A Young Math Book

Computers

By Jane Jonas Srivastava

Illustrated by James and Ruth McCrea

A YOUNG MATH BOOK

Computers

BY JANE JONAS SRIVASTAVA

illustrated by
James and Ruth McCrea

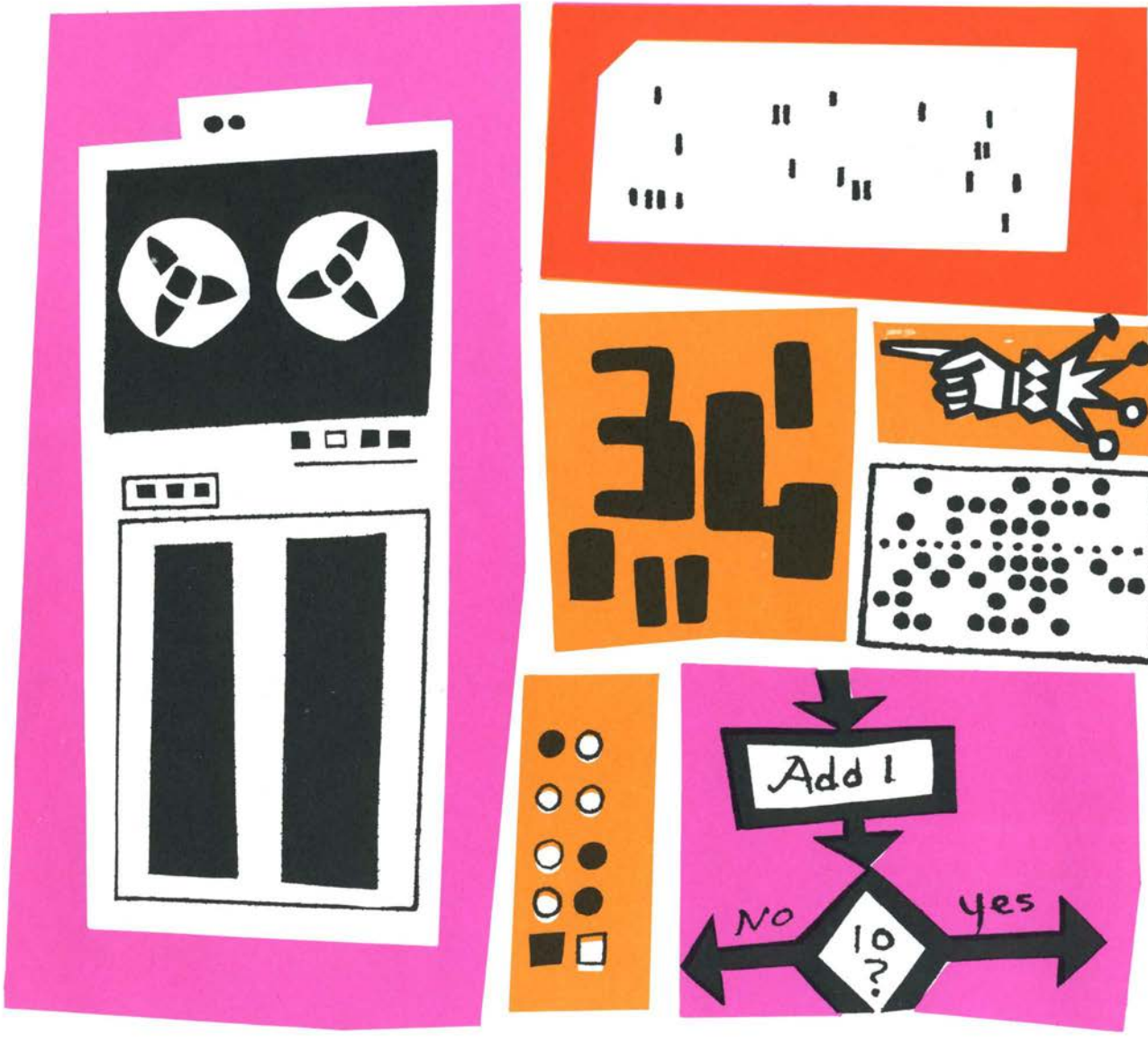
Comparing a computer to a five-ring circus, this book tells what a computer is and how it works. In easy-to-understand language, Jane Jonas Srivastava outlines the basic units which make up all computers, and explains special computer language like printout, data, program, and FORTRAN.

In COMPUTERS, the young mathematician will learn what a programmer uses a flowchart for, and how to design a flowchart of his own. One of the flowcharts in the book is for counting from one to ten; the other is for counting giraffes met on the way to school.

This book also tells what sort of tasks people ask computers to do. As the author points out, most times computers are used to do quickly and accurately the same job over and over again. Unlike humans, they can do this without getting bored and asking, "When's recess?" Most important, the reader learns that computers can do only the things that programmers ask them to do.

This is a lighthearted, information-filled book that will fascinate young readers. The delightful illustrations by Ruth and James McCrea are a perfect complement to the text.

Computers


Add 1
NO
10
?
yes

Computers

By Jane Jonas Srivastava

Illustrated by James and Ruth McCrea

Thomas Y. Crowell Company, New York

YOUNG MATH BOOKS

Edited by Dr. Max Beberman, Director of the Committee on School Mathematics Projects, University of Illinois

BIGGER AND SMALLER
by Robert Froman

CIRCLES
by Mindel and Harry Sitomer

COMPUTERS
by Jane Jonas Srivastava

THE ELLIPSE
by Mannis Charosh

ESTIMATION
by Charles F. Linn

FRACTIONS ARE PARTS OF THINGS
by J. Richard Dennis

GRAPH GAMES
by Fredérique and Papy

LONG, SHORT, HIGH, LOW, THIN, WIDE
by James T. Fey

ODDS AND EVENS
by Thomas C. O'Brien

PROBABILITY
by Charles F. Linn

RIGHT ANGLES: PAPER-FOLDING GEOMETRY
by Jo Phillips

RUBBER BANDS, BASEBALLS AND DOUGHNUTS: A BOOK ABOUT TOPOLOGY
by Robert Froman

STRAIGHT LINES, PARALLEL LINES, PERPENDICULAR LINES
by Mannis Charosh

WEIGHING & BALANCING
by Jane Jonas Srivastava

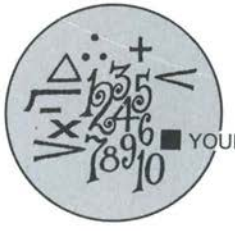
WHAT IS SYMMETRY?
by Mindel and Harry Sitomer

Manufactured in the United States of America

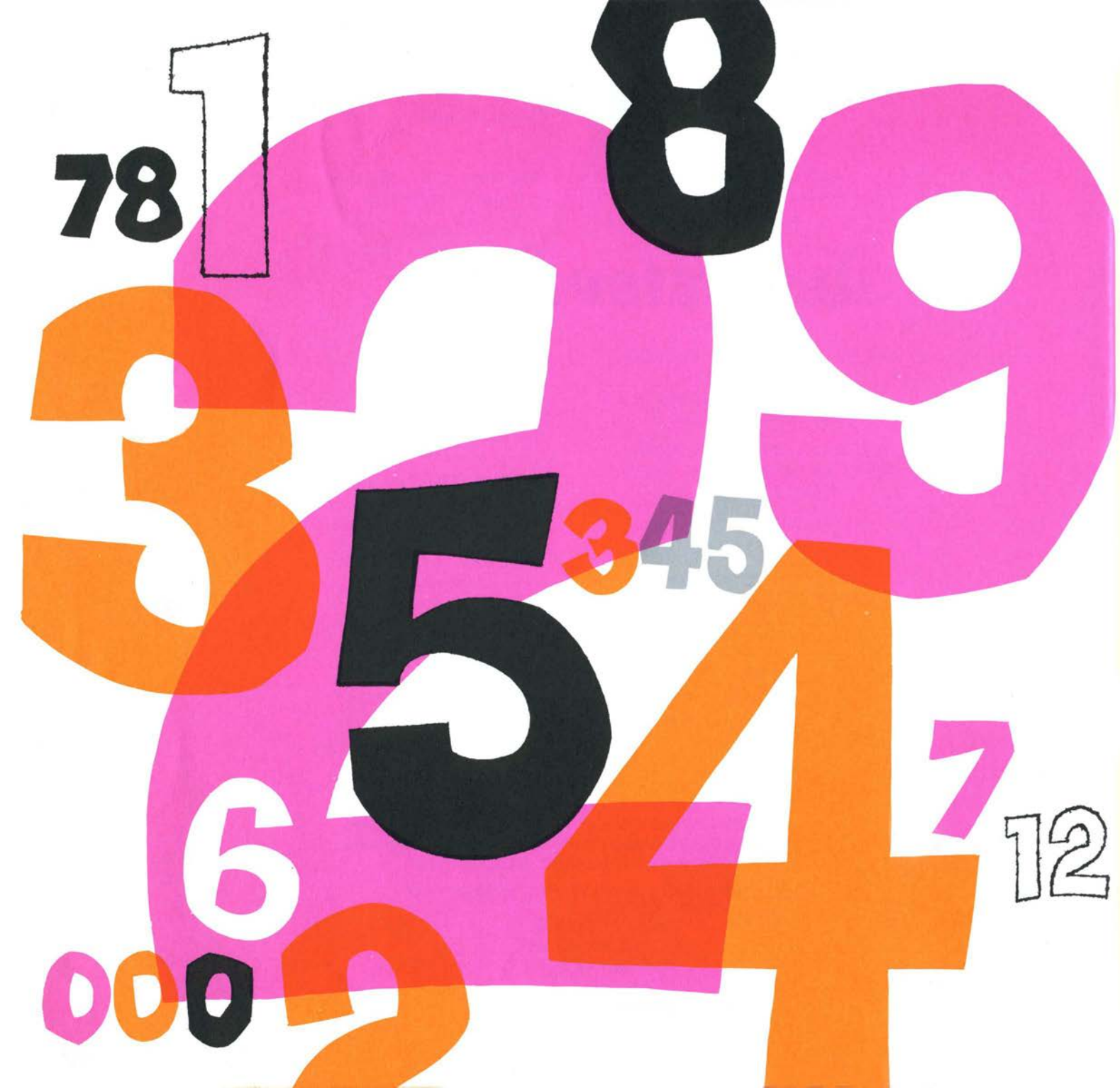
L.C. Card 70-171009
ISBN 0-690-20850-2
0-690-20851-0 (LB)

