4-H Introduction to Computers

4-H 461

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                        │    COMPUTERS        │
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│   PROGRAMMING       │ │    SOFTWARE         │ │  COMPUTER HARDWARE  │
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│  Using programs     │ │  Using Software     │ │  Using Hardware     │
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Introduction to Computers: Section I
Learning About Computers

Welcome to the fascinating world of computers. Computers play an active role in everyone's life. Think about the things you do every day. You will soon realize that computers affect you directly in many ways. Banks, restaurants, department stores, toys, games, and even automobiles use computers in some form.

As the field of computers continues to grow, there will be an increased need for people familiar with computer technology. The purpose of this project is to introduce persons with little or no computer experience to the fundamental operations of computers. There are two important points to remember while completing this project. First, there is nothing to fear about computers; computers will not fall apart because of the mistakes you make. Second, it will always take a human to operate a computer.
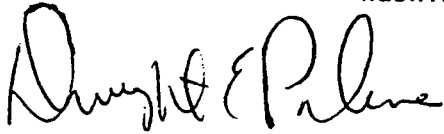
To begin, let's look at the functions of a computer.

- Perform complex, lengthy arithmetic operations quickly and accurately.
- Provide activities for entertainment and education.
- Remember and retrieve information.
- Make judgments for us by comparing stored facts.
- Sort data into meaningful information and statistics.
- Instantly balance checkbooks or inventory.
- Save busineses and individuals time, money, and space.

4-H COMPUTER PROJECT INFORMATION

Please complete and mail this self-addressed, stamped information sheet BEFORE
starting this 4-H project. We need to evaluate the project, its effectiveness
and the uses made of it. Evaluation will be the only use made of this
information. Thank you. We hope you enjoy this new 4-H project.

Washington - Oregon - Idaho State 4-H Leaders,

Dwight Palmer
Washington

Duane Johnson
Oregon

Corinne Rowe
Idaho

Check project enrolled in: ☐ Introduction
to Computers   ☐ Learning
About
Software   ☐ Learning
About
Programming

Members's Name_____ County_____

Street Address_____ Phone (____)_____
                                              area code
City_____ State_____ Zip_____

Parent's Name_____

Is there presently a computer available in your home? ☐ yes   ☐ no

Is so, please indicate brand of computer_____

How is it presently being used? ☐ home entertainment/games

☐ word processing

☐ record keeping/data management

☐ financial spreadsheets

☐ business

☐ other

Does your family plan to buy a computer ☐ yes   ☐ no   ☐ not sure

If yes, when?_____

THANK YOU for taking time to fill out this sheet.

WOI 4-H Computer Group

FOLD HERE

||||||

055-C015

University of Idaho

Ms. Corinne Rowe
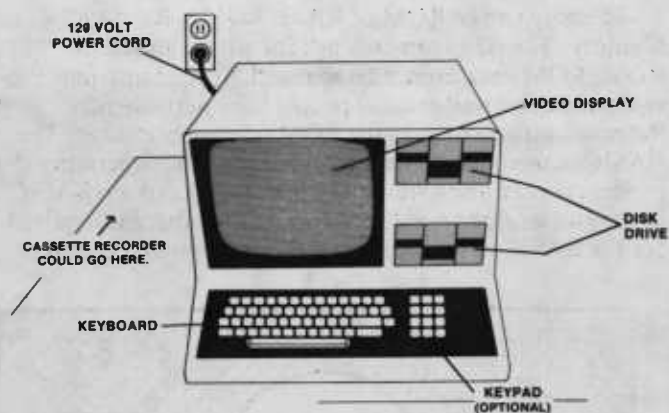State 4-H Office
Morrill Hall 223
Moscow, Idaho 83843

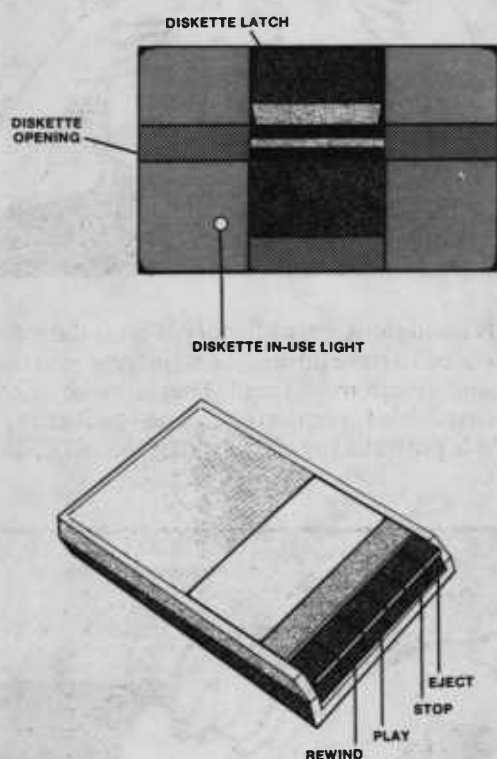Fig. 1—The main features of popular micro-computers.

Fig. 2—Storage devices for microcomputers include cassette tapes (used with a cassette recorder) and diskettes.

What You Will Learn in This Section

- The basic parts of a computer and how they function together.
- The important keys on a keyboard.
- How to use a microcomputer as a calculator.
- How to run a simple tape or diskette program.
- How to take care of diskettes and cassette tapes.

What You Will Do in This Section

- Interact with a microcomputer.
- Use the computer as a calculator.
- Run prepared programs.
- Share what you have learned by giving a demonstration.
- Keep a record of your 4-H computer project.

Understanding the Microcomputer

Small, portable, low-cost computers that are used in the home or for small businesses are called microcomputers. The main features of popular microcomputers used in 4-H computer projects are shown in Figures 1 to 2. There are other similar types and models available.

Figure 3 shows the parts of a microcomputer and how information is sent from one part to another. Study the figure closely. Understanding these parts is basic to understanding computers. Later in this project you will be asked to identify and label these parts.
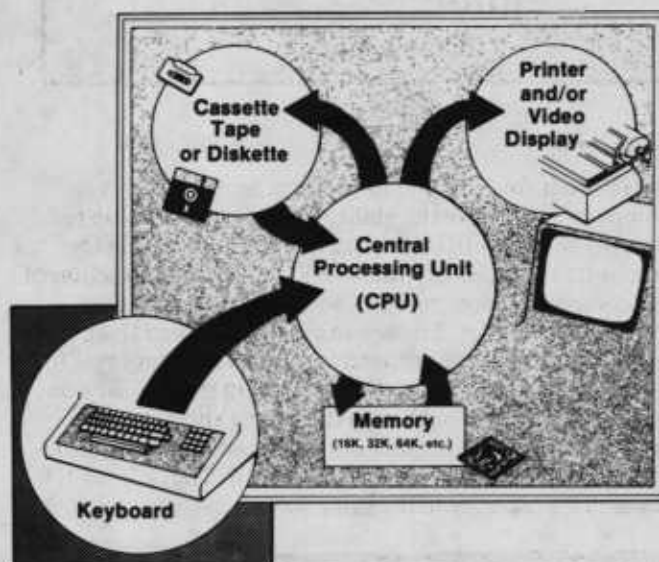

Fig. 3.—The flow of information from one part of a microcomputer to another.

Components of a Computer

As shown in Figure 3 the basic components of the microcomputer include the central processing unit (CPU), memory, keyboard, video display, printer, and tape or diskette storage. These are typical of all computer systems. However, the larger the computer, the larger the devices and greater the number of keyboard, video, printer and storage devices that are connected to the central processing unit.

Central Processing Unit (CPU)

The CPU is the "brain" of the computer. In microcomputers, the CPU is a complex integrated circuit called a microprocessor. It is located on the main control circuit board and receives, manipulates, and directs electrical signals to all the other computer components.
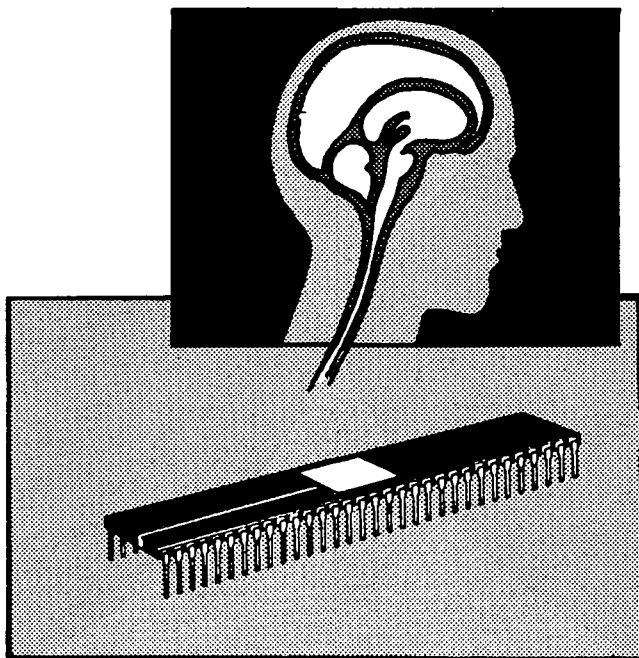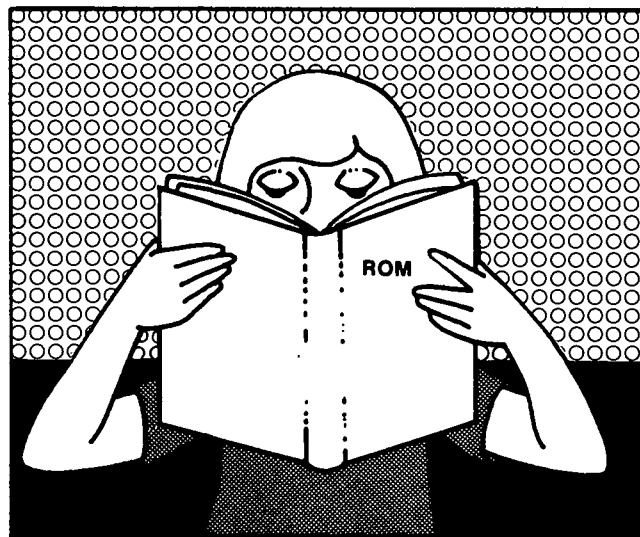
Memory

In order for the CPU to perform useful work, a computer must have the ability to store information (or data). The ability to store data internally or within the computer is known as MEMORY. The memory section of the computer is composed of solid-state devices. One "chip" about ½ × 2 inches in size and ¼-inch thick with 16 to 32 terminal connections can act as a "memory" for 1K to 2K bytes. (Look up K and bytes in the glossary on pages 12 and 13.) That's equivalent to a short written report in a package smaller than a five-stick package of chewing gum. Newer memory devices will have 10 to 100 times more capacity in the same space.
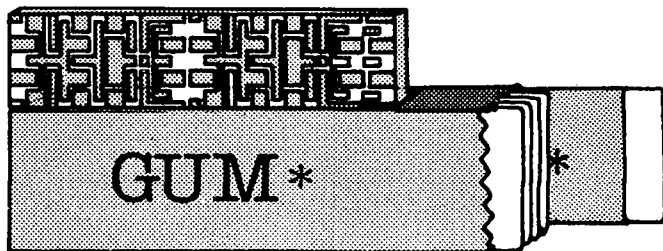
Memory can be ROM or RAM. ROM is Read-Only-Memory. The CPU can only ask for what's stored in ROM. ROM data cannot be changed. Special instruments, equipment and well-trained people have permanently "stored" information in the ROM of your computer. The BASIC language instructions and many other operating procedures are often stored in the ROM. (Look up BASIC in the glossary on page 12). About 12K of space is required for the BASIC language storage in many small computers.

