Users' Group  
25 Quartz Mill Rd.  
Newark, DE 19711

Kent County 99/4A Computer Users Group  
P.O. Box 354 Andrews  
Lake Felton, DE 19943

#### **FLORIDA**

Daytona 99er Users' Group  
P.O. Box 4596  
S. Daytona, FL 32021

Manasota 99 Users' Group  
6625 Roxbury Dr.  
Sarasota, FL 33581

Northwest Florida 99er HC Users' Group  
3256 Las Brisas Ct.  
Pensacola, FL 32506

South Florida 99 Users' Group  
433 Wright Dr.  
Lake Worth, FL 33461

Tampa Bay 99er Users' Group  
13097 Lois Ave.  
Seminole, FL 33542

West Jax 99'ers  
7266 Bunion Dr.  
Jacksonville, FL 32222

#### **GEORGIA**

Atlanta 99/4A Users' Group, Ltd.  
P.O. Box 19841  
Atlanta, GA 30356

Georgia 99/4A Users' Group, Ltd.  
P.O. Box 88464  
Dunwoody, GA 30356

Savannah Computer Users Group  
2723 Skidaway Rd.  
Savannah, GA 31404

#### **HAWAII**

Aloha 99/4A Computer Users' Group  
92865 Palailai St.  
Makakilo, HI 96706

#### **ILLINOIS**

Chicago 99/4 Users' Group  
353 Park Dr.  
Palatine, IL 60067

East Central Illinois 99 Users' Group  
3701 Tuttle  
Danville, IL 61832

K\* 3 Users Group  
Rt. 2 Box 203  
Mokena, IL 60454

Lincolnland 99 Computer Group  
P.O. Box 1434  
Springfield, IL 62705

#### **INDIANA**

Miami County Area 99/4A HC Users' Group  
163 W. Third  
Peru, IN 46970

#### **IOWA**

Cedar Valley 99er Users' Group  
2705 16th Ave.  
Marion, IA 52302

Des Moines 99/4 Users' Group  
3013 E. 32nd St.  
Des Moines, IA 50317

Northeast Iowa HC Users' Group  
1421 Delta Dr.  
Cedar Falls, IA 50613

#### **KANSAS**

Mid America 99/4 Users' Group  
P.O. Box 2505  
Shawnee Mission, KS 66201

#### **KENTUCKY**

Kentuckiana 99/4 Computer Society  
9801 Tiverton Way  
Louisville, KY 40222

#### **MARYLAND**

Baltimore Users' Group  
5504 Forge Rd.  
White Marsh, MD 21162

Severna Park 99/4A Users Group  
27 Whittier Parkway  
Severna Park, MD 21146

#### **MASSACHUSETTS**

MAGNETIC  
57 River Rd.  
Andover, MA 01810

## **User Groups**

---

MIT Lincoln Laboratory 99/4A Users Group  
244 Wood St.  
Lexington, MA 02173

M.U.N.C.H.  
1241 Main St.  
Worcester, MA 01603

New England 99'ers  
99 School St.  
Weston, MA 02193

Personal Computer Users'  
P.O. Box 782  
Westborough, MA 01581

Pioneer Valley 99/4A Users' Group  
3 Market St.  
Northampton, MA 01060

### **MICHIGAN**

Central Michigan Computer 99  
1970 Kibby Rd.  
Jackson, MI 49230

### **MINNESOTA**

Greater Minneapolis-St. Paul  
Home Computer Users' Group  
P.O. Box 12351  
St. Paul, MN 55112

### **MISSOURI**

Kansas City 99/4A Computer Users  
4511 N. Troost  
Kansas City, MO 64116

Ozark 99'er Users Group  
Rt. 1  
Republic, MO 65738

99/4 Users Group of St. Louis  
4127 Quincy  
St. Louis, MO 63116

### **NEBRASKA**

Cross Roads 99'er Computer Group  
511 Iowa St.  
York, NE 68467

### **NEW HAMPSHIRE**

New Hampshire 99'ers Users Group  
P.O. Box 7199 Heights Station  
Concord, NH 03301

### **NEW JERSEY**

Central Jersey 99/4A Users Group  
P.O. Box 673  
Brick, NJ 08723

New Jersey Users Group (NEW JUG)  
Iselin NJ Public Library Green St.  
Iselin, NJ 08030

Northern N.J. 99er Users' Group  
P.O. Box 515  
Bedminster, NJ 07921

9900 Users Group  
P.O. Box K  
Moorestown, NJ 08057

### **NEW MEXICO**

Bernalillo 99/4A HC Users' Group  
2008 Lead Ave.  
SE Albuquerque, NM 87106

### **NEW YORK**

New York 99/4 Users' Group  
34 Maple Ave., Box 8  
Armonk, NY 12205

Upstate New York 99/4 Users' Group  
7 Steve Ln.  
Albany, NY 12205

Upstate New York 99/4A Users' Group  
P.O. Box 13552  
Albany, NY 12212

### **NORTH CAROLINA**

Bits And Bytes Users Group  
139 Vance St.  
Roanoke Rapids, NC 27870

Carolina 99/4A Users Group  
8467 Southard Rd.  
Stokesdale, NC 27357

Charlotte '99 Users Group  
DOWD House at 2216 Momentum St.  
Charlotte, NC 28208

Piedmont 99'er Users Group  
316 Reynolds Dr.  
Statesville, NC 28677

### **OHIO**

Central Ohio TI Users' Group  
1456 Grandview Ave.  
Columbus, OH 43212

Cin-Day Users' Group  
11987, Cedar creek Dr.  
Cincinnati, OH 45240

Cin-Day Users' Group  
P.O. Box 519  
West Chester, OH 45059-0519

Cleveland Area 99/4A Computer Group  
13771 Oakbrook Dr.  
#206 North Royalton, OH 44133

C.O.N.N.I.  
1456 Grandmin Ave.  
Columbus, OH 43212

ECO 99er Users Group  
P.O. Box 1601  
E. Canton, OH 44730

### **OREGON**

Pacific Northwest 99/4 Users' Group  
P.O. Box 5537  
Eugene, OR 97405

Portland Users of Ninety Nines  
421 Northwest 69th St.  
Vancouver, WA 98665

Salem Oregon Ninety-Niner (SONN)  
4981 Jones Rd. SE  
Salem, OR 97302

### **PENNSYLVANIA**

Airport Area Computer Club  
P.O. Box 710  
Coraopolis, PA 15108

Capital Area Users' Group  
P.O. Box 637 Fed. Sq. Station  
Harrisburg, PA 17108-9998

Central PA 99/4A Users Group  
I 83 and Union Deposit  
Harrisburg, PA 17109

Hazleton Users Group  
P.O. Box 285  
Hazleton, PA 18201

Lehigh Users Group  
213 Eagle St.  
Wescosville, PA 18106

Philadelphia 99'er Users Group  
552 Seville St.  
Philadelphia, PA 19128

Pittsburg Users' Group  
P.O. Box 18124  
Pittsburgh, PA 15236

### **RHODE ISLAND**

Tri-State Users' Group  
P.O. Box 457  
Lincoln, RI 02864

### **SOUTH CAROLINA**

Carolina Computer Club  
225 Wynchwood Dr.  
Irmo, SC 29063

### **TENNESSEE**

Athens 99/4 Computer Users' Group  
c/o Bob Lamb  
2215 Congress Parkway  
Athens, TN 37303