1 2 3 4 5 6 7 8 9 10

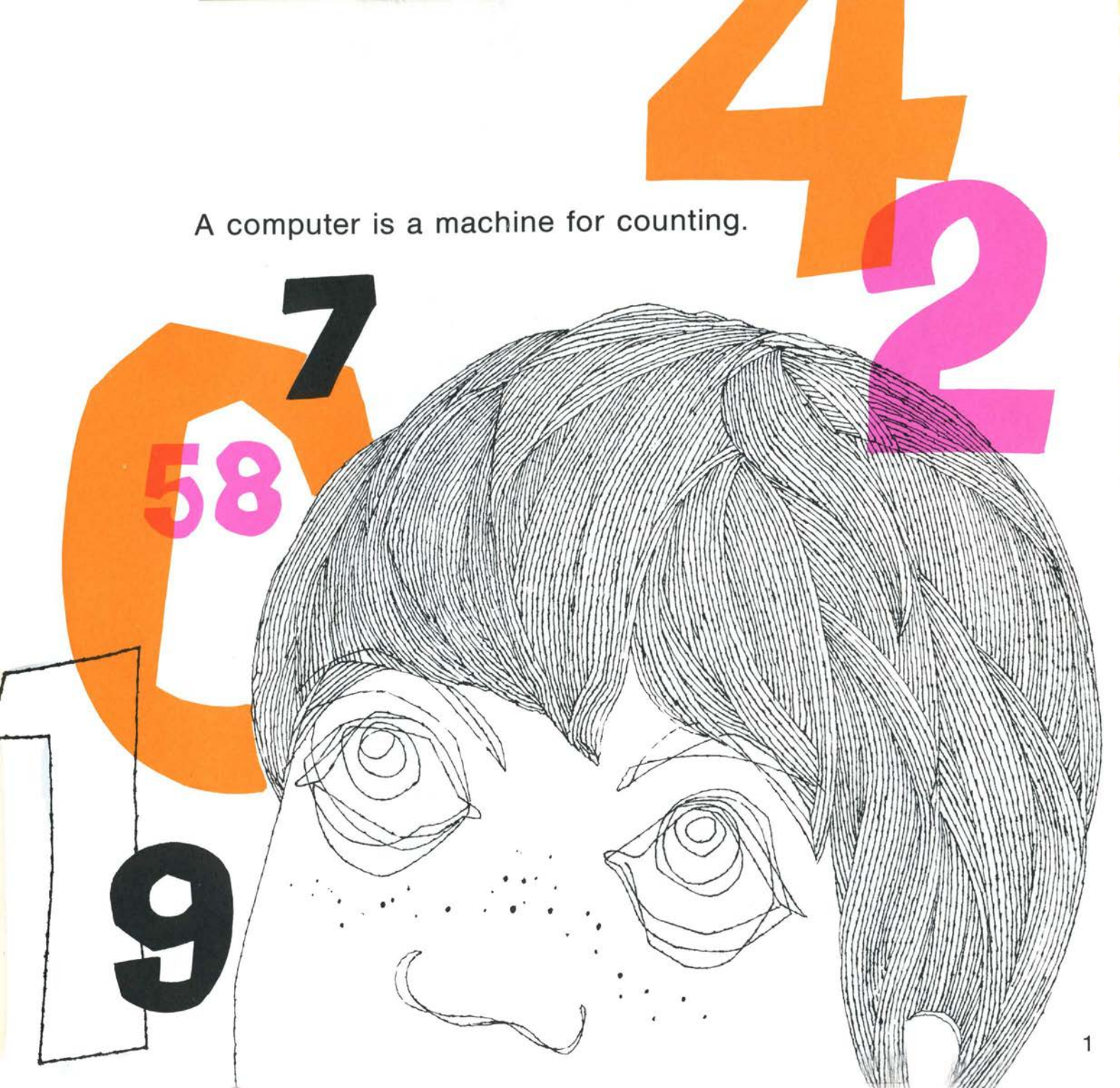
Computers



YOUNG MATH BOOKS


78
1
8
9
3
345
5
6
7
12
0
0
0
2
4

A computer is a machine for counting.



The first counting machine was an abacus. Although it was invented more than 2,000 years ago, people use it even today.

What other machines do we use for counting?

Adding machines and cash registers are simple computers.


13.75
Oats

There are other computers that read, and write, and count, and do arithmetic. They can remember things, and they can follow very complicated instructions.

Banks use computers to sort checks.

Stores use computers to make out bills.

Factories use computers to tell how long each person works and how much he should be paid. Sometimes a computer even writes out the paychecks!

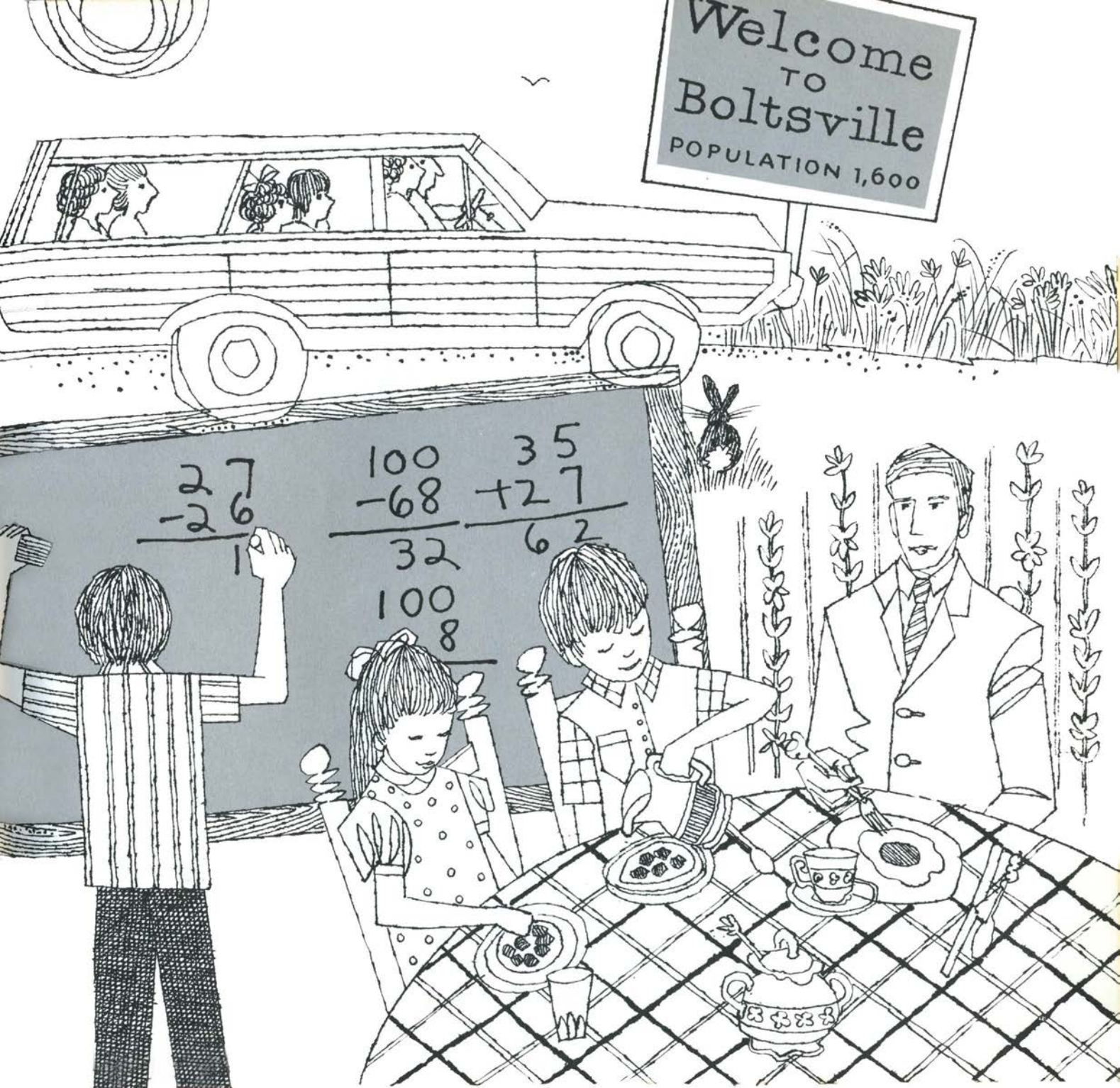
Some computers are as big as a house; some are small enough to fit on a desk.

The computers that do many jobs are made up of smaller parts called UNITS.