RAM is Random-Access-Memory. This is the memory that can be used to store information you type into the computer and "randomly" recall. That is, any byte of the memory is available for both storage and recall at any time. RAM is generally the add-on type (16K, 32K, 48K, etc., sizes).
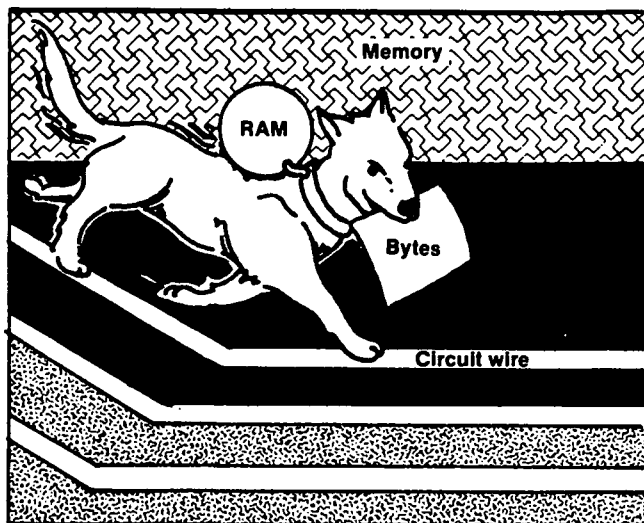
Keyboard

The keyboard is the tool you will use to communicate with the computer. The keyboard serves the functions of letting the operator select and construct instructions to enter into the computer and to type information and data for desired programs.
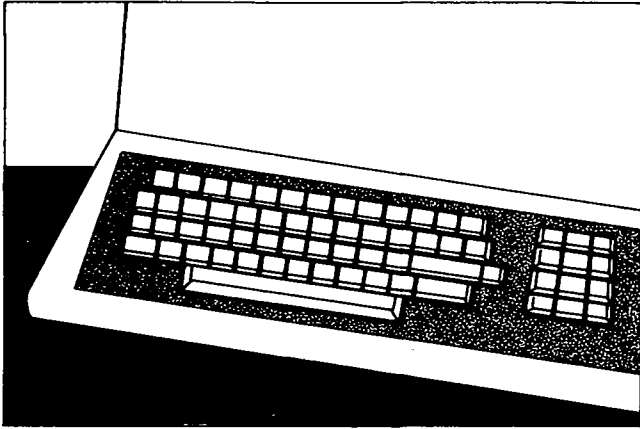
Video Display

The video display is the direct opposite of the keyboard for it is the computer's means of "communicating" to the operator. The video display is a cathode ray tube (CRT) just like a black and white television that gives a visual display of the computer's output.

With special small electronic adapters and converters, any TV set can serve as a video display for the computer, but the quality is not as good as regular television viewing.
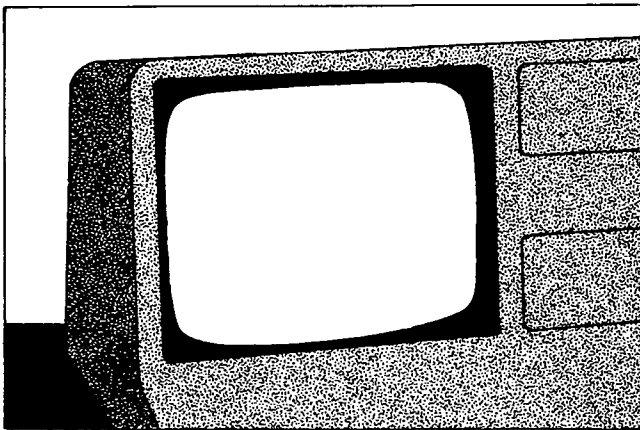
Printer

In order to have permanent records of computer output, you must have a printer. With the video display, the computer output is visible only as long as you keep it on the screen. With a printer you can have a permanent printed copy of the computer output. Many types of printers are available. Some electric typewriters can be adapted and connected to a computer.
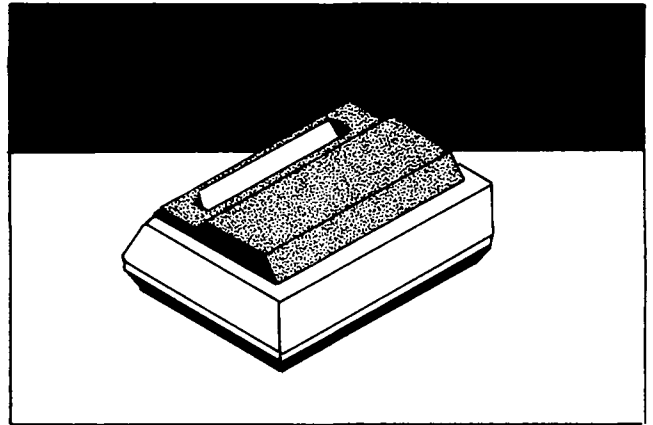
Storage Systems

Many microcomputers use magnetic storage media for permanent external storage of data, programs, and various types of files. There are a variety of different storage devices, but for this project you will be using either a cassette tape or a diskette.

Cassette Tapes

Cassette tapes are an economical method for the microcomputer to store information. These tapes have magnetic impulses that the computer is able to interpret. If you were to listen to the tape it would sound like "static" or a high-pitched tone but the computer can interpret this "static."
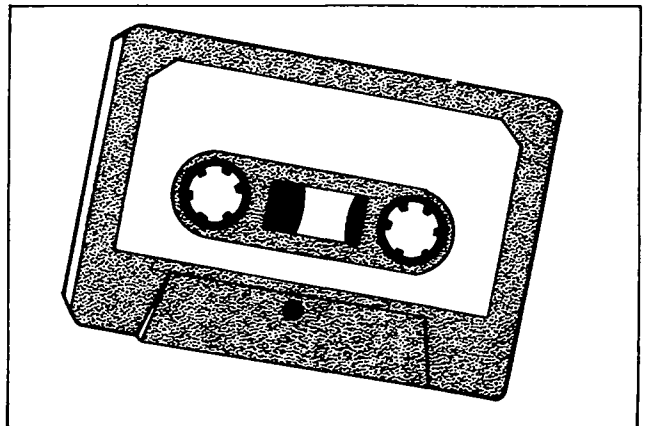
Cassette tapes used for digital computer data must be much better quality than the tapes used for music reproduction. Data are stored on a cassette tape at 500 to 1,500 bits of data each second. (Look up "bit" in your glossary on page 12.) Even the smallest flaw in the tape could produce a useless tape since the loss of only one bit would produce inaccurate information. The cassette tapes used with computers should be rated as "digital" quality.

To use a cassette tape with a microcomputer you must load the cassette into a tape recorder and the recorder must

be connected to the computer. You will need to study the manual for the computer you will be using for instructions on how to use the cassette tape. Correct usage is absolutely vital to your success with the computer.

Remember the following rules in using cassette tapes:
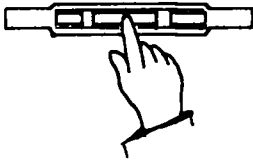
1. Do not touch the exposed cassette tape.
2. Keep cassette tape within a temperature range of 52°F to 125°F.
3. Keep cassette tape away from electrical or magnetic fields.
4. Store cassette tape in a plastic box for protection from dust, dirt, etc.

Diskettes

Diskettes are similar to cassette tapes in that storage of information is performed magnetically. The difference is in the form. Diskettes are round, flexible disks that are magnetically coated. Diskettes have more storage capacity than cassette tapes. The diskettes come in 8-inch floppy diskettes and 5¼-inch mini floppies; even smaller floppies are now in development.

The diskette looks like a small phonograph record. It is inserted into a "slot opening" in the "disk drive," the small flap door is closed, and the computer is then ready to respond to your commands. Each computer has a unique system; so you will need to study the manual for your computer to learn how to use the diskette.
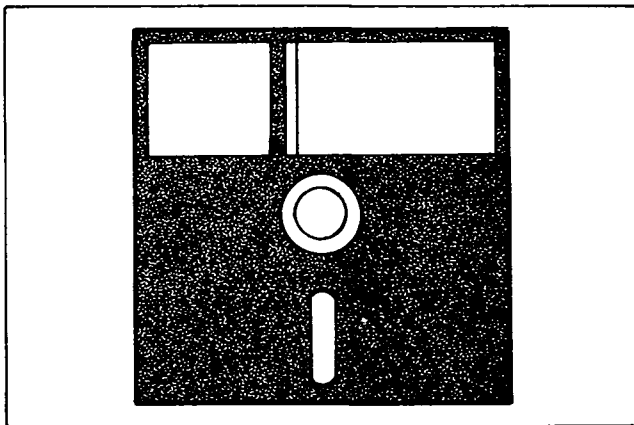
Diskettes must be handled carefully or they will not operate correctly. Observe the following rules of use:
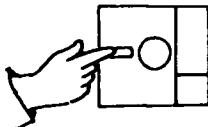
1. Do not touch exposed parts of the diskette.
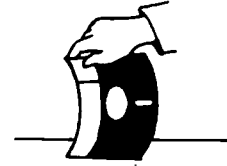
2. Do not bend or crimp a diskette.
3. Keep diskette within a temperature range of 50°F to 125°F.
4. Keep diskette away from electrical or magnetic fields.
5. When inserting the diskette, insert gently but fully into the drive position. Be sure the diskette label is positioned according to instructions for the computer you are using.
6. Store your diskette in a cover envelope to protect it from dust, dirt, etc.

Let's Review

Try and answer these questions. If you have trouble, reread the section "Understanding the Microcomputer." Then try again.

1. What is MEMORY? _____

_____

_____

2. Memory can be divided into two types:

_____ and _____

3. What is the difference between the two?

_____

_____

_____

4. What part of the computer do you use to tell the computer what to do? _____

_____

5. The video display is the way the _____

_____

communicates with you.

6. What is the printer's function? _____

_____

_____

7. What part of the computer is its BRAIN?

_____

8. What does a computer use for internal storage of data?

_____

9. What does a compter use for external storage of data?

_____ and _____

10. Look at the illustration below. Can you label each of the blank circles correctly? (If you need help, go back to page 3.)
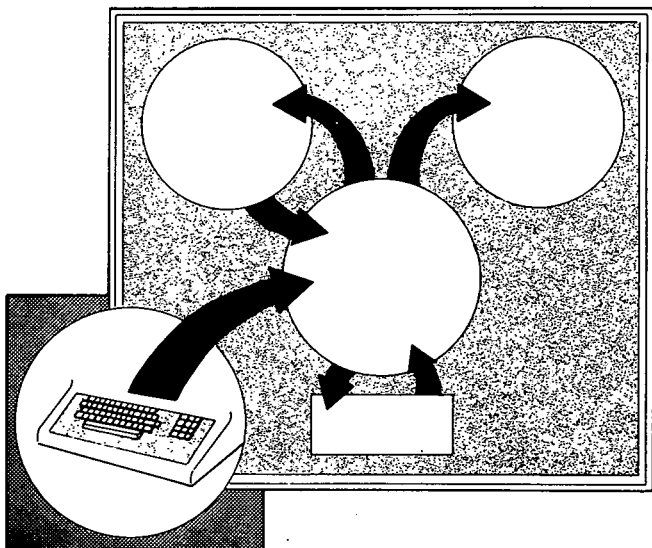
Are You Ready?

If you have carefully read this booklet up to this point, you should be ready to interact with your computer. The keyboard is the first thing you start with.

The keyboard is important because it is the way you tell the computer what you want it to do. You should carefully study the basic keyboard keys in the following section. To operate the microcomputer properly, you need to know where each key is located on the keyboard and what each one does. Each brand of keyboard has different types of keys. To find more information on the keys for a specific machine, read the manual for your computer.

The Keys of a Command Keyboard

You are now ready to learn the basic keys of most computers. The best way to get first-hand experience is to find the keys on your keyboard. Now, go to the computer, if one is available, and find each key on this page.

"Equal" (S)*

"Subtraction" key

"Multiplication" key(S)*

"Back Space" key

"Addition key" (S)*

"Period" or "Decimal" key

"Divide" key

or "Exponential" key

 "Parentheses" key (S)*

 These are the numbers "one" and "zero" which are two of the 10 numbers on keyboard.

 These are the letters "I" and "O" which are two of 26 letters on keyboard. Notice the difference between the two letters and two numbers.

 "Enter" key or "Return" key

"Shift" key used with (S)* keys

This is called the "space bar" key. If a blank is needed in a certain spot while typing, press the bar.

*(S) means you must press the shift key while pressing that key to produce the symbol desired.

