SYBEX COMPUTER BOOKS

POWER UP!

Kids' Guide to the COMMODORE 64™



Marty DeJonghe
Caroline Earhart

Power Up!
Kids' Guide to the Commodore 64

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Marty DeJonghe and Caroline Earhart

SYBEX®

Berkeley • Paris • Düsseldorf

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