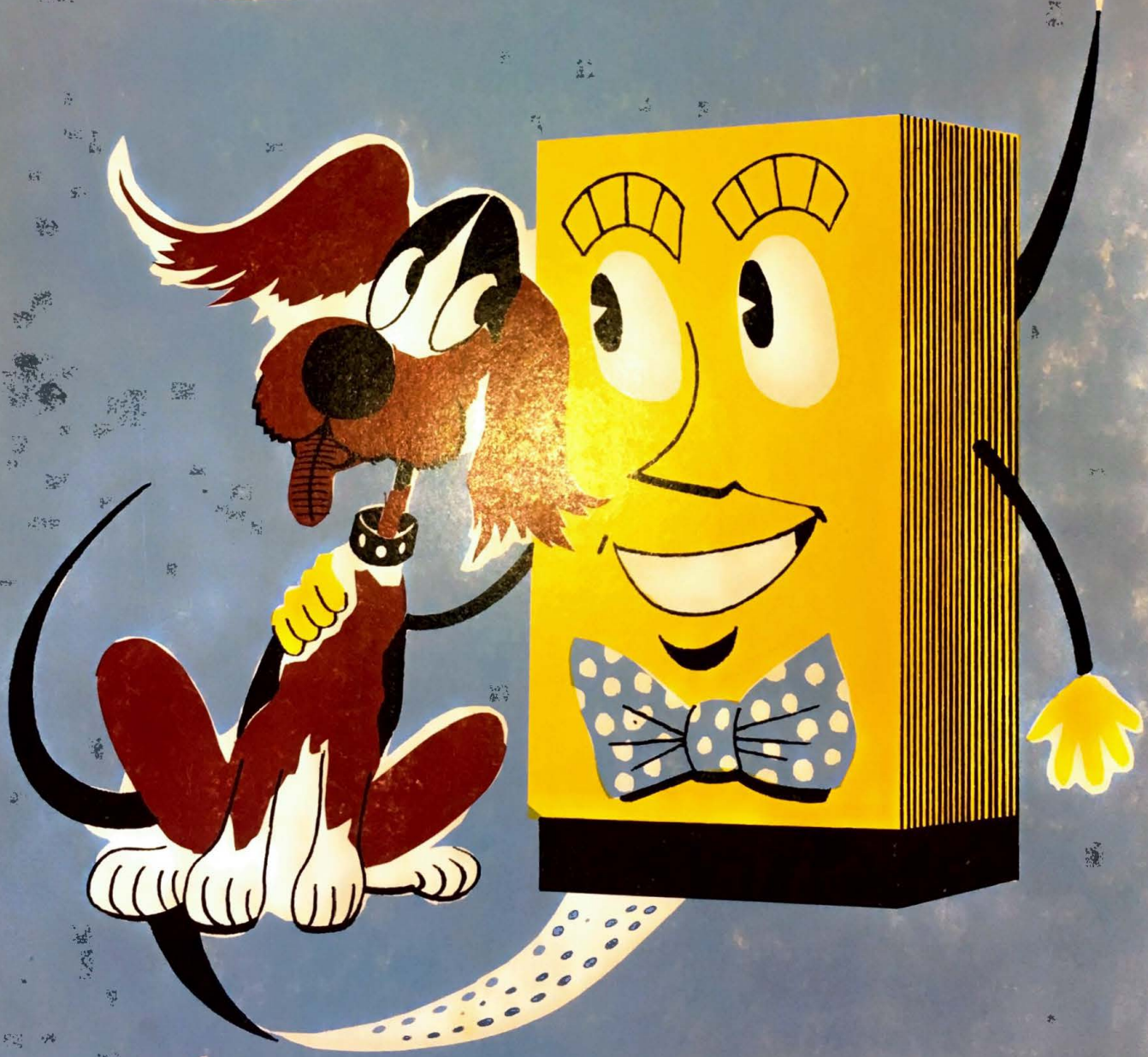
JEAN RICE

MY FRIEND-THE COMPUTER



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Rohnert Park
Cotati Schools

MY FRIEND THE COMPUTER

MY FRIEND THE COMPUTER

To Kit, Stuart and Brian

MY FRIEND THE COMPUTER

BY JEAN RICE

Illustrations by Howard Lindberg
based on design by Judy Lieber

Publishers
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FOREWORD

An 11-year old child once said, "I like working with computers. They're fun and easy."

Children at an early age can and are most eager to learn about the computer. They discover quickly it does not take a genius to operate one. All children, from the slow learner to the high achiever, quickly learn to use the computer. This gives them a reinforcing sense of achievement, even at the elementary level.

Ours is a computer world. But how little we still all know about computers! Educators are striving desperately to keep pace with the rapid moving and ever changing technology.

This book developed as a set of lesson plans for an elementary class at Highlands Elementary School in Edina, MN. I would like to thank the students in this class as well as the students in the summer school class, who used the book. Their spontaneous enthusiasm provided me with the stimulus for its creation.

My thanks also to 11-year old Danny Poppelaars for the use of his program shown on pages 55 and 56 of the text. This program was a winner in an Arts Contest sponsored by MECC (Minnesota Educational Computing Consortium) and the Association of Computing Machinery (ACM).

It would be impossible to list and thank all the people who provided me with ideas, material, and encouragement. I would like especially to thank Mr. Donald Holznagel, Mrs. Carole Bagley, Mr. Vladimir Kedrovsky, Miss Linda Borry, Mr. Robert Burnett, Mrs. Ann Kuster, Mr. Gary Schafer, and Dr. Dan Klassen for the many suggestions, encouragement and assistance in the preparation of this book. My thanks also to the rest of the staff at MECC (Minnesota Educational Computing Consortium) and T.I.E.S. (Total Information for Educational Systems) as well as the Edina School administration for their support. To the many others who have kindly read and commented upon the book as well as encourage me, my grateful thanks.

And to Judy Lieber, whose original illustrations made the book come to life with warmth and humor, my sincere appreciation.

FOREWORD

Computers have become very much a part of contemporary American society. Furthermore, there is no doubt that computers will become an even more important part of our everyday lives at an accelerating pace in the near future. It is only reasonable, then, that we should become acquainted with these electronic marvels and learn, not merely how to cope with them, but how to take advantage of their great usefulness and even greater potential.

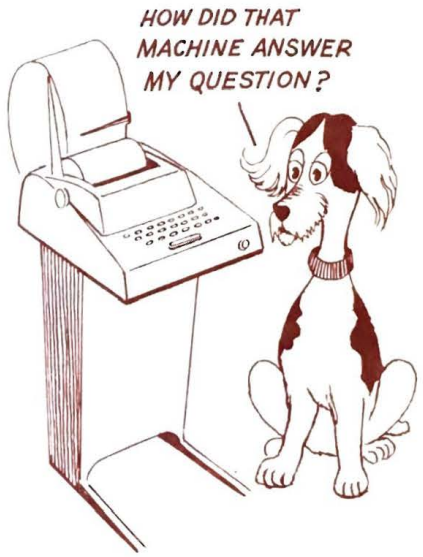
But why teach grade school children about computers? Isn't that pushing things a little? Ask any of Mrs. Rice's students. It probably never occurred to any of them that computers are too complicated for them. They are fascinated by computers, and they have the desire and ability to learn quickly. Indeed, if anyone is reticent to come to grips with computers, it is very likely we moldy-oldies who are entirely too set in our ways!

MY FRIEND—THE COMPUTER provides a means by which to satisfy the hunger of the younger students and dispel the mystery for the rest of us.

Vladimir J. Kedrovsky
Supervisor for Information
and Data Processing
Edina (Minnesota) Public Schools

PART ONE

How would you feel if you sat down at a machine with a keyboard like a typewriter and typed, "How are you?" and the machine typed back, "I am fine." You might feel surprised, or pleased, or just confused.



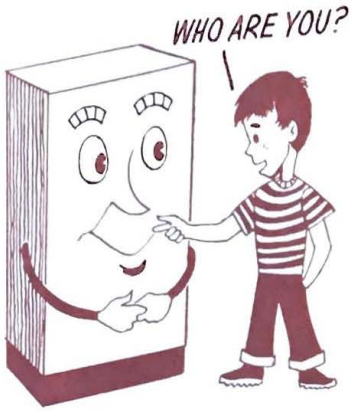
You might feel surprised because you didn't expect the machine to answer you. You might be pleased to think you could "talk" to a machine, or you might feel confused because you couldn't understand how a machine could answer you.

The machine you were using was not a genius with an I.Q. of 200. Rather, it probably was a piece of equipment called a TERMINAL.

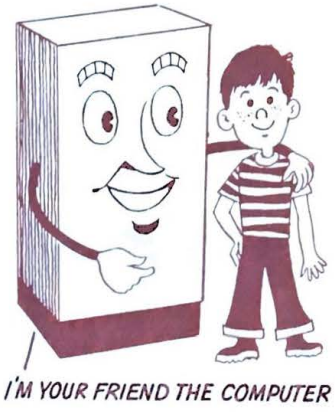
The TERMINAL was hooked up to another machine called a COMPUTER. The word COMPUTER comes from a Latin word meaning to count. The computer is the one who really gave you the answer.

Terminal

What is a computer? How does it work? Why is the computer being used so much today? These are just a few of the questions you will be able to answer when you finish this book.

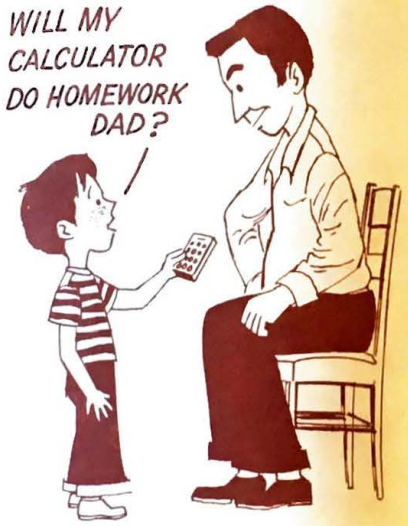


It is hoped the computer will be like a new friend. You will want to learn more about it and have it with you when you need to solve a problem.



A COMPUTER is a machine with a memory, which accepts information, works on the information to solve a problem, and puts out the answer.

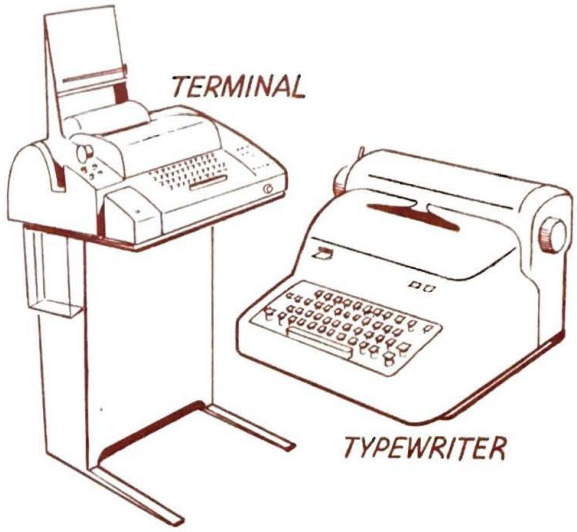
The computer is like a powerful calculator. To do a problem on a calculator, you put your problem in by pressing the keys on the machine. The machine then works on the information and you see the answer displayed on the dials of the calculator.



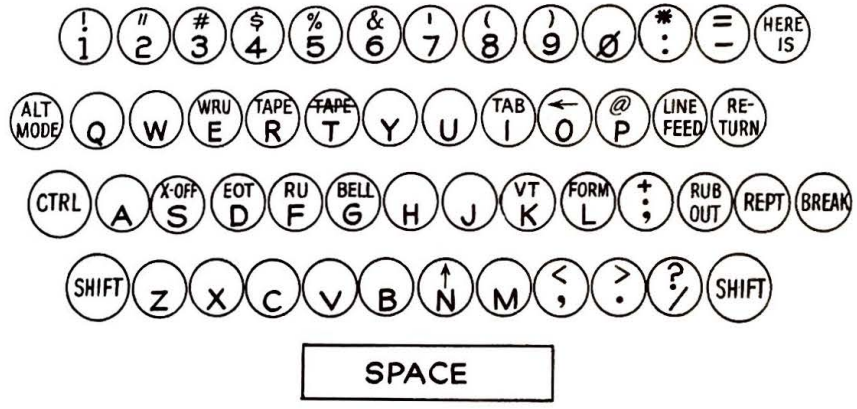
There are several ways of putting information into a computer. We will talk about these later.

What machine, with a memory like a calculator, takes a problem, works on a problem and sends out the answer?

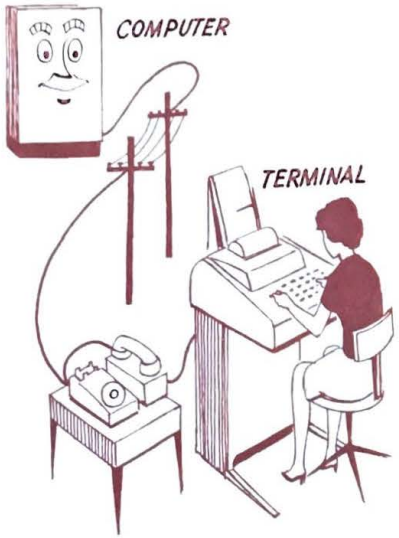
Let's get to know our new friend, the computer better. There are many ways to communicate with a computer. One way is using the machine we just talked about called a TERMINAL.



The TERMINAL has a keyboard like a typewriter. You type your information in on it just as you do on the typewriter.

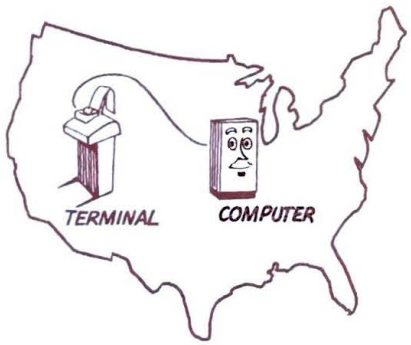


Name a machine with a keyboard like a typewriter that can be hooked up to a computer over telephone lines.



The terminal is hooked up to the computer over a telephone line. When the computer and the terminal are hooked up in this way, this is called being ON-LINE.

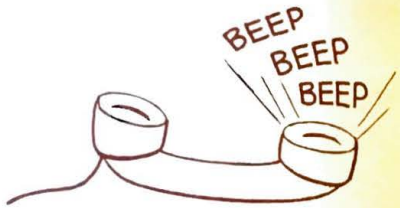
What is it called when machines are hooked up to a computer over telephone lines?



The computer may be located in another part of the city or sometimes in another part of the country from where the terminal is located. When you dial the computer's number to get ON-LINE, it's just like dialing your relatives in another part of the country.

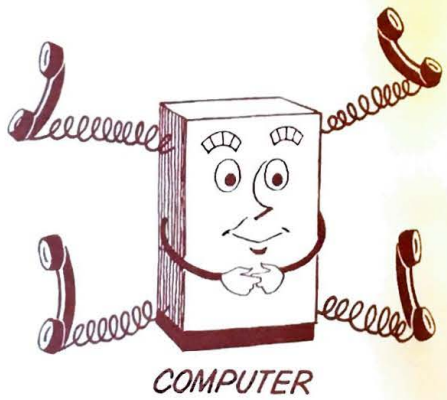
Must you have the computer in the same room with you when you use it?

After you dial the computer's telephone number, the computer will respond through the receiver with a high-pitched tone. This tone is really a series of little beeps. When you hear this tone, you will be ready to "talk" to the computer. We will discuss how we "talk" to a computer at a later time.



Once in a while you may get a busy signal. This means too many people are using the computer, so you must wait.

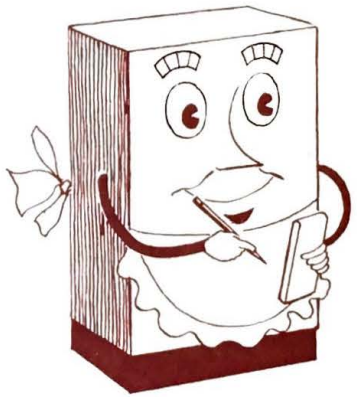
Certain kinds of computers allow many different people to use the same computer at the same time. This is called TIME-SHARING.



What is it called when several people use the same computer at the same time?