Using the Keyboard

You, the operator, place information into the computer by typing on a keyboard. Follow the arrows in Figure 3 on page 3 to see how this information is distributed. The commands or instructions you type in or have sent in by the cassette tape or diskette cause the CPU to start working. The CPU sends the information to the MEMORY, where it is stored. Later, when you give the proper commands, the CPU gives you the results on the printer or the video display. Since the memory is limited in size and loses information stored in it when the power is turned off, the cassette tapes and diskettes are used for saving and storing information when not being used in the computer.

Let's Review

1. What device sends data to memory to be stored? _____

_____

_____

2. What device is used to place human information into

the computer? _____

_____

Using the Computer as a Calculator

Using the computer as a calculator is a good way to become familiar with your machine. It is one of the easiest operations for learning to use the computer. Find the manual or instructions that explain the computer you are using and read the steps for its proper use. If you have questions ask your leader.

Math Symbols

Here are six math symbols used for calculations:

Symbol	Meaning	Example
+	Addition	$3 + 1 = 4$
–	Subtraction (minus or take away)	$6 - 2 = 4$
*	Multiplication (asterisk)	$3 * 2 = 6$
/	Division (slash)	$6 / 3 = 2$
↑ or ∧	Exponentiation (raising a number to a power—Some machines will print a [instead of a ↑ or ∧ but the computations will be the same.)	$2 ↑ 3 = 8$ $3 ↑ 2 = 9$ $2 ∧ 3 = 8$
( )	Parentheses (to enclose a group of computations)	$(3 + 2) = 5$

Order of Operation or "Hierarchy"

When several math symbols (+ ,-,*,/) are used, the computer uses a priority rule to do the computations. Here is how the computer will work, going from first to last priority.
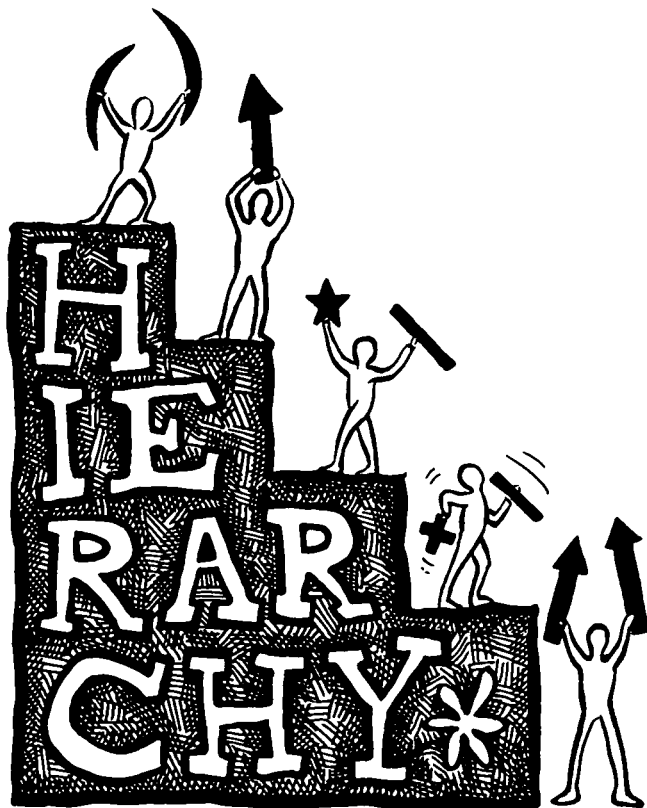
Priority		Operation
1st	( )	Any combination enclosed in parentheses is solved first.
2nd	↑ or ∧	Exponentiation is the second priority.
3rd	* /	Multiplication and division are next priority.
4th	+ −	Addition and subtraction are done last.
5th	L to R	For two or more of the same symbols together, computations are done from left to right.

Example: $2 * 5 + (3 * 4) - 3 \uparrow 2 = ?$

First, the computer solves the two numbers in the parentheses, that is:
$2 * 5 + (12) - 3 \uparrow 2 = ?$

Second, the computer solves the exponent:
$2 * 5 + 12 - 9 = ?$

(Notice the ( ) are not needed anymore.)

Third, the computer performs the multiplication and division moving from left to right:
$10 + 12 - 9 = ?$

Fourth, and finally, the computer does the addition and subtraction moving from left to right, to give the final answer:
$22 - 9 = 13$

Doing Calculations on the Computer

Try these calculations on the computer. After you have a prompt symbol > or - (press the **ENTER/RETURN** key for it), tell the computer to calculate by typing **PRINT** and the computations you wish. Then press the **ENTER/RE-TURN** key. The computer shows the answer and the ready message. If an "error" message occurs, don't get alarmed. Try again.

Examples

1. Type: **PRINT 3 - 2**
   Press: **ENTER/RETURN**
   The computer responds: 1
   The ready prompt will appear.

2. Type: **PRINT 3 * 5**
   Press: **ENTER/RETURN**
   The computer responds: 15
   The ready prompt will appear.

3. Type: **PRINT 3 ↑ 2**
   Press: **ENTER/RETURN**
   The computer responds: 9
   The ready prompt will appear.

4. Type: **PRINT (3 * 5)/(2 + 3)**
   Press: **ENTER/RETURN**
   The computer responds: 3
   The ready prompt will appear.

Work the following problems in your head and place your answers in the column. Then let the computer work the problems and compare answers. (Note: Extra blank spaces before or after the math symbols may not cause any errors depending on the machine.) Remember to press **ENTER/RETURN** each time you wish the computer to do something.

Type	Your Answer	Computer's Answer
PRINT 5 * 40/10	_____	_____
PRINT 5 + 40/9	_____	_____
PRINT (50 + 50)/10	_____	_____
PRINT 10 + (20/4)	_____	_____
PRINT 4 * 2 ↑ 3	_____	_____
PRINT 1 ↑ 5	_____	_____

PRINT 3 ↑ 2 * 4 _____ _____

PRINT 2 + (3 * (2 ↑ 1))/3 _____ _____

The proper use of parentheses in mathematical statements is very important when using the computer. Look at the following example where we want to compute an answer of 6. Notice the answer is 6 if the parentheses are placed correctly. Without the parentheses the answer is 5.

EXAMPLE: 2 * 2 + 1 = 5
2 * (2 + 1) = 6

Now try this problem. Revise the mathematical statement below to compute an answer of 15. Do this by putting the parentheses in the right places. Remember the order of hierarchy.

1 * 6/2 * 9 − 4 * 1

Now that you have put the parentheses where you think they should go, enter the equation into the computer (remember to put a **PRINT** statement before your equation) and check your answer.

Try some more examples on your own. There is a limit on the size of numbers you can use and how many consecutive computations you can put on one line. As you learn more about the computer, you will learn these limits. Just keep it simple for now.

Your Examples   **Computer's Answers**

_____   _____

_____   _____

_____   _____

_____   _____

If you would like some words in the answer, try the following procedure using quotation marks and a semicolon.

Type: **PRINT "THE ANSWER IS"; 4 + 5**

Press: **ENTER/RETURN**

The computer will show: **The ANSWER IS 9**

You can put whatever words or symbols you wish between the quotation marks. Always be sure to put the semicolon in the position shown.

Think of the **PRINT** statement as a camera. The information you are "photographing" is what you are printing. Your end result is a reproduction of the desired information.

Put your name in quotes and your age after the semicolon. Watch the information appear on the screen. Now try two examples on your own.

Your Examples   **Computer's Answers**

_____   _____

_____   _____
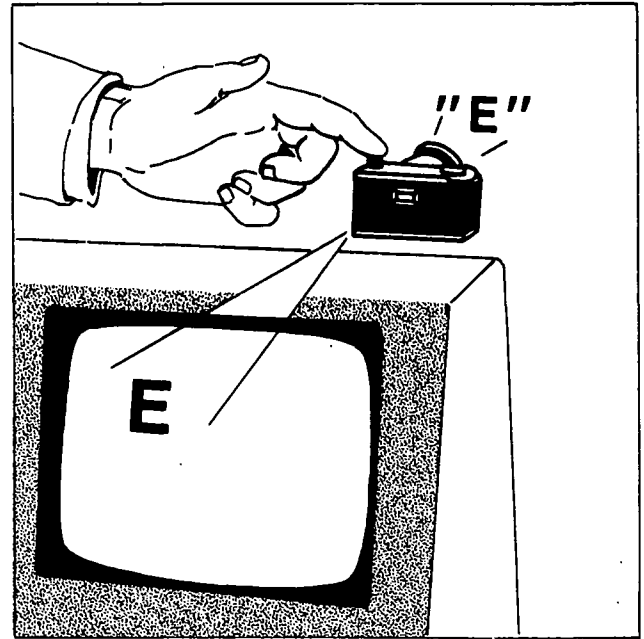
Let's Review

The computer "understands" in a way that is different from human understanding. Many humans will think that the answers to these arithmetic problems are the same. Try them on the computer.

1. **PRINT 10 + 20 / 4**
Your answer = _____

Computer's answer = _____

2. **PRINT (10 + 20) / 4**
Your answer = _____

Computer's answer = _____

If you did not get the same answer, why? (Think about hierarchy or order of operations.)

3. How will the computer solve this problem?
PRINT 5 * 3 ↑ 2 + (10 − 4) _____
First operation the computer will solve =

_____

Second operation the computer will solve =

_____

Third operation the computer will solve =

_____

ANSWER = _____

10

Learning More About What's Inside the Black Box

What happens inside the "black box" of the computer deserves a brief summary. This material should give you some insight as to how a computer works so you can better understand the computer and be prepared to read other manuals and publications on computers.

To start with, you must realize that a computer is not a "thinking" machine, nor does it have any "magical" capabilities. The computer must be "instructed" on every step it makes. Everything a computer does has been predetermined by a human. This is called "programming." The computer's main characteristics are **speed** and **precision.** It can also store information, although storage capabilities are limited at this time. Enormous storage capabilities are now becoming possible, and soon programming can enter a new dimension.

The "Program" or "Your Orders"

A computer "program" is a set of instructions prepared by a person who directs the computer to do desired calculations, information sorting, or word processing. It is necessary that the computer be programmed in the desired sequence. The word "sequence" means that your program or directions to the CPU must be written so that the operations logically follow one another.

Bits and Bytes

Being an electrical device, the computer recognizes only two electrical conditions—ON or OFF; that is, a positive or negative charge, or the presence or absence of a voltage. A one (1) and a zero ($\emptyset$) are used to denote these two conditions. All *letters, numbers, symbols, etc.,* used in a computer are represented by one's and zero's. This is called a "binary" system (meaning two parts). Each electrical signal representing a one or zero is referred to as a bit from the words BInary digiT. For most small computers, eight bits are used to represent each number, letter, character, etc. (Some new "small" computers and all large computers use 16 or 32 bits.) These eight bits together are called a byte.

The memory and operating capacity of a computer is expressed in terms of thousands of bytes with K representing 1,000. Thus, for example, 16K size means that the internal memory is capable of receiving, storing and manipulating approximately 16,000 characters (letters, numbers, "spaces," symbols, etc.). The microcomputers are expandable to 32K, 48K, 64K and even greater internal memory. For many games and personal uses, 16K or 32K may be adequate. However, for business uses, 48K or 64K is necessary and even larger is preferable. External "diskette" storage devices can add large amounts of readily accessible storage "memory."

The large institutional or corporate computers will have millions of bytes of available internal memory and virtually unlimited external storage and usable "memory" in the form of 12-inch magnetic disks and/or 1-inch wide
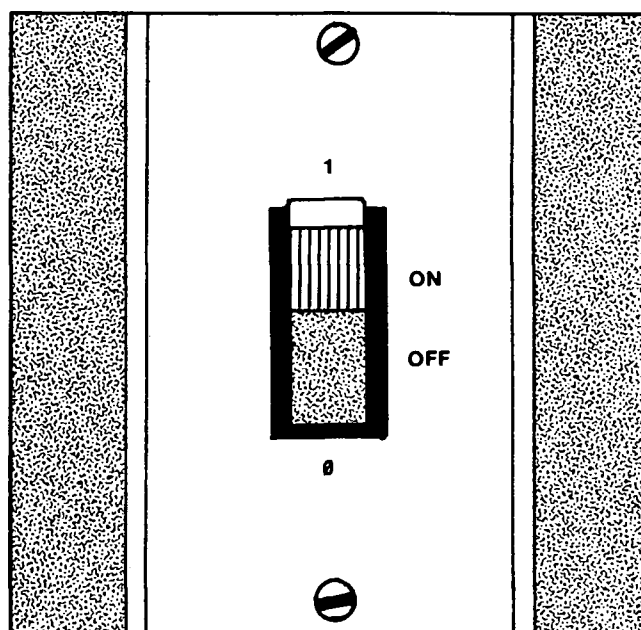
by 12-inch diameter rolls of magnetic tape. Access of data on disks is very fast whereas tape is rather slow if the equipment has to unroll several hundred feet of tape to find the desired data.