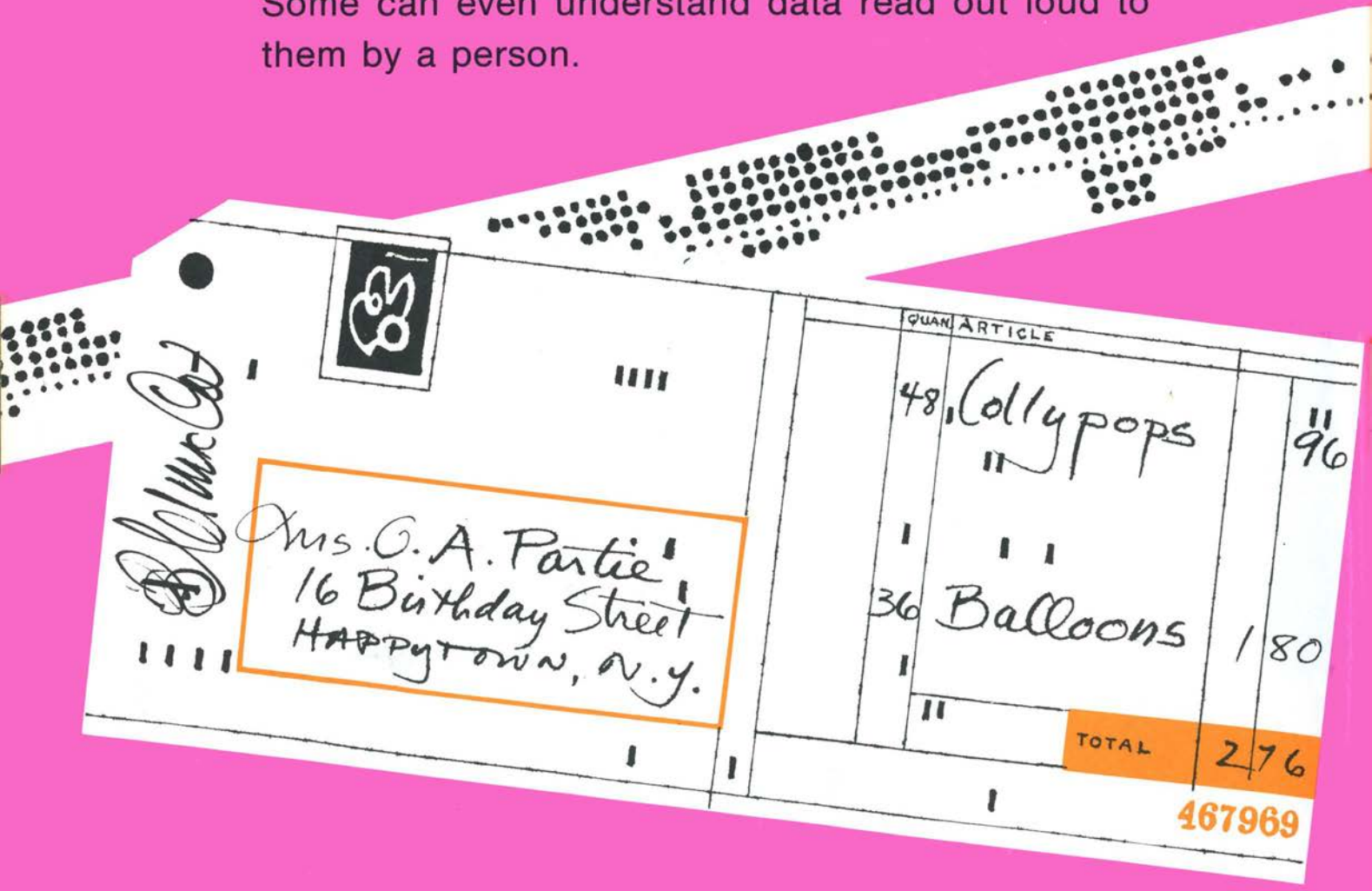
The INPUT UNIT reads information that is given to the computer. This information is called DATA.

Data is the information a computer needs to do a job. For example, the date a person was born, or the name of the city or the street where he lives, is data. Data is also numbers, like the number of people in a family, or the number of people who eat Munchies for breakfast. Number facts like $1 + 1 = 2$, or 27 is bigger than 26, are data, too.

The kind of data a computer uses depends on the job the computer is doing.


Welcome
TO
Boltsville
POPULATION 1,600
27
-26
1
100
-68
32
100
8
35
+27
62

Computers read data from holes punched in cards or in paper tapes. They also read data from magnetic signals on paper, on records, and on plastic tapes. Some computers can read data written on paper. Some can even understand data read out loud to them by a person.



As well as reading data, the Input Unit reads instructions that tell it how to use the data. These instructions are called a PROGRAM.

A program may tell the computer: "Find the names of all the people you know who were born on January 1, 1967," or "Count all the families who have more than two children," or "Add these two numbers and remember the answer 17,4."

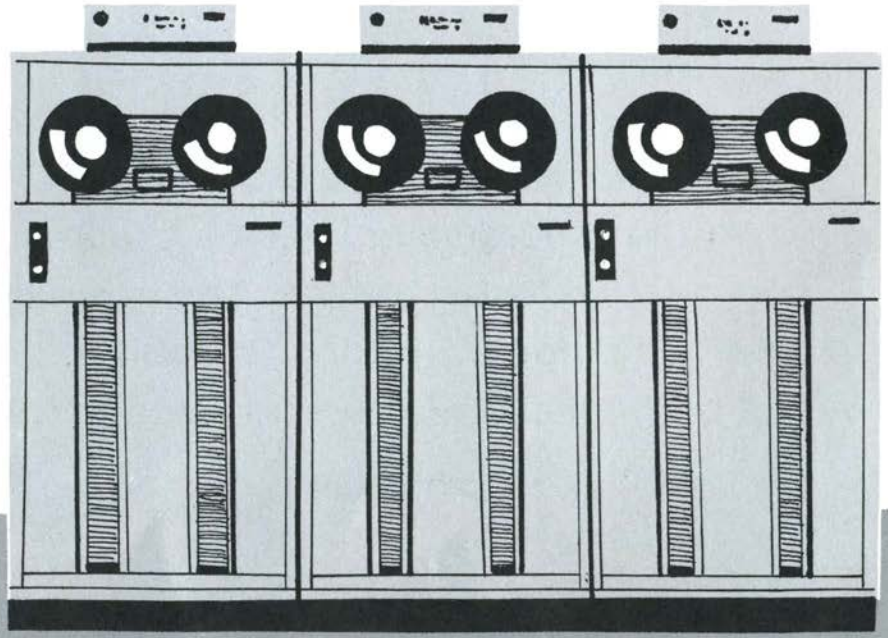
The people who give instructions to computers are called PROGRAMMERS.

The programmer writes each program in a language which is like our language, but easier for the computer to use.

Our language is English. Each time we talk to a friend, or write a letter, or think a thought, we use the English language. You are using the English language to read this book.

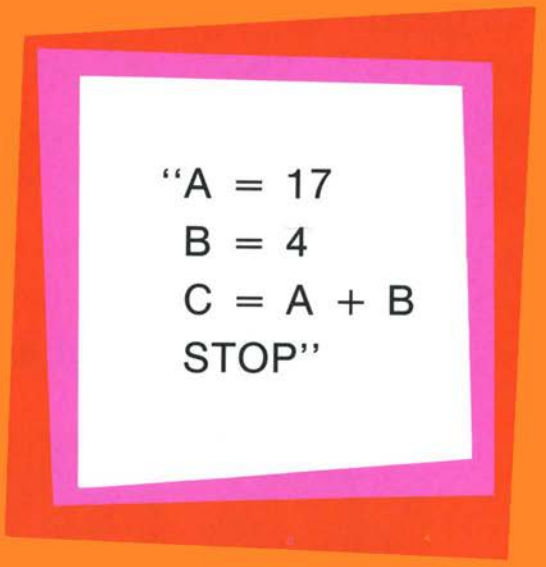
In English we say:

"Add 4 to 17 and then stop."



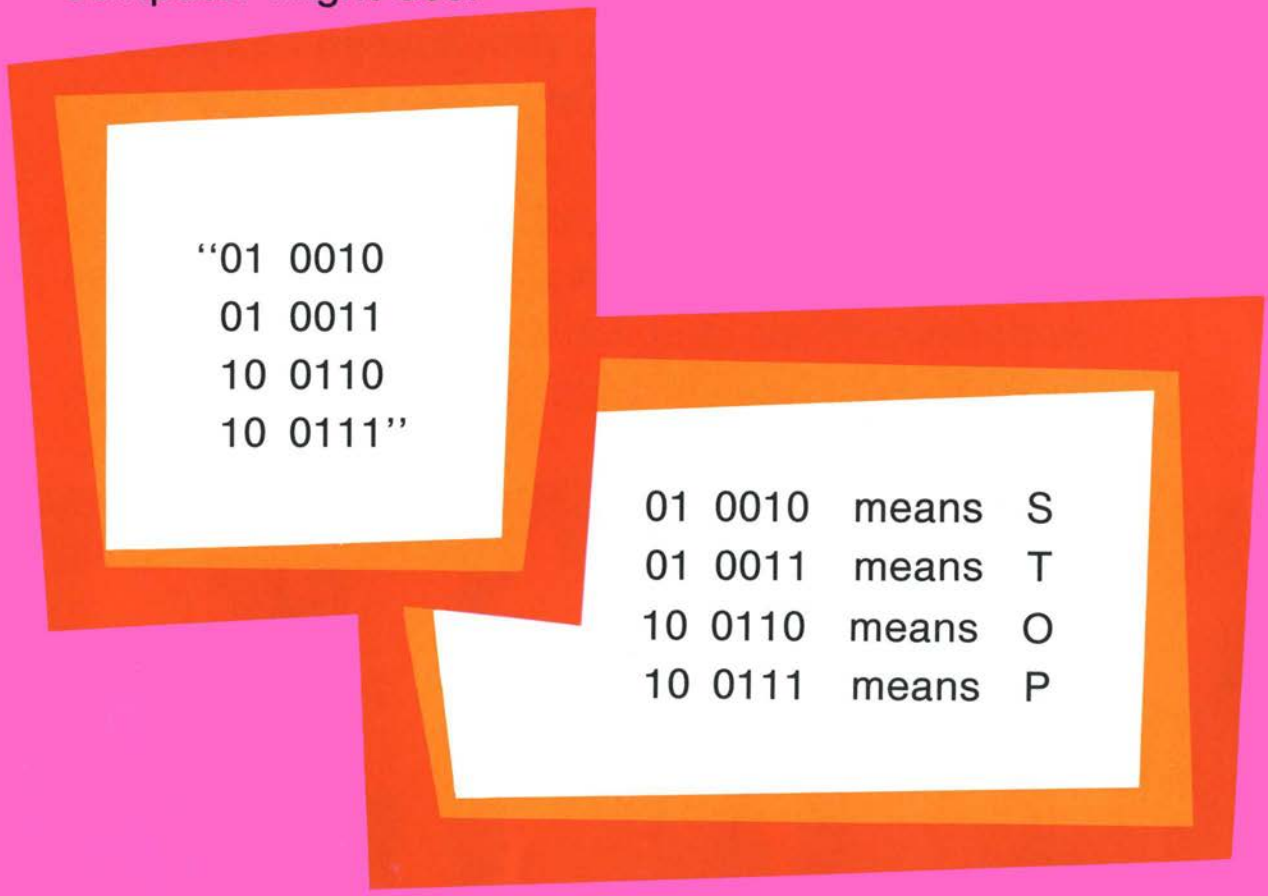
Some computer languages are ALGOL, COBOL, and FORTRAN.