Mid South Users Group  
8067 Neshoba  
Germantown, TN 38138

Middle Tennessee Users Group  
P.O. Box 367  
Estill Springs, TN 37330

### **TEXAS**

Central Texas 99/4A Users Group  
P.O. Box 3026  
Austin, TX 73330

Corpus Christi 99ers  
3602 Braeburn  
Corpus Christi, TX 78415

Dallas Home Computer Group  
P.O. Box 672  
Wylie, TX 75098

Ft. Worth 99/4 Users' Group  
Route 2, Box 75-U  
Mansfield, TX 76063

JSC Users' Group (JUG)  
1572 El Camino Real  
Houston, TX 77062

Houstons Users' Group (HUG)  
10107 Westview #112  
Houston, TX 77043

Houston Users' Group (HUG)  
18103 Bambridge  
Houston, TX 77090

Lubbock Computer Club  
5730 67th St.  
Lubbock, TX 79424

Lubbock Computer Club  
3211 27th St.  
Lubbock, TX 79410

SC Users' Group (JUG)  
2321 Coryell St.  
League City, TX 77090

## **User Groups**

---

Texas Instruments, Inc.,  
Attn: Users' Group Coordinator  
P.O. Box 10508 MS 5890  
Lubbock, Texas 79408

The Greater Randolph 99ers  
P.O. Box 721  
Randolph AFB, TX 78148

West Texas 99/4 Users' Group  
P.O. Box 6448, M/S 3030  
Midland, TX 79701

### **VIRGINIA**

Tidewater Microcomputers Users' Group  
942 Bolling Ave. #106  
Norfolk, VA 23501

### **WASHINGTON, D.C.**

Washington, D.C. 99/4 Users' Group  
P.O. Box 267  
Leesburg, VA 22075

### **WASHINGTON STATE**

Puget Sound 99'ers  
P.O. Box 6073  
Lynnwood, WA 98036

Western Washington Computer Club  
Grindstaff Library  
Fort Lewis, WA 98433

### **WISCONSIN**

Fox Cities Users Group  
Box 51  
Appleton, WI 54913

Madison Area Home Computer Users Group  
3518 Concord Ave.  
Madison, WI 53704

Program Innovators  
2007 North 71st St.  
Wauwatosa, WI 53213

Sheboygan Area Users' Group  
P.O. Box 1151  
Sheboygan, WI 53081

### **AUSTRALIA NATIONAL COORDINATOR**

Shane Anderson  
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### **CANADA**

Carleton Home Computer Users' Group,  
John Street R.R. #2  
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Edmonton Users' Group  
P.O. Box 11983  
Edmonton, Alberta  
Canada T5J 311

Kawartha 99'er Users Group  
45-30 Champlain Crescent  
Peterborough, Ontario,  
Canada K9L 1T1

Mr. Paul Langlois  
706-10883 Saskatchewan Dr.  
Edmonton, Alberta  
Canada T6E 4S6

Sudbury 99'er  
2530 Ida St.  
Sudbury, Ontario, Canada P3E 4X1

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3175 Kirwin Ave  
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Mississauga, Ontario  
Canada L5A 3M4

Vancouver Home Computer Users Group  
5825 Mayview Cr.  
Burnaby, British Columbia  
Canada Z5E 4B7

Victoria 99'er Group  
402-1471 Fort St.  
Victoria, British Columbia  
Canada V8S 1Z4

### **COLUMBIA**

Asociacion Colombiana  
de Usuarios 99/4, Av.  
Nutivara #C 3-6  
Medellin Colombia S.A.

### **ENGLAND**

T.I. Home, Paul Michael Dicks  
157 Bishopford Rd.  
Morden Surrey SM46BH

### **GERMANY**

Frankfort—American Express International  
Dept. 204  
Attn: Mr. C. Quiglar  
APONY 09757

### **INTERNATIONAL GROUPS**

The 99/4 Program Exchange  
P.O. Box 3242  
Torrance, CA 90510

99/4 Users of America  
5028 Merit Dr.  
Flint, MI 48506

International 99/4A Users' Group, Inc.  
P.O. Box 3547  
Gardena, CA 90247-7247

#### **LOGO USERS' GROUP**

Young Peoples' LOGO Association  
1208 Hillsdale Dr.  
Richardson, TX 75081

#### **MELBOURNE INTERIM COORDINATOR**

Alwyn Smith  
42 Palm Tree Ave.  
Scarborough, Old, Australia, 4020

#### **PERTH INTERIM COORDINATOR**

Kim Schlunke  
P.O. Box 246  
Mt. Lawley, Western Australia 6014

#### **SYDNEY INTERIM COORDINATOR**

Brian Lewis  
P.O. Box 149  
Pennant Hills

#### **TASMANIA INTERIM COORDINATOR**

Gerald Tan  
Pamela St.  
Happy Valley, S.A. 5159

**USRT** Universal Synchronous Receiver/Transmitter. A serial-to-parallel converter for high-speed communications.

**Utilities** Software used for routine tasks, to simplify or aid in the operation and use of the computer for a number of different uses. Examples of utilities are an editor, a sort, a debugger, and a file handler.

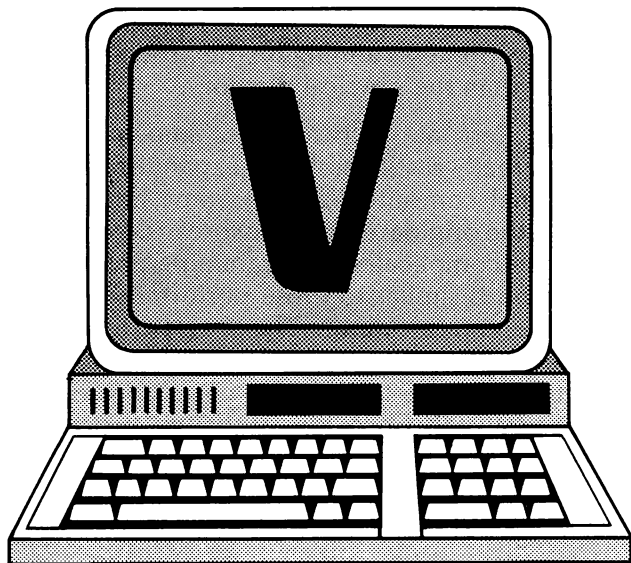
**Utilities I\*** Point-Plotting and screen-dumping routines in Assembly language, Console BASIC, and Extended BASIC. Includes a disassembler and speech utility for creating your own words. Republic Software.

**UUT** Unit Under Test.

**UV** UltraViolet.







**V** Codes. ASCII 86, HEX 56. v—ASCII 118, HEX 76.

**V** Volt. Also, the oVerflow status flag.

**VAL** BASIC Function. VAL returns the numerical value of the beginning of string <x\$>. The format is:

<variable> = VAL(<x\$>)

<x\$> is a string expression.

The VAL function strips blanks, tabs, and line feeds from the argument string and selects numeric characters in order to determine the result. If the characters of <x\$> are not numeric, the program stops and prints a \*bad argument error message. Refer also to STR\$.

**Variable** A symbolically named entity which may assume an assigned value or number of values.

**Variable Names** Rules for BASIC. See Names, Variable.

**VAX** A 32-bit minicomputer manufactured by Digital Equipment, which also executes PDP-11 Machine language.

**VCHAR** BASIC Subprogram. CALL VCHAR is used to display a character anywhere on the monitor screen. Can be repeated vertically, or for horizontal repetition, see HCHAR, under CALL. The format is:

CALL VCHAR (<row>,<column>,<x>[,<r>])

<row> is the row number, from 1-24, 1 at the top.  
<column> is the column number, from 1-32, 1 at the left.

<x> is the ASCII value of the character that will be displayed.

<r> is the number of times <x> will be repeated

vertically, starting at <row,column> and moving down. The range here is 2-768.

**VDI** Video Display Input.

**VDT** Video Display Terminal. The term used in the newspaper community for CRT.

**VDU** Video Display Unit. The British term for CRT.

**Vector Cross Product\*** Two vectors can be input to this program to calculate the vector cross product. Disk. or cassette. Data System.

**Vector Display** A CRT which moves the electron beam randomly to trace figures on the screen. Contrast this with a raster display, which sweeps the beam through a fixed pattern, building up an image with a matrix of points. Vector displays are used in many arcade games.