Let's Review

1. A _____ must instruct a computer to do everything it does.

2. What is a computer program? _____

_____

_____

3. What are the two numbers that represent ON and OFF in the binary system? _____

_____

4. What does "K" represent in computer talk?

_____

Using Cassette Tapes and Diskettes to Run Programs

Now that you have become familiar with the computer by doing the mathematical computations you are ready to "run programs."

Be sure to observe all the rules for taking care of the cassette tapes and diskettes. (See page 6 if you need to refresh your memory.) If you are learning about

computers with a group, your leader or instructor will have cassette tapes or diskettes for you to use, or you may already have your own cassette tapes or diskettes.

If you are not familiar with the proper operation of microcomputers, then refer to separate instructions or the manuals on how to operate a microcomputer and how to use the cassette tapes or diskettes. Your next step is to load the diskette or cassette tape and start the program running. Your program will ask you many questions and tell you how to answer them. Choose your best answer and enter it properly into the microcomputer.

Now, press **ENTER/RETURN.** Follow all the instructions and remember to press **ENTER** or **RETURN** each time you wish the computer to do something. Good luck!

For More Information

- Read the instruction manual that accompanies the microcomputer that you have been using. This is one of the best sources for extra information.

- Ask your local gas, electric, and water companies if their records are computerized and how they use computers to do work. Take a group tour, if possible. Ask about careers related to the computer.

- Check with your principal to see if any computers are used at your school. Ask to see these at work. Find out how computers help with the administrative work of the school.

- Ask your parent if his/her company uses computers. Find out how.

- Get university, college, or technical school bulletins. Find out what degrees the schools give in computer science.

- Ask your counselor how you can prepare yourself for a career with computers.

Demonstrations and Illustrated Talks

Give a demonstration or illustrated talk on computers to help others learn.

- Demonstrate how to load and unload a diskette or cassette tape and how to care for it.

- Show how to use the computer to run a complicated mathematical computation.

- Research computer science careers and tell what you have learned to your 4-H group or any group.

- Give an illustrated talk on what goes on "Inside the Black Box."

Glossary

The definitions below introduce you to selected computer terms. Many of these words are used in this project book. However, the glossary also contains a few additional words not mentioned in this project to broaden your knowledge of computer terms. Scan the glossary for words that you don't understand and read the definitions carefully.

BASIC—Beginners All-purpose Symbolic Instruction Code, a simplified "language" using numerous common English words as commands and instructions to tell the microcomputer what to do.

BAUD—Denotes the rate of signal transfer in bits per second. Three hundred baud is approximately 63 characters/second. The typical baud is 300, but it may range up to 600 or 1,200.

BIT—The basic electronic signal, "voltage" or "no voltage" condition (ON or OFF), to which all information is coded.

BYTE—Refers to a certain number of bits (8 for most microcomputers) grouped together to represent coded numbers, letters, characters, etc.

COMPUTER—A machine that performs high-speed data calculations and manipulates data according to a set of coded instructions.

DISKETTE—Generally refers to a "floppy" diskette used with microcomputers to store software and data outside the "memory." Two sizes are standard at this time: 5¼- and 8-inch diameter. Other sizes are possible in the future.

DISK DRIVE—The hardware item that receives the floppy diskette and enables recording and reading of the information between the microcomputer and diskette.

HARDWARE—The microcomputer equipment, including all input and output devices (disk drives, printers, etc.).

HIGH-LEVEL LANGUAGES—Powerful languages that have to be transformed to machine language for the computer to use. Languages, such as BASIC, FORTRAN, COBOL, PASCAL, PL/1, etc., are high-level languages.

K—Stands for approximately 1,000 bytes.

KEYBOARD—The means of human communication with the microcomputer.

MACHINE LANGUAGE—The number and letter codes that the electronics of the microcomputer "understands." It is concise and fast. Machine language is the high-level language converted for the computer to understand.

MEMORY—The electronic components in the microcomputer that receive, store, and allow recall of computer-related information.

MODEM—The electronic device that interfaces the microcomputer to the telephone for transfer of software, data, etc., with electrical signals.

PRINTER—A device for producing a hands-on, readable copy of results from the computer. There are several makes and models of printers available.

PROGRAM—A set of instructions or steps telling the computer how to handle a problem or task.

RAM—Acronym for Random-Access-Memory. Known as the main or internal memory. This memory is built into microcomputers for your software.

ROM—Acronym for Read-Only-Memory. Another form of internal storage not available to the user. This memory is specifically used for built-in programs.

SOFTWARE—The series of instructions loaded into the computer's internal memory that commands the computer on how to accomplish a problem or task, e.g., a program.

VIDEO DISPLAY—The "screen," technically a cathode ray tube (CRT).

Answers to Review Questions

Let's Review, page 6.

1. The ability to store data internally or within the computer.

2. RAM and ROM

3. ROM (Read-Only-Memory) data cannot be changed; RAM (Random-Access-Memory) data can be typed into the computer and can be randomly recalled.

4. Keyboard

5. Computer

6. Gives you a permanent copy of the computer output.

7. CPU

8. Memory

9. Cassette tapes and diskettes

Let's Review, page 8.

1. CPU

2. Keyboard

Let's Review, page 11.

1. Human

2. A set of instructions prepared by a person who directs the computer to do desired calculations, information sorting or word processing.

3. 1 and 0

4. 1,000

Introduction to Computers: Section II
Learning About Programming

In Section I: "Learning About Computers" you learned how the parts of the computer function, how to operate a computer keyboard, how to do calculations on a computer, how to take care of cassette tapes and diskettes, how diskettes and cassette tapes store information, and how to load and run programs from the cassette tapes and diskettes. In this section you will learn about programming a computer.

In Section I we discussed the word "program." Do you remember the meaning of a program? Let's review. A program is the statements and commands stored in the computer by the operator. Programs must be written to the specific format for each type of computer. If you do not follow the format to the letter, the computer will not understand. This is one characteristic that makes each type of computer unique.

In this section you will be asked to type and run programs. The programs are already written for you in ordinary language. What you must do is look on pages 40 to 45 and select the computer language—the matching computer commands or keys—for your unique machine. You must type in the computer commands letter by letter. To type the keys, you simply locate and press the correct ones. Following the exercises on commands and their functions, you will complete activities in which you write your own programs.

What You Will Learn in This Section

- How to communicate with the microcomputer
- How to make information appear on the video screen
- How to write, run, and list a program
- How to use input and produce output in various ways
- How to recongize specific computer instructions

What You Will Do in This Section

- Type commands
- Write programs
- Run programs
- Change short programs
- Give a demonstration on a computer
- Keep a record of your 4-H computer project

Computers Are All Around Us

Computers are used widely. You can find them in banks and businesses, in many government offices, in schools, and in some homes, maybe yours. You can even find them in typewriters, microwave ovens, cars, and wristwatches.

Where have you seen computers used in your community?

_____

_____

_____

_____

_____
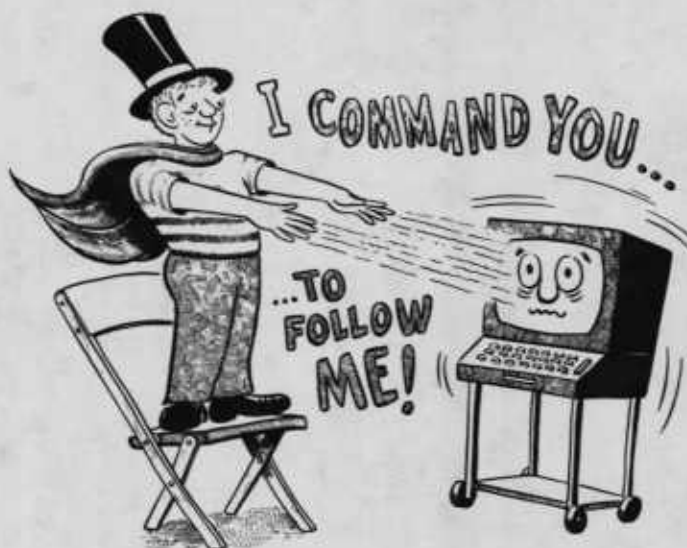
You, a Programmer?

The following activities will let you type short programs into the computer and see what happens. By observing the results of certain commands, you will learn how to program the computer. Each activity shows you a new command word and asks you to apply the command. Be sure to learn how these command words work since you will be using them to write programs in this computer project. The activities in this project book use the BASIC computer language—the language used by most micro-computers.

Before You Begin

First you must know the type of computer you will be using. Then you must find the computer keys or commands for your computer that match the English instructions below. Use the list on pages 40 to 45. When you find the proper key or command for each of these instructions, write the names in the spaces provided. If a computer is available, find the keys on the keyboard. The four instructions will occur quite frequently as you work through this project. Remember the key or command that matches each instruction. Now, look up these instructions:

- stop execution key: _____

- clear key: _____

- enter/return key: _____

- new program command: _____

The following is a description of important keys on the keyboard and symbols that appear on the video display (screen). You will use these often during this project. If a computer is available, locate the keys and symbols. Remember, you will have to check the list on pages 40 to 45 to find some of these keys.

Key or Symbol	Use
stop execution key	A key (or keys) that stops the computer and tells it to wait for a new command.
clear key	A key (or keys) that clears the video display but does not erase information in memory.
enter or return	A key that causes the computer to respond to any statement or information just typed (used as **ENTER/RETURN** in the rest of this project book).
> or **OK** or]	These symbols are called the prompt and mean that the computer is ready to receive a new statement or command. Computers have different prompts. These are some examples. The prompt appears on the screen after you press the **ENTER/RETURN** key.
_ or ■	The underline is called the cursor and shows you, on the screen, where you will type the next character. Some micro-computers use a blinking cursor. Also, the cursor could be a white rectangle rather than an underline.
←	The left arrow is the backspace key on many microcomputers and is handy to correct errors. On some equipment it erases each character you backspace over. Just type or space again, and you are on your way.
"	Quotation marks
,	Comma
;	Semicolon
@	"at" symbol
=	Equal key (S)*
−	Subtraction key
*	Multiplication key (S)*
+	Addition key (S)*
.	Period or decimal key
/	Divide key

15

Key or Symbol	Use
↑ ∧	Exponential key
>	Greater than
<	Less than
1 0	These are the numbers one and zero, which are two of the 10 numbers on the keyboard.
I O	These are the letters I and O, which are two of 26 letters on the keyboard. Notice the difference between the two letters and the two numbers.
shift	Shift key is used with (S)* keys.
space bar	This is called the space bar key. If a blank is needed in a certain spot while typing, press the bar.

*(S) means you must press the shift key while pressing that key to produce the symbol desired.

Activity 1. Your First Program

You will now learn how to clear the video screen; print words onto the video; go to a line number; and use the list, end, new and run commands.

1. First, you may need to power-up the computer and obtain the prompt indicating the BASIC language is ready to use. (Check the operations manual for your computer.) Then prepare the computer for a new program by pressing the stop execution key, clear key, **ENTER/RETURN** key; typing the new program command and pressing the **ENTER/RETURN** key. (For example, for one type of computer you may press **BREAK, CLEAR, ENTER:** type **NEW** and **ENTER.**)

2. Locate the following instructions in the list on pages 40 to 45 and see how specific commands or statements for the computer are written. (See *Sample Program* below. Remember, this is an example for one type of computer. Yours may be different.)