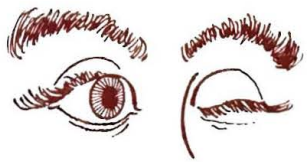
The computer works on the information it is given so fast that it seems like each one using the computer is the only one using it.

It's like ordering a meal in a restaurant. The waitress takes your order. It seems like you're the only one she's waiting on. Actually, she has many orders to fill. The waitress remembers each order she takes. She serves each customer what was requested.



COMPUTER

The computer also does this. It takes the requests, works on them, and sends out the answers.



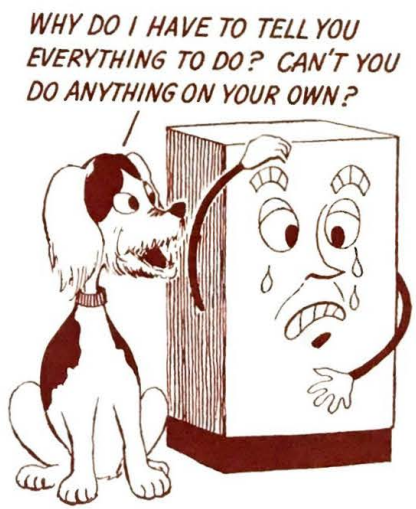
Some computer operations such as addition are done in NANOSECONDS. A NANOSECOND is a billionth of a second. How long does it take you to blink your eye? It might take a tenth of a second. In the time you can blink your eye, a computer can do at least 500 additions.

It would take a computer 30 seconds to do a problem that would take a man a year to do, working day and night with a paper and pencil.

Given information and directions, a computer solves a problem (about as fast as, more slowly then, or faster than) man doing the same problem?

The computer seems to be very smart. Actually, the computer is not smart at all. It has an I.Q. of zero. It cannot think by itself. It has to be told what to do. It is an extension of man's mind. Since man has to tell the computer what to do, man has complete control over it.

The computer is very obedient. Whether it is told rightly or wrongly, it still does what it is told to do. So, if it makes a mistake, it's probably because it was given the wrong information.

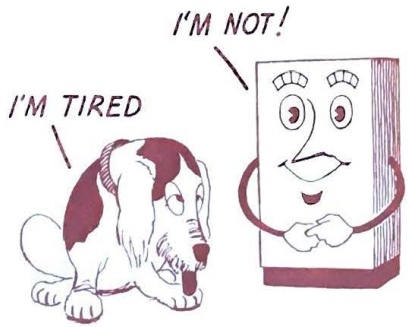


Computers are run by electricity. They have no moving parts like other machines such as cash registers do.

From what do computers get their power?

Computers can do many calculations in a short period of time without getting tired.

They will work day and night without stopping, as long as their source of power, which is electricity, does not stop. How long do you think you could work before you would have to stop and rest?



Humans can also do many calculations, but not as fast as computers. Humans also get tired.

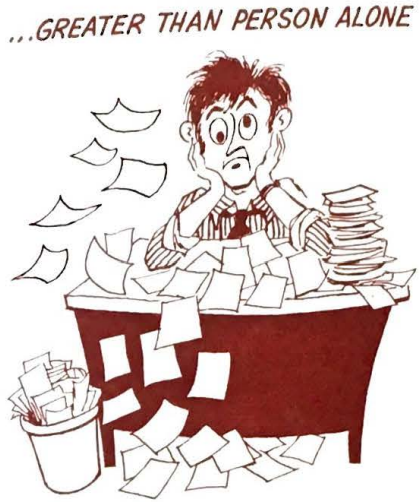
Therefore, humans are more likely to make mistakes doing many calculations. However, computers doing the same number of calculations would probably not make a single mistake.

One way a computer might make a mistake is if the equipment is not working properly.

People are not as fast as computers. They also make more mistakes over a long period of time. However, they are smart. So, we put the two together.

You can see that computers have many advantages over humans. They are fast and make fewer mistakes over a long period of time. They do not tire.

However, computers cannot think! Man is their master.



Do you feel you are getting to know your new friend, the computer, better?

We've started to get acquainted with our new friend, the computer. After each section of the book, there will be some questions you can ask yourself to make sure you understand everything so far. There will also be some activities to do.

BEFORE YOU GO ON TO THE NEXT PART, CAN YOU ANSWER THESE QUESTIONS? (The answers are given in the column to the right. Cover the answers to test yourself.)

	ANSWER
1. What is it called when many people use the same computer at the same time? (page 14)	1. time-sharing
2. What machine with a memory like a calculator, takes a problem, works on the problem, and sends out the answer? (page 12)	2. computer
3. What is it called when you are hooked up to a computer over telephone lines? (page 14)	3. on-line
4. What machine has a keyboard like a typewriter and can be hooked up over telephone lines to a computer? (page 13)	4. terminal
5. Given information and directions, a computer solves a problem (about as fast as, more slowly than, or faster than) man doing the same problem? (page 15)	5. faster than

If you got 4 out of 5 right, go on to the next section in the book. If you got less than 4 right, reread this section again. The answers to the question and the question itself are discussed on the page number that is listed after each question.

THINGS TO DO!

1. Draw a picture of what you think a computer is.
2. Start a collection of jokes and cartoons about computers to bring to class.
3. Look in newspapers, magazines, and television guides for articles about computers to bring to class to put in a scrapbook.
4. Interview someone who works with computers. Find out what he does.
5. Make a computer scrapbook. Include in your scrapbook computer articles and pictures you collect, activities from your workbook and other class projects.

PART TWO

How much do you think computers cost? The cost of a computer varies from millions of dollars to less than $1,000. Their size also varies from very large (as big as a room in your house) to very small (about the size of a suitcase). The cost and size depends upon what the computer is going to be used for.

Minicomputer

A Large Computer

If a company needs a computer to do many different kinds of jobs, it will buy a large computer. For example, a large computer might figure pay checks, keep track of all the items in a store as well as do other jobs. A large computer would be much more expensive than a smaller one used for possibly only one job.

Some computers are as small as a suitcase. (true or false?)

A large computer might cost a million dollars. (true or false?)

Computers can be used in many different ways. How many times have you stood at the checkout counter waiting to pay for your purchase? Did you know the cash register might have been hooked up to a computer?

In most stores all the things you buy have a number printed on them. In some stores when a clerk presses the keys on the cash register for the cost of the purchase, the clerk also punches in the number.

If you bought a carton of milk, the computer automatically keeps track of the fact that one carton of milk has been sold. When the supply of milk on the shelf gets low, the milk is automatically reordered. The computer keeps track of all this information. It then prints out an order for more milk for the store. In this way the store can control how much milk they have on hand at all times. All the other things in the store are controlled in this way also.

In other stores, such as large grocery stores, new equipment takes away the need for pressing the keys on the cash register. Everything you buy in the stores using this equipment has a marking on it as shown below.

The marking is a code for the number shown below the mark. This code is called the UNIVERSAL PRODUCT CODE. The distance between each bar on the mark stands for part of the code. The width of each bar is also part of the code.

The code number is usually made up of 2 parts. The first part sometimes stands for the manufacturer. The second part stands for the name of the item. In other cases the first part of the code stands for the name of the item. The second part stands for the price.

A piece of equipment called a scanner, which is located at the check out counter, detects the mark and sends a signal to the computer. The number shown below the mark is not understood by the computer, only the bar mark itself. Your purchase is recorded by the computer. The sales slip is then printed automatically with the name of the item and the cost in addition to other things.

What are some ways computers are used in stores?

COMPUTER - ASSISTED CHECKOUT: SAMPLE SALES RECEIPT

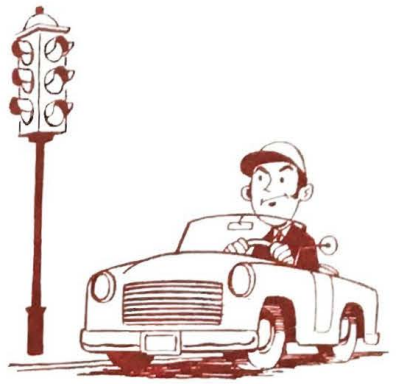
	ABC FOOD-SEVERNA PARK		STORE LOCATION
	CORN FLAKES	.33	ITEM DESCRIPTION
	GT PORK&BEAN	.27	
	GT ORANGE JC	.43	FIRST ITEM OF 2/85¢
	GT FACIALS	.34 T	
	GT ALUM FOIL	1.59 T	TAXABLE ITEM
	BEEF GRAVY	.22	
	HI-C PUNCH	.55	
	JELLO	.25	
	FANTASTIK	.87 T	
	CRANBERRY JC	.65	
	LUX LIQ DET	.43 T	
	GT LGHT TUNA	1.09	
	SKIM MILK QT	.43	
	PUSS-N-BOOTS	.33 T	
	GALLON MILK	1.43	
	JELLO	.24	
	HUD NAPKINS	.21 T	
	FRISK CAT FD	.27 T	
	PORK LIVER	1.81	
	GT ORANGE JC	.42	SECOND ITEM OF 2/85¢
	SIRLOIN STK	1.40	
WEIGHT	3.54# BANANAS	.42	
	COUPON	1.00-	COUPON ALLOWANCE
	TAX DUE	.17	TOTAL TAX
	TOTAL	13.15	TOTAL OF ORDER
	FS BAL DUE	9.94	TOTAL AMOUNT OF ORDER WHICH MAY BE PAID WITH FOOD STAMPS
	FS TEND	5.00	FOOD STAMPS PAID
	BALANCE DUE	8.15	REMAINDER OWED FOR ORDER
	CK TEND	15.00	AMOUNT PRESENTED BY CHECK
	FS CHG	.00	NO FOOD STAMP CHANGE DUE
	CHG DUE	6.85	CHANGE DUE
DATE, TIME	1/09/75 17:15 1407 2		STORE NUMBER, CHECKOUT LANE
	THANK YOU - COUNT ON US		

Computers are used by the airlines. When you call to have a seat reserved for you, the agent checks the computer. The computer tells the agent whether or not that flight is filled. Within seconds you will have your seat reserved for you. The pilot of the airplane also calls the computer to help him decide what flight plan to use.

What are some ways the airlines use computers?

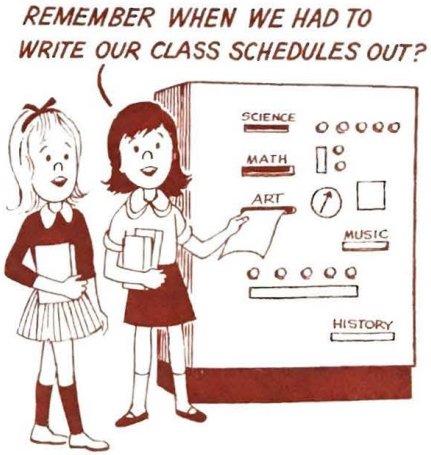
Doctors use computers to help treat patients. Computers are used to help translate books from French to English and to compose music.

Computers are also used by artists to draw pictures, by banks to figure bank accounts, by engineers to design buildings and cars. Computers control traffic in large cities. Poets also use computers when they write poetry.



What are some other ways computers are used?

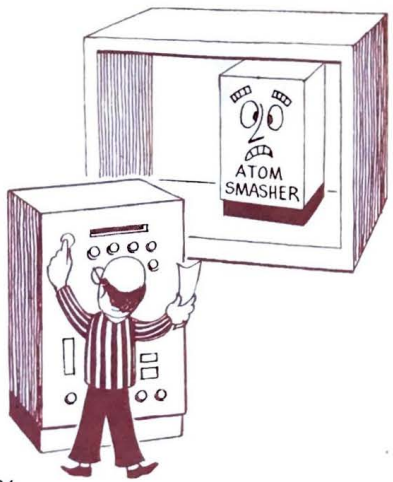
Schools use a computer to schedule classes. They also help report grades and attendance. Students use a computer to find out the answer to complicated problems



Why do schools use computers?

Computers can be used in some homes to plan meals, to figure out income tax and other problems. They can also be used to play games such as chess or checkers.

Many of the things we have just talked about could be done by human beings without a computer. The job would take a lot longer, however, if a computer were not used. Some things could not be done without the computer.



There probably would not be an atomic energy industry without computers. Much of the work done with atomic energy must have such careful control that humans cannot do it. Atoms must be smashed automatically with human beings protected behind thick walls since atoms give off deadly rays. Computers can control this process.

In 1960 there were 1,700 computers. Today there are over 100,000 computers.

Without the computer, man would not have walked on the moon. A computer figured out what path the spaceship would take to the moon. It also figured out how long it would take to get to the moon and back as well as many other things. It also allowed scientists to try out the trip in advance. This is called simulation.

Do you suppose computers are used in predicting the weather?

Are you beginning to feel that your new friend-the computer-is really important to all of us? It seems to touch our lives everyday in some way, doesn't it?

BEFORE YOU GO ON TO THE NEXT PART, CAN YOU ANSWER THESE QUESTIONS? (The answers are given in the column to the right. Cover the answers to test yourself.)

	ANSWER
1. Some computers are as small as a suitcase. True or False? (page 19)	1. true
2. A large computer might cost a million dollars. True or False? (page 19)	2. true
3. What are some ways computers are used in stores? (page 21)	3. keep track of supplies
4. What are some ways the airlines use computers? (page 23)	4. reservations, flight plans
5. Why do schools use computers? (page 23)	5. to make out report cards and schedules faster; to find the answer to problems
6. What are some other ways computers are used? (pages 23 and 24)	6. banks, artists, engineers, traffic control, poets, space exploration

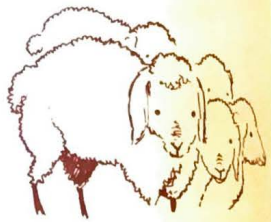
If you got 5 out of 6 right, go on to the next section in the book. If you got less than 5 right, reread this section again. The answers to the question and the question itself are discussed on the page number that is listed after each question.

THINGS TO DO!

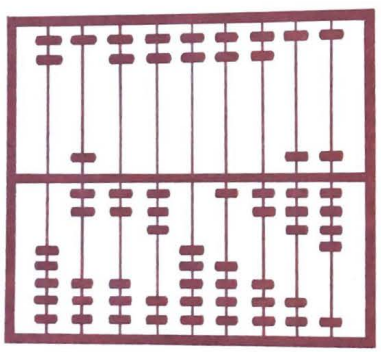
1. Bring a grocery store item with a computer code number on it to show class. Write to a large grocery store to find out more about the Universal Product Code.
2. In the next two weeks, make a list of ways the computer is used. Find a new way the computer is used each day and write it down with the date you discovered it. Have your parents and friends give you ideas.
3. Make a list of ways you wish computers could help you in the future.
4. Ask 3 people (they could be parents or friends) how they think the computer will help in the future. Make a list of these ways.

PART THREE

Different ways of counting date back to early man when he used sticks and stones. Shepherds put pebbles in their pockets to keep track of how many sheep they had. They would put nine pebbles in one pocket to remember they had nine sheep. To count the next sheep, the tenth pebble was put in the other pocket. So began the method of counting we use today—the decimal system.



What tools did early man use when counting?



ABACUS

One of the earliest counting devices was used by the ancient Chinese and Egyptians. The device was called the ABACUS and is still being used today.

The ABACUS was used in ancient China and Egypt as well as today as what kind of device?