**Vector Dot Product\*** Two vectors will calculate the vector dot product. Disk or cassette. Data Systems.

**Vectored Interrupt** An interrupt scheme in which information about the type of event which caused the interrupt is provided by hardware at the time of the interrupt.

**Vectoring** Automatic branching to a specified address. See Interrupt.

**Verb\*** Verb conjugations and definitions, along with sample drills for elementary school students. Disk or cassette. Micro-Ed.

**Version** Programs and software packages are changed from time to time to correct errors or add new capabilities. To keep programs from being in a constant state of flux and to simplify distributing modified programs to users, a number of changes are made, tested, and packaged as a new version or release of the program.

Versions or releases are typically numbered: 1.0 for the first version, 1.1 for the first minor revision, 1.2 for the second minor revision, etc. When a major change or large number of minor changes have been made, a new number may be assigned, as Version 2.0. Version numbers help programmers support a program by letting them know which version the user has had problems with. Numbering also helps users know which changes are effective in the version they possess.

**VERSION** XBASIC Subprogram. CALL VERSION allows you to determine the version number of the Extended BASIC you own. The format is:

CALL VERSION<x>

<x> is the variable the computer will assign to the version number. Type in this two-line program:

```
100 CALL VERSION(X)
110 PRINT X
```

The computer will print either 100 or 110.

**V/F** Voltage to Frequency converter.

**VHF** Very High Frequency.

**Video Chess\*** Allows you to play against an opponent or the computer. Features different levels of difficulty and a replay operation. Developed with David Levy for chess players of all ages. Texas Instruments.

**Video Games I\*** Includes Pinball, Doodle, and Pot-Shot. Texas Instruments.

**Video Graphs\*** Create your own designs with preprogrammed graphics. Explore the unique color capabilities of the TI-99/4. For all ages. Texas Instruments.

**Video Monitor\*** Compatible with the Home Computers wide range of graphic and musical capabilities, this ten-inch monitor has a sharp picture and good sound.

**Video Signal** An electronic signal containing information specifying the location and brightness of each point on a CRT screen, providing timing signals to place the image properly on the screen.

**Video Titles I\*** A graphics package for home video. Disk or cassette. J & KH Software.

**Video-300\*** Video-300 is a 12" green phosphor video monitor. Features a non-glare screen, easy reading and operation, 18 MHz bandwidth and 900 lines (center) resolution, composite input, and compatibility with every computer or word-processing system. UL and FCC approved. Amdek Corporation.

**Vid-O-Thello\*** Derived from the ancient game of GO. Can be played by one or two players. Features a help mode. Titan Software.

**VIP** An RCA board using the COSMAC MPU.

**Virtual Address** A system or user-generated address which references objects in a logical address space regardless of the physical memory location. A virtual address must be translated by the operating system into a valid physical address which may, in turn, involve the movement of data between primary and secondary storage (usually disk).

**Virtual Memory** The memory address space available to any process running on the processor. May be larger than the physical memory.

**VisiCalc** Personal Software, also known as VisiCorp, is greatly responsible for expanding the use of personal computers in the home and office. VisiCalc, the original electronic spreadsheet, translates once complicated programming procedures into methods similar to those performed by pencils, paper, and calculators. The program makes the same old calculations, but it eliminates painstaking recalculations due to a simple change in figures. The program also provides sufficient processing sophistication to handle many business planning and forecasting needs. VisiCalc is not available on the 99/4 or /4A. See Multiplan\*.

**VLSI** Very Large Scale Integration. A technology holding over 10,000 transistors per chip.

**VMOS** Vertical MOS. The technology used to increase the density of components per square inch. This is done by cutting a V-shaped groove in the silicon substrate.

**Vocabulary Series\*** Helps expand the student's vocabulary by using word definitions, sample sentences, and practice drills. Progress is shown at the end of each lesson. Disk. Micro-Ed.

**Voice Processing Units** See Terminal Emulator II.

**Volatile Storage** Storage which loses its contents when power is removed.

**VOM** Volt Ohm Multimeter. A test instrument for measuring voltage, resistance, and current. It is usually portable, with an analog meter or digital display for readout.

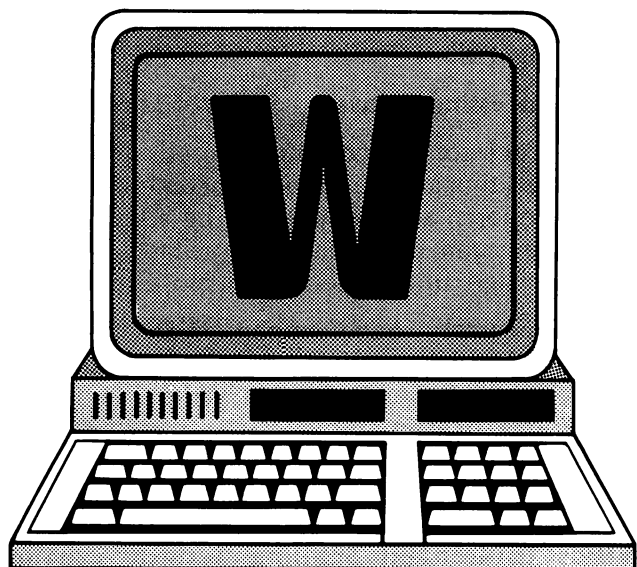
**Voodoo Castle Adventure Database\*** Count Cristo has a curse on him and you must break the spell. Requires the Adventure cartridge; disk or cassette. Texas Instruments.

**VSS** Voltage for Substrate and Sources—the ground for MOS circuits.

**VSNC** Vertical SYNC signal in a TV. Determines the vertical position of the image.

**VTAM** Virtual Teleprocessing Access Method (IBM mainframe telecommunications system).

**VTR** Video Tape Recorder.



**W** Codes. ASCII 87, HEX 57. w—ASCII 119, HEX 77.

**W** Write.

**Wafer** A slice of a silicon ingot on which integrated circuits are fabricated. After testing and fabrication, the wafer is cut up into individual circuits called dice or chips. The dice that were not rejected in the wafer test are packaged and further sorted and tested before being used as finished IC components.

**Wait State** A micro-cycle or internal state entered by an MPU when a synchronizing signal is not present. Used to synchronize a fast processor with a slower memory.

**Waldoball\*** The soccer of tomorrow pits robots against androids in a game combining the machine cool of pinball with the action of team sports. Not-Polyoptics.

**Wall Street\*** Try to turn your initial investment into a windfall. Cassette. Futura Software.

**Wall Street Challenge\*** A program for youngsters to learn the workings of the stock market and the Dow Jones averages. Cassette. Image Computer Products.

**Walls and Bridges\*** A medieval game of knights and gallantry in a world ruled by warlords, dragons, and demons. TImagination.

**Wand** A stick used to read the optically coded product labels (usually bar codes) on retail sales items.

**War of the Worms\*** Manage a rapidly expanding worm within the confines of a playing field. Disk or cassette. Prometheus Software.

**Wari\*** Game modeled after African tribal history. For one or more players. Disk or cassette. Prometheus Software.

**Way** One of several electrical connectors printed on the connecting edge of a printed circuit board (or "card").

**WD** Western Digital Corp. A manufacturer of processor and controller chips.

**WE** Write Enable. A control signal which allows writing to a memory device. Typically used to provide write-protection, as in diskette and cassette drives. Also used in bank switch organization.

**Weight Control and Nutrition\*** Helps plan balanced meals using US recommended daily allowances for adults. Helps improve fitness through nutrition and weight tracking, and uses personal information to determine recommended weight and caloric requirements. Recipes are included. Cartridge. Texas Instruments.

**WEMA** Western Electronics Manufacturers Association.

**Width** To set to sixty characters (for example) per line, enter BASIC statement:

```
PRINT#<n>:CHR$(81);CHR$(60);CHR$(155)
```

**Wildcatting\*** Find oil wells and drill for gushers. Cassette. Image Computer Products.

**Wildcatting\*** A strategy game that dares you to drill for oil and strike it rich. M.W. Ruth CO.

**Winchester Disk** A hard disk system characterized by very light read/write heads, low head-to-disk clearance, and complete enclosure of the magnetic media in a dust-free environment to increase information density and access time. In the world of microcomputers, hard disk and Winchester disk are synonymous.