Instructions	Sample Program
10 Clear the screen	10 CLS
20 Print to video "your name" (Put your name between the quotes.)	20 PRINT "your name"
30 End of program	30 END
Run the program	RUN

Now do the same program for your machine. Look up the various computer commands and write the proper statements and commands for your machine. You may need to refer to the instruction manual for your machine.

Instructions	Write Your Program
10 Clear the screen	10
20 Print to video "your name" (Hint: Put your name between the the quotes.)	20
30 End of program	30
Run the program	Run

3. If a computer is available, type your program into it. Type **RUN** and press **ENTER/RETURN.** What happened? Let's review the steps that occurred. Typing the command word **NEW** tells the computer to forget the old program, if there was one, and to receive a new program. The clear screen command clears the video display. Your name appears on the top line as a result of the **PRINT** command. **END** signals the end of the program. The numbers identify each command or statement line and the order of execution. **RUN** causes the computer to execute the program.

4. If you have forgotten what your program looks like, press the stop execution key, press the clear key, type **LIST**, and press **ENTER/RETURN.** The program that is stored in the computer will appear.

5. Now retype line 30 as follows:

30 GO TO 20

Press **ENTER/RETURN**, type **RUN**, and press **ENTER/RETURN.**

What happened? Your name appears on all lines repeatedly at the left-edge of the screen. There is a slight flicker as the computer prints your name over and over, going from line 30 to 20 and back to line 30. This is caused by the statement **GOTO,** which makes the computer repeat line 20 over and over.

6. The only key that will stop the program is the stop execution key. Try pressing it. The prompt symbol appears at the bottom and lets you know the computer is ready to receive another command or statement.

17

7. You could put in a new name on line 20. Try it. Type:

20 PRINT "new name"

and press **ENTER/RETURN**. Type **RUN** and press **ENTER/RETURN**. The new name appears. Notice that by typing an existing line number with new information following, you replace the old information with new information, whereas a new line number will add another line in numerical order.

8. Add the following lines and run the program:

20 PRINT "new name"
22 PRINT "your address"
24 PRINT "your city, state, zip"

What happened? _____

_____

_____

9. To print your name and address only once, retype line 30 as follows:

30 END

Press **ENTER/RETURN**. Type **RUN** and press **ENTER/RETURN**.

10. Try some other names and addresses by retyping lines 20, 22, and 24.

What have you told the computer to do? _____

_____

_____

When could you use the **PRINT** command? _____

Are You Ready to Write Your Own Program?

1. Type the new program command and press the **ENTER/RETURN** key.

2. Write a short program to clear the screen, print the day, month and year on one line and run the program.

Write your program below. Remember to include line numbers beside each line.

_____

_____

_____

_____

3. Now type your program into the computer and run the program. If the day, month and year do not appear on the screen, then type **LIST** and press **ENTER/RETURN**. Check for your mistake and correct it by typing the line over. Did you get information from the previous program? If so, remember to type **NEW** when starting a new program.

Activity 2.   Punctuation , ; : It Changes Things!

You will learn the importance of the comma, semicolon and colon (, ; :) with the print to video instruction.

1. Prepare the computer for a new program by pressing the stop execution key, clear key and **ENTER/RETURN.** Type the new program command and press **ENTER/RETURN.**

2. Locate the following instructions in the table, and write the commands or statements for your computer in the spaces to the right of the instructions.

Instructions   **Write Your Program**

1Ø Clear the screen   _____

2Ø Print to video "your name"   _____

3Ø Go to line 2Ø   _____

Run the program   _____

No punctuation after **PRINT** " " causes your name to be printed how?

_____

3. Stop the program and clear the screen. (Remember how?)
Type in a new line 2Ø by adding a *comma* at the end:

   2Ø PRINT "your name",

Run this program. Your name will be printed in how many columns? _____

4. Stop this program. Type a new line 2Ø by adding a *semicolon* in place of the comma:

   2Ø PRINT "your name";

Run this program. Your name will fill the screen and may "march" left or right, depending on the spaces in your name.

Why? _____

_____

5. Stop the program and add a few *spaces* to your name between the " ", such as:

   2Ø PRINT "your name ",

Then run the program. What is the difference? _____

_____

6. Stop the program and type a new line 2Ø with a *colon* and another **PRINT** command on the same line:

   2Ø PRINT "your name":PRINT "your address"

Run this program.
What does the colon permit you to do? _____

_____

7. Stop the program and type a new line 2Ø with multiple commas on the same line.

   2Ø PRINT "your name", "your favorite food", "your weight"

Run this program. Then press the stop execution key.
What do the multiple commas produce on the video display?

_____

_____

8. Stop the program and type a new line 2Ø with multiple semicolons on the same line. Insert your favorite number between the quotes.

    2Ø PRINT "your favorite number"; "your favorite number minus one";

Run this program. Press the stop execution key. What do the multiple semicolons produce on the video display?

_____

_____

How would a single semicolon after **PRINT** " " cause your name to be printed?

_____

_____

Are You Ready to Write Your Own Program?

1. Prepare the computer for a new program.

2. Write a program to clear the screen and print your name and city on one line in columns. On the next line print your favorite hobby and then your birthday. The video display should look as follows:

    your name   your city
    your hobby   your birthday

Write your program here. Remember to write the line numbers beside each line.

    _____

    _____

    _____

    _____

3. Now type your program into the computer. Type **RUN** and press **ENTER/RETURN**. If the program does not work, press the clear key, type **LIST** and press the **ENTER/RETURN** key to see your program and check for a mistake. To correct a mistake, retype the line number and a new or corrected statement.

The Importance of Line Numbers

The line numbers you have been using, 10, 20, 30, 40, etc., are like mailboxes. Each one holds or stores information. You could have used the numbers 12, 13, 16, 17, 18 or 300, 330, 360, 361, etc. The line numbers are not a part of the commands you give the computer.

EXAMPLE:
```
10   CLS
12   PRINT "your name"
14   GO TO 12
```

Line numbers are mailboxes to "store" information.

Command words tell the computer what to do in the sequence of line numbers.
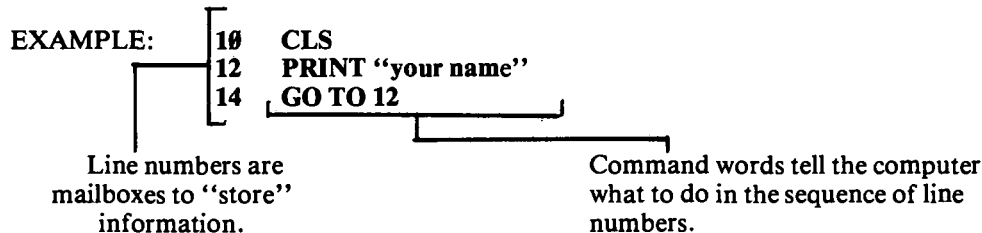
Frequently numbers will be omitted between numbered lines so that other lines of information may be added later. Usually line numbers will increase by 10, to allow you to go back and add extra information if needed. The computer automatically arranges the lines in sequence beginning with the smallest number and ending with the largest number. It "executes" the commands in the same sequence, unless a special command, such as **GOTO**, tells the computer to "jump" to some other line number.

Let's Review

You have used lots of new words and symbols to communicate with the computer. Stop for a moment and write the meaning for these computer commands or statements.

CLS or HOME _____

GOTO _____

PRINT " ", _____

PRINT " "; _____

PRINT " ": _____

If you had trouble remembering the meaning for these computer commands, refer to the first two activities. *Do not* go on until you know and understand these commands and keys.

21

Activity 3. Where Am I?

You will learn how to print in different columns.

1. Clear the computer for a new program. (Remember how from Activities 1 and 2?)

2. Locate the following statements in the table, and write them in the appropriate language for your computer in the spaces to the right of the statements. Then type your program into the computer!

Instructions	Write Your Program
1θ Clear the screen	_____
2θ Print in column 25 "your name"	_____
3θ Go to line 2θ	_____
Run the program	_____

Remember to press **ENTER/RETURN** key after each command.
With this program you can position your name anywhere on the line by putting a column number in the ( ).

3. Stop the program and clear the screen.

4. Type in a new line 2θ as above except changing the column 25 to some other number that is not larger than the screen width. Run the program. Do you see how you can move your name anywhere on the horizontal line?

Understanding the Print Command

The **PRINT** command is used as an "output" command to show results on the video display. There are several forms or versions of the **PRINT** command. Here are some of the easy ones.

PRINT TAB(n):

This command prints information at a specified tab or column position anywhere from θ (the left of the screen) to the end of the screen line. You put the desired postion number in the ( ). A blank space between the T's of **PRINT** and **TAB** is optional on some microcomputers and required by other microcomputers. Using the blank space is good for clear reading of the statement, therefore, its use is recommended. *Do not* put a space between **TAB** and ( ). For example:

PRINT TAB(3) "name";TAB(20) "address";
PRINT TAB(3) "city, state, zip code"

To put several items on the same line, use a semicolon after each entry and repeat **TAB(n)**.

PRINT

The command **PRINT** alone will cause a blank line to be added; it is useful when you want to put blank lines in your output on the video display.

Exercises Using the Print Command

1. Write on the video display outline below where the **PRINT** commands will print the words.

a. **1Ø PRINT "FRED"**

b. **1Ø PRINT TAB(2Ø) "SALLY"**
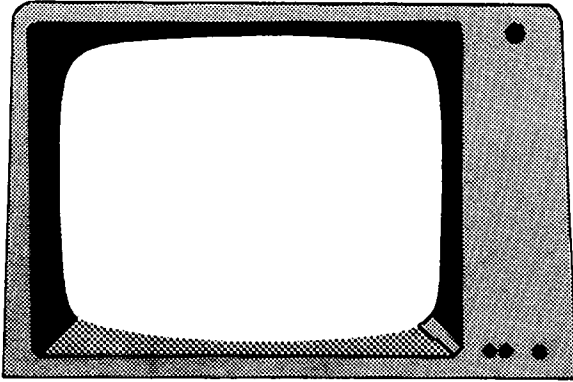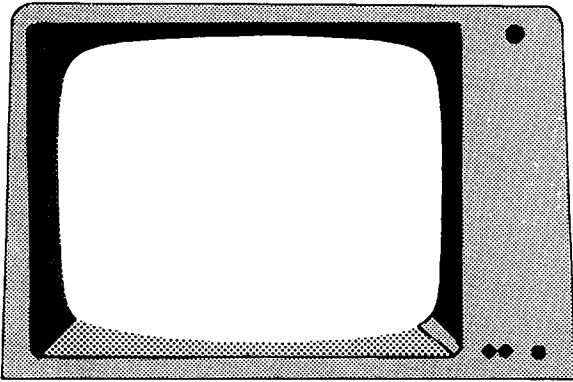
c. **1Ø PRINT "SALLY LEAPER"**
   2Ø PRINT "2468 SHORT STREET"
   3Ø PRINT "PARIS, KY 42471"
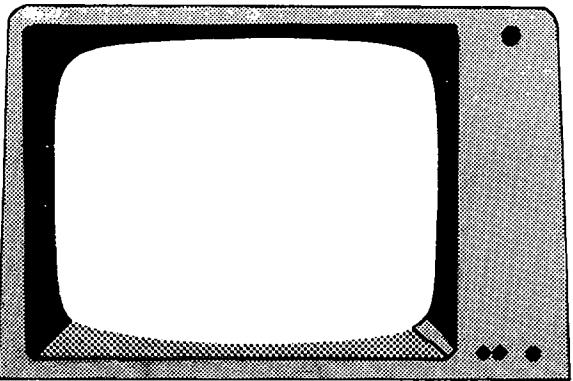
d. **1Ø PRINT "TIM ANGEL";TAB(15) "1Ø3 STATE ST"**
   2Ø PRINT TAB(1Ø) "MIDWAY, KY 4Ø671"
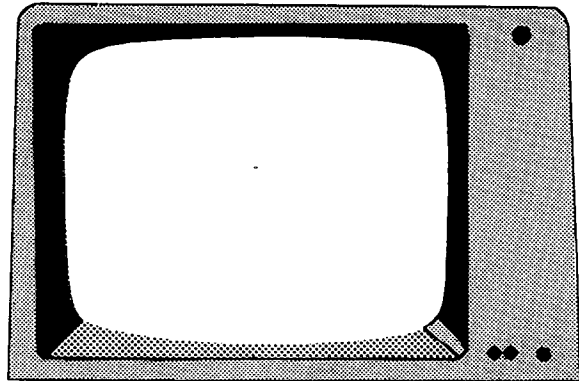
2. Write the **PRINT** commands that tell the computer to print the information below.

```
1    5                  3Ø        35
-----------------------------------------

     STUDENT'S NAME     AGE       GRADE
     --------------     ---       -----
1.   JERRY BROWN        1Ø        5
2.   SUZY JONES         12        7
3.   JOHN SMITH         9         4
4.   TOM NELSON         16        1Ø
```