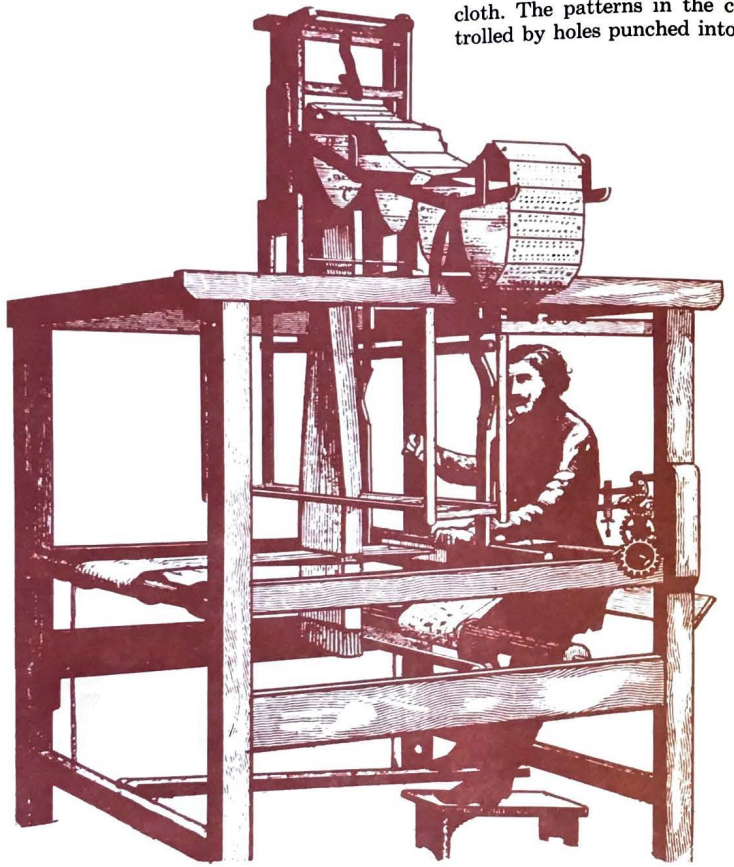
In 1642 a 19-year old French mathematician by the name of Blaise Pascal invented the first mechanical machine. A mechanical machine has moving parts. This machine could add and subtract and used gears and moving parts.

Pascal's Calculator

Pascal's adding machine looked much different from the adding machines today.

Adding Machine

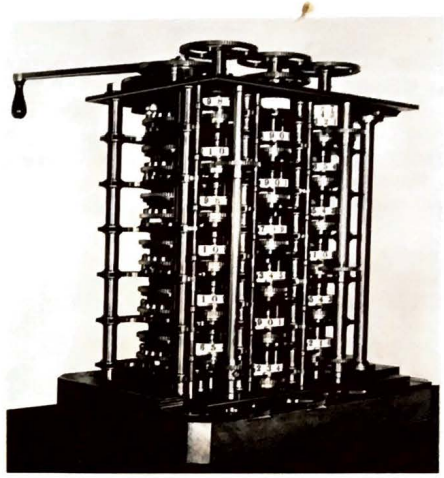
In the early 1800s a Frenchman by the name of Jacquard invented a loom for weaving cloth. The patterns in the cloth were controlled by holes punched into cards.



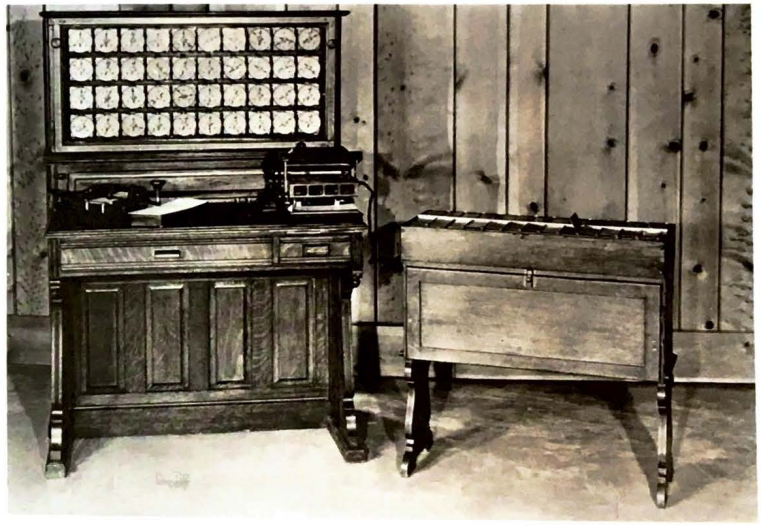
The punched card was first used by Jacquard with what kind of machine?

In the 1820s the British government gave a British mathematician by the name of Babbage money to design a calculating machine. He first designed the Difference Engine and later the Analytical Engine. Government money ran out for the project and Babbage never finished his machines. The parts and ideas for these machines were used in the creation of modern day computers.

In the late 1800s the United States Government hired Dr. Herman Hollerith to help count all the people in the country. Dr. Hollerith invented a way to record the information in punched cards. His tabulating machine using the punched card saved the government two years time in counting its people. The company Dr. Hollerith started, which used the punched cards, later became the IBM Company.



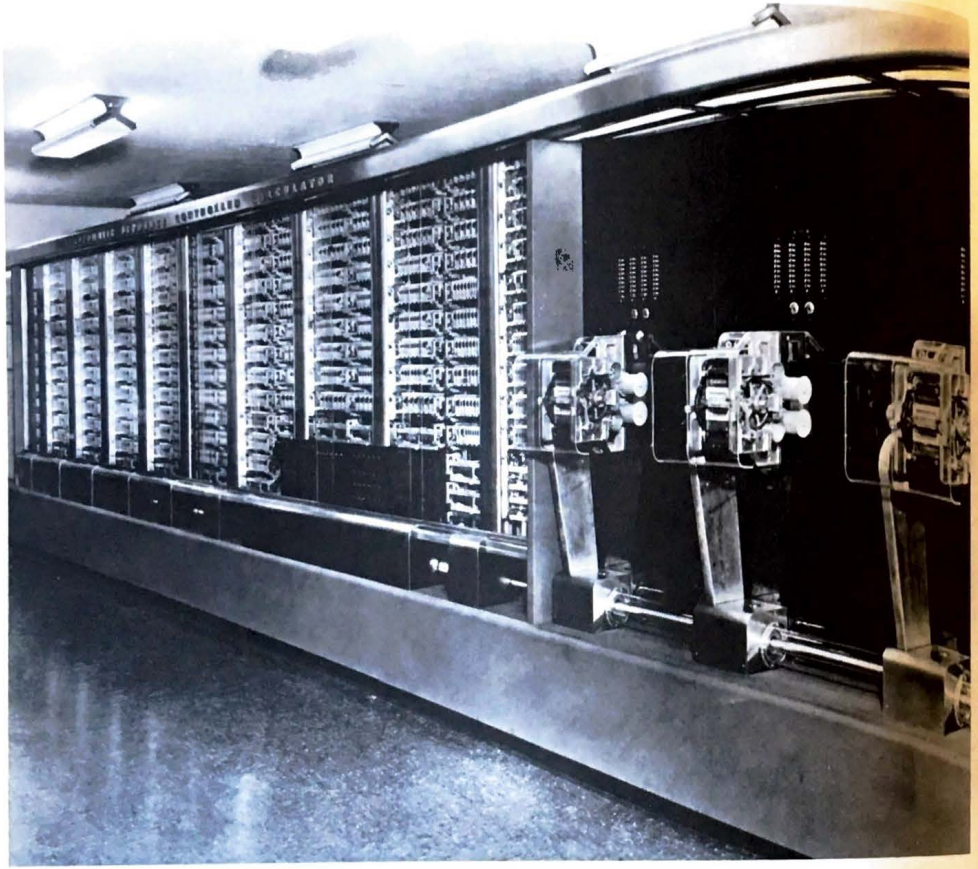
Babbage's Difference Engine



Herman Hollerith's Tabulating Machine.

Dr. Hollerith found a way to record information on what?

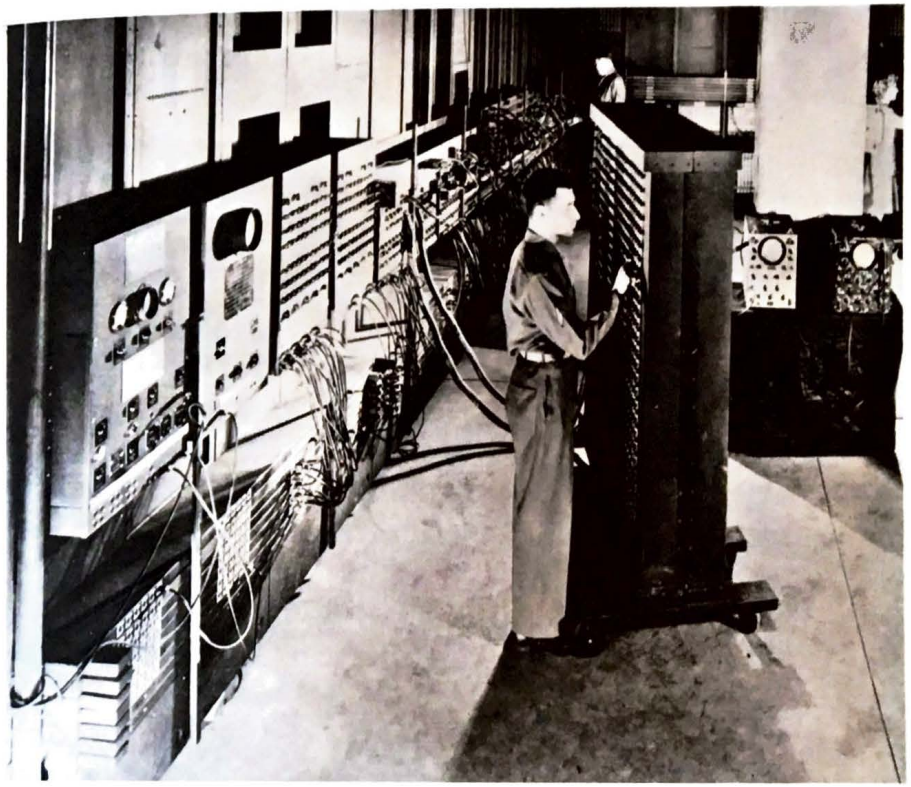
The MARK 1 is considered to be the first computer and was invented in 1944 by Professor Aiken at Harvard University. The computer was made up mainly of mechanical parts with some electronic parts. Modern day computers use electronic parts. Electronic parts are parts controlled by electricity.



Mark 1

What is the name of the first computer that had both mechanical and electronic parts?

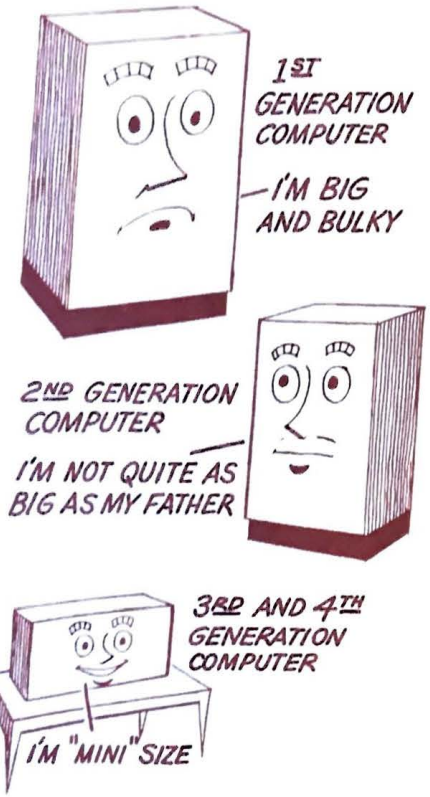
The ENIAC was the first all-electronic computer. It was built by Eckert and Mauchly at the University of Pennsylvania in 1946. The ENIAC weighed 30 tons and occupied a whole room. It could do a problem in 2 hours that would have taken 100 engineers a year to do.



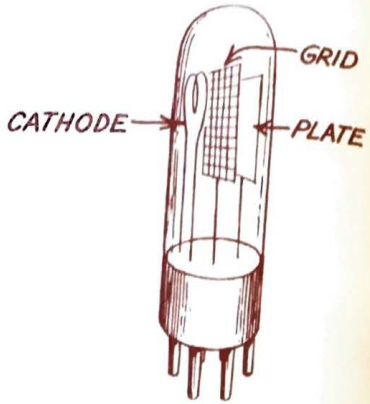
ENIAC

What was the name of the first all-electronic computer?

We refer to generations of computers in the same way we refer to generations of a family of people. With each new generation computer, parts have become smaller and the computers less expensive. The kinds of electrical parts that are used identify the different generations of computers.

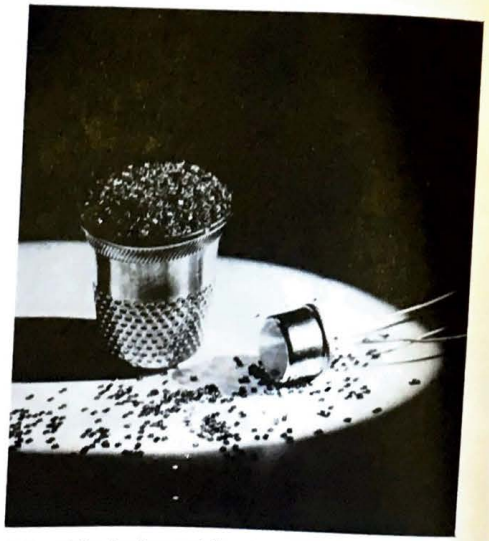


The first generation computers used VACUUM TUBES in their electrical circuits. These computers were big and bulky and produced a lot of heat. The ENIAC was a first generation computer. These computers could do thousands of calculations per second.



What kind of electrical parts were used in first generation computers?

The second generation computers came after 1960 and used TRANSISTORS instead of vacuum tubes. Because of the TRANSISTORS the computers were smaller, cooler, and more dependable than first generation computers. They were also 10 times faster.



A transistor is shown at the right. Thousands of tiny chip transistors are also shown.

What electrical parts were used in second generation computers?

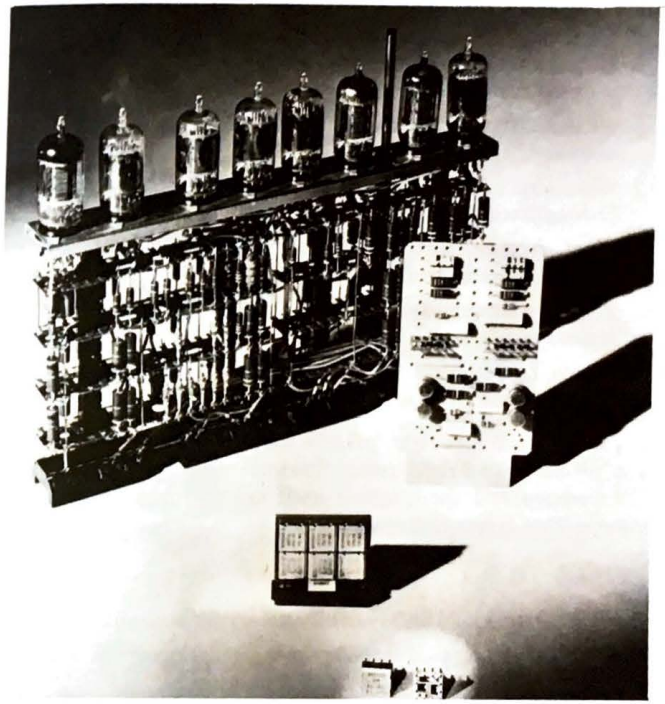
Third generation computers came after 1965 and use small INTEGRATED CIRCUITS. These computers can do millions of calculations per second. The tiny CIRCUITS are now being made smaller and smaller.

Fourth generation computers are being used today. 1,000 tiny CIRCUITS are being put into a part called a CHIP, which may be smaller than a transistor.

By making the parts of the computer smaller and smaller, companies have been able to make computers run faster and cost less money.

People who make computers see the day in the future when it will be just as common to see a small computer in a home as a TV set.

What electrical parts are used in third generation computers? Fourth generation computers?



Electrical parts for the various generations of computers are shown from the large vacuum tubes to the miniature integrated circuits.

BEFORE YOU GO ON TO THE NEXT PART, CAN YOU ANSWER THESE QUESTIONS? (The answers are given in the column to the right. Cover the answers to test yourself.)

	ANSWER
1. What tools did early man use when counting? (page 26)	1. pebbles, sticks, stones
2. The abacus was used in ancient China and Egypt as well as today as what kind of device? (page 26)	2. counting
3. The punched card was first used by Jacquard with what kind of machine? (page 28)	3. loom
4. Dr. Hollerith found a way to record information on what? (page 29)	4. punched cards
5. What was the name of the first computer that had both mechanical and electronic parts? (page 30)	5. Mark 1
6. What was the name of the first all-electronic computer? (page 31)	6. ENIAC
7. What kind of electrical parts were used in first generation computers? (page 32)	7. vacuum
8. What electrical parts were used in second generation computers. (page 32)	8. transistors
9. What electrical parts are used in third generation computers? (page 33)	9. integrated circuits
10. What electrical parts are used in 4th generation computers? (page 33)	10. chip

If you got 8 out of 10 right, go on to the next section in the book. If you got less than 8 right, reread this section again. The answers to the question and the question itself are discussed on the page number that is listed after each question.