**Winchester Disk and Controller\*** This five or ten megabyte Winchester hard drive and controller is upwardly compatible with the TI's floppy disk system. It includes a set of disk utilities and customized directory management. Up to forty megabytes of on-line storage is possible by hooking four drives. Myarc, Inc.

**Window** A section of a CRT screen dedicated to displaying specific types of information. See Split Screen.

**Winging It\*** An airplane flight simulator that tests your skill as a pilot with a series of games. Cassette. Not-Polyoptics.

**Wire Wrap** A mechanical method for connecting wires in complex circuits. Each wire is wound tightly around square posts to make the electrical connection. Now seldom used except for hardware during system development.

**Wizard's Dominion\*** You must outsmart the prince to capture the gold that lies in the caverns of the Wizard's Dominion. An adventure game in Extended BASIC. American Software.

**WOM** Write-Only Memory. Usually used as a semi-humorous term for those parts of the computer's address space not actually populated with memory devices, or for those that had to be disabled for some reason.

**Word** A logical unit of information. It may have any number of bits, but for MPUs, a word is usually 4, 8, 16, or 32 bits. For the TI-99, a word is two bytes or 16 bits starting at an even numbered address.

**Word Beginnings\*** Seven lessons for prefix recognition for first through fifth graders. Requires Extended BASIC Cartridge; disk. Texas Instruments and the Minnesota Educational Computing Consortium.

**Word Family Bingo 1\*** Combines word patterns using music and graphics, with the game of bingo. For elementary school students. Disk or cassette. Computer-Ed.

**Word Family Bingo 2\*** Combines word patterns using music and graphics with the game of bingo. For elementary school students. Disk or cassette. Computer-Ed.

**Word Family Bingo 3\*** Combines word patterns using music and graphics with the game of bingo. For elementary school students. Disk or cassette. Computer-Ed.

**Word Family Bingo 4\*** Combines word patterns using music and graphics with the game of bingo. For elementary school students. Disk or cassette. Computer-Ed.

**Word Family Bingo 5\*** Combines word patterns using music and graphics with the game of bingo. For elementary school students. Disk or cassette. Computer-Ed.

**Word List Package\*** Expand your child's vocabulary by writing stories yourself. The program lists the words to learn for reading the text. Can be used with the Early Reading Program\*. Cassette. Anthistle Systems & Programming, LTD.

**Word Processing\*** Program your computer to do most standard word processing functions using the

edit mode. Cassette. Anthistle Systems & Programming, Ltd.

**Word Processing Software** See Word Processors.

**Word Processor** A computer-based system for writing, editing and formatting documents such as letters, reports, and books. May be a specialized hardware system dedicated to these tasks or a program package run on a general purpose computer.

**Word Processors** See Companion, Direct Writer II, Futura Word Processing, Letter Writer, TED Version I, Textiger, Tex-Writer, TI Writer, TY-Priter, and Word Processing.

**Words, Reserved** BASIC. See BASIC—Reserved Words.

**Words In Context Spelling Series\*** Expand vocabulary through the lessons and drills. For elementary school children. Disk or cassette. Micro-Ed.

**Wordstar\*** This word processing system is one of the most widely used programs in the world. Although exclusively for microcomputers, Wordstar still ranks ahead of all word processors in sheer number of users. Only the Wang dedicated word processing machines have a comparable number of users. Wordstar is not available for the 99/4 or /4A. MicroPro.

**Workspace** An area of memory allocated for working storage.

**Workspace Pointer Register** A key register in the TI 9900 MPU which identifies the start of a sixteen word area used to simulate sixteen workspace registers used by a subroutine (or "in a context"). See Workspace Registers and Context Switch.

**Workspace Registers** These are RAM words (16 bits) used to simulate an MPU register. They are used in arithmetic and byte manipulation just as a real internal MPU register would be used. Many sets of workspace registers may be defined. The workspace pointer register in the 9900 MPU identifies the currently active set of 16 workspace registers R0R15. Changing the workspace pointer register establishes a new set of sixteen workspace registers which will be used until the next "context switch" changes the value of the workspace pointer register again. See Context Switch and Workspace Pointer Register.

**World Defender\*** Protect earth from attacking aliens. Cassette. Requires Extended BASIC cartridge. Western Properties Investment Company.

**WPM** Words Per Minute.

**Wrap\*** A fast action containment game. Cassette. Requires joysticks. Kemp Software.

**Write Data to File** BASIC. See PRINT#.

**Write-Protect** Preventing information from being written onto a storage medium. Often, adhesive tabs can be removed from placed on a disk jacket to write-protect it by disabling the disk drive's write circuitry. Cassettes have a plastic break-out tab providing a write-protection option.

**Write-Protected Diskette** A diskette is write-protected if it does not have a write-protect notch one inch down on the right side. The notch could be missing or covered with an adhesive tab which blocks a small spring-loaded switch or light beam inside the disk drive. You will get an error message anytime you attempt to alter a file on a write-protected diskette by changing, deleting, copying a file, or initializing it.

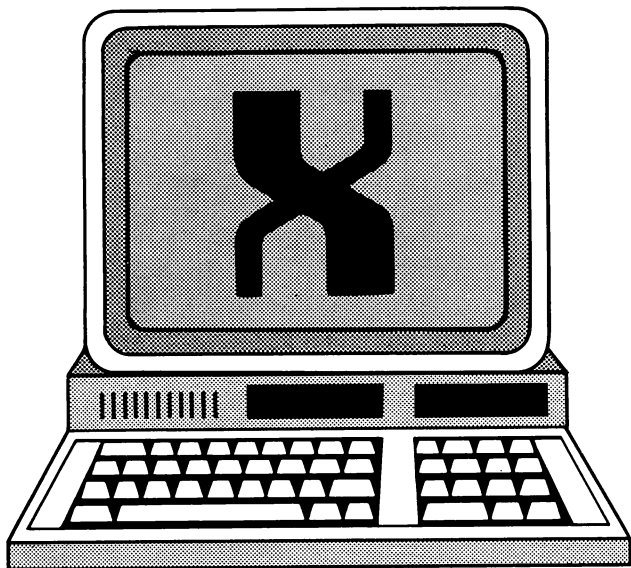
You are allowed to use, load, or copy files from the write-protected diskette. The purpose of these limitations is to prevent loss of the only copy of programs or data. In most cases the procedure is to copy the write-protected diskette onto a notched diskette, put away the write-protected diskette as a permanent copy, then modify the notched diskette. In some cases you might decide to remove the adhesive tab from the write-protect notch and change the diskette.

You should put an adhesive tab (supplied with boxes of diskettes) over the write-protect notch of any important diskette you will backup. Then if you accidentally ask for the backup in the wrong direction (from the old diskette to your important diskette), you will get a second chance to make the backup and avoid losing your data.

**WS** Workspace.

**WV** Working Voltage.





**X** Codes. ASCII 88, HEX 58. x—ASCII 120, HEX 78.

**X** Index Register.

**X-BASIC Color Bars\*** Test the performance of your video display terminal using the color bars generated by this program. Vid-Com.

**X-BASIC Directory 4.0\*** Build and edit your own custom directory. Auto-dial numbers with some additional circuitry on your system. Auto-Dial functions include auto-dial on/off, call log and timer, and redial. Vid-Com.

**X-BASIC Geosat Locator\*** Provides information about geostationary satellite locations, and antenna alignment for better reception. Specific information includes elevation, azimuth, distance, polar offset correction, and magnetic deviation. There is also a routine for corrected look-angles for the standard satellite belt. Vid-Com.