Write your program here:

_____

_____

_____

_____

_____

_____

_____

_____

Run your program to see how you did. Did you write it correctly? _____

23

3. Think of some information (poem, verse, message, letter, etc.) you would like to program into the computer. Write it on the video display below. Then write **PRINT** commands to program the information into the computer.
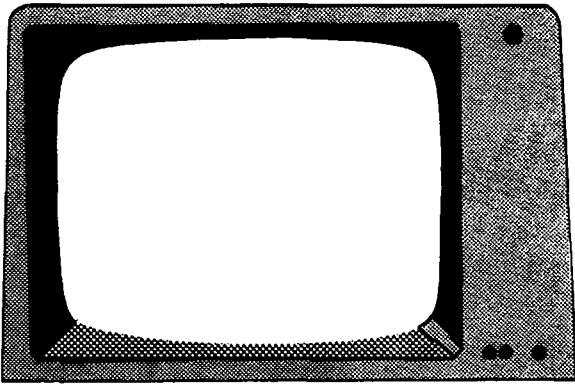
Write your program here:

_____

_____

_____

_____

_____

_____

_____

_____

Type the program and run it. Does it look the way you thought it would? _____ If not, rework it until it appears on the video display properly.

Activity 4. A Pinch Hitter!

> You will learn how to use a variable for characters, and a variable for numbers.

1. Clear the computer for a new program.

2. Locate the following instructions in the table. Write them in the appropriate language for your computer in the spaces to the right of the instructions.

Instructions	Write Your Program
10 Clear the screen	_____
20 A variable for character = **"your name"**	_____
30 Print to video the variable **for characters**	_____
40 Go to line 30	_____

Does this program look familiar? Where did you get the same results on the screen?

_____

What is different? _____

3. A variable is used to represent or "pinch hit" for something else. By using a variable, you can use one or two letters for a long name or other information. The symbol $ after the letter A tells the computer to expect letters or words. For humans, a dollar sign $ indicates money. The computer understands this symbol to mean that alphabetic letters are coming. Stop the program and retype line 30 as follows. Then run the program again.

    30 PRINT A$, (Use the comma.)

4. Then try:

    30 PRINT A$: (Use the semicolon.)
and run the program.

5. A letter without the $ symbol is a pinch hitter (variable) for a number, not a letter. Try the following lines and run the program.

    20 X = 1
    30 PRINT X

(Remember, **PRINT 3 - 2** was used in *4-H Computer Section I, Learning About Computers.)*

6. Can you think of some other examples using **A$ =** and **X = ?**

_____

_____

_____

NOTE: You can use any one or two letters, or a letter and a number, for a variable in most versions of the BASIC programming language. Only one-letter variables are shown here for simplicity. Can you think of some different variable names using two letters or a letter and a number?

_____

_____

Are You Ready to Write Your Own Program?

1. Prepare the machine for a new program.

2. Write a program to set the variables C$ and T$ equal to:

        C$ = "the name of the computer you are using"
        T$ = "the time you began using the computer"

Print the two variables so the output appears as below. Program the words **MACHINE:** and **TIME:** to start in column 6 on your video screen. The name of your computer and the time you began using the computer should start in column 18.

      MACHINE: the computer name
      TIME: the time

Write your program here:

_____

_____

_____

_____

_____

_____

_____

3. Type and run your program. If the program doesn't work (an error message occurs), press the clear key, type **LIST** and press the **ENTER/RETURN** key to see your program and check for a mistake. To correct the problem, retype the line number and a corrected statement. Run the program again.

Activity 5. Entering More Than Once

> You will learn the input command, how to input characters and numbers using variables, and how to use the word prompts with the input command.

1. Clear the computer for a new program.

2. Locate the following instructions and write them in the appropriate commands for your computer in the spaces to the right of the instructions.

Instructions	Write Your Program

10 Clear the screen

_____

15 Print to video the words
   "ENTER YOUR MESSAGE"

_____

20 Input with the prompt
   "TYPE IT HERE"; and a
   variable for characters

_____

30 Print to video a blank line

_____

31 Print to video the words
   "THIS IS YOUR MESSAGE"

_____

32 Print to video the variable for
   characters

_____

40 Print to video "- - - - - - - - - - "

_____

45 Go to line 15

_____

50 End of program

_____

Run the program

_____

    Do you see the **"TYPE IT HERE"** message on the video? There may be a prompt symbol following, depending on the type of computer. The computer wants you to type in some information. (Now type in your name or other message and press **ENTER/RETURN.**)
    The **INPUT** command causes the computer to pause and ask for some additional information. The information is stored in memory with the variable until you command it to be printed.

3. Stop the program, clear the screen, and run the program again for another input prompt.

4. Type your message again, but this time add a few spaces before or after your message and then press **ENTER/RETURN.** What changed?

_____

_____

5. Stop the program. Retype lines 15, 20, and 32 as follows:
     15 PRINT "ENTER YOUR NUMBER"
     20 INPUT X
     32 PRINT X

Type **RUN** and press **ENTER/RETURN**. The computer is waiting for data from the keyboard. There may be a prompt on the screen or the computer may be just waiting without a prompt. After the input prompt, type your favorite number and press **ENTER/RETURN**. Remember, variables without $ will accept only numbers from the user. What happened?

_____

_____

6. Stop the program. **LIST** the program. Retype lines 15, 20 and 32 as follows:

     15 PRINT "ENTER YOUR MESSAGE"
     20 INPUT A$
     32 PRINT A$

Type **RUN** and press **ENTER/RETURN**. After the input prompt, type your name or message. Press **ENTER/RETURN**. What happened?

_____

_____

7. Stop the program. **LIST** the program, retype lines 32 and 45 as follows:

     32 PRINT "OUTPUT",A$
     45 GOTO 31

Run the program. After the input prompt, type your name or message and press **ENTER/RETURN**. What happened?

_____

_____

8. Can you think of some uses for the **INPUT** command? _____

_____

9. Stop the program. **LIST** the program and retype lines 20 and 32 as follows:

     20 INPUT A$,B$
     32 PRINT A$,B$,A$

Run the program. After the input prompt appears type: **HI, THERE.** Make sure you place the comma to separate the two inputs. Press **ENTER/RETURN**. What happened?

_____

_____

10. Stop the program. **LIST** the program and retype line 15, 20 and 32. Type a new line 33.

     15 PRINT "ENTER NAME AND GRADE"
     20 INPUT X$,Y
     32 PRINT X$
     33 PRINT Y
     45 PRINT

Type **RUN** and press **ENTER/RETURN**. After the input prompt, type your name and your grade in school separated by a comma. Remember that the $ symbol after a letter indicates alphanumeric information—information containing letters and numbers. Without the $ symbol the numbers are the only data that the computer will accept. What happened?

_____

_____

Before You Write Your Own Program

1. Prepare your computer for a new program.

2. Locate the following instructions in the table and write the commands or statements for your computer in the spaces to the right of the instructions.

Instructions	Write Your Program
10 Clear the screen	_____
20 Input data using two variables for numbers	_____
30 Print to video one variable for numbers;" + "; additional variable for numbers	_____
40 End of program	_____
Run the program	_____

3. After the input prompt or once the machine is in a waiting state, type: **3,1**. Make sure you place the comma to separate the two inputs. Press **ENTER/RETURN**. What happened?

_____

_____

4. Now retype line 30 as below:

    30 PRINT X;" + ";Y;" = ";X + Y

Run the program. Input the numbers **3,1**. Make sure you place the comma properly. The output should look as below:

    3 + 1 = 4

Did you get the right output? _____

5. Stop the program and clear the video. Type **LIST**, press **ENTER/RETURN**. Notice line 30 with the **X + Y** at the end of the statement. Remember how we used the calculator in 4-H Computer Project I to find the answer to **X + Y**? For example, **PRINT 3 + 1** will compute and print **4** on the computer video. The statement above using X and Y as variables works in the same manner. The semicolons, as you should already know, display every item following one another on the *same* line. Now try writing your own program using the same ideas in this exercise.

Are You Ready to Write Your Own Program?

1. Prepare the machine for a new program.

2. Write a program with the input variables of X and Y. The values of X and Y are not given. You must input them with an input statement and enter them from the keyboard. Then compute and print the sum, difference, product and quotient of the two numbers X and Y with a title heading called **RESULTS**. Review the section "Before You Write Your Own Program" to help you solve the program. For example, the output would look like this if the inputs were 3 for X and 2 for Y.

    RESULTS
    5
    1
    6
    1.5

```
RESULTS

- - - - - -

3 + 2 = 5

3 * 2 = 6

3 - 2 = 1

3 / 2 = 1.5
```
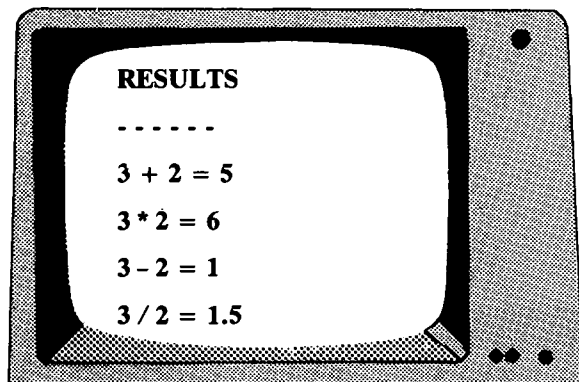
3. The program should accept the two inputs separated by a comma.

4. To help you write your program look at the following flowchart. It shows the order in which the computer will read and perform your program directions. (For an explanation of a few flowchart symbols refer to p. 39.)

```
        ┌─────────────────┐
        │      START       │
        └─────────────────┘
                 │
                 ▼
        ┌─────────────────┐
        │    Input the     │
        │ variables X and Y │
        └─────────────────┘
                 │
                 ▼
        ┌─────────────────┐
        │    Print the     │
        │    heading       │
        └─────────────────┘
                 │
                 ▼
        ┌─────────────────┐
        │   Compute and    │
        │ print the results │
        └─────────────────┘
                 │
                 ▼
        ┌─────────────────┐
        │      END         │
        └─────────────────┘
```

Write your program here:

_____

_____

_____

_____

_____

_____

_____

30
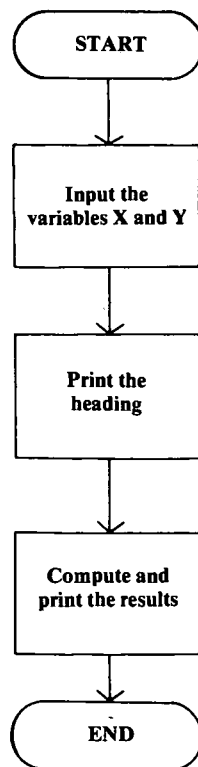
Let's Review

Stop for a moment and answer these questions.

1. What command word will show your program on the screen? _____

2. What does a $ symbol mean to a computer when you are using it after a variable in the commands? _____

_____

3. What does a **TAB(25)** mean to the computer when used in a **PRINT** statement?

_____

4. What program command allows you to enter data from the keyboard to the computer within a program?

_____

    If you had trouble with these questions, refer to the first activities. Do not go on until you know and understand the questions.

Activity 6.   Is It True?

You will learn the instruction: IF an expression is true THEN perform certain commands.

1. Clear the video and memory for a new program.
2. Locate the following instructions in the table. The sample program shows the proper commands for one computer.