THINGS TO DO

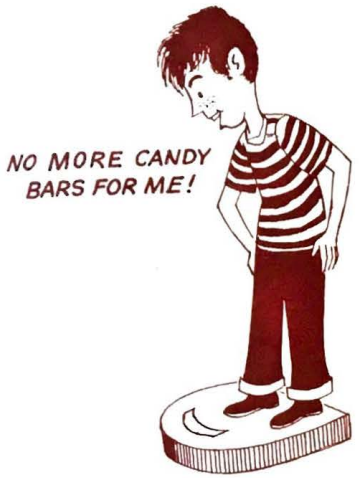
1. Check your school library or city library for books on computers.
2. Look up a computer inventor in the encyclopedia or computer library book. Write a short report on what he did.
3. Check the yellow pages of your telephone directory for computer companies. Write to a computer company for pictures of computer equipment. Ask them about different kinds of careers with computers.
4. Collect jokes and cartoons about computers to bring to class.

PART FOUR

Computers may be divided into two groups depending upon the way they work. These two groups are called ANALOG COMPUTERS and DIGITAL COMPUTERS.

ANALOG COMPUTERS measure amounts and compare one thing with another. An example of an ANALOG COMPUTER is a bathroom scale.

When you step on the scale, your weight makes the dial on the scale move to a number. This number is your weight. Your weight is compared against a standard weight.



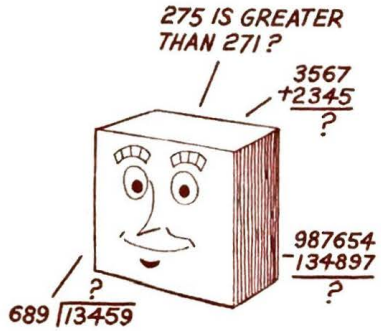
A scale is an example of what kind of computer?

A thermometer is also an ANALOG computer. A person's body heat causes mercury to rise in a tube to a certain number, which measures the body temperature.

Is a clock an ANALOG computer?

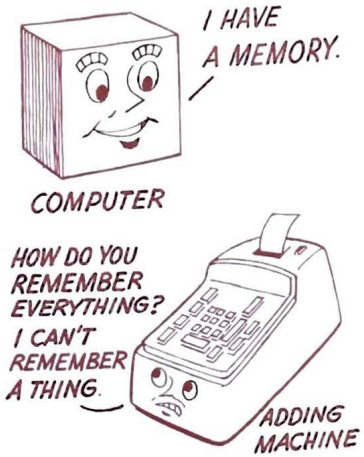
What other examples of ANALOG computers can you think of?

DIGITAL computers solve problems by calculating with numbers. Numbers can be added, subtracted, multiplied, or divided by DIGITAL computers. They can also decide of two numbers which is the greater.



What kind of computers solve problems by calculating with numbers?

Other kinds of machines also calculate numbers. An adding machine works by calculating numbers. The difference between an adding machine and a digital computer is the digital computer has a MEMORY. The digital computer uses its memory to store a problem before it works on the problem.



The digital computer stores two kinds of information in its memory. These two kinds of information are DATA and the PROGRAM. DATA is the information the computer needs to solve a problem.

For example, your age is an example of data. The time of day is another example of data. Any information the computer uses to solve the problem is data. The PROGRAM is the set of instructions which tells the computer how to solve a problem using the data that has already been stored in the memory.

What is the information the computer uses to solve a problem called?

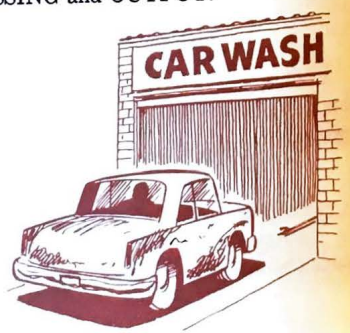
What is the set of instructions that tells the computer what to do called?

If you wanted to see how old you would be 65 years from now, you would write a program telling the computer to add 65 to your age. The person who writes the program is called the PROGRAMMER.

A computer programmer at work.

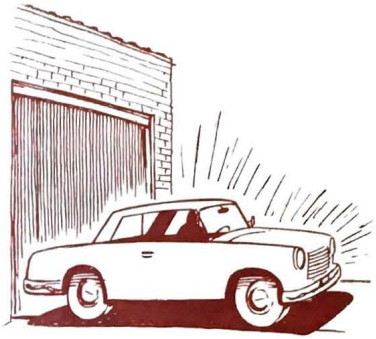
What is the person who writes the program called?

We might compare a computer to a car wash. A computer and a car wash have three things in common: INPUT, PROCESSING and OUTPUT.



The dirty car you take to the car wash is the INPUT.

The PROCESSING takes place inside the car wash. The car is washed, rinsed, dried and sometimes waxed.



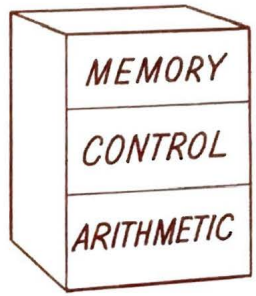
The OUTPUT is the shiny clean car that comes out of the car wash.

What other things can you think of that have INPUT, PROCESSING and OUTPUT?

A computer uses INPUT, PROCESSING and OUTPUT just as a car wash does.

The INPUT is the information that goes into a computer. This information is in the form of the PROGRAM and DATA. We remember the PROGRAM is the set of instructions the computer follows to solve a problem. The DATA is the information the computer uses to solve a problem. There are several ways of getting INPUT into a computer. We will talk about these ways later.

What is another name for the data and program?



CENTRAL PROCESSING UNIT

The computer operates on a problem inside the CENTRAL PROCESSING UNIT.

This PROCESSING UNIT has 3 parts called:

MEMORY
CONTROL
ARITHMETIC

What part of the computer has 3 units called control, arithmetic and memory?

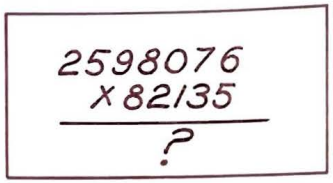
When INPUT is first received by a computer it goes to the MEMORY unit. The program and data are stored there until they are needed.

People also have memories. The computer's MEMORY is better than a human's, however. It never forgets. Think how smart we'd be if we never forgot a single thing we learned.

A computer remembers everything that goes into its MEMORY. It can remember something instantly that was put in its MEMORY a long time ago.

Where are the data and program stored?

The ARITHMETIC unit is where the adding, subtracting, multiplying and dividing take place. It is the place where the problem is solved.



ARITHMETIC UNIT

Where is the problem solved?

The third unit is the CONTROL unit, which acts like a policeman directing traffic. The CONTROL unit follows the instructions in the program.

By using the program, the CONTROL unit finds where the data is stored. It then directs where the data should be sent.

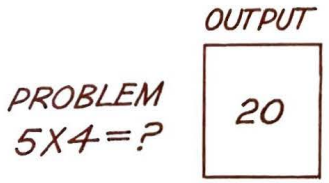
If a mathematical problem needs to be solved, it directs the problem to the ARITHMETIC unit.

If the data needs to be stored, it directs it to the MEMORY.

If the program calls for an answer to be printed out, the CONTROL unit directs the answer out of the computer.

Which unit of the processing section directs the traffic in the computer?

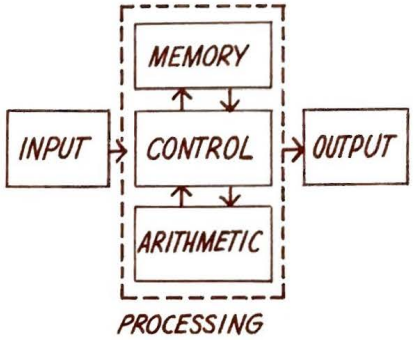
The OUTPUT from a computer is the answer to the problem. If you asked the computer to multiply 5 x 4, the OUTPUT would be 20.



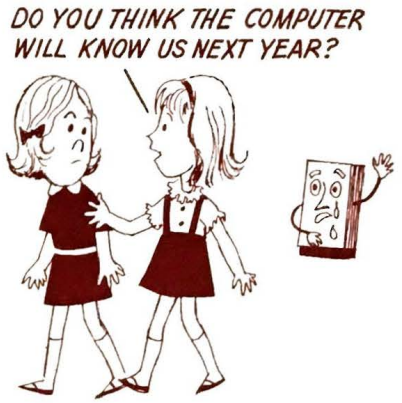
What is another name for the answer from a computer?

A computer is like a football team. All parts must work together or it becomes a loser. Each part has its role to play. Let's now look at how a whole computer system works.

INPUT is sent into the PROCESSING section. In the PROCESSING section, the CONTROL unit directs data out of the MEMORY unit. It also directs data in and out of the ARITHMETIC unit. The answer comes out as OUTPUT.



Do you feel you know your new friend, the computer, better now?



BEFORE YOU GO ON TO THE NEXT PART, CAN YOU ANSWER THESE QUESTIONS? (The answers are given in the column to the right. Cover the answers to test yourself.)

	ANSWER
1. A scale is an example of what kind of computer? (page 35)	1. Analog
2. What kind of computers solve problems by calculating with numbers? (page 35)	2. Digital
3. The information the computer uses to solve a problem is called what? (page 36)	3. Data
4. What is the set of instructions the computer uses which tells it what to do called? (page 36)	4. Program
5. What is the person who writes the program called? (page 36)	5. Programmer
6. What is another name for the data and program? (page 37)	6. Input
7. What part of the computer has 3 units called control, arithmetic and memory? (page 37)	7. Processing
8. In what part of the computer are the data and program stored? (page 37)	8. Memory
9. Where is the problem solved in the computer? (page 38)	9. Arithmetic
10. Which unit of the processing section directs the traffic in the computer? (page 38)	10. Control
11. What is another name for the answer from a computer? (page 39)	11. Output

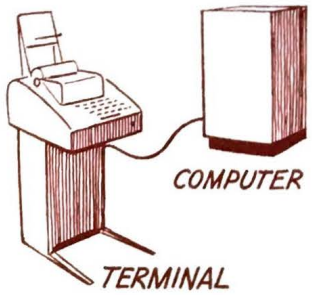
If you got 9 of 11 right, go on to the next section in the book. If you got less than 9 right, reread this section again. The answers to the question and the question itself are discussed on the page number that is listed after each question.

THINGS TO DO!

1. Bring an analog or digital device to class. See how many different devices your class can collect.
2. Build a model of a computer from cardboard.
3. Write a poem to express your feelings about a computer.
4. Mark the parts of a computer system on a diagram.

PART FIVE

There are many ways to get input into a computer. One way is typing the program and data in on different kinds of devices including the terminal we discussed earlier. The program and data then go directly to the computer. On this kind of terminal, you see what you are typing being printed on paper as on a typewriter.

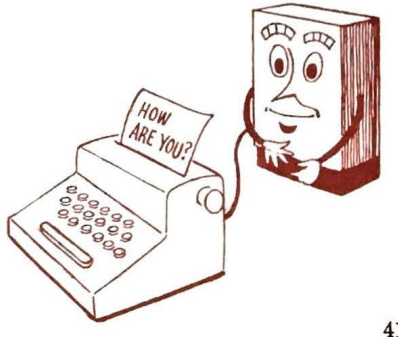


Cathode ray tube display unit.

Another type of terminal used to get input into the computer is a cathode ray tube (CRT). This machine has a keyboard like a typewriter. It also has a TV screen. You type in your program and data. The program and data are seen on the TV screen as you type it in.

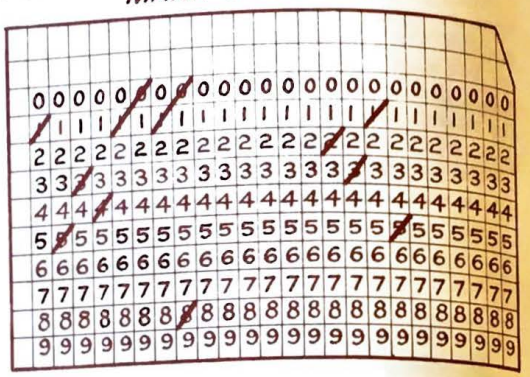
What machine, with a keyboard like a typewriter and a TV screen, can be used to put a program into a computer?

Special typewriters are also used as input machines.



Another way to get input into the computer is on different kinds of cards. One type of card is the MARK-SENSE CARD. Pencil marks are made in the card in code form. Pencils contain a special substance called graphite.

MARK-SENSE CARD

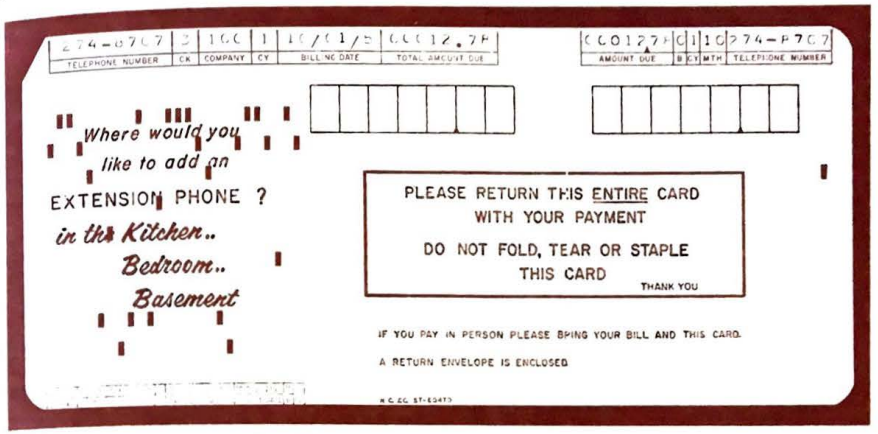


The cards are put in a machine called an optical scanner or reader. The graphite in the pencil marks is reflected by light. As the cards pass through the scanner, signals are sent to the computer as the light is reflected. Mark-sense cards are used by many schools to keep track of attendance.

Optical reader.

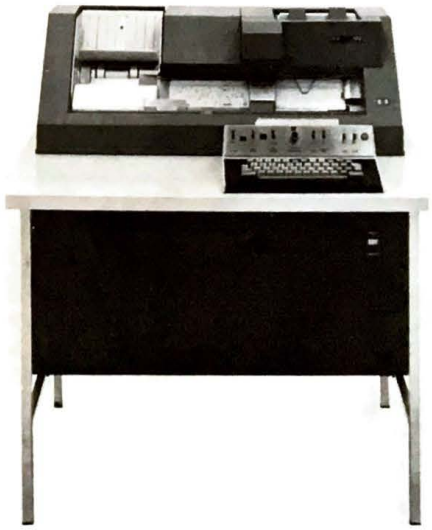
What substance is reflected by light on a mark-sense card?

Another card used as input into the computer is the PUNCHED CARD. Your telephone and water bills probably come to you in the form of a punched card.



Card used as bill by telephone company.

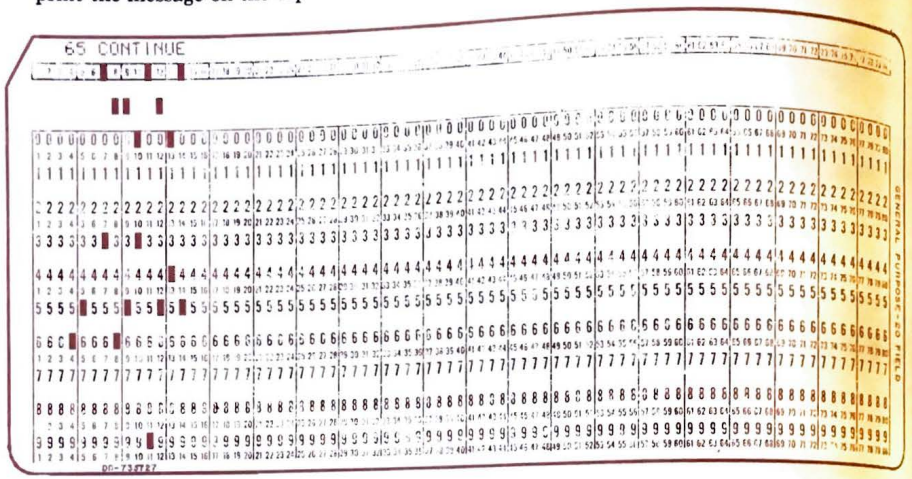
Information is punched into a card using a KEYPUNCH machine. This machine also has a keyboard like a typewriter.