Here are the same instructions written in FORTRAN.



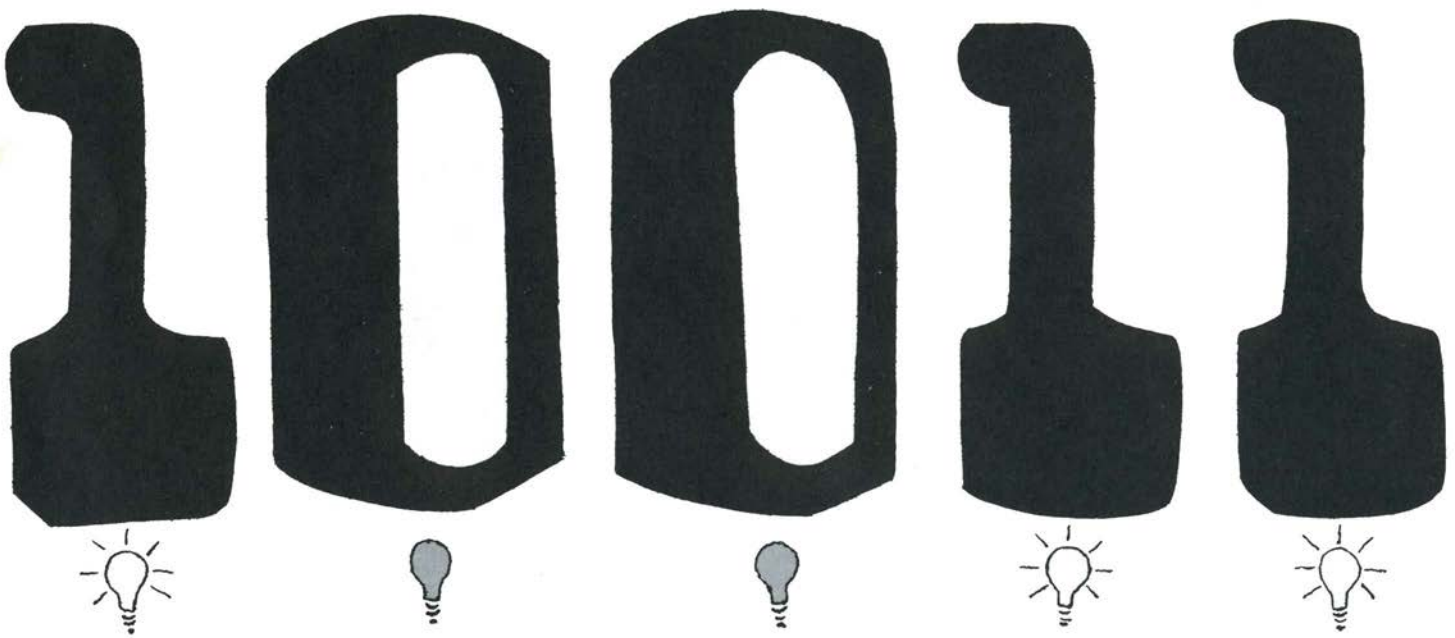
Computer languages like FORTRAN are used when the programmer writes a program or when a computer writes an answer. The computer uses another language for talking to itself. It changes data and programs into a number code which it records with electric signals.

Here is a sentence written in the number code a computer might use:



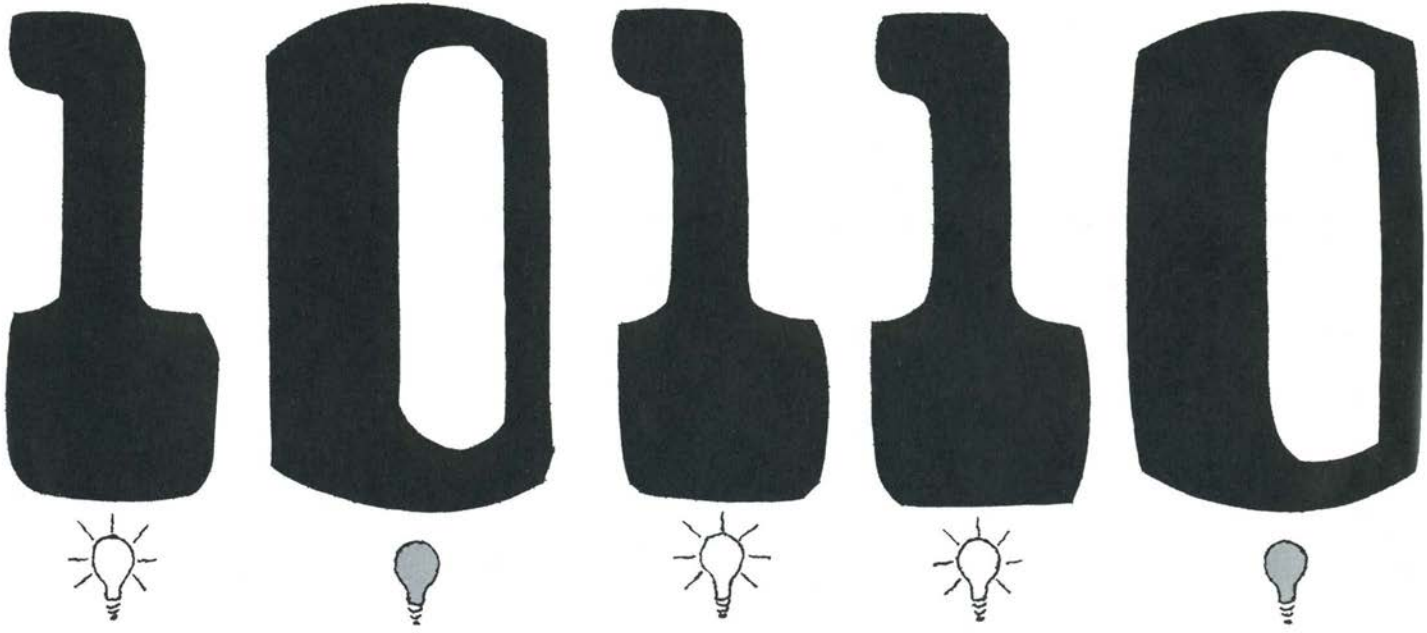
The ARITHMETIC UNIT is like an adding machine. It adds by counting, just as you sometimes add by counting on your fingers. A computer subtracts by counting, too. A computer does all its arithmetic by counting!

A computer reads and writes to itself, and counts, by opening and closing tiny switches. These switches turn on and off like the light switches in your house. The computer moves these switches

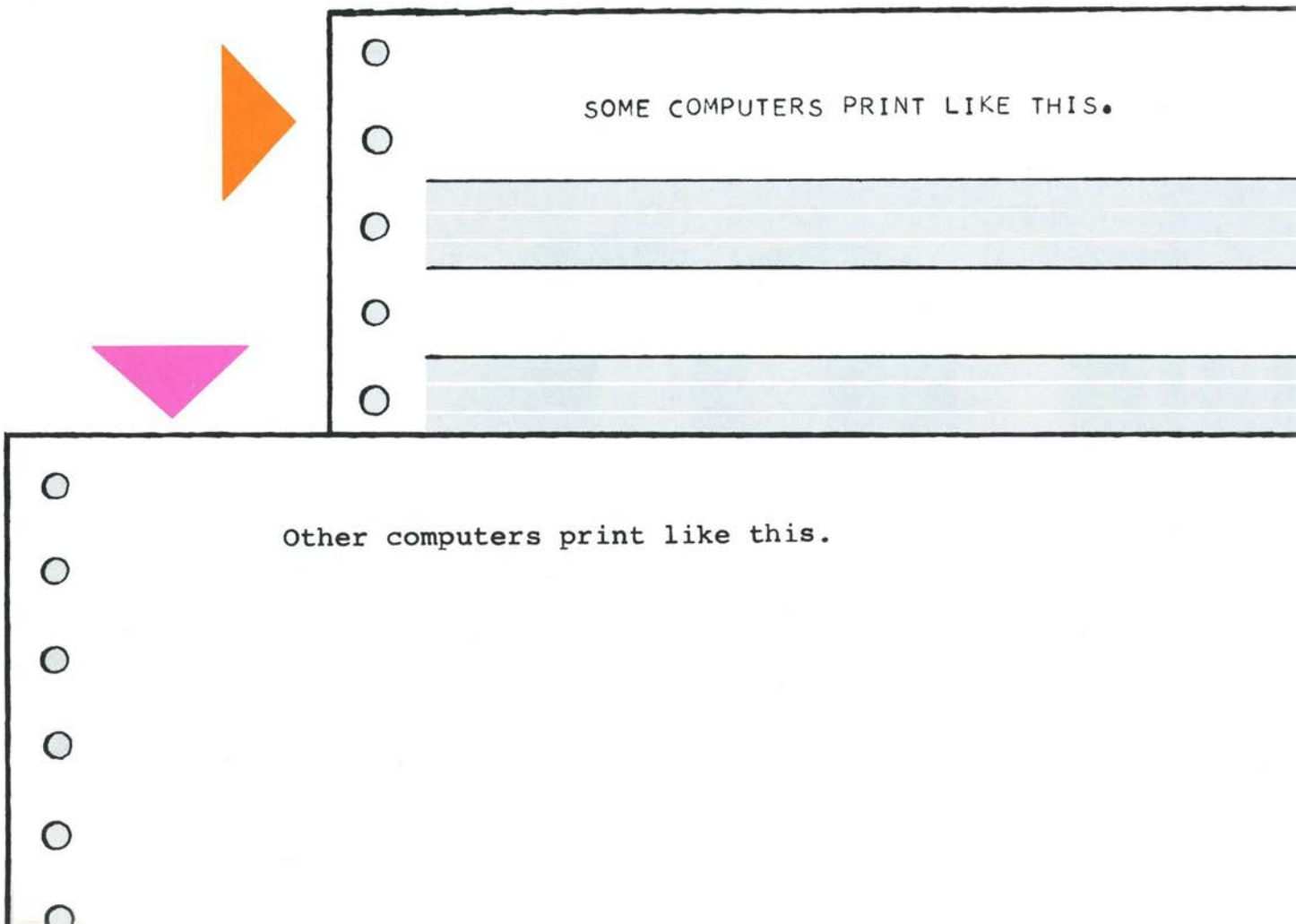


very quickly, much faster than you can turn a light on or off.