Instructions	Sample Program
1θ Clear the screen	1θ CLS
2θ A variable for numbers equal to 1	2θ X = 1
3θ IF X equals 1 is true THEN print to video "TRUE"	3θ IF X = 1 THEN PRINT "TRUE"
4θ End of program	4θ END
Run the program	RUN

Now do the same program for your machine by looking up the instructions and writing the statements and commands. (Some machines will need additional lines for line #30.)

Instructions	Write Your Program
1θ Clear the screen	_____
2θ A variable for numbers equal to 1	_____
3θ IF X equals 1 is true THEN print to video "TRUE"	_____
4θ End of program	_____
Run the program	_____

Type your program into the computer. Type **RUN**. Press **ENTER/RETURN**. The program should print **TRUE** because the condition X = 1 is true. Type **NEW** when finished to get ready for the program below.

3. Try this program on your own:

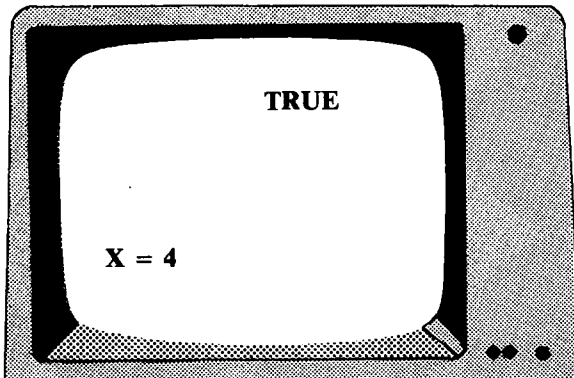| Instructions	Write Your Program
1θ Clear the screen	_____
2θ A variable for numbers equal to 4	_____
3θ IF X is greater then 3 THEN print in column 1θ "TRUE" (Hint: Look up the greater than symbol in the table.)	_____

32

**4Ø PRINT to video "X = " and the
variable for numbers**

_____

5Ø End of program

_____

Run the program

_____

What did the program print on the screen? _____

The program should have printed:

The expression X is greater than 3 is true, and as a result, the word **TRUE** and X = 4 are printed on the screen. If the variable X is not greater than 3 (a FALSE condition), the computer will skip anything listed after the **THEN** in the IF...THEN statement, and the program execution continues on the next line. Therefore, the command **PRINT "TRUE"** would never be executed by the computer when the program is run.

4. Stop the program. Type in a new line 2Ø by changing the 4 to a 2 as follows:

2Ø X = 2.

Run this program. What is printed now? _____

It should have been printed only **X = 2** because 2 is less than 3. (Look up the less than symbol in the list on pages 15 to 16).

Thus, the **IF** statement is false. The computer skips what follows **THEN** and **prints X = 2 as stated by the next line.**

Are You Ready to Write Your Own Program?

1. Prepare the machine for a new program.

2. Write a program to input values for the variables X and Y. The program should print the message **RESULT < 1Ø** if the quotient of X divided by Y is less than 1Ø, the message **RESULT > 1Ø** if the quotient is greater than 1Ø, and the message **RESULT = 1Ø** if the quotient equals 1Ø. For example, with inputs X = 3 and Y = 1 the output should look the same as below including printing the right columns.

Columns: Ø----------1Ø-----15----------

$$X = 3$$
$$Y = 1$$
$$X/Y = 3$$
$$\text{RESULT } 10$$

3. To help you write your program look at the following flowchart. It shows the order in which the computer will read and perform your program directions.

Write your program here:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

```
              ( START )
                  |
                  v
            +-------------+
            | Input the   |
            | variables   |
            | X and Y     |
            +-------------+
                  |
                  v
            +-------------+
            | Print the   |
            | values X and Y |
            | in column 15 |
            +-------------+
                  |
                  v
            +-------------+
            | Compute and |
            | print the value |
            | of X/Y in   |
            | column 13   |
            +-------------+
                  |
                  v
    < 10      < Is X/Y? >      > 10
   +----------              ----------+
   |              = 10                |
   |               |                  |
   v               v                  v
+----------+  +----------+     +----------+
| Print in |  | Print in |     | Print in |
| column 10|  | column 10|     | column 10|
|'RESULT < 10'| 'RESULT = 10'|  |'RESULT > 10'|
+----------+  +----------+     +----------+
       |           |                 |
       |           v                 |
       +------->( END )<-------------+
```

4. Type **RUN** and press **ENTER/RETURN.** If the program doesn't work, then clear the video and list the program to check for a mistake. To correct the problem, retype the line number and the new statement. Keep trying until you get a correct program—this process of correcting your logic is valuable in computer programs.

5. What part of this program caused you the most trouble? _____

_____

Activity 7. Counting Fast!

> You will learn how to use a variable for numbers and index from a low value to a high value in a loop with a next command step increment.

1. Prepare the computer for a new program.

2. Locate the following instructions in the table and write them in the appropriate commands for your computer in the spaces to the right of the instructions.

Instructions   **Write Your Program**

1Ø Clear the screen

_____

2Ø For variable for numbers
**   = 1 to 1Ø**

_____

3Ø Print to video the variable
**   for numbers**

_____

4Ø Next variable for numbers

_____

5Ø End of program

_____

Run the program

_____

Did your program run successfully the first try? _____ If not, check for mistakes and try again. If the program did run, can you count this fast? _____

The **FOR...NEXT** command forms a loop that causes the computer to count from the smaller value given to the larger value and perform the statements between the **FOR** line and the **NEXT** line. In this example, the value of X, the "counter," is printed out during each time through the "loop." (NOTICE: The loop is increased by 1 until it reaches 1Ø.)

3. Retype line 2Ø as below and run the program.

2Ø FOR X = 1 to 2Ø STEP 2

What does the **STEP** command do? _____

_____

4. List your program.

5. Now retype line 3Ø as below and run the program.

3Ø PRINT X, X + 1 (Notice the comma.)

How did the numbers appear on the video? _____

_____

Are You Ready to Write Your Own Program?

1. Prepare the machine for a new program.

2. Write a program to loop through the numbers 1 to 2Ø with a **STEP** of 2 and print the odd numbers. Print the output in the same format as on the following page. After the odd numbers 7 and 17 notice the dashed line. Write the commands to also print these lines. (HINT: Use **IF...THEN** statements and print 10 dashes together.)
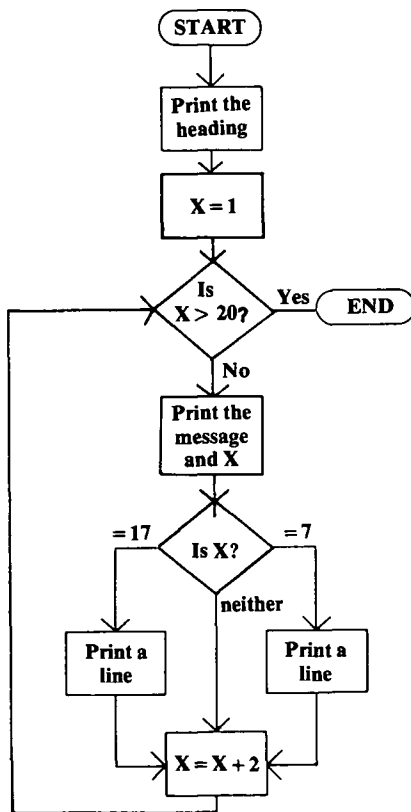
35

Example Output:

<div align="center">

ODD NUMBERS 1-20

NUMBER 1
NUMBER 3
NUMBER 5
NUMBER 7

NUMBER 9
NUMBER 11
NUMBER 13
NUMBER 15
NUMBER 17

NUMBER 19

</div>

3. To help you write your program, look at the following flowchart. It shows the order in which the computer will read and perform your program directions.

Write your program here:

```
          ( START )
             |
             v
      +-------------+
      | Print the   |
      | heading     |
      +-------------+
             |
             v
        +---------+
        |  X = 1  |
        +---------+
             |
             v
          /  Is  \    Yes
         <  X > 20? >------( END )
          \      /
             | No
             v
      +-------------+
      | Print the   |
      | message     |
      | and X       |
      +-------------+
             |
    = 17     v      = 7
    +----< Is X? >----+
    |        |        |
    |    neither      |
    v        |        v
+--------+   |    +--------+
| Print a|   |    | Print a|
| line   |   |    | line   |
+--------+   |    +--------+
    |        |        |
    +-->  X = X + 2  <-+
```

_____

_____

_____

_____

_____

_____

_____

_____

4. Now, run the program. If the program doesn't execute, then list it on the video display. Check for any mistakes and correct them by typing the line number and the new statement. Keep trying until you are successful, or ask for help if you cannot find the mistake or error.

Activity 8. Building a Timer

> You will learn these instructions: print to video " " and for variable for numbers = low to high.

1. Prepare the computer for a new program.

2. Locate the following instructions on the table, and write them in the appropriate commands for your computer in the space to the right of the instructions.

Instructions	Write Your Program
10 Clear the screen	_____
20 A variable for characters equal to "your name"	_____
30 Print to video the variable for characters followed by a semicolon	_____
31 For variable for numbers = 1 to 100	_____
32 Next variable for numbers	_____
33 Go to line 30	_____
40 End of the program	_____
Run the program	_____

This program prints your name across the screen, line by line, with a delay between each printing until the screen is filled. You may stop the program, clear the video, and rerun it if you wish. Notice that the **PRINT** command is outside the .FOR...NEXT loop, and there is no command inside the **FOR...NEXT** loop. The computer counts to the given number, and then goes to the next command. Thus the information is not printed every time inside the **FOR...NEXT** loop.

3. List your program. You may type a new line 20 and add spaces after your name to separate it on the screen. Run your new program.

4. You may stop the program. List your program and type a new line 31 and change the 100 to 500 for a longer delay. Run this program.

5. You can now type a new line 31 and type any number you please for the 100 to make the delay faster or slower. Try some other values. Can you count that fast? _____ The time delay is how long it takes the computer to count from 1 to the value you used.
About how many seconds of time delay were caused by the 100 value? _____
About how many seconds of time delay were caused by the 500 value? _____
You could estimate that 5 seconds of time delay could be obtained by counting to a value of _____ .

Are You Ready to Write Your Own Program?

1. Prepare the machine for a new program.

2. Write the same program as in Activity 7 with a timer. This program should loop through the numbers 1 to 20 with step of 2 for computing odd numbers. Following the same output, program a timer with a 2-second time delay between each printed line. (EXAMPLE: On one machine FOR 1 to 400 is approximately equal to 1 second of time. You will have to find the high value for your own computer.)

3. To help you write your program look at the following flowchart. It shows the order in which the computer will read and perform your program directions.
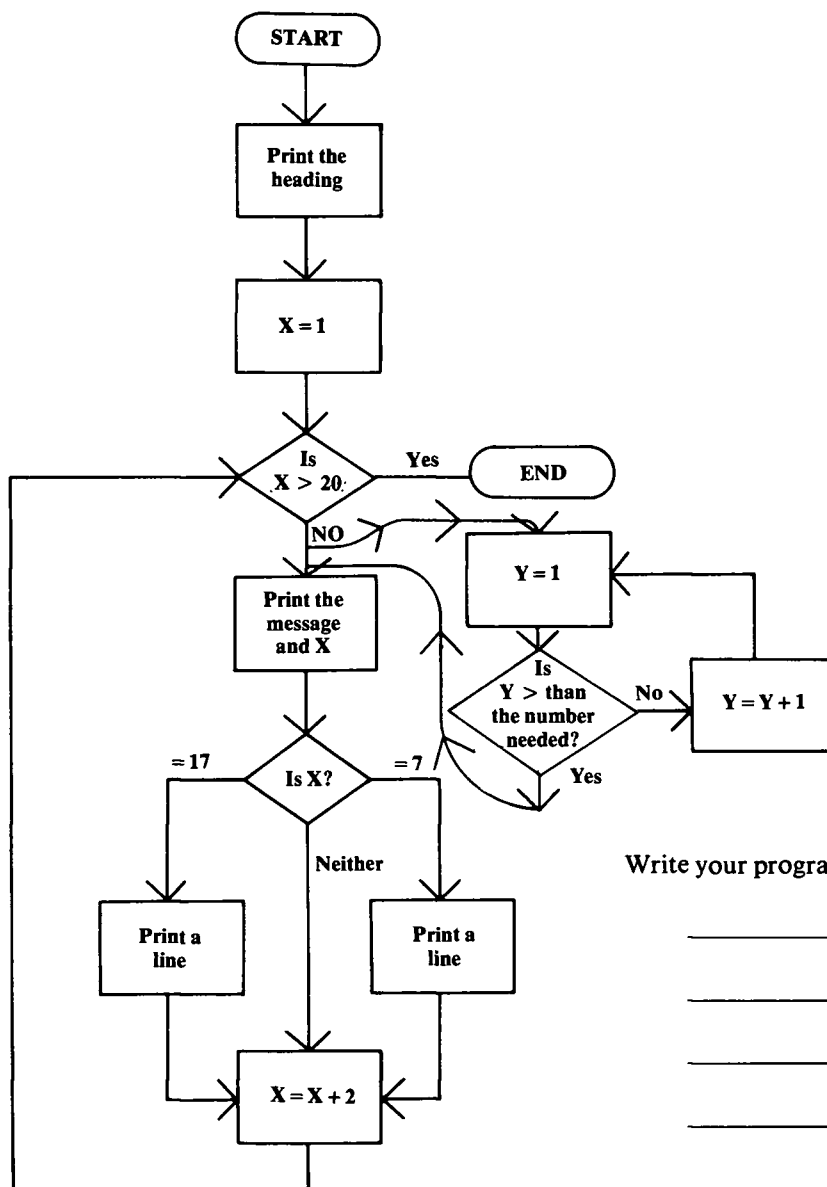
Write your program here.

_____

_____

_____

_____

_____

_____

_____

_____

_____

4. Run the program. If a problem occurs and the program doesn't execute properly, list the program. Check for any mistakes and correct them by typing the line number and the new line.

For More Information

- Check your local library for books on microcomputers.
- Go to the nearest retail store that sells microcomputers and ask to see a demonstration of the equipment.
- Ask the banks, travel agents and car dealers in your community if their records are computerized and how they use computers to do work.

Demonstrations and Illustrated Talks

Giving a 4-H demonstration and making an educational display can be a good learning experience for you and for others. Work with your leader in deciding on a good topic. You may want to:

- Explain some of the command words you have learned and show how they make the computer do what you want it to do.
- Demonstrate "how to program" a simple program on the computer.
- Make the 4-H pledge appear in the center of the screen.
- Use your imagination and come up with some good ideas!
- Make an educational display highlighting what you have learned. Examples, parts of a computer, how a computer works, etc.
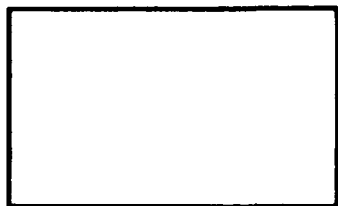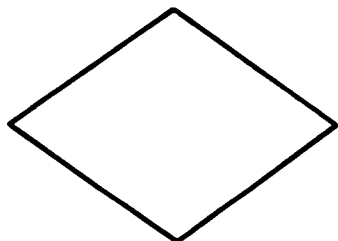
Flowchart Symbols	Meaning
Ovals	A START or STOP point in a flowchart
Square/rectangles	Indicates statements that tell what to do
Diamonds	Indicates decisions (Yes/No questions) or where choices are needed

Table 1—Keys for Typed Statements and Commands on Various Microcomputers

INSTRUCTIONS		APPLE II E	ATARI*	COMMODORE 64
1.	Clear key	SHIFT, ESC + @	CLEAR	CLEAR
2.	Enter/Return Key	RETURN	RETURN	RETURN
3.	Stop execution key	CTRL & C	BREAK	STOP
4.	New Program Command	NEW	NEW	NEW
5.	Clear the screen	HOME	PRINT "ESC SHIFT/CLEAR"	?CHR$ (147)
6.	Print to video the words	PRINT "WORDS"	PRINT "WORDS"	PRINT "WORDS"
7.	Print to video a variable for numbers	PRINT X	PRINT X	PRINT X
8.	Print to video the words and a variable for numbers	PRINT "WORDS";X	PRINT "WORDS";X	PRINT "WORDS";X
9.	Print to video a variable for numbers and an additional variable for numbers	PRINT X;Y	PRINT X;Y	PRINT X;Y
10.	Print to video a variable for characters	PRINT A$	PRINTA$	PRINT A$
11.	Print to video a variable for characters, and an additional variable for characters	PRINT A$;B$	PRINT A$;B$	PRINT A$;B$
12.	Print to video a blank line	PRINT	PRINT	PRINT
13.	Go to a line number	GOTO number	GOTO number	GOTO number
14.	List command	LIST	LIST	LIST
15.	Print in column n	PRINT TAB(n)	**	PRINT TAB(n)
16.	A variable for characters	A$	A$	A$
17.	An additional variable for characters	B$	B$	B$
18.	A variable for numbers	X	X	X
19.	An additional variable for numbers	Y	Y	Y
20.	Input information using the variable for characters	INPUT A$	INPUT A$	INPUT A$
21.	Input data using the variable for numbers	INPUT X	INPUT X	INPUT X
22.	Input with a word prompt and a variable for characters	INPUT "WORDS"; A$	PRINT "WORDS" INPUT A$	INPUT "WORDS"; A$

40

Table 1—Keys for Typed Statements and Commands on Various Microcomputers—Continued

	INSTRUCTIONS	APPLE II E	ATARI*	COMMODORE 64
23.	Input data using a variable for numbers and a variable for characters	INPUT X,A$	INPUT X,A$	INPUT X,A$
24.	IF an expression is true THEN perform certain commands	IF...THEN...	IF...THEN...	IF...THEN...
25.	For variable for numbers = low to high	FOR X = low TO high	FOR X = low TO high	FOR X = low TO high
26.	Next variable for numbers	NEXT X	NEXT X	NEXT X
27.	Step increments	STEP	STEP	STEP
28.	For variable for numbers = low to high STEP increments	FOR X = low TO high STEP...		FOR X = low TO high STEP
29.	Print using	None		
30.	$##.##	None		
31.	Integer variable	None		
32.	Single precision variable	None		
33.	Double precision variable	None		
34.	Run the program	RUN	RUN	RUN
35.	End of program	END	END	END
36.	Will this computer do if... then print all in one command?	NO	YES	YES

* Atari needs a DIM statement
for all string variables

**No tab.   You can use an extra command:
FOR I = 1 TO N: ?" "; : NEXT I
(for N use the TAB number)

41

	INSTRUCTIONS	COMMODORE VIC	IBM	RADIO SHACK
1.	Clear key	CLEAR	CTRL & HOME	CLEAR
2.	Enter/Return Key	RETURN	←	ENTER
3.	Stop execution key	STOP	CTRL & SCROLL/ LOCK	BREAK
4.	New Program command	NEW	NEW	NEW
5.	Clear the screen	"PRINT, SHIFT/CLEAR"	CLS	CLS
6.	Print to video the words	PRINT "WORDS"	PRINT "WORDS"	PRINT "WORDS"
7.	Print to video a variable for numbers	PRINT X	PRINT X	PRINT X
8.	Print to video the words and a variable for numbers	PRINT "WORDS";X	PRINT "WORDS";X	PRINT "WORDS";X
9.	Print to video a variable for numbers and an additional variable for numbers	PRINT X;Y	PRINT X;Y	PRINT X;Y
10.	Print to video a variable for characters	PRINT A$	PRINT A$	PRINT A$
11.	Print to video a variable for characters, and an additional variable for characters	PRINT A$;B$	PRINT A$;B$	PRINT A$;B$
12.	Print to video a blank line	PRINT	PRINT	PRINT
13.	Go to a line number	GOTO number	GOTO number	GOTO number
14.	List command	LIST	LIST	LIST
15.	Print in column n	PRINT TAB(n)	PRINT TAB(n)	PRINT TAB(n)
16.	A variable for characters	A$	A$	A$
17.	An additional variable for characters	B$	B$	B$
18.	A variable for numbers	X	X	X
19.	An additional variable for numbers	Y	Y	Y
20.	Input information using the variable for characters	INPUT A$	INPUT A$	INPUT A$
21.	Input data using the variable for numbers	INPUT X	INPUT X	INPUT X
22.	Input with a word prompt and a variable for characters	INPUT "WORDS"; A$	INPUT "WORDS"; A$	INPUT "WORDS"; A$

	INSTRUCTIONS	COMMODORE VIC	IBM	RADIO SHACK
23.	Input data using a variable for numbers and a variable for characters	INPUT X,A$	INPUT X,A$	INPUT X,A$
24.	IF an expression is true THEN perform certain commands	IF...THEN...	IF...THEN...	IF...THEN...
25.	For variable for numbers = low to high	FOR X = low TO high	FOR X = low TO high	FOR X = low TO high
26.	Next variable for numbers	NEXT X	NEXT X	NEXT X
27.	Step increments	STEP	STEP	STEP
28.	For variable for numbers = low to high STEP increments	FOR X = low TO high STEP . . .	FOR X = low TO high STEP . . .	FOR X = low TO high STEP . . .
29.	Print using		PRINT USING	PRINT USING
30.	$##.##		$##.##	$##.##
31.	Integer variable		C%	C%
32.	Single precision variable		C!	C!
33.	Double precision variable		C#	C#
34.	Run the program	RUN	RUN	RUN
35.	End of program	END	END	END
36.	Will this computer do if... then print all in one command?	YES	?	YES

43

Table 1—Keys for Typed Statements and Commands on Various Microcomputers—Continued

	INSTRUCTIONS	T.I.	TIMEX SINCLAIR
1.	Clear key	Type "CALL CLEAR"	CLS Key,Enter
2.	Enter/Return Key	ENTER	ENTER
3.	Stop execution key	FCTN/CLEAR	BREAK
4.	New Program command	NEW	NEW
5.	Clear the screen	CALL CLEAR	CLS
6.	Print to video the words	PRINT "WORDS"	PRINT "WORDS"
7.	Print to video a variable for numbers	PRINT X	PRINT X
8.	Print to video the words and a variable for numbers	PRINT "WORDS";X	PRINT "WORDS";X
9.	Print to video a variable for numbers and an additional variable for numbers	PRINT X;Y	PRINT X;Y
10.	Print to video a variable for characters	PRINT A$	PRINT A$
11.	Print to video a variable for characters, and an additional variable for characters	PRINT A$;B$	PRINT A$;B$
12.	Print to video a blank line	PRINT	PRINT
13.	Go to a line number	GOTO number	GOTO number
14.	List command	LIST	LIST
15.	Print in column n	PRINT TAB(n)	PRINT TAB(n)
16.	A variable for characters	A$	A$
17.	An additional variable for characters	B$	B$
18.	A variable for numbers	X	X
19.	An additional variable for numbers	Y	Y
20.	Input information using the variable for characters	INPUT A$	INPUT A$
21.	Input data using the variable for numbers	INPUT X	INPUT X
22.	Input with a word prompt and a variable for characters	INPUT "WORDS": A$	PRINT "WORDS" INPUT A$

Table 1—Keys for Typed Statements and Commands on Various Microcomputers—Continued

INSTRUCTIONS	T.I.	TIMEX SINCLAIR
23. Input data using a variable for numbers and a variable for characters	INPUT X INPUT A$	INPUT X,A$
24. IF an expression is true THEN perform certain commands	IF...THEN...	IF...THEN...
25. For variable for numbers = low to high	FOR X = low TO high	FOR X = low TO high
26. Next variable for numbers	NEXT X	NEXT X
27. Step increments	STEP	STEP
28. For variable for numbers = low to high STEP increments	FOR X = low TO high STEP	FOR X = low TO high STEP
29. Print using	None	
30. $##.##		
31. Integer variable		
32. Single precision variable		
33. Double precision variable		
34. Run the program	RUN	RUN
35. End of program	END	END
36. Will this computer do if... then print all in one command?	NO	YES