Keypunch machine.

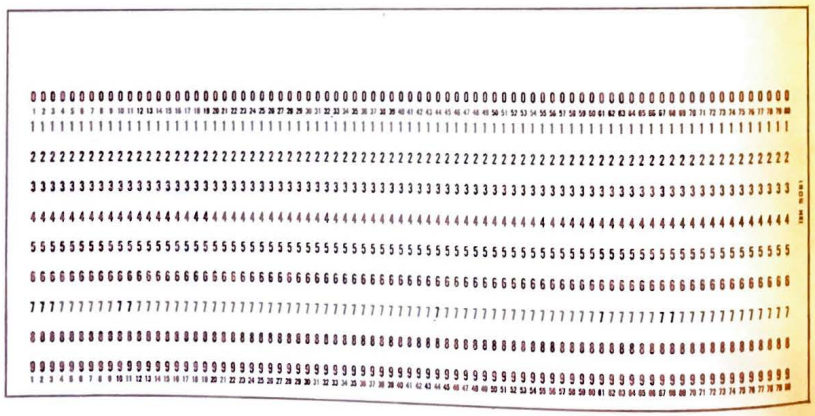
What machine punches holes in cards?

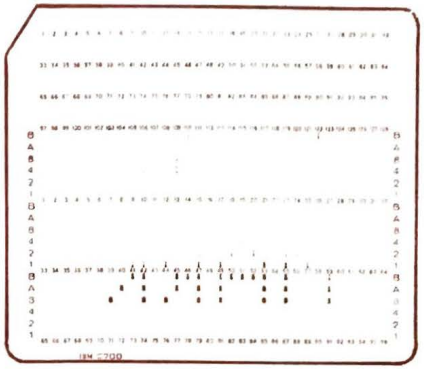
The keypunch punches holes in a card using a special code. Some keypunch machines also print the message on the top of the card.



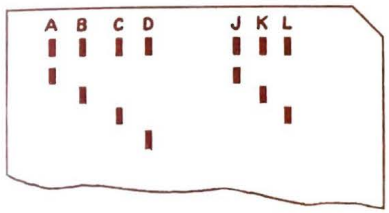
The keypunch punches holes in a card. It sometimes also prints the message on a card. (true or false?)

One type of punched card has 80 columns which run up and down across the card. Another type of card has 96 columns.

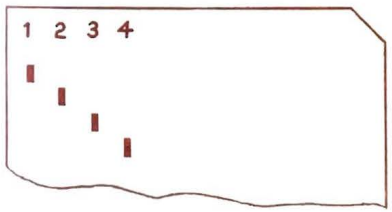




96-Column Card



In the 80-column punched card, all letters of the alphabet have two punches in each column.



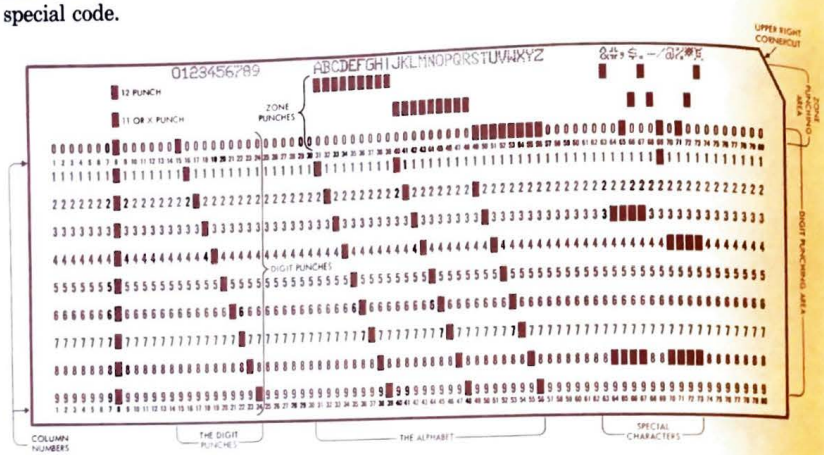
Numbers from 0 to 9 have only one punch in each column.

The code for the 80-column punched card is shown on page 46.

How many punches in a column for a number on the 80-column card?

How many punches in a column for a letter?

The 80-column IBM card is shown below. Notice the 80 columns across the card. Each column has the numbers 0 through 9 running from near the top to the bottom of the card. Only one character (for example, letter or number) is punched into each column using a special code.



There appear to be only ten rows for holes running across the card. These rows seem to start with the 0-row and end with the 9-row. Actually, there are two more rows above the 0-row that are not marked in the same way as the other ten rows. The row above the 0-row is called the 11-row and the row at the top of the card is called the 12-row.

We talked in part 3 about Dr. Herman Hollerith who designed the punched card. The code shown above is known as the Hollerith code.

There is only one letter or number punched in each column in a punched card. (true or false?)

Can you answer these questions?

a. To represent the number 3, what hole is punched?

b. To represent the letter C, what holes are punched?

c. To represent the letter N, what holes are punched?

d. To represent the number 0, what hole is punched?

e. To represent the letter O, what holes are punched?

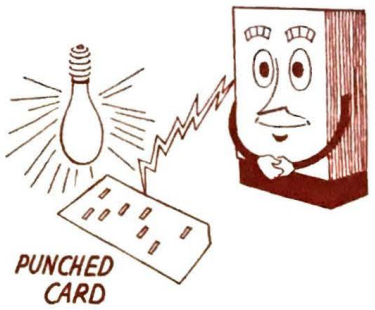
One of the disadvantages of using the punched card is that only a small amount of information can be put on it. Other forms of input allow much more information to be recorded. We will talk about these later.

When using punched cards, the cards are put in a machine called a CARD READER. The CARD READER has a device which detects the holes.

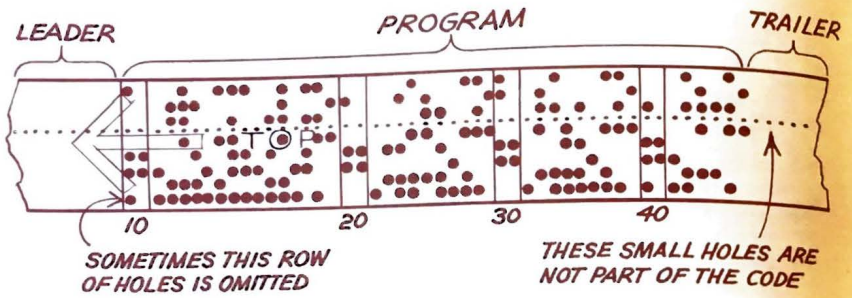
Card reader.

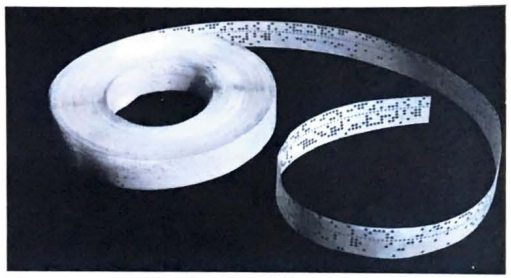
What machine detects holes in punched cards?

In some readers, a light passes through the holes. In other readers, brushes pass through the holes. When either a light or a brush pass through a hole in the card a signal is sent to the computer. In this way the computer understands the holes in the card. Some card readers can "read" over 1,000 cards per minute.



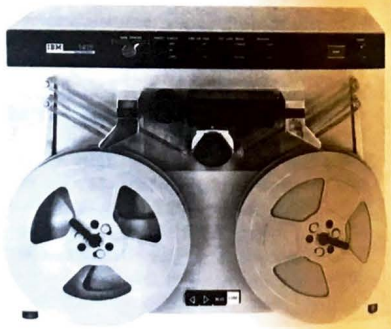
Using PAPER TAPE is another way of getting a program and data into a computer. Paper tape is a long paper ribbon. The program and data are punched into it in code form just as on the punched card.





A roll of paper tape.

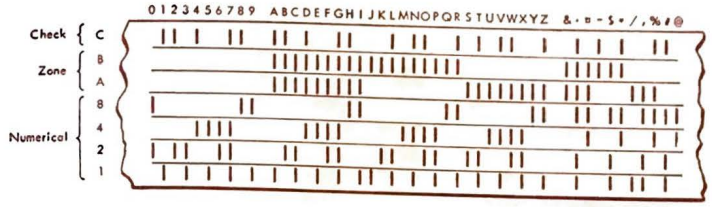
Tape readers detect the holes in the same way card readers do. They also send the proper signals to the computer. A roll of paper tape can store much more information than a box of punched cards. Paper tape has the advantage of storing information on one long tape rather than on many punched cards.



Paper tape reader.

Tape readers detect holes in the same way card readers do. (true or false?)

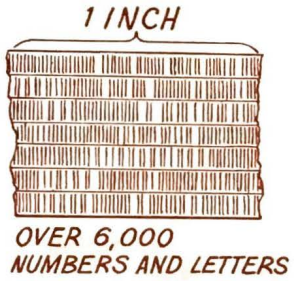
Another way of getting information into the computer is using MAGNETIC TAPE. This tape is like tape recorder tape. The data and program are recorded on magnetic tape as magnetized spots. These spots are in code form just as the punched holes are in paper tape.



Magnetic Tape Code.

How are the data and program recorded on magnetic tape?

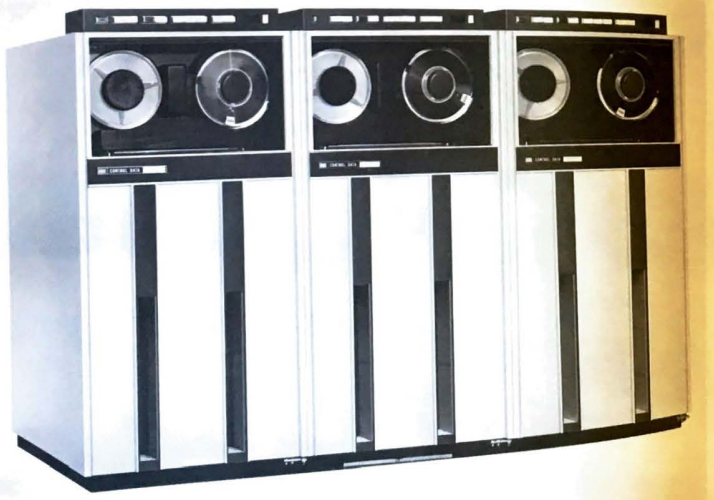
Some types of magnetic tape can store over 6,000 numbers and letters on one inch of tape.



A reel of magnetic tape can store much more information than a reel of paper tape or a box of punched cards. The tape is wound on a reel like a movie film. These tapes may be stored in a tape library.

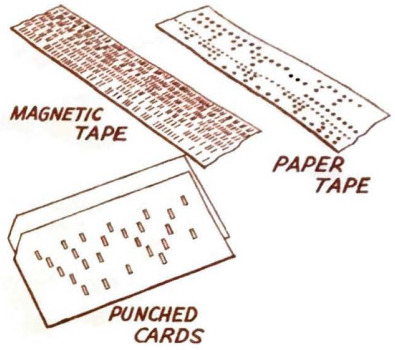
Magnetic tape reels.

Magnetic tape reels are put on a machine called a TAPE DRIVE. The spots on the tape are detected and the proper signals sent to the computer.



Tape drives.

So far we have talked about three different ways of storing information to be put into the computer. These are punched cards, paper tape, and magnetic tape.



Another method of storing information is on MAGNETIC DISKS. These disks look like phonograph records. If you move the needle of the phonograph to the middle of a record, you'll hear that part of the record.

MAGNETIC DISK

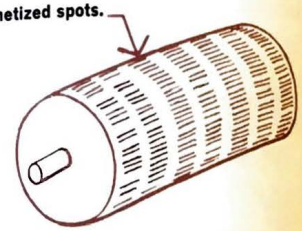
When a computer program calls for some data, which is stored in the middle of the disk, a special disk "head" moves over to that part of the disk and gets that information.

Using the magnetic disk has the advantage of being able to locate the data immediately at a certain spot. With paper or magnetic tape, the whole tape must be gone through from the beginning to get the data at the end of the tape.

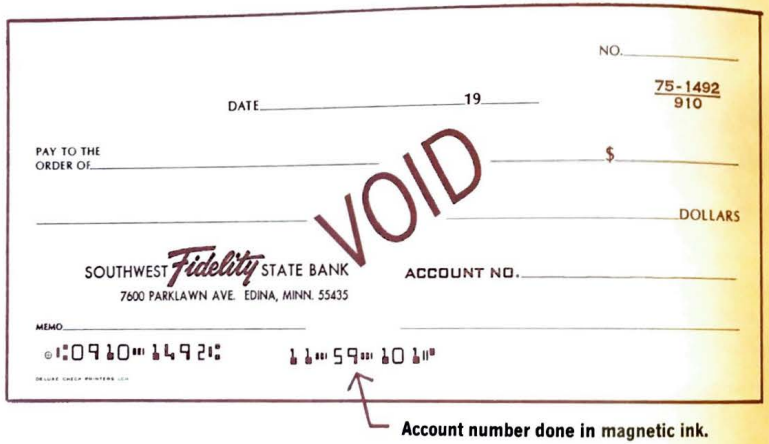
What device looks like a phonograph record and is used to store information to be put into the computer?

Disk drive.

MAGNETIC DRUMS also store data and programs. These round drums hold information on a magnetic surface of the drum in much the same way as on magnetic disks.

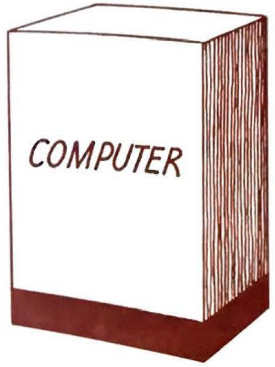


Another way of storing information is using a special kind of ink called magnetic ink. Checks from a bank have the person's check number printed in magnetic ink.

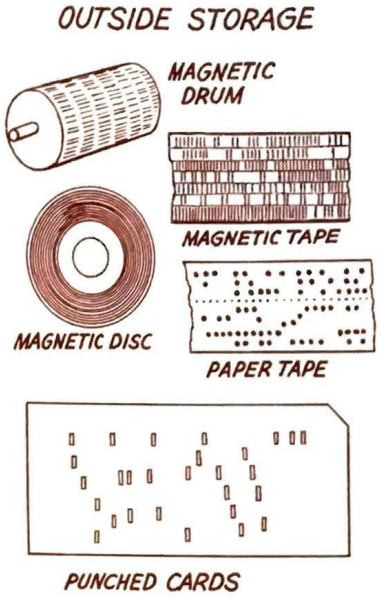


The check number is understood by a piece of equipment called a magnetic character reader or scanner. The scanner detects the ink and sends the signals to the computer to understand.

Up until now, we have discussed a number of ways of storing information *outside* the computer itself. Let us now talk about how information is stored *inside* the computer.



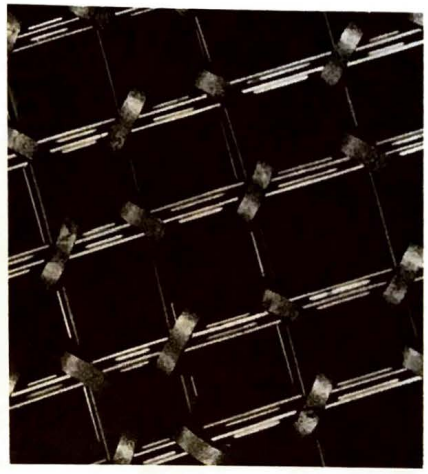
INSIDE STORAGE



When information is sent to the memory unit *within* the computer, that information is stored on MAGNETIC CORES.

Magnetic cores are tiny doughnut-shaped metal rings, which are strung on wires. They are about the size of a period at the end of a sentence. When electricity is sent through the wires, the cores are magnetized and store either a zero or a one. This means that an electric current begins to move around the core. When it travels in one direction, it stands for a zero. When it travels in the opposite direction, it stands for a one.