Computers also have a unit called a MEMORY BANK. The computer keeps data and programs in its Memory Bank. Some data are kept in the Memory Bank for a long time; other data may be kept only for a short time, then used and taken out to make room for new or better data. A computer can "remember" only the data and programs it has in its Memory Bank.

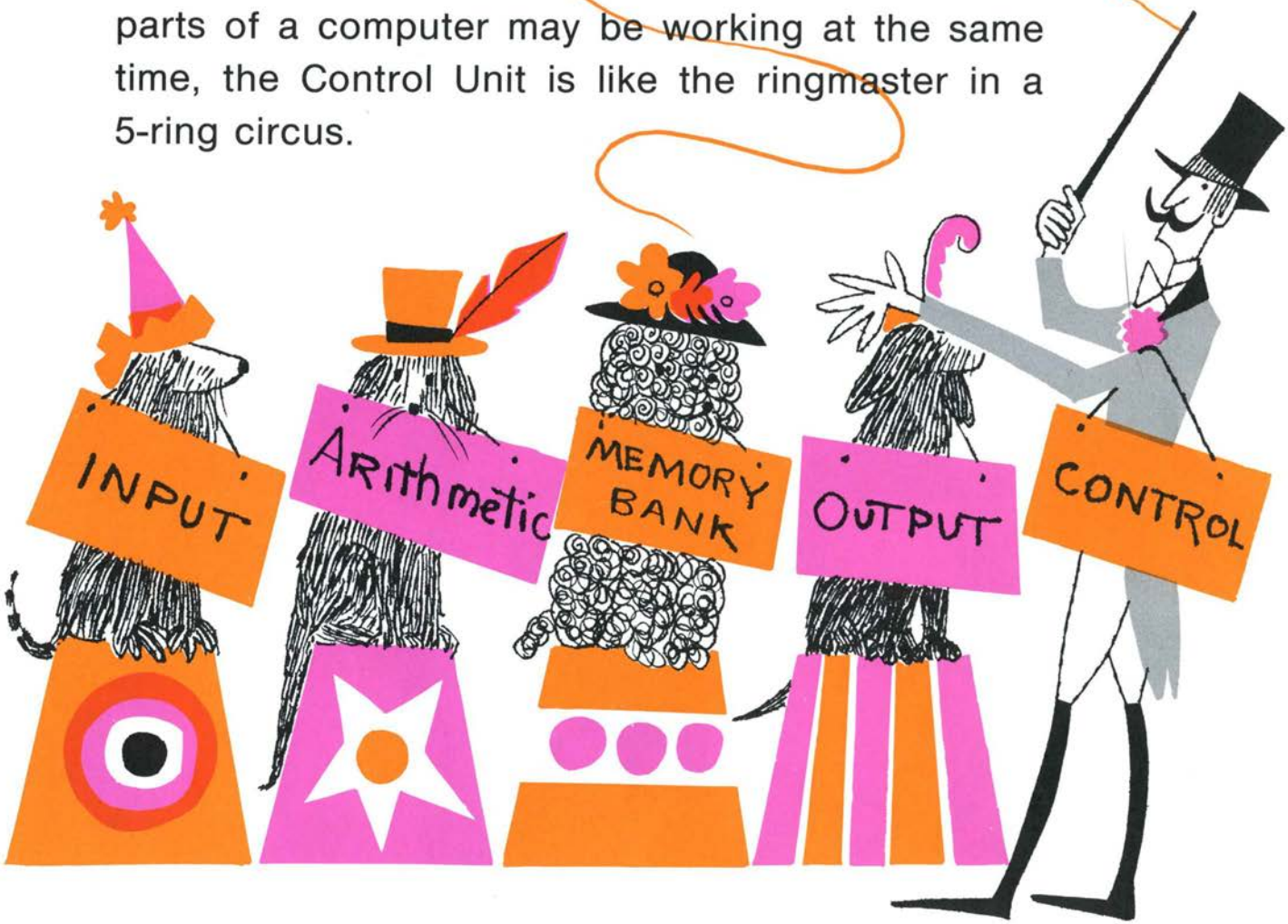


When a computer has finished a job, the OUTPUT UNIT prints the answers on paper for people to read. This part of the computer is like a typewriter, and the answers it writes are called the PRINTOUT.



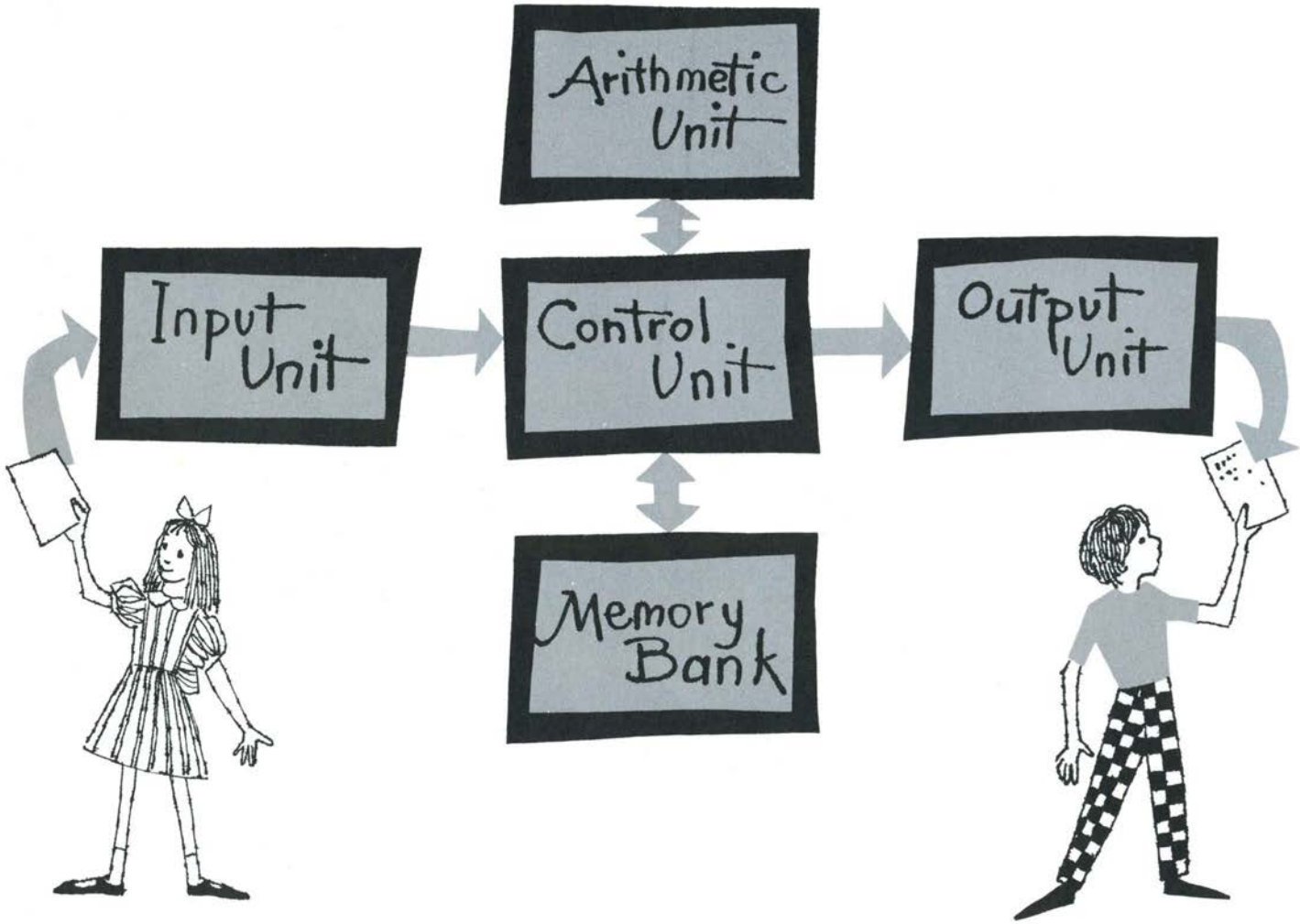
Instead of printing, some computers tell us the answers by making sounds like a human voice.

The CONTROL UNIT makes sure that the computer is doing the right job the right way. Since all of the parts of a computer may be working at the same time, the Control Unit is like the ringmaster in a 5-ring circus.



Can you draw a picture of a computer circus with the Control Unit telling all the other Units how to do their jobs?

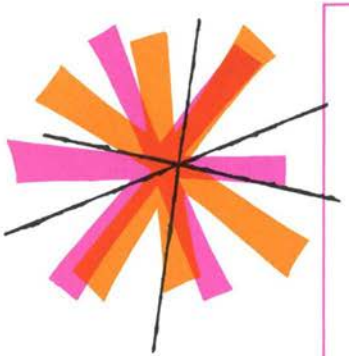
This is the way people who work with computers usually draw the picture:



For each job the computer does, the programmer gives it lots of data and many instructions. Although the instructions are simple, they are very exact and must be followed one by one. For example:

"Do you want to read the next page? If you do, then turn this page."

Using simple instructions, the computer can do very complicated things. Some computers can even tell us how to build new and better computers.