**XENIX** The Microsoft implementation of the UNIX operating system for microcomputers.

**XMIT** TransMIT.

**XMT** TransMiT.

**XOR** X BASIC. Use with IF...THEN...ELSE. Extended BASIC allows the use of XOR (exclusive OR) as a logical operator in the IF...THEN...ELSE statement. The complex condition created with XOR will be true if either, but not both of two smaller logical expressions (one on the right and one on the left) of XOR are true. Here's an example:

```
IF X+3=14 XOR Y<32 THEN B$="YOU WIN"
  :: GOSUB 1250.
```

**Xorkle\*** A dice game in which you try to throw a triple before you "xorkle." Try to beat the odds. For up to six people. BeeJay Funware.

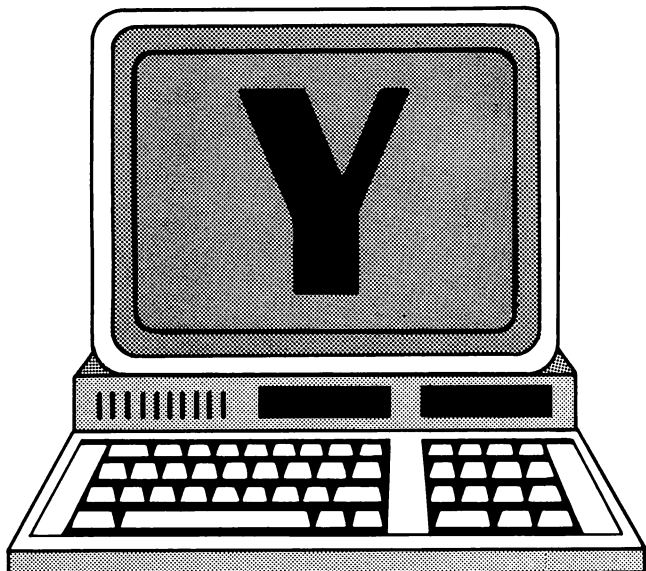
**Xorkle II\*** The same as Xorkle I, except that it can be played on the phone with a friend. BeeJay Funware.

**XR** EXternal Reset.

**XTAL** CrysTAL.







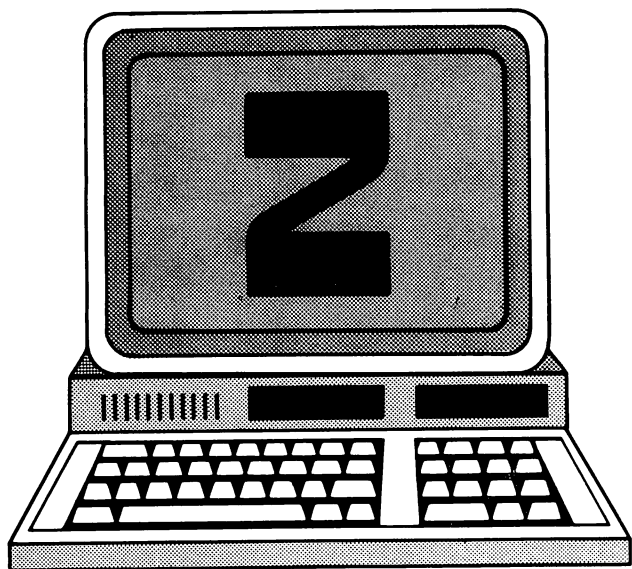
**Y** Codes. ASCII 89, HEX 59. y—ASCII 121, HEX 79.

**Y Plotter** A device that draws points or lines on a sheet of paper based on X and Y coordinates from a computer.

**Yahtzee\*** A combination strategy and chance game that has players roll dice to build points. Developed by Milton Bradley Company. Texas Instruments.

**Yield** The proportion of usable chips in a production batch.  $\text{Yield} = \text{good chips} / \text{total chips on a wafer}$ .





**Z** Codes. ASCII 90, HEX 5A. z—ASCII 122, HEX 7A.

**Z** Impedance measured in ohms. Also, the Zero flag.

**ZeroZap\*** A computerized pinball game that allows you to use sound and graphic effects to design your own playing field. For ages six and older. Milton Bradley Company. Texas Instruments.

**Zirexx\*** A space battle between you and alien vessels. Requires Extended BASIC command module and joysticks; cassette. Western Properties Investment Company.

**Zombie Mambo\*** Explore a subterranean maze of tunnels and chambers while you battle mystical creatures in your quest for the keys to the sorcerer's crypt. TImagination.

**Zone** To skip over while printing. To leave space on the print line between items, put an extra comma(,,) in the print listing,enter BASIC statement:

```
PRINT#<n>:A, ,B
```

This prints A in print zone 1, nothing in print zone 2, and B in print zone 3 (column 29). See also Zones and Print Zones.

**Zones** Each group of fourteen spaces across the print line is called a print zone. A comma (,) in a list of items to be printed means "start printing the following item at the start of the next print zone." The format is:

```
PRINT#<n>:<list of items, with  
commas in it, to be printed>
```

Contrast this with the semi-colon (;) which means the next item is to print immediately after this one,

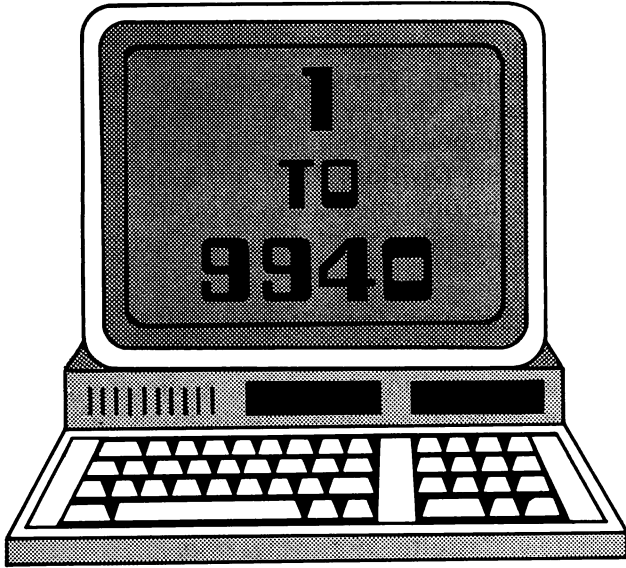
without even a single space between. The print zones begin in columns 1, 15, 29, 44, 58, and 72. See also Print Lines.

**Zygon\*** You are on an alien planet with a disabled propulsion drive and must defend yourself against such threats as meteors, attacking aliens, and an energy-sapping weed that will further drain your power supply if you touch it. Try to survive until your solar cells can be recharged, allowing you to continue your fight. Graphic Software.

**zYield** The proportion of operational chips in a production batch. The actual proportion is computed with the equation:

Yield= good chips/total chips on a wafer.





**“1”** To set for the line spacing of 72/7 lines-per-inch, enter BASIC statement:

```
PRINT#<n>:CHR$(27);“1”
```

or

```
PRINT#<n>:CHR$(27);CHR$(49)
```

This is a good setting for spacing with compressed print. See Type Formats.

**1-2-3** See Lotus 1-2-3.

**“2”** To set for the line spacing of 6 lines-per-inch, enter BASIC statement:

```
PRINT#<n>:CHR$(27);“2”
```

See Type Format.

**2x2 Matrix Determination\*** The user inputs a 2 by 2 matrix and the program will compute the matrix, determinant, and inverse. Disk or cassette. Data Systems.

**3-D Maze\*** Includes a variety of different mazes, from easy to complex. Retain your spatial orientation while exploring the passages and dead ends, and trying to solve the maze. Disk or cassette. American Software Design & Distribution.

**3-D Startrek\*** This game brings three dimensional graphics to your favorite Star Trek action. Norton Software.

**3x3 Matrix\*** The user inputs a 3 by 3 matrix and the program calculates the matrix, its inverse, and determinant. Disk or cassette. Data Systems.

**6 Lines-Per-Inch** To set for this line spacing, enter BASIC statement:

```
PRINT#<n>:CHR$(27);“2”
```

See Type Formats.