The zero and one are enough to create a system with which to calculate.



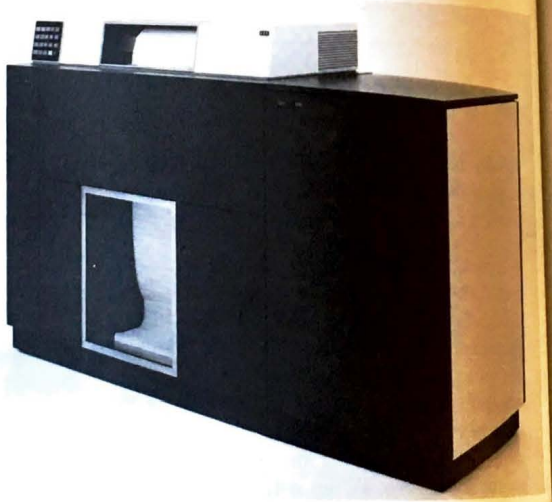
Magnetic cores.

Many of the machines used for getting data and programs in the computer also receive the output (answer) from the computer.

Terminals such as cathode ray tubes, and special typewriters can be used as output machines. When the computer sends back the answer to a problem, it is seen on the cathode ray tube screen.

Cathode ray tube display unit.

ARE WE FRIENDS NOW?



Printer.

Another output machine is a high-speed printer. This machine prints out information much faster than terminals. Some printers will print over 2200 lines per minute.

Name an output machine.

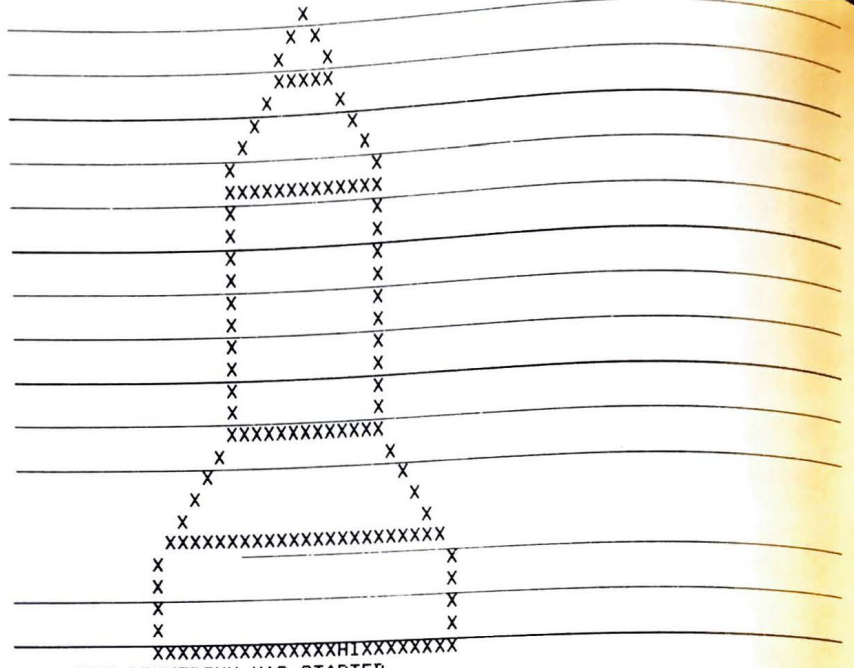
The paper on which the answer to a problem is printed is called the PRINT OUT or READ OUT. A sample of a PRINT OUT is shown below.

```
set-mouse
run
MOUSE

PRESENTING HERBERT

          XXX     XXX
        X   X   X   X
       X    X   X    X
      XX    X   X    XX
      X     X   X     X
     X      XXXXX      X
     X      XX XX      X
    X       XX  XX      X
    X      XX    XX     X
   XXXXXX          XXXXXX
      X     @     X
     X              X
     X    )XXX(     X
      XX          XX
        XXXXXXX
         X   X
        XXXXX
        XX   XX
       X XXXXX X
      X XX   XX X
     X X XXXXX X X
    X X  X   X  X X
   X X    XXXXX    X X
  XXXX     X   X     XXXX
  X  X     X   X     X  X
  XXXX     X   X     XXXX
           X   X
           X   X
          XXXXXXX
          X     X
          XXXXXXXXX

HERBERT'S MISSION IS TO GET TO THE MOON AND SEE IF THE
MOON IS REALLY MADE OUT OF CHEESE.
HERE IS THE ROCKET THAT HERBERT WILL BE FLYING IN.
```



```
THE COUNTDOWN HAS STARTED.

20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
**********IGNITION**********
 IT WILL TAKE HERBERT TEN DAYS TO REACH THE MOON.
   10 DAYS LATER
WE HAVE VISUAL CONTACT WITH HERBERT.
HE IS MAKING AN ANNOUNCEMENT .
I HAVE MADE A GREAT DISCOVERY.
THE MOON IS NOT MADE OUT OF CHEESE.
HERBERT IS SAFELY BACK IN MOUSEVILLE,BUT HE IS
 VERY DISAPPOINTED!

DONE
```


BEFORE YOU GO ON TO THE NEXT PART, CAN YOU ANSWER THESE QUESTIONS? (The answers are given in the column to the right. Cover the answers to test yourself.)

	ANSWER
1. What machine, with a keyboard like a typewriter and a TV screen, can be used to put a program into a computer? (page 41)	1. Cathode ray tube
2. What machine punches holes in cards? (page 43)	2. Keypunch
3. How many punches in a column for a number on the 80-column card? (page 45)	3. one
4. How many punches in a column for a letter on the 80-column card? (page 45)	4. two
5. There is only one letter or number punched in each column in a punched card. (true or false?) (page 46)	5. true
6. What machine detects holes in punched cards? (page 47)	6. card reader
7. When using punched cards, a signal is sent to the computer after a light (or brush) passes through what part of the card? (page 47)	7. holes
8. Tape readers detect holes in the same way card readers do. (true or false?) (page 48)	8. true
9. How are the program and data recorded on magnetic tape? (page 49)	9. As magnetized spots
10. What device looks like a phonograph record and is used to store information to be put into the computer? (page 51)	10. magnetic disk
11. What substance is reflected by light on a mark-sense card? (page 42)	11. graphite
12. Name an output machine. (page 54)	12. printer

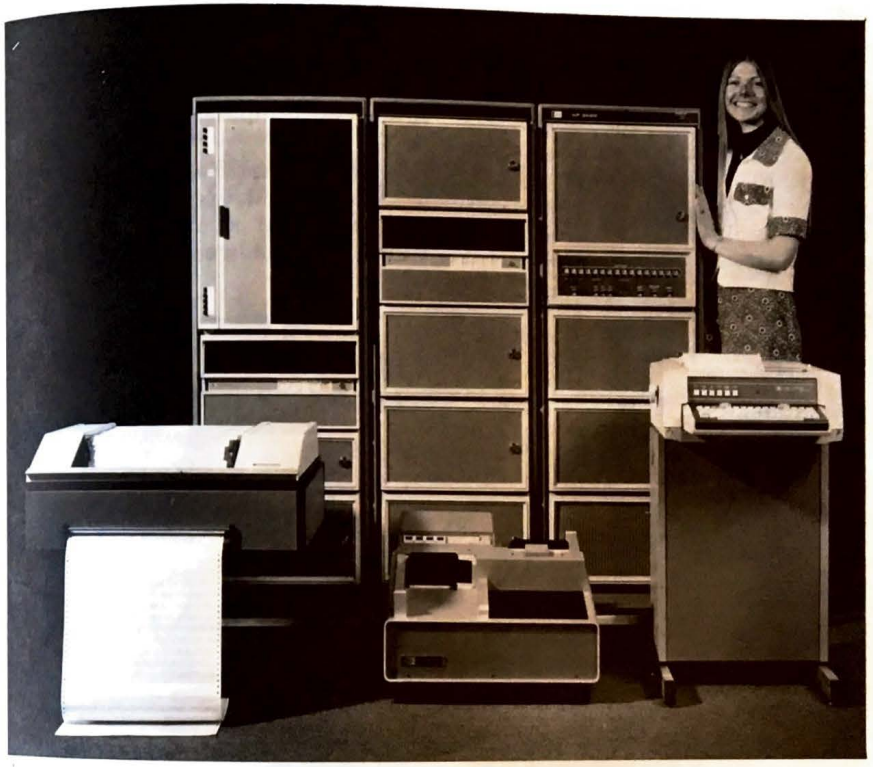
If you got 10 out of 12 right, go on to the next section in the book. If you got less than 10 right, reread this section again.

THINGS TO DO!

1. Check the library for uses of the mark-sense card.
2. Ask your parents whether or not you may bring a bill produced by a computer to class.
3. Mark a secret message in code on a computer card. Give it to a friend to decode.
4. Go to a bank and get some information on magnetic ink used on checks.
5. Make a model of magnetic cores connected by wires. HINT: Try thread spools and wire.

PART SIX

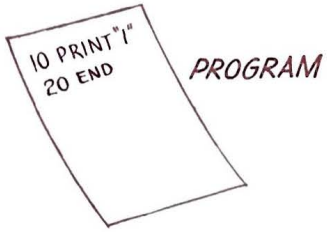
Up until now, we have talked about the computer and its parts. All the machines used in a computer system are called the HARDWARE. Some examples of HARDWARE are the terminal, printer, and card reader. Can you think of some other examples?



Hewlett Packard computer hardware.

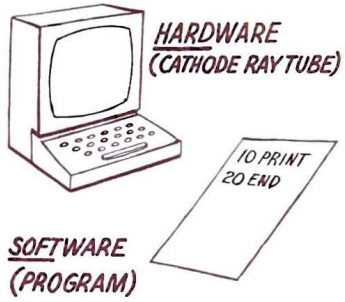
_____ware are the machines in a computer system.

The programs that go into a computer are called the SOFTWARE.



What are the programs called?

To remember this easily, think of it like this. Machines in a computer system are made of very "hard" material like steel. So, they are called HARDWARE. The programs are written on "softer" material like paper. They are called SOFTWARE.



We talked earlier about the person who writes the programs. We remember the program is the set of instructions the computer uses to solve a problem. Do you remember what this person who writes the program is called?

Many times the computer is blamed for an error. More often than not, the error is done by the person writing the program or putting the program into the computer.

If a program will not run properly, there is probably a "bug" in the program. Computer bugs are errors in the program.

3. What are computer bugs?

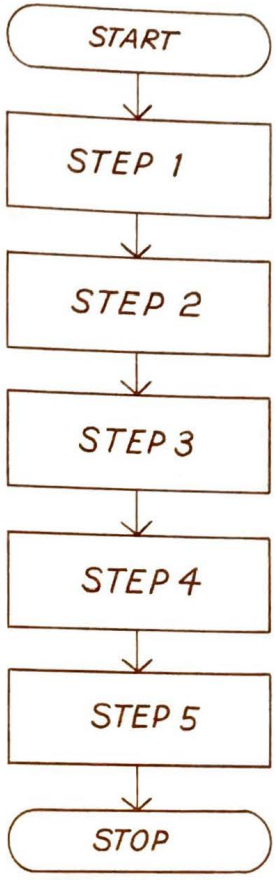
Before a programmer writes a program, he must think of all the steps he will use in his program. He must put all his steps in order. We put things in order each time we do something.

When you get up in the morning you follow certain steps. You will do certain things before you do other things. For example, the first thing you do is GET UP. Let's think of some of the other things you do in the morning.

What is wrong with the above list? If you said they were not in the correct order, you would be right. Let's put them in the correct order.

In working on a problem, we need to do 2 things:

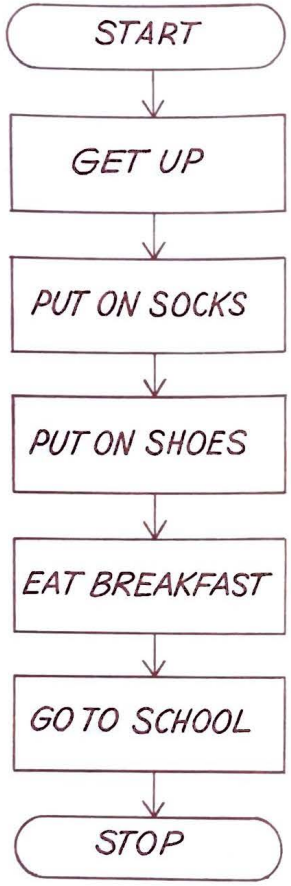
1. Think of all the steps to use.
2. Think of the order in which the steps must go.



A programmer does these two things. To help him plan his steps, he makes a FLOW CHART. A flow chart is a road map or drawing of all the steps used to solve a problem. It shows the order of the steps. It also shows how each step is connected to the other steps.

What is a drawing of the steps used in solving a problem?

A flow chart showing the 5 steps we talked about on page 61 would look like this.



The arrows tell you which step to follow next.

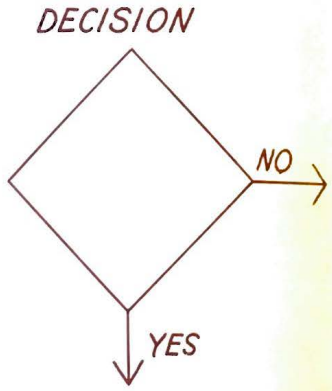
Certain symbols are used when making a flow chart. One symbol will begin and end a program. It looks like this.

Another symbol looks like a rectangle. This is called a "do-something" or processing box.

The ▭ is a "do-something" symbol. (true or false?)

The ▭ symbol starts or stops a program. (true or false?)

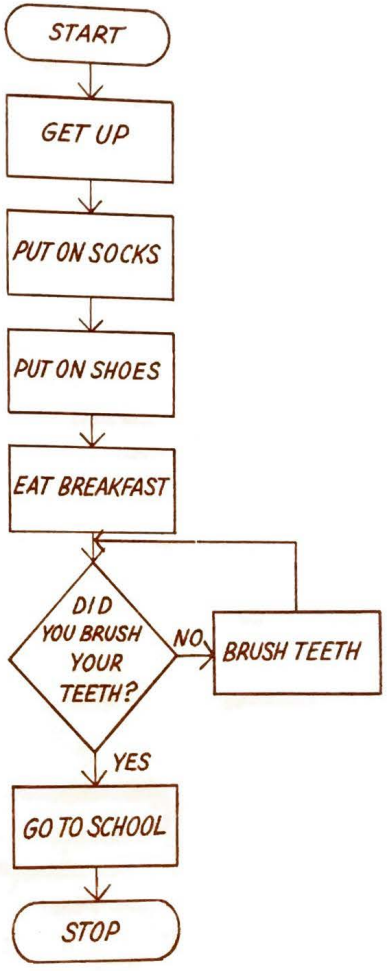
Sometimes we have to ask a yes or no question and make a decision when we're doing a problem. A symbol used to ask a question in a flow chart is the decision symbol. It is diamond shaped.



There are always at least 2 arrows coming out of a decision box. If the answer to the question is yes, an arrow will lead you one place. If the answer to the question is no, an arrow will lead you another place.