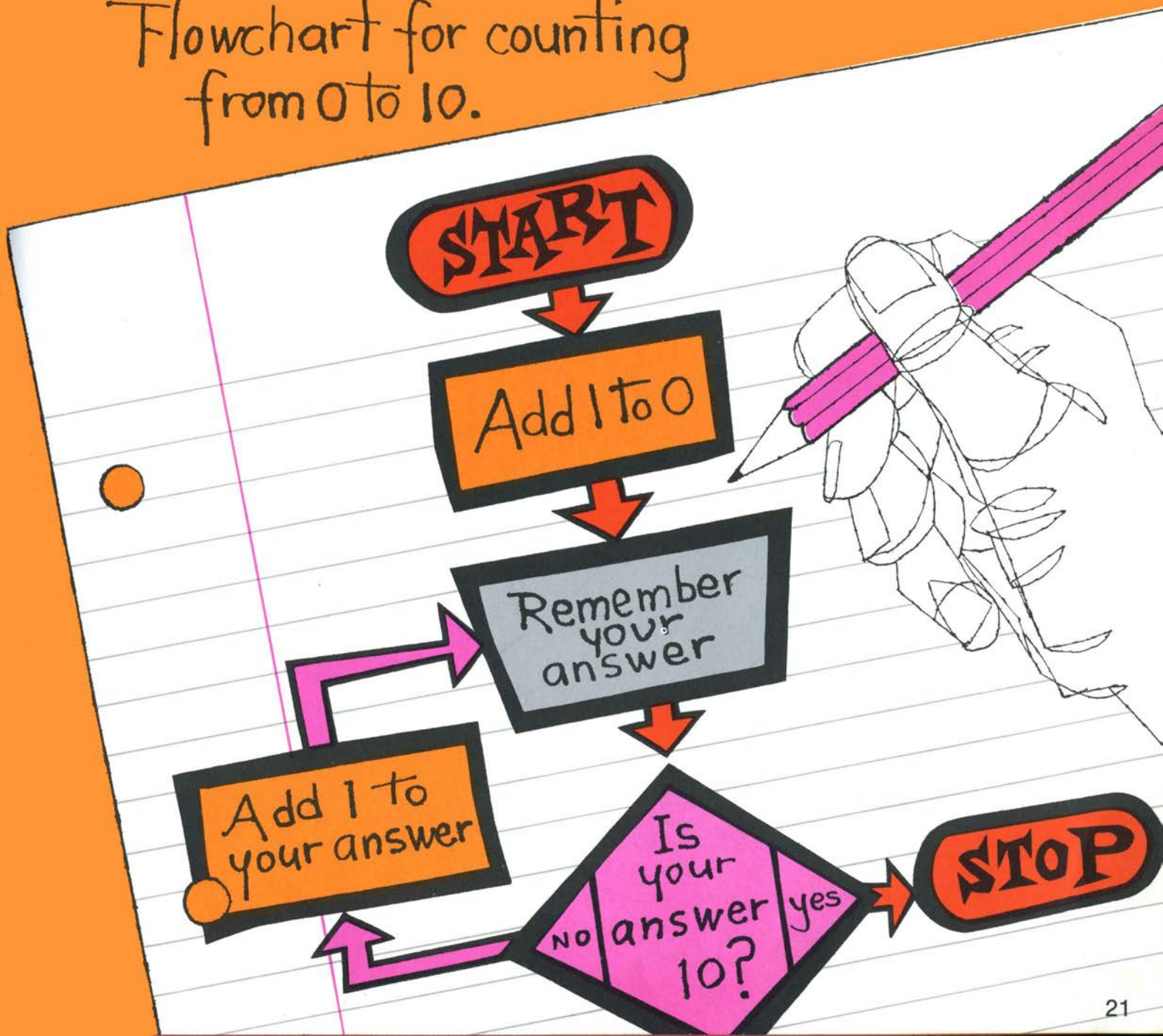


But remember, since computers are machines, they can use only the data fed into the Input Unit or stored in the Memory Bank. They can do only what the program tells them to do.

In order to write a program a programmer first makes a plan like a road map. This plan is called a FLOWCHART.

Can you read this flowchart? Follow the arrows. When a question is asked, you have to choose between a yes-path and a no-path. Sometimes the path seems to go in circles! Programmers call this kind of path a LOOP.

Flowchart for counting from 0 to 10.

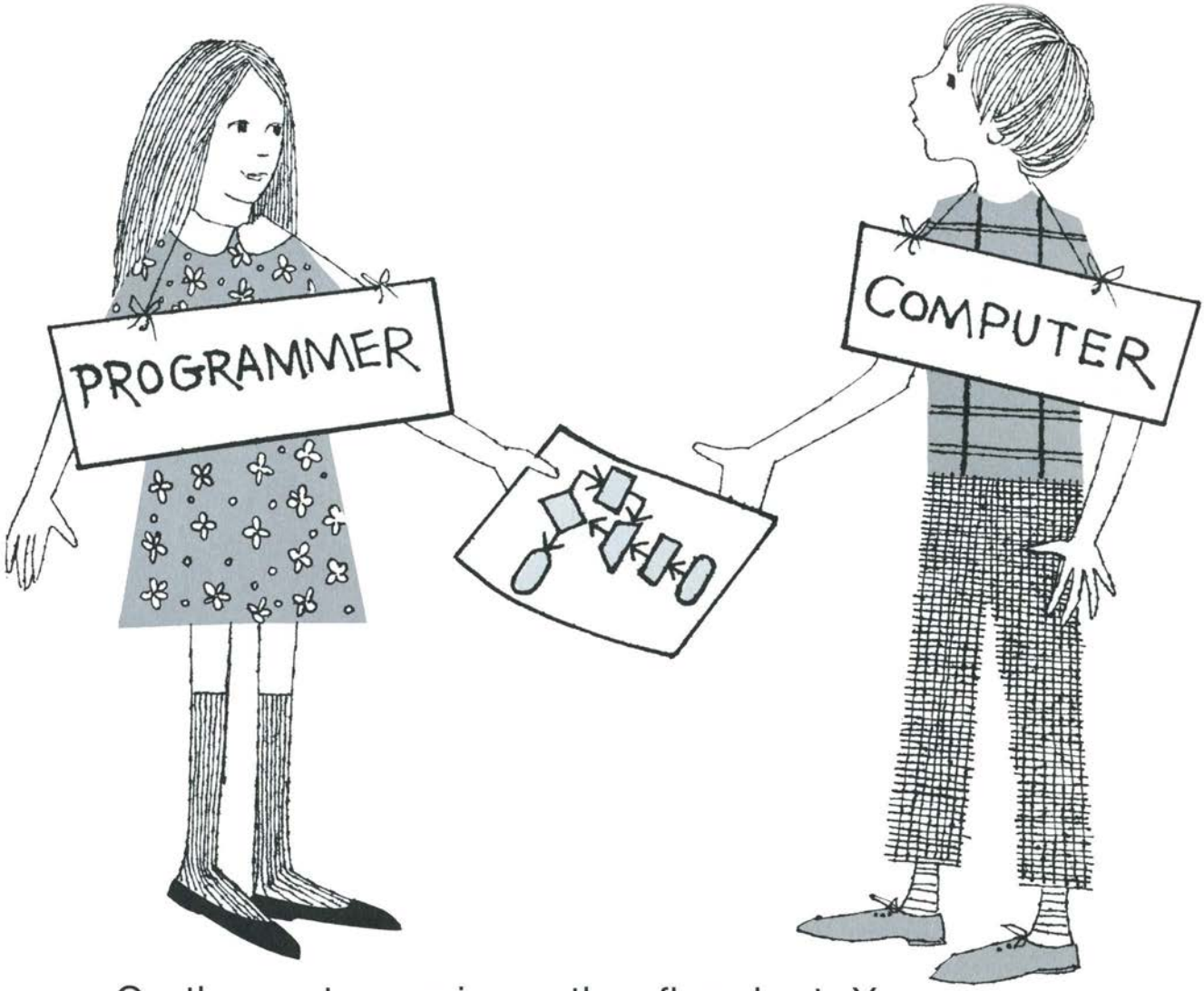


How many times did you take the loop?

Follow the flowchart again, and put a mark on a piece of scrap paper each time you go through the box that says "Add 1 to your answer."

Can you make a flowchart for asking a computer to count from 20 to 30?

Give your flowchart to a friend. Remind him that he is like a computer, and can do only what the flowchart tells him to do. Can he count from 20 to 30 following your flowchart?



On the next page is another flowchart. You can use this flowchart for counting the giraffes you may meet on the way to school.

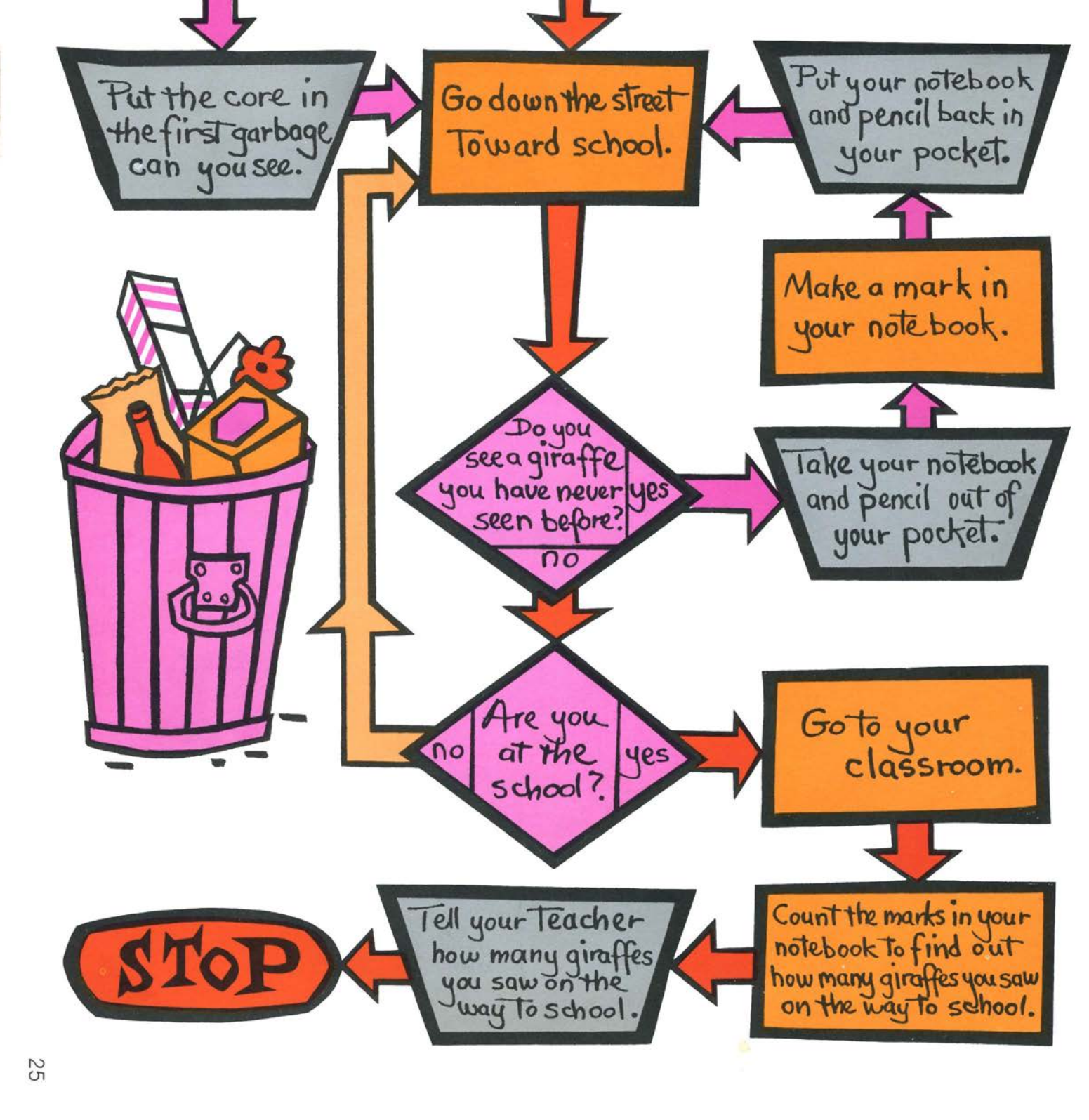
Flowchart for counting giraffes met on the way to school.

START

Put in your pocket: an apple, a notebook, a pencil.

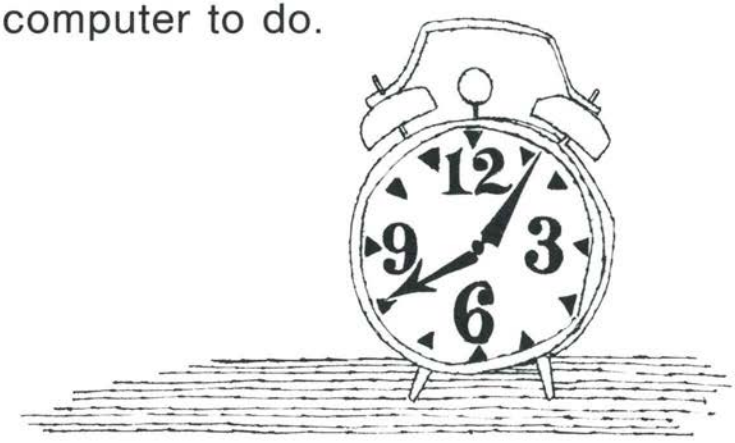
Is it raining?
- yes → Pick up your umbrella.
- no

Did you forget to eat breakfast?
- yes → Take the apple from your pocket. → Eat the apple.
- no

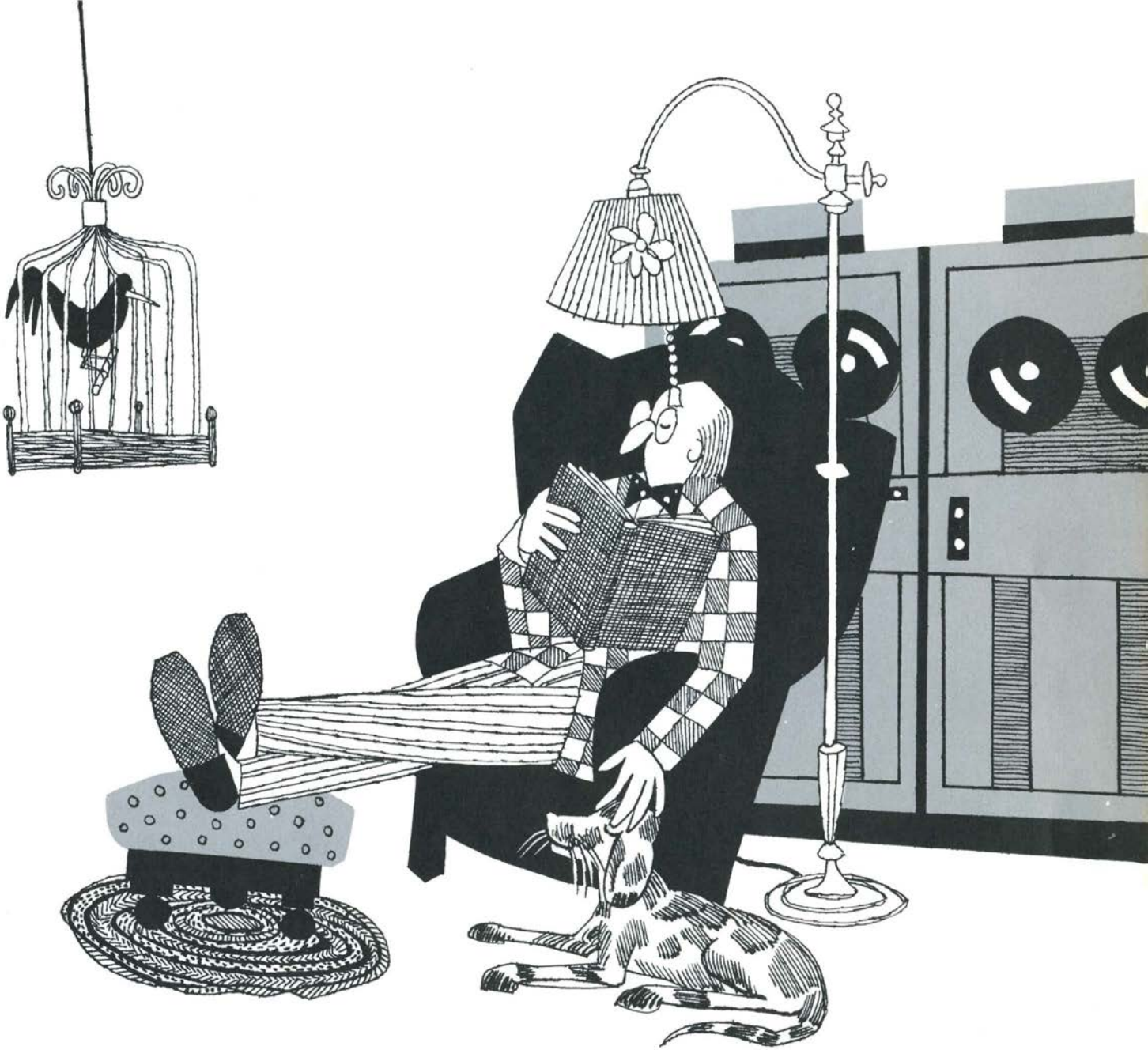

Put the core in the first garbage can you see.
Go down the street Toward school.
Put your notebook and pencil back in your pocket.
Make a mark in your notebook.
Do you see a giraffe you have never seen before?
yes
no
Take your notebook and pencil out of your pocket.
Are you at the school?
no
yes
Go to your classroom.
Count the marks in your notebook to find out how many giraffes you saw on the way to school.
Tell your Teacher how many giraffes you saw on the way to school.
STOP

After a programmer has written a flowchart, he changes the instructions on the flowchart into a program written in computer language. Then he feeds the program into the Input Unit of a computer.

When a programmer gives a computer a job, the computer does the job very fast, much faster than the programmer could do the job. This gives the programmer time to read a book, pat a dog, or make up more jobs for the computer to do.



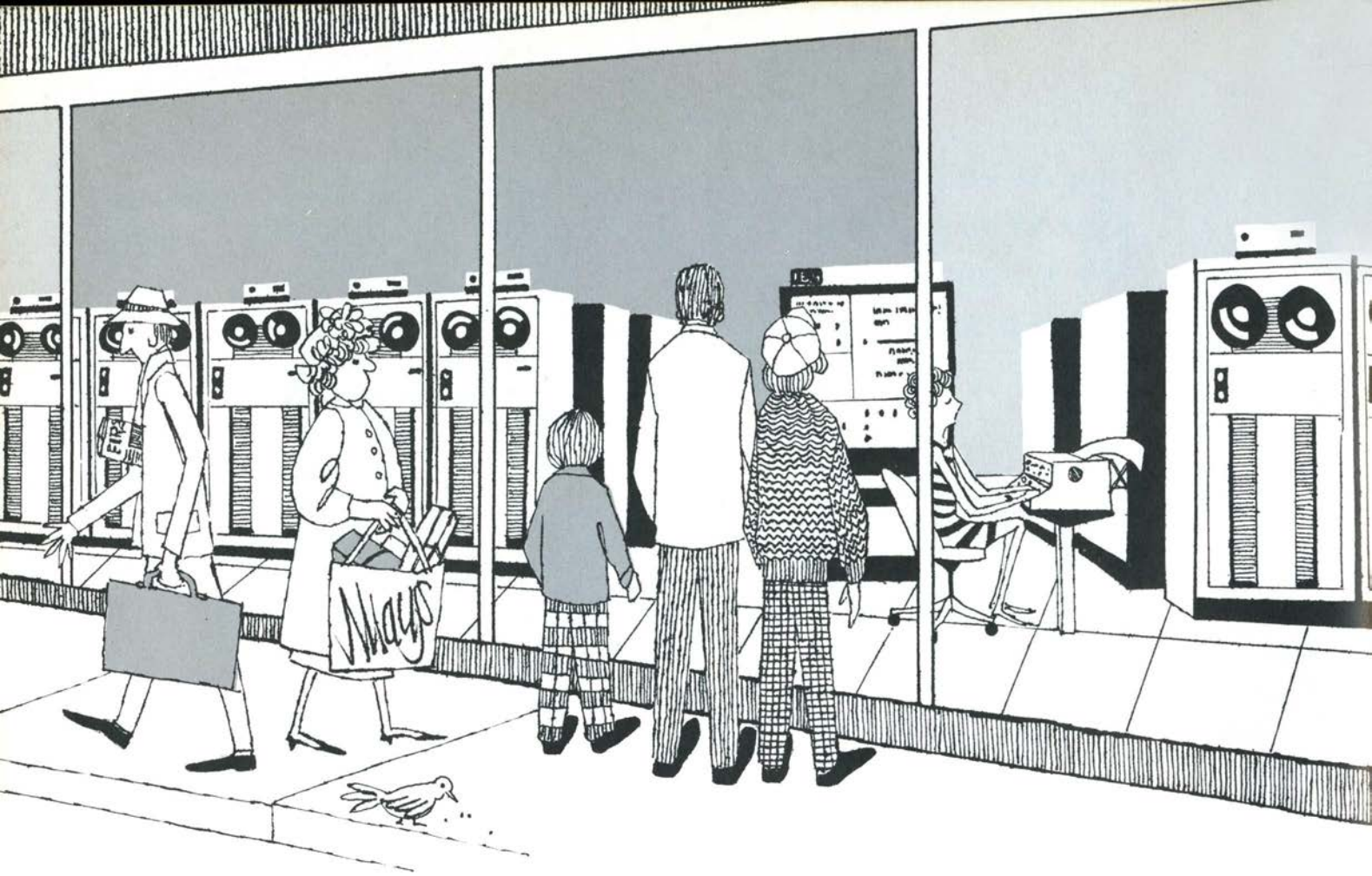
How quickly can you count from 1 to 100? Time yourself. A computer can count from 1 to 100 in a very small part of one second.



Besides being fast, computers never make mistakes. Well, hardly ever! Every time they read or write a word, they check to see that it makes sense. If it does not make sense, the computer asks the programmer to make a correction.

Computers can do the same thing over and over and over again, and never get bored and ask "When's recess?" That's another reason why computers don't make mistakes.

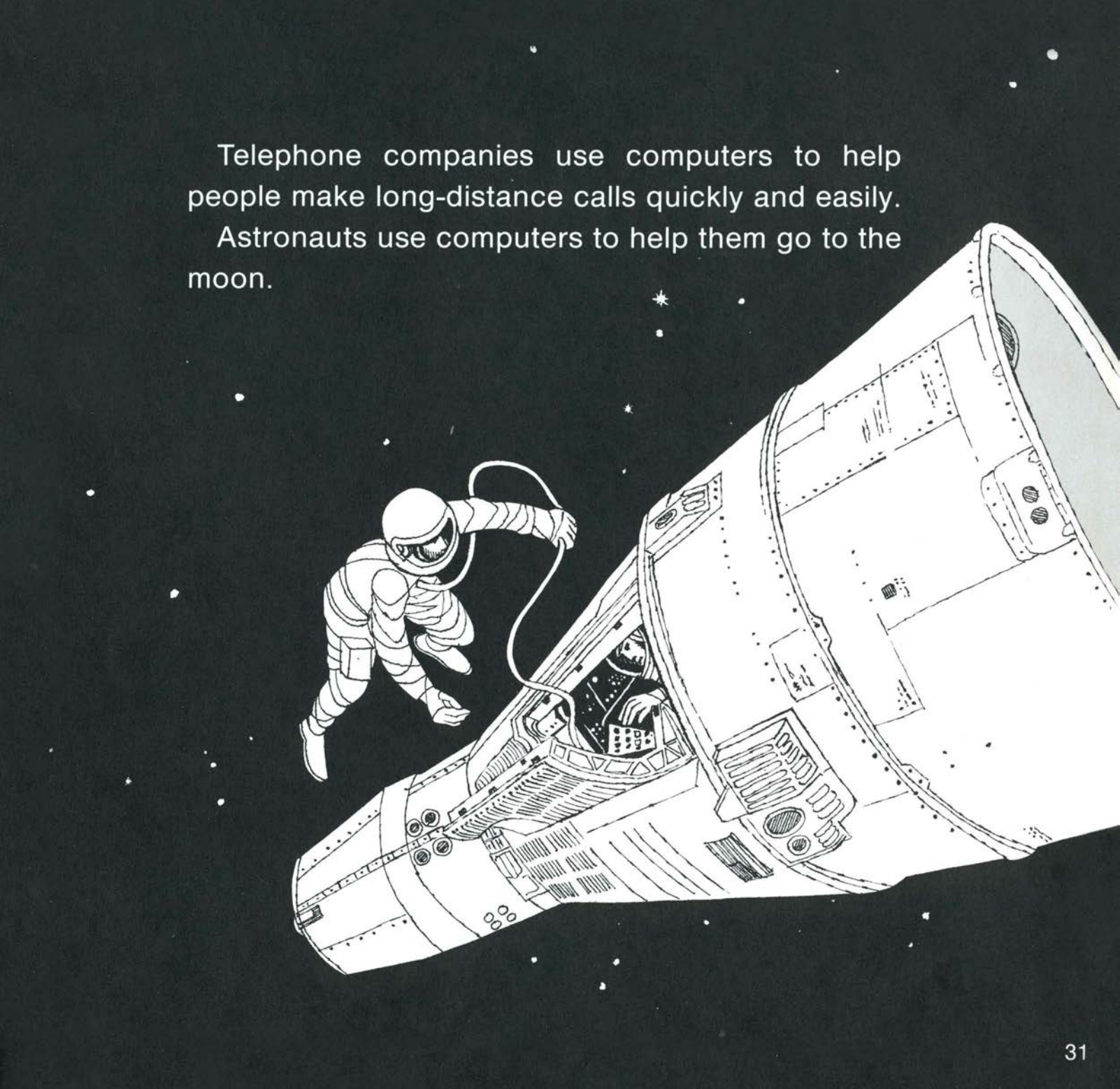
Was your friend able to count from 20 to 30 using your flowchart? He had to do exactly what you asked, and could not do anything else. If he made a mistake, it was because you did not write the instructions carefully enough. Sometimes computers do make mistakes. This happens when the data or the program is not correct, or when a part of the computer gets broken.



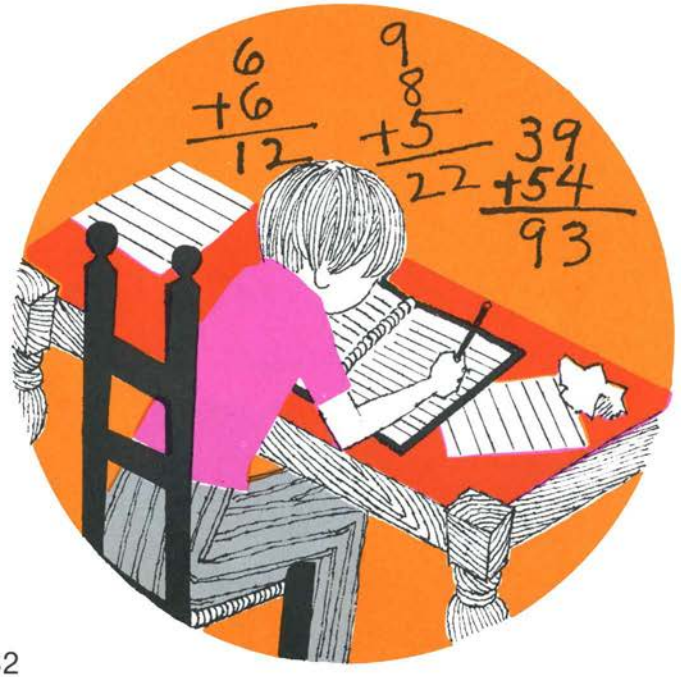
If you live in a large city, you have probably seen big buildings with computers in them. People use computers to do things that are very hard, or to do easy things quickly and correctly.

Telephone companies use computers to help people make long-distance calls quickly and easily.

Astronauts use computers to help them go to the moon.



If you had a computer, how would you use it?




think

ABOUT THE AUTHOR

Jane Jonas Srivastava has been teaching mathematics since receiving her master's degree in education. She has worked in the University of Illinois Arithmetic Project in Watertown, Massachusetts, and in Simon Fraser University's project to initiate a new primary arithmetic program in local schools.

Mrs. Srivastava now teaches elementary school. Her hubsand is a professor of biological sciences at Simon Fraser University. They live in North Vancouver, British Columbia.

ABOUT THE ILLUSTRATORS

Ruth McCrea was born in Jersey City, New Jersey. James, her husband, is a native of Peoria, Illinois. They both grew up with an interest in writing and drawing. Ever since they met in art school, they have worked together writing, designing, and illustrating books.

The McCreas, who have a son and two daughters, live and work in a more-than-100-year-old house in Bayport, Long Island.

A YOUNG MATH BOOK

WEIGHING & BALANCING

BY

JANE JONAS SRIVASTAVA

Illustrated by Aliki

What is a balance? Seesaws and mobiles are balances, and balances can be used as weighing machines. People can be weighing machines too.

The reader of *Weighing and Balancing* learns how to construct a simple but very sensitive balance out of a wooden rod, some string, cup hooks, and paper plates. Equipped with this tool, it is easy for him to answer such questions as "Which is heavier, three pencils or two lumps of clay?" and to check the apparently obvious answer to the question "Which weighs more, an eight-ounce package of candy or an eight-ounce package of nuts?" The familiar question "Which is heavier, a pound of feathers or a pound of stones?" is no longer a riddle.

In his investigations, the reader uses nonstandard units of measure—jelly beans, marbles, and pencils—as well as standard units—pounds and ounces. Asked "Why does a boat float?" he uses his own balance and a jar of water, a piece of wood, and a stone in a fascinating experiment to explore the rather complicated subject of density.

This is an intriguing book packed with activities and ideas. The delightful illustrations are by Aliki.

Thomas Y. Crowell Company
New York Established 1834

THIS IS ONE OF CROWELL'S YOUNG MATH BOOKS

Using an imaginative new approach to basic principles, these books invite the very young reader to explore, to understand, and to enjoy mathematics. Lively, accurate texts and pictures show clearly the relationships and patterns of things and numbers that are the foundations of modern mathematical concepts.

All these books have been prepared under the direction of Dr. Max Beberman, director of the University of Illinois Committee on School Mathematics Projects.

Here is a message from Max Beberman about Crowell's Young Math Books.

> *Children want to know and do mathematics. Learning and doing mathematics is part of growing up. Mathematics deals with the patterns and relationships that man has discovered in his environment. Since children are naturally curious about their environment, learning and doing mathematics helps to satisfy this curiosity and stimulate it further.*
>
> *These books are designed to enrich the child's knowledge of mathematics. Some of them deal with topics that are not ordinarily taught in school. Some extend ideas that are taught in school. All of them stimulate the child to be actively involved with mathematics.*