**8 Lines-Per-Inch** To set for this line spacing, enter BASIC statement:

```
PRINT#<n>:CHR$(27);“0”
```

See Type Formats.

**9-Bit Rotation** Rotation in which the carry bit of the CPU is considered a ninth, high-order bit for the 8-bit register being rotated.

**10 ASCII, Uses of** Printer. To advance one line on the printer (space up) without carriage return, enter BASIC statement:

```
PRINT#<n>:CHR$(10)
```

or use the “line feed” (LF) button on your printer. Entering just

```
PRINT#<n>:
```

gives a line feed—both space up one line (line feed) and return to left margin (carriage return).

**10 Characters-Per-Inch** To return to 10 characters-per-inch print size, turn off all the non-standard print options currently turned on. See Type Formats.

**12 ASCII, Uses of** Printer form feed. To advance the paper to the top of a page in the printer, enter BASIC statement:

```
PRINT#<n>:CHR$(12)
```

or use the “top of form” or “form feed” manual control button (FF) on your printer.

You may need to adjust the paper in the printer so it actually is at the top of a page as defined by the perforations. In a program, you may want to provide instructions to the operator and a pause to allow for adjustment of the paper. See Pause.

**15 ASCII, Uses of** Compressed print. For this small type size enter BASIC statement:

```
PRINT#<n>:CHR$(15)
```

or

```
PRINT#<n>:CHR$(143)
```

This gives 132 characters on the 8 inch line or about 16 characters-per -inch. To return to normal size print, enter

```
PRINT#<n>:CHR$(146)
```

See Type Formats.

**16 Characters-Per-Inch** For compressed print (small type size), enter BASIC statement:

```
PRINT#<n>:CHR$(15)
```

or

```
PRINT#<n>:CHR$(143)
```

either in a program with numbers or directly without a line number. This gives 132 characters on the 8

inch line, or about 16 characters-per-inch. To return to normal size print, enter

```
PRINT#<n>:CHR$(146)
```

See Type Formats.

**27 ASCII, Uses of** Enter ASCII 27 (escape) for printer control in PRINT#<n>: statements to set lines-per-inch, page length, and print size or use 128 + 27 = 155 to avoid complications in some programs. See Type Formats.

**32K Memory Card\*** This memory card fits into the Peripheral Expansion Box, has no wait states inserted, and features "transparent" refresh. Foundation.

**32K Memory Expansion Peripheral\*** There is no need for the Peripheral Expansion Box with this memory expansion unit; it plugs directly into the TI-99/4A. It is available in two versions, Model I and the Model V, which includes extra pin-outs for adding on the Peripheral Expansion Box. Hi-Tech Systems.

**40-Column Display Enhancement Package\*** Allows you to use your computer's Video Display Processor to its full 40-column capacity. Features include split screen functions and forward and backward scrolling. Disk. Oak Tree Systems.

**49 ASCII, Uses of** To set for the line spacing of 72/7 lines per inch enter BASIC statement:

```
PRINT#<n>:CHR$(155);"1"
```

or

```
PRINT#<n>:CHR$(155);CHR$(49)
```

See Type Formats.

**50 ASCII** How to turn off special lines-per-inch. To return to the standard line spacing of 8 lines per inch after using a different lines per inch spacing, enter the BASIC statement:

```
PRINT#0<n>:CHR$(155);CHR$(50)
```

See Type Formats.

**72/7 Lines-Per-Inch** To set for this line spacing, enter BASIC statement:

```
PRINT#<n>:CHR$(155);"1"
```

or

```
PRINT#<n>:CHR$(155);CHR$(49)
```

To return to the standard 8 lines-per-inch, this special line spacing must be turned off. To do this, enter BASIC statement:

```
PRINT#<n>:CHR$(155);CHR$(50)
```

This line spacing is a good setting for spacing with compressed print.

See Type Formats.

**99'er Magazine on Tape Package #E1\*** This is a package of five programs used for instruction. The subjects include: Typing for Accuracy; Let's Learn Notes (music); Mystery Words (Musical note recognition); Homework Helper: Fractions; and Homework Helper: Division. They are available separately and the documentation is found in issues of *99'er Magazine* (Vol. 1, Nos. 1,3,4). Cassette. *99'er Magazine*.

**99'er Magazine on Tape Package #U1\*** This is a package of several different programs: an address book, a personal inventory file, a telephone call monitor program, a home bartending program with graphics and recipes, a program to generate forms, and a music player/editor. Back issues of magazines containing documentation are available separately. Cassette. *99'er Magazine*.

**99'vaders\*** Defend the last Earth outpost against wave after wave of invaders. Home version of the arcade game. Not-Polyoptics.

**99/4 Literacy** This program offers a complete introduction for the new user to the 99/4 computer. Requires Extended BASIC Cartridge; disk or cassette. W.R. Wilson, Inc.

**128K Memory Card\*** Plugs into your Peripheral Expansion Box and runs the same programs as the TI card. Foundation.

**132 Characters-Per-Line** Compressed print. For small type size, enter BASIC statement:

```
PRINT#<n>:CHR$(143)
```

either in a program with line numbers or directly, without a line number. This gives 132 characters on the 8 inch line, or about 16 characters-per-inch. To return to normal size print, enter

```
PRINT#<n>:CHR$(146)
```

See Type Formats.

**371 Chip** Cassette controller. Made by NEC.

**372 Chip** FDC. Made by NEC.

**400 Chip** 4-bit 1 2 L slice. Made by TI.

**481 Chip** 4-bit slice. Made by TI.

**601 Chip** 16-bit chip. Made by Data General.

**1000 Chip** 4-bit microprocessor available in various versions. Also called TMS-1000. Made by TI.

**1070** See 1000 Chip.

**1100** See 1000 Chip.

**1200** See 1000 Chip.

**1270** See 1000 Chip.

**1300** See 1000 Chip.

**1600 Chip** Set designed for PDP-11/03 emulation. Made by Western Digital.

**1702 Chip** An ultra-violet erasable PROM organized as 256 words by 8 bits.

**1771 Chip** Single-density floppy disk controller chip.

**1791 Chip** Double-density floppy disk controller chip.

**1802 Chip** Cosmac 8-bit CMOS microprocessor. Made by RCA.

**2102 Chip** Common static RAM integrated circuit, organized as 1K by 1 bit.

**2114 Chip** Static RAM organized as 1K by 4 bits.

**2650 Chip** 8-bit microprocessor. Made by Signetics.

**2651 Chip** 2650 UART. Made by Signetics.

**2652 Chip** SDLC chip. Made by Signetics.

**2655 Chip** 2650 PIO. Made by Signetics.

**2702 Chip** See 1702 Chip.

**2708 Chip** An ultraviolet-erasable PROM organized as 1K by 8 bits.

**2716 Chip** An ultraviolet-erasable PROM organized as 2K by 16 bits. Made by Intel.

**2716 Chip** An ultraviolet-erasable PROM organized as 2K by 8 bits. Not compatible with the Intel part. Made by TI.

**2732 Chip** An ultraviolet-erasable PROM organized as 4K by 8 bits.

**2900 Chip** A family of 4-bit slice components. Widely used to construct special-purpose controllers and microprocessors. Introduced by AMD and second-sourced by many other manufacturers.

**2901 Chip** A 4-bit slice processor. Made by AMD.

**2902 Chip** Look-ahead carry generator. Made by AMD.

**2903 Chip** An improved version of 2901. Made by AMD.

**2909 Chip** Microprogram sequencer. Made by AMD.

**2911 Chip** Microprogram sequencer. Made by AMD.

**2114 Chip** Static RAM organized as 1K by 4 bits.

**2650 Chip** 8-bit microprocessor. Made by Signetics.

**2651 Chip** 2650 UART. Made by Signetics.

**2652 Chip** SDLC chip. Made by Signetics.

**2655 Chip** 2650 PIO. Made by Signetics.

**2702 Chip** See 1702 Chip.

**2708 Chip** An ultraviolet-erasable PROM organized as 1K by 8 bits.

**2716 Chip** An ultraviolet-erasable PROM organized as 2K by 16 bits. Made by Intel.

**2716 Chip** An ultraviolet-erasable PROM organized as 2K by 8 bits. Not compatible with the Intel part. Made by TI.

**2732 Chip** An ultraviolet-erasable PROM organized as 4K by 8 bits.

**2900 Chip** A family of 4-bit slice components. Widely used to construct special-purpose controllers and microprocessors. Introduced by AMD and second-sourced by many other manufacturers.

**2901 Chip** A 4-bit slice processor. Made by AMD.

**2902 Chip** Look-ahead carry generator. Made by AMD.

**2903 Chip** An improved version of 2901. Made by AMD.

**2909 Chip** Microprogram sequencer. Made by AMD.

**2911 Chip** Microprogram sequencer. Made by AMD.

**2914 Chip** PIC. Made by AMD.

**3000 Chip** Family of 2-bit slice components. Made by Intel.

**3001 Chip** Microprogram control unit. Made by Intel.

**3002 Chip** Central processing element 2-bit slice. Made by Intel.

**3003 Chip** Look-ahead carry generator. Made by Intel.

**3850 Chip** The F8 family processor chip. Part of an 8-bit, 2-chip microcomputer. Made by Fairchild.

**3851 Chip** The F8 family program storage unit used with the 3850. Made by Fairchild.

**3852 Chip** Dynamic memory interface for the F8. Made by Fairchild.

**3853 Chip** SMI for the F8. Made by Fairchild.

**3854 Chip** DMA for the F8. Made by Fairchild.



## 3862 Chip • 8253 Chip

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**3861 Chip** PIO for the F8. Made by Fairchild.

**3870 Chip** An 8-bit, 1-chip microcomputer. Contains 4032 bytes of ROM, and 128 bytes of RAM. Made by Mostek.

**3876 Chip** An 8-bit 1-chip microcomputer. Upgrade of the 3870, contains 4032 bytes of ROM, and 256 bytes of RAM. Made by Mostek.

**3880 Chip** Mostek Z80.

**4004 Chip** 4-bit microprocessor. Made by Intel.

**4040 Chip** 4-bit microprocessor. Upgrade of the 4004, contains more registers and executes a larger instruction set. Made by Intel.

**4044 Chip** Static RAM organized as 4K by 1 bit.

**4116 Chip** Dynamic RAM organized as 16K by 1 bit.

**4164 Chip** Dynamic RAM organized as 64K by 1 bit.

**4264 Chip** 4040 PIO.

**4308 Chip** ROM 1K by 8 with I/O ports for the 4040. Made By Intel.

**5701 Chip** MMI 4-bit slice predecessor of the 2901 mil version.

**6100 Chip** Intersil 12-bit CMOS microprocessor which emulates the PDP-8.

**65XX Chip** Support chips belonging to the 6502 family. Made by MOS.

**6502 Chip** 8-bit microprocessor. Widely used in mass-marketed computer systems, such as Apple, Pet, and Atari. Made by MOS Technology.

**6520 Chip** PIO. Made by MOS Technology.

**6530 Chip** RAM, ROM, I/O, and timer. Made by MOS Technology.

**6701 Chip** Same as the 5701 in the commercial version.

**6800 Chip** 8-bit microprocessor. Made by Motorola.

**6801 Chip** 8-bit one-chip microcomputer.

**6802 Chip** 8-bit two-chip microcomputer. Upgrade of the 6800, contains functions that were previously in the other 6800 family components. Made by Motorola.

**6809 Chip** 8-bit high performance upgrade of the 6800. Has an expanded instruction set and 16-bit word handling capability. Made by Motorola.

**6820 Chip** 6800 PIO. Made by Motorola, Fairchild, and Mostek.

**6828 Chip** PIC. Made by Motorola.

**6845 Chip** CRT controller. Made by Motorola.

**6850 Chip** 6800 UART. Made by Motorola.

**6860 Chip** Modem. Made by Motorola, Fairchild and AMD.

**6870 Chip** Clock. Made by Motorola.

**7400 Chip** Series of TTL logic. Made by TI.

**8008 Chip** 8-bit microprocessor. Made by Intel.

**8048 Chip** 8-bit family of one-chip microcomputers with one-chip RAM and ROM. The 8748 version has an EPROM on the same chip as the processor.

**8080 Chip** 8-bit microprocessor. Upgrade from the 8008; has a different instruction set but retains a similar architecture to the 8008. The 8080 was the dominant microprocessor of the 1970s. Made by Intel.

**8085 Chip** 8-bit microprocessor. Upgrade of the 8080, contains functions that were previously on other 8080 family chips as well as two extra instructions and four interrupt levels. Made by Intel.

**8086** Full 16-bit version of the 8088.

**8086 Chip** 16-bit byte-oriented microprocessor that resembles the 8085, but has an expanded instruction set and 16-bit arithmetic capabilities. Made by Intel.

**8087 Chip** Numeric data co-processor for the 8086 and the 8088. Implements proposed IEEE floating-point standard.

**8088** 16-bit microprocessor. Slightly stripped-down version of 8086. Intel.

**8089 Chip** 16-bit input/output processor. Made by Intel.

**8212 Chip** Parallel latch and buffer in the 8080 family. Made by Intel.

**8224 Chip** Clock generator for the 8080. Made by Intel.

**8228 Chip** System controller for the 8080. Made by Intel.

**8251 Chip** USART for the 8080 family. Also called a PCI. Made by Intel.

**8253 Chip** Programmable interval timer for the 8080 family. Made by Intel.

**8255 Chip** Programmable parallel interface for the 8080 family. Made by Intel.

**8257 Chip** Direct memory access controller for the 8080 family. Made by Intel.

**8259 Chip** Interrupt controller for the 8080 family. Made by Intel.

**8271 Chip** Single-density floppy disk controller in the 8080 family. Made by Intel.

**8273 Chip** Synchronous data link controller in the 8080 family. Made by Intel.

**8275 Chip** CRT controller in the 8080 family. Made by Intel.

**8279 Chip** Keyboard and display controller in the 8080 family. Made by Intel.

**8291 Chip** IEEE 488 bus talker/listener interface chip. Made by Intel.

**8292 Chip** IEEE 488 bus controller chip. Made by Intel.

**8708** See 2708 Chip.

**8748 Chip** 8048 with EPROM on the same chip as the processor. Made by Intel.

**9080 Chip** AMD's 8080.

**9400 Chip** Bipolar Macrologic family. Made by Fairchild.

**9511 Chip** Arithmetic processing chip. Made by AMD.

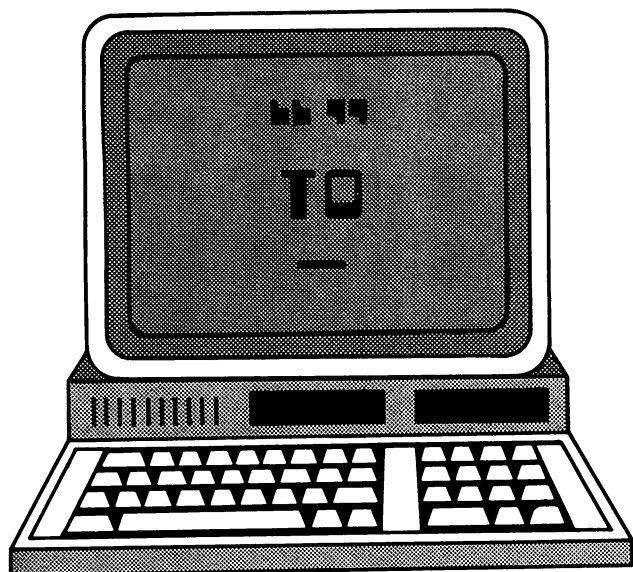
**9900 Chip** 16-bit microprocessor used as the CPU of the 99/4 and /4A. Made by TI.

**9904 Chip** 9900 clock. Made by TI.

**9914 Chip** IEEE 488 bus interface chip. Supports talker/listener and controller functions.

**9940 Chip** 16-bit, 1-chip microcomputer.





“ ” Spacing. To get one or more spaces between fields printed by your BASIC programs, use a literal of spaces like: “ ”. To get several spaces between the printed values of A\$ and B\$, enter BASIC statement:

```
PRINT#0<n>: A$;" ";B$
```

See also Print Zones.

! A special character in BASIC, indicating the exclamation point or tail remark delimiter {xb}; cannot be used for any other purpose.

" A special character in BASIC, indicating the double quotation mark or string delimiter; cannot be used for any other purpose.

# A special character in BASIC, indicating the number (or pound) symbol; cannot be used for any other purpose.

\$ A special character in BASIC, indicating the dollar sign or the string type declaration character; cannot be used for any other purpose.

% A special character in BASIC, indicating the percent symbol; cannot be used for any other purpose.

& A special character in BASIC, indicating an ampersand, or the string concatenation symbol; cannot be used for any other purpose.

' A special character in BASIC, indicating the single quotation mark or apostrophe; cannot be used for any other purpose.

( A special character in BASIC, indicating the left parenthesis; cannot be used for any other purpose.

) A special character in BASIC, indicating the right parenthesis; cannot be used for any other purpose.

\* A special character in BASIC, indicating the times sign (multiplication); cannot be used for any other purpose.

× A special character in BASIC, indicating the plus sign (addition); cannot be used for any other purpose.

, A special character in BASIC, indicating the comma delimiter; cannot be used for any other purpose.

, Comma. Each group of 14 spaces across the print line is called a print zone. A comma (,) in a PRINT #<n>: <list of items to be printed> means "start printing the following item at the start of the next print zone." Contrast this with the semi-colon (;), which means the next item is to print immediately after this one, without even a single space between. The print zones begin in columns 1, 15, 29, 44, 58, and 72.

See also Print Lines.

- A special character in BASIC, indicating the minus sign (subtraction); cannot be used for any other purpose.

. A special character in BASIC, indicating the period or decimal point; cannot be used for any other purpose.

/ A special character in BASIC, indicating the division symbol or slash and cannot be used for any other purpose.

: A special character in BASIC, indicating the colon symbol, statement separator or print separator {xb}; cannot be used for any other purpose.

: Colon. In a BASIC program you can put a double colon (::) at the end of one statement and continue entering another statement on the same line, without giving a new line number. The line number at left refers to all statements on the line. (!) allows a comment or remark to be added after a statement with or without a statement separator.

; A special character in BASIC, indicating the semi-colon symbol; cannot be used for any other purpose.

; Semi-colon. Each group of 14 spaces across the print line is called a print zone. A comma (,) in a PRINT#<n>: <list of items to be printed> means "start printing the following item at the start of the next print zone." Contrast this with the semi-colon (;), which means the next item is to print imme-

diately after this one, without even a single space between. The print zones begin in columns 1, 15, 29, 44, 58, and 72.

See also Print Lines.

< A special character in BASIC, indicating the less than symbol; cannot be used for any other purpose.

= A special character in BASIC, indicating the equal sign, or an assignment symbol; cannot be used for any other purpose.

> A special character in BASIC, indicating the greater than symbol; cannot be used for any other purpose.

? A special character in BASIC, indicating the question mark; cannot be used for any other purpose.

? Prompt. This is a program's way of letting you know that it is waiting for you to type in information. When you write a BASIC program, it is a good idea to include a descriptive prompt such as "Enter check amount 9999.99" in the program so the operator (or you) will know exactly what should be entered in response to the ? prompt. An example of how to do this:

```
100 INPUT "ENTER CHECK AMOUNT 9999.99"  
      ,CHECKAMOUNT
```

which will give the operator using this program this prompt on the screen:

```
ENTER CHECK AMOUNT 9999.99
```

\ A special character in BASIC, indicating the backslash; cannot be used for any other purpose.

^ A special character in BASIC, indicating the exponentiation symbol or caret; cannot be used for any other purpose.

\_ A special character in BASIC, indicating the underline symbol; cannot be used for any other purpose.

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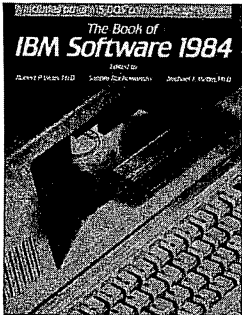
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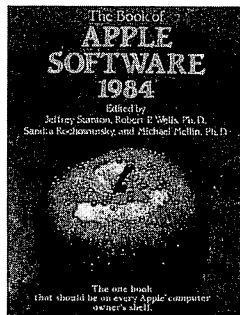
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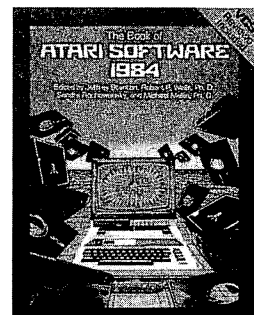
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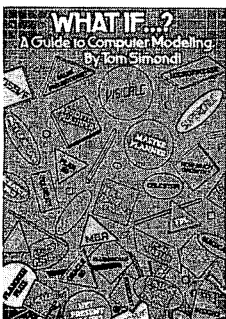
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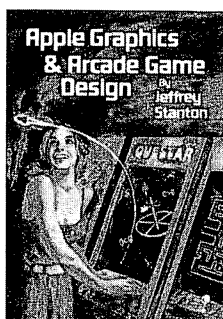
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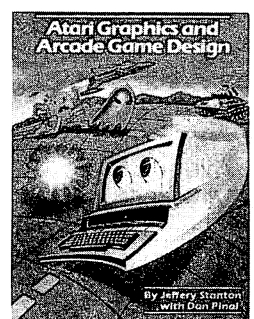
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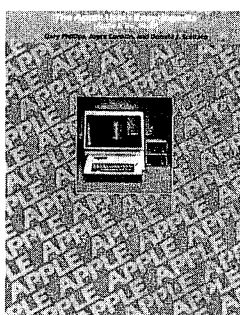
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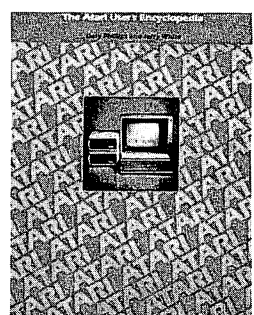
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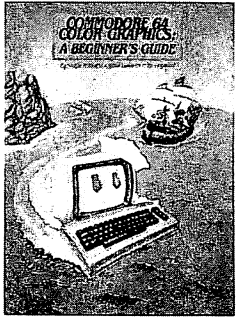
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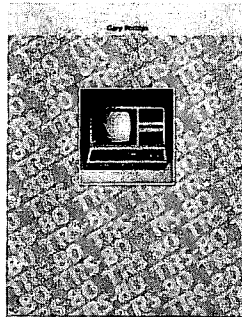
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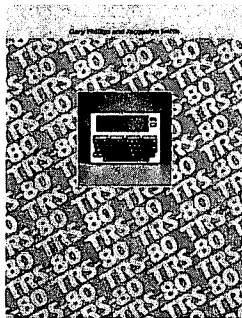
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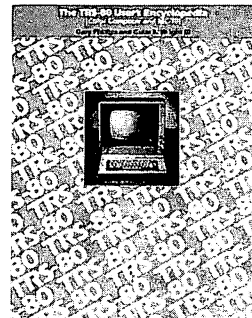
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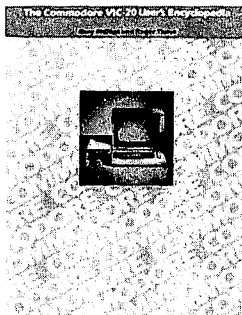
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