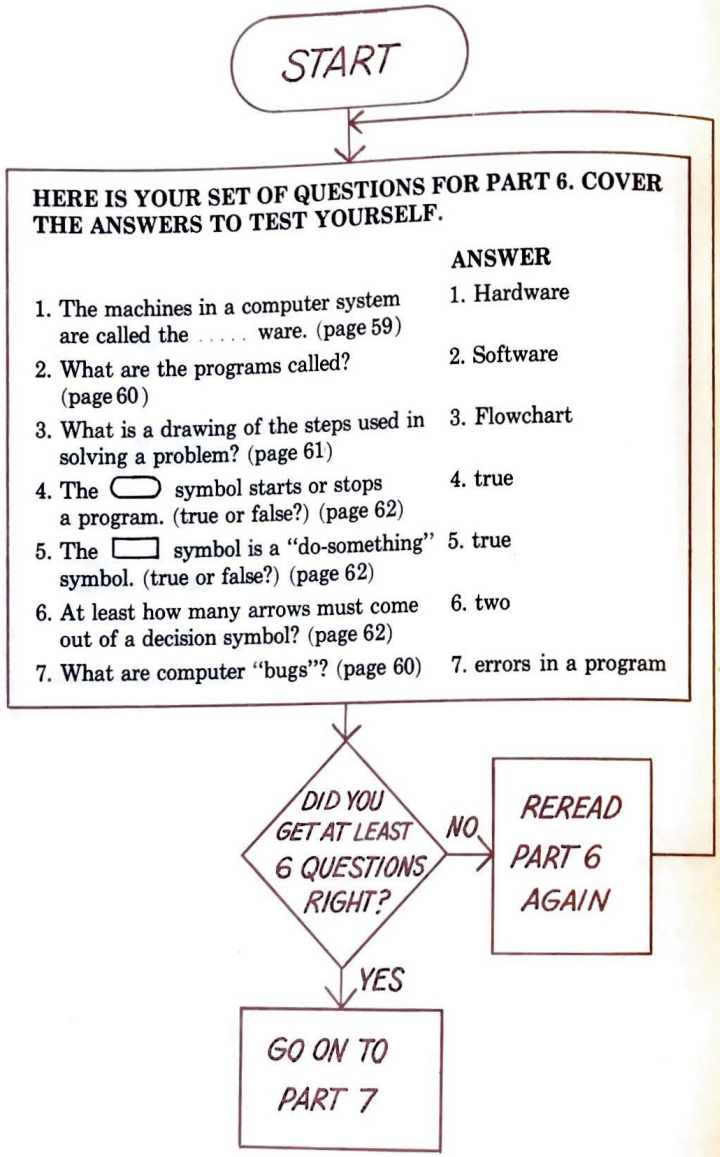
How many arrows must come out of a decision symbol?

Let's put a question in the flow chart from page 62



What happened when you came to the decision symbol? If you hadn't brushed your teeth, did you follow the arrow to the right? Where did you go after you brushed your teeth?

You can see you may go either one of 2 ways out of a decision symbol. If you chose the "no" route, it led you away from the regular path of the flow chart. This is called "looping."

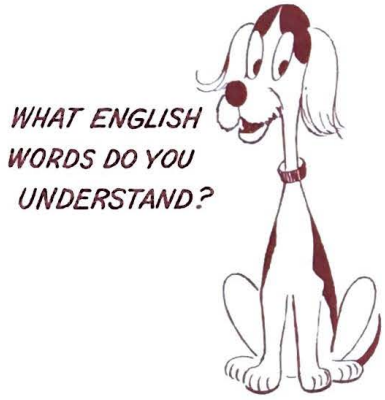


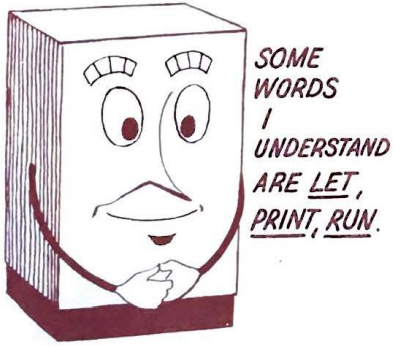
THINGS TO DO!

1. Fill out a flow chart on watching a television program.
2. Make a list of things you know how and like to do. For example, some things might include playing baseball, making lemonade or riding your bike. From this list choose one and make a flow chart of the steps you follow each time you do this particular activity.

PART SEVEN

After a programmer has written a flow chart, he writes the program. Earlier, we talked about how the computer doesn't do anything unless it's told to. To communicate with a computer, we must give it information in a language it understands. The computer understands numbers and certain English words.





There are many languages the computer understands. Examples are FORTRAN, COBOL, and BASIC. Scientists use FORTRAN to communicate with a computer. Businesses use COBOL. We will use a language called BASIC. It is a language designed to be easily used especially for beginners.

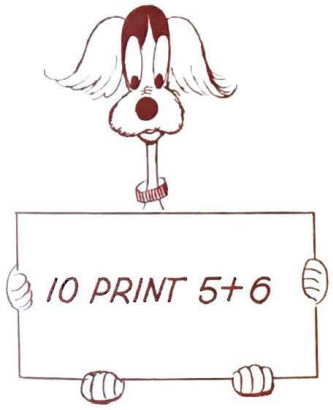
What computer language is a good language for beginners?

In the BASIC language, every instruction goes on one line called a STATEMENT. A STATEMENT in BASIC would look like this:

Every STATEMENT begins with a whole number. This number is called the STATEMENT NUMBER or LINE NUMBER. What is the STATEMENT NUMBER in the example above?

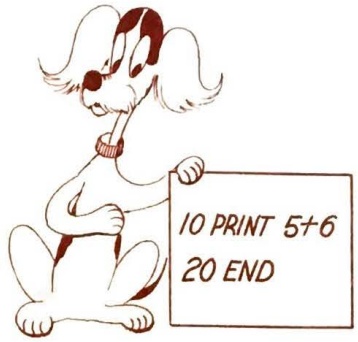
What is the number at the beginning of a statement called?

Every STATEMENT has a special English word following the STATEMENT NUMBER. This word tells the computer what to do. Look at our example again.



This statement tells the computer to print the sum of 5 and 6. What is the English word following the statement number?

Every program must have an END statement before the program will work. The END statement must be the highest number in the program. Look at the following program:



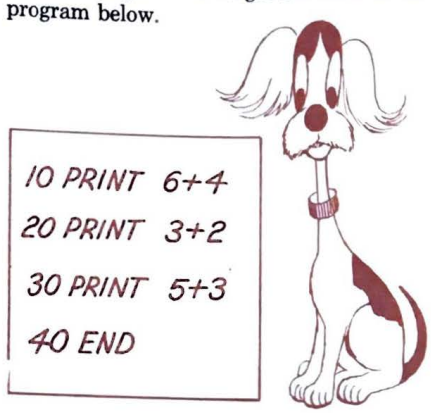
What is the highest statement number in the program above? This program would print the sum of 5 and 6.

What statement in a program must have the highest statement number?

We talked earlier about the OUTPUT being the answer to the problem. The OUTPUT to the problem above would look like this.

The problem would not be printed on the OUTPUT. Only the answer would be printed.

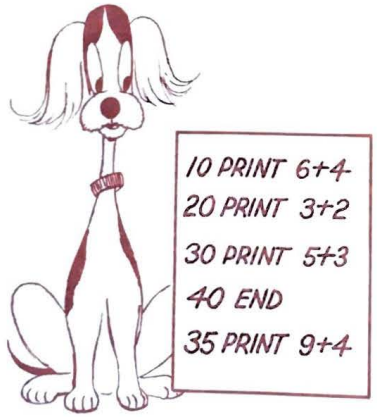
Numbers with two digits or more (like the number 10) are usually used for the statement number. These numbers are used instead of single digit numbers like 1, 2, or 3. This allows the programmer to put in a statement he might have forgotten. Look at the program below.



The programmer might have forgotten he also needed the answer to the problem 9 + 4 in his program. To include this problem he would add the statement

35 PRINT 9 + 4

He could add this statement at the end of the program like this



The computer searches through all the statement numbers and does them in order. It first finds the smallest statement number, then the next highest. It will continue doing this until it gets to the largest number. Notice statement 35 was written at the end of the program. However, the computer did statement 35 after it did statement 30.

Does the computer work on the lowest or highest statement number first?

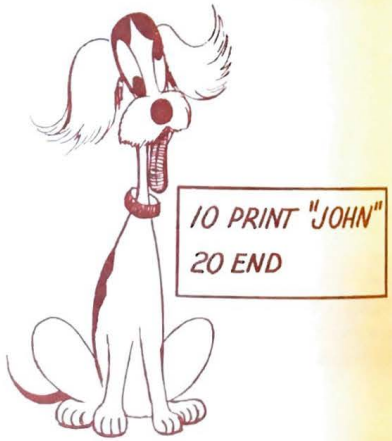
The computer understands certain math symbols in the same way we use them. However, some math symbols are used in a different way. These are the symbols the computer understands.

\+ addition
\- subtraction
* multiplication
/ division

Which symbols are different from the symbols you use in mathematics?

The symbol * is used for division. (true or false?)

Quotation marks to a computer mean something different than what we are used to in the English language. We can tell a computer to print any word we want. To do this, we must put the word or words we want printed in quotation marks. An example is this.



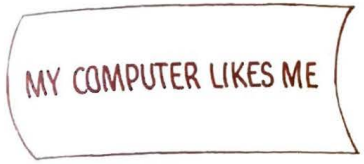
This program would tell the computer to print the name JOHN.

What is used to tell the computer to print words?

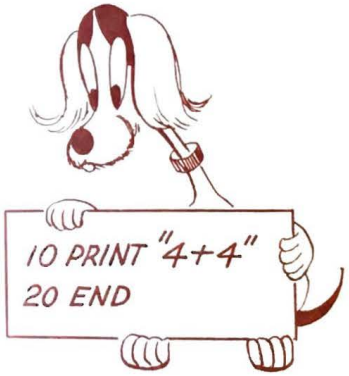
To tell the computer to print a sentence, we put the whole sentence in quotation marks like this.

10 PRINT "MY COMPUTER LIKES ME"
20 END

The OUTPUT would look like this.

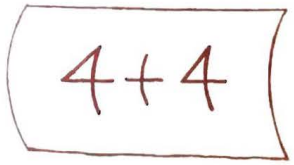


We can also tell the computer to print mathematics problems. To do this, we put the problem in quotation marks. A program to print the problem 4 + 4 would look like this.

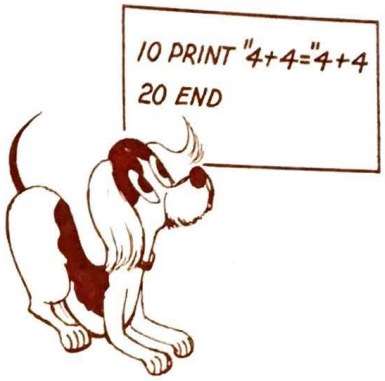


Notice 4 + 4 is in quotation marks.

The OUTPUT would look like this.

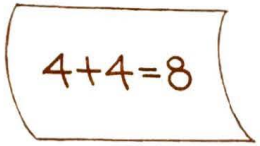


To print the problem and the answer, the program would look like this.



Notice the = sign is also inside the quotation marks.

The OUTPUT for this problem would look like this.



We talked earlier about printing the answer to arithmetic problems like 6 + 4, 3 + 2, and others. Notice we did not need quotation marks to print the answers to these problems. The reason for this is the computer automatically does any arithmetic problem it is told to do.

To print the answer to an addition problem, we do not need quotation marks. (true or false?)

When using a terminal to type in a program, it is easy to change a line in a program. To do this, simply retype the whole line. You must use the same statement number. The computer uses the last line typed with the same statement number. For example, look at this program.

```
10 PRINT "JANICE SMITH"
20 END
```

To change the girl's name, retype statement number 10 at the end of the program. It would look like this.

```
10 PRINT "JANICE ANDERSON"
20 END
10 PRINT "JANICE MARIE ANDERSON"
```

The computer would print this program in the following way:

OUTPUT

To change a line in a program, simply retype it. (true or false?)

BEFORE YOU GO ON TO THE NEXT PART, CAN YOU ANSWER THESE QUESTIONS? (The answers are given in the column to the right. Cover the answers to test yourself.)

	ANSWER
1. What computer language is a good language for beginners? (page 66)	1. BASIC
2. What is the number at the beginning of a statement called? (page 67)	2. statement or line number
3. What statement has the highest statement number? (page 67)	3. END statement
4. To change a line in a program, simply retype it. (true or false?) (page 70)	4. true
5. Does the computer work on the lowest or highest statement number first? (page 68)	5. lowest
6. The symbol * is used for division. (true or false?) (page 68)	6. false
7. What symbols are used to tell the computer to print words? (page 68)	7. quotation marks
8. To print the answer to an addition problem, we do not need quotation marks around the problem. (true or false?) (page 69)	8. true

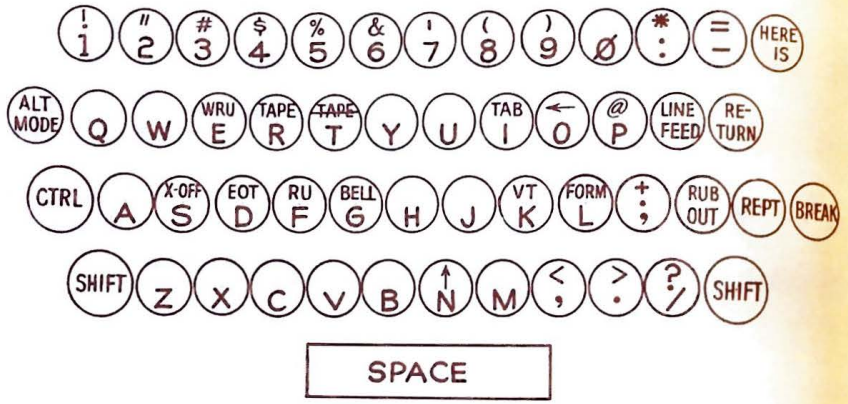
If you got 7 out of 8 questions right, you have satisfactorily completed all the questions in the book. If you got less than 7 right, reread this section again.

THINGS TO DO!

1. Make a flow chart and write the programs for problems your teacher will give you.
2. Write a program to print your initials. Use graph paper to set up the program. Be sure you put quotation marks at the beginning and end of each statement. Also be sure to include an END statement.

APPENDIX A

A terminal is one of the machines we can use to communicate with a computer. Let us take a closer look at a terminal. Notice the keyboard below.

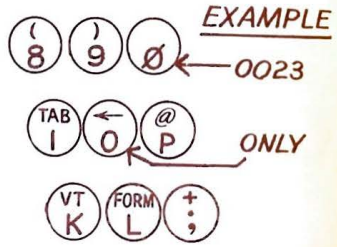


The terminal keyboard is much like a typewriter keyboard. There are 4 rows of keys. Some terminals print small and capital letters. On many terminals, however, all letters are capital letters. There are no small letters on these terminals.

The numbers are all on the top row of the keyboard. The number 1 is at the far left. Some typewriters use the letter "L" for a 1. This will not work on a terminal. You must use the 1 key.

You type on a terminal in much the same way you type on a typewriter. (true or false?)

The zero and the letter 0 are not the same. You must use the zero for numbers and the letter O in words.



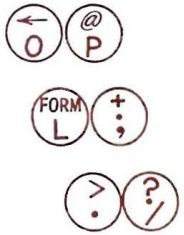
Notice the symbols above the numbers on the top row of keys.

To get a symbol above the numbers, you press the SHIFT KEY and the key itself. There are 2 SHIFT KEYS. One is on the lower right side of the keyboard and the other is one the lower left side.

SHIFT KEY

For example, if you want to print the $ sign, you press the SHIFT KEY. While you hold down the SHIFT KEY, you press the $ 4 key.

You get the symbols above letters on other parts of the keyboard in the same way. Some of these symbols are shown below.

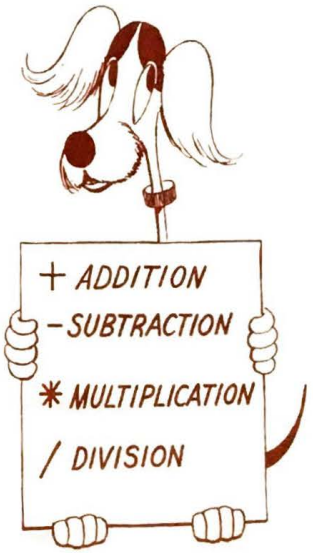


What key do you press to get a symbol on top of a number key?

The bar at the bottom is the SPACE BAR. When pressed, this will leave a space between words, sentences or other places where a space is needed.

The computer understands certain mathematics symbols that you use in problems. However, some symbols are different. Below are the symbols the computer understands.

The symbol + is for addition.
— is the symbol for subtraction.
To multiply use the symbol *.
The / is used for division.



To type 12 divided by 3, you would type 12/3. To type 3 times 4, you would type 3*4.

WHICH MATH SYMBOLS DOES THE COMPUTER UNDERSTAND WHICH ARE DIFFERENT FROM THE MATH SYMBOLS YOU USE?

THE * SYMBOL IS USED FOR DIVISION. (true or false?)

HOW WOULD YOU TYPE THE FOLLOWING PROBLEMS SO THAT THE COMPUTER COULD UNDERSTAND YOU? DO NOT WRITE THE ANSWER IN THE BOOK.

25 times 35

$5\overline{)950}$

38 x 24

65 ÷ 5

9 plus 17

Some of the other keys you will use are these.

CONTROL 

On some terminals when you hold the control key down and press a letter, you will not see the letter printed. The computer will know you typed the letter, however. This allows you to type a secret letter to the computer. The letter cannot be seen by anyone. On some computers you may use CONTROL letters when you are signing in to use the computer. Using hidden letters will keep others from using your password. A password is assigned to a person for use when signing in on a computer.

For example, let's use the password DA^CN^CJ. The A and N were typed holding the CTRL key down. The only thing that printed was DJ. However, the computer understood it to be DANJ.

REPEAT 

Press this key to have a letter repeated several times. Hold the key down while pressing the letter.

RETURN 

Always press the RETURN key when you have finished typing a line. This returns the printing carriage to the left side.

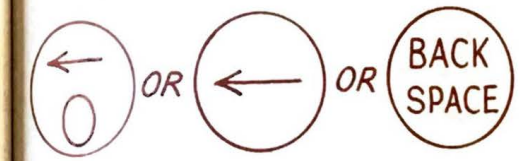
BREAK 

To stop the computer in the middle of a program, press the BREAK key.

LINEFEED 

To space up a line when you are using the terminal off-line (not hooked up to the computer over telephone lines), press the LINEFEED key. When hooked up on-line this key is not necessary, because it is automatically done.

ERROR KEY



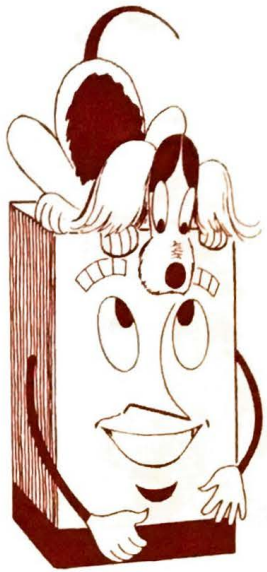
If you make a mistake, press the key with the arrow pointing to the left. On some keyboards the arrow will be above the zero. (You must use the SHIFT KEY in this case.) On other machines, the arrow will be a key by itself. (You do not need the SHIFT KEY in this case.) On still other machines, the error key may be the backspace key. Ask your teacher about which key you will be using. When you press this key, it tells the computer not to use the letter you had just typed.

For example, maybe you typed PRINO. You wanted a T in place of the O. After you had typed the O, press the arrow key. Then press the T. It will look like this.

PRINO←T

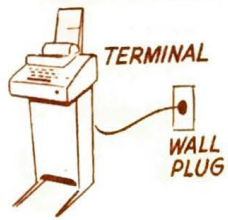
The computer will understand it like this.

PRINT

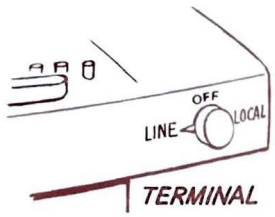


We talked earlier about using a terminal ON-LINE to a computer. On-line means being hooked up to a computer over telephone lines. To do this certain steps must be followed to get ready.

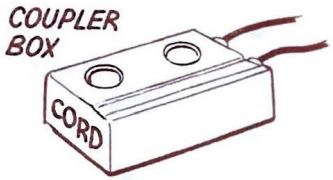
1. Be sure the terminal is plugged in.



2. Turn the knob on the front of the terminal to "line."

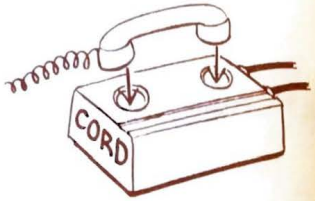


3. Set the coupler box switch to "on." (The coupler box holds the telephone receiver. It may be a separate box from the terminal or it may be part of the terminal.) At one end of the box is a switch marked full or half. Ask your teacher where to set the switch.

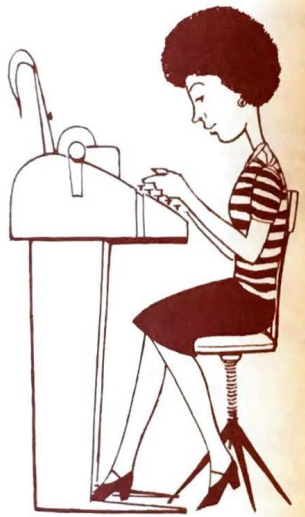


4. Dial the computer number.

5. When the high-pitched tone is heard, place the telephone receiver in the coupler. Be sure the cord end of the receiver is in the correct end of the coupler box. On some boxes this end is marked CORD.



The knob on the terminal should be set in the line position in order to communicate with the computer. (true or false?)



You are now ready to communicate with the computer. Before the computer will talk to you, you must sign in. This is called LOGGING IN. This means you give the computer a special identification number and password.

The reason this is done is because many people are using this computer at the same time. Remember, we call this TIME-SHARING. The computer keeps track of programs you do by using your identification number.

What is it called when you sign in to use the computer?

There are several ways of LOGGING IN. It all depends on what computer you are using. One way of LOGGING IN is like this.

1. Press any number on the keyboard. Then press the (RE-TURN) key.
2. Type HEL- followed by your identification number, a comma and your password. You may type either HEL or HELLO. They mean the same thing. For example look at the following:

   HEL-A840,DA^{c}N^{c}J

Notice there are no spaces between words or after the comma. There must be a dash (—) after HEL. The A and N are CONTROL keys. The A840 is the identification number and the DA^{c}N^{c}J is the password. Press the RETURN key after LOGGING IN.

If you have logged in correctly, the computer will give you a message. It will also tell you it's ready for you to use. Below you will see a sample of a message typed by the computer after someone had logged in.

```
PORT #06 AT 10:49 AM, THURSDAY, 30 OCT 75  DAY: 303
FOR SYSTEM NEWS GET & RUN NEWS
T.I.E.S.  2000C2    ...READY
```

This is the method of logging in used with the time-sharing computer at T.I.E.S. (Total Information for Educational Systems) in Roseville, Minnesota.

Another way of LOGGING IN is like this.

1. Press the (RE-TURN) key.
2. The computer will respond by typing PLEASE SIGN ON WITH "HELLO"
3. After the carat sign > , type HELLO. Leave a space after HELLO, then type your user identification number. Next type a slash and then your password. Press the (RE-TURN) key. Your LOGGING IN might look like this.

   > HELLO H7LT560/2031

4. The computer will type over your user identification number and password and give you a message like the following:

```
PLEASE SIGN ON WITH 'HELLO'.
>HELLO
UNIVAC-1100 RTP-2.2.2 ID:01   11:34:21 15 SEP 75
```

This method of logging in is used with the time-sharing computer at MECC (Minnesota Educational Computing Consortium in St. Paul, Minnesota.)

Your logging in procedure may be different from one of these methods. If so, take special care to write down each instruction carefully. For example, if a space is left out when it was not supposed to be left out, you will not be able to get logged in. So you see, it's very important to write down all instructions carefully.

There are several ways of signing off from the computer. This depends on which computer you are using. On some computers you type BYE. The computer then responds with the number of minutes you have been hooked up to the computer.

```
BYE
016 MINUTES OF TERMINAL TIME
```

After signing off, follow the steps below:

1. Hang up the telephone.
2. Turn off the terminal.
3. Turn the coupler box off.

CAN YOU ANSWER THESE QUESTIONS? (**The answers are given in the colmn to the right. Cover the answers to test yourself.**)

	ANSWER
1. You type on a terminal in much the same way you type on a typewriter. (true or false?) (page 72)	1. true
2. What key do you press to get a symbol on top of a number key? (page 73)	2. Shift key
3. The / symbol stands for multiplication. (true or false?) (page 73)	3. False
4. To communicate with the computer, set the knob on the teletype to LINE. (True or false?) (page 76)	4. True
5. What is it called when you sign in on the computer? (page 76)	5. LOG-IN

If you got 4 out of 5 right, go on to the next section. If you got less than 4 right, reread this section again.

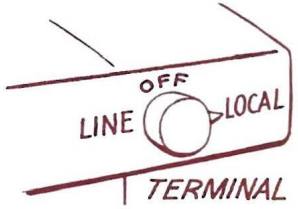
APPENDIX B

You may at some time want to make a copy of a message on a punched paper tape. To do this, the terminal does not need to be hooked up to the computer over telephone lines. In other words, the terminal will be used OFF-LINE. You can make a paper tape while ON-LINE to the computer also.

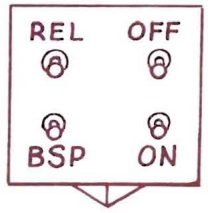
What is it called when you use a terminal when it's not hooked up to a computer?

If your terminal has a paper tape attachment, you may make a paper tape by following certain steps.

1. Turn the switch on the terminal to LOCAL This means the terminal is being used OFF-LINE.

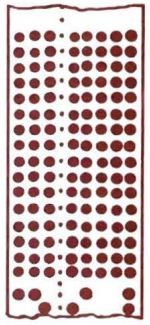


2. Press the ON button on the tape punch. The tape punch is usually located on the left side of the terminal.



TAPE PUNCH

3. Hold down the RUB OUT and REPT (REPEAT) keys together. Hold them down until at least two inches of paper tape has been punched. Notice the solid lines of holes on the tape. This is called the leader. There is no message on this part of the tape. On some terminals another way to put a leader on a paper tape is by holding down the HERE IS key.



PAPER TAPE LEADER

You are now ready to type in your message and have it recorded on paper tape.

1. Type your program in. After each line of typing, press the RE-TURN key, the LINE FEED key and the RUB OUT key. This will return the printing carriage to the left and space the paper up one line. By pressing the RUB-OUT key after each line of your program, you will be able to tell on the paper tape where one line leaves off and another begins.

When using the terminal OFF-LINE, you must use the LINE FEED key. When using the terminal ON-LINE, the computer will cause the terminal to space up a line. You do not need to use the line feed when you are ON-LINE.

2. After finishing your program, press the REPT and RUB OUT keys at the same time as you did to start the tape. This will put trailing leader on the tape.

3. Press the OFF button on the tape punch.

4. Tear off the paper tape.

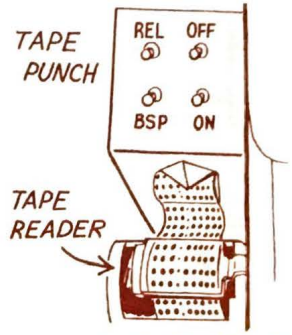
You now have a copy of your message on paper tape. Having your message stored on paper tape means you can use it over again.

Putting a program on paper tape also saves computer time. It takes less time to put a program in using a tape reader than it does to type it in directly.

You must use the line feed key to space up a line when using the terminal off-line. (true or false?)

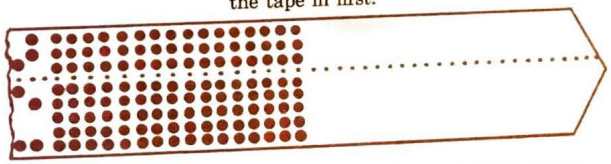
To put a leader on a paper tape, you press the repeat and rubout keys at the same time. (true or false?)

You may check a tape to see if it was typed correctly by using a TAPE READER. Some tape readers are located on the left side of the terminal below the tape punch.



When using a TAPE READER, follow the steps below.

1. Check to see the terminal switch is on LOCAL.
2. Be sure the tape punch button is OFF.
3. Be sure the switch on the tape reader is OFF.
4. Unsnap the plastic guard on the tape reader.
5. Put the tape on the tape reader. Make sure the tiny holes in the tape are on the teeth of the tape reader. Put the arrow end of the tape in first.



6. Fasten the plastic guard over the tape.
7. Press the tape reader switch to ON.
8. When the tape is done running, push the tape reader switch OFF.

A tape reader will check a paper tape. (true or false?)

CAN YOU ANSWER THESE QUESTIONS? (The answers are given in the column to the right. Cover the answers to test yourself.)

	ANSWER
1. . . . . -LINE is using a teletype without being hooked up to a computer. (page 80)	1. OFF
2. You must use the LINE FEED key to space up a line when using the terminal off-line. (True or false?) (page 81)	2. True
3. To put a leader on a paper tape, you press the REPEAT and RUBOUT keys at the same time. (True or false?) (page 81)	3. True
4. A tape reader will check a paper tape. (True or false?) (page 81)	4. True

If you got 3 out of 4 right, you have finished this section. If you got less than 3 right, reread this section again.

GLOSSARY

ABACUS A counting frame used to do mathematics.

ANALOG COMPUTER A computer which compares one thing with another. An example is a bathroom scale.

ARITHMETIC UNIT The part of a computer that does the mathematics of a problem.

BASIC An easy computer language used by beginners.

BUGS Errors in a computer program.

CARD READER A machine used to detect holes in punched cards. It then sends signals to a computer to translate the information from the holes.

CATHODE RAY TUBE (CRT) A machine, with a keyboard like a typewriter and a TV screen, which can be used as both an input and output device.

CENTRAL PROCESSING UNIT The part of the computer where the information is worked on.

CHIP Electrical part which is used in 4th generation computers.

COBOL A computer language used by business.

COMPUTER A machine, with a memory like a calculator, which accepts information, works on the information to solve a problem, and puts out the answer.

CONTROL UNIT A part of the computer that directs the flow of data through the computer.

DATA The information a computer needs to solve a problem.

DIGITAL COMPUTER A computer, with a memory, that works by using numbers and follows a set of instructions called a program.

END The statement in a computer program which has the highest statement number.

ENIAC The first all electronic computer, built in 1947.

FLOW CHART A drawing or map that tells the steps needed to solve a problem. It also shows the correct order for doing the steps.

FORTRAN A computer language used by scientists.

GENERATIONS Computer generations refer to groups of computers using certain kinds of parts. For example, first generation computers used vacuum tubes.

HARDWARE The computer machinery.

INPUT Information that goes into the computer.

INTEGRATED CIRCUITS Electrical connections between points which control third generation computers.

KEYPUNCH A machine used for punching holes in cards.

LOG-IN To sign in on a computer.

MAGNETIC CORES Tiny doughnut-shaped metal rings used to store information inside a computer.

MAGNETIC DISK A device which looks like a phonograph record. It contains information which can be sent to the computer.

MAGNETIC DRUM A round drum-like device which holds information on a magnetic surface.

MAGNETIC TAPE A plastic ribbon, which resembles tape recorder tape. Information is recorded on the tape in the form of magnetized spots.

MAGNETIC TAPE DRIVE A machine used to detect the spots on magnetic tape.

MARK I The first digital computer. It was party mechanical and partly electronic.

MARK-SENSE CARD A card which has pencil marks on it to record information.

MEMORY The part of the computer where programs and data are stored.

MINICOMPUTER A small computer about the size of a suitcase.

NANOSECOND A billionth of a second.

OFF-LINE Using a computer terminal when it is not hooked up to a computer.

ON-LINE Using a computer terminal when it is hooked up to a computer.

OPTICAL SCANNER A device used to interpret the pencil marks on a mark-sense card.

OUTPUT The answer to a problem, which comes out of a computer.

PAPER TAPE A paper ribbon that contains information in the form of patterns of holes.

PAPER TAPE READER A machine used to detect the holes on paper tape.

PRINT An instruction to the computer which tells it to type out a certain thing.

PRINT OUT A form of output from a computer which contains the information the computer has just processed. It is also called a read out.

PRINTER The machine used to print the output from the computer.

PROGRAM A set of instructions which tells the computer what to do.

PROGRAMMER A person who writes a computer program.

PUNCHED CARD A card which may be punched with holes that stand for letters, numbers, or symbols.

SOFTWARE The programs that go into the computer.

STATEMENT A line of a computer program.

STATEMENT NUMBER OR LINE NUMBER A number at the beginning of a line in a computer program.

TERMINAL A device with a keyboard like a typewriter that can be hooked up to a computer over telephone lines.

TIME-SHARING A computer system where many people use the computer at the same time.

TRANSISTOR An electrical part which controlled the flow of electricity in second generation computers.

UNIVERSAL PRODUCT CODE A mark on store purchases which tells something about the purchase. In some cases it is a code which tells the name of the manufacturer and the name of the product. In other cases it tells the price of the item.

VACUUM TUBES An electrical part which were used in first generation computers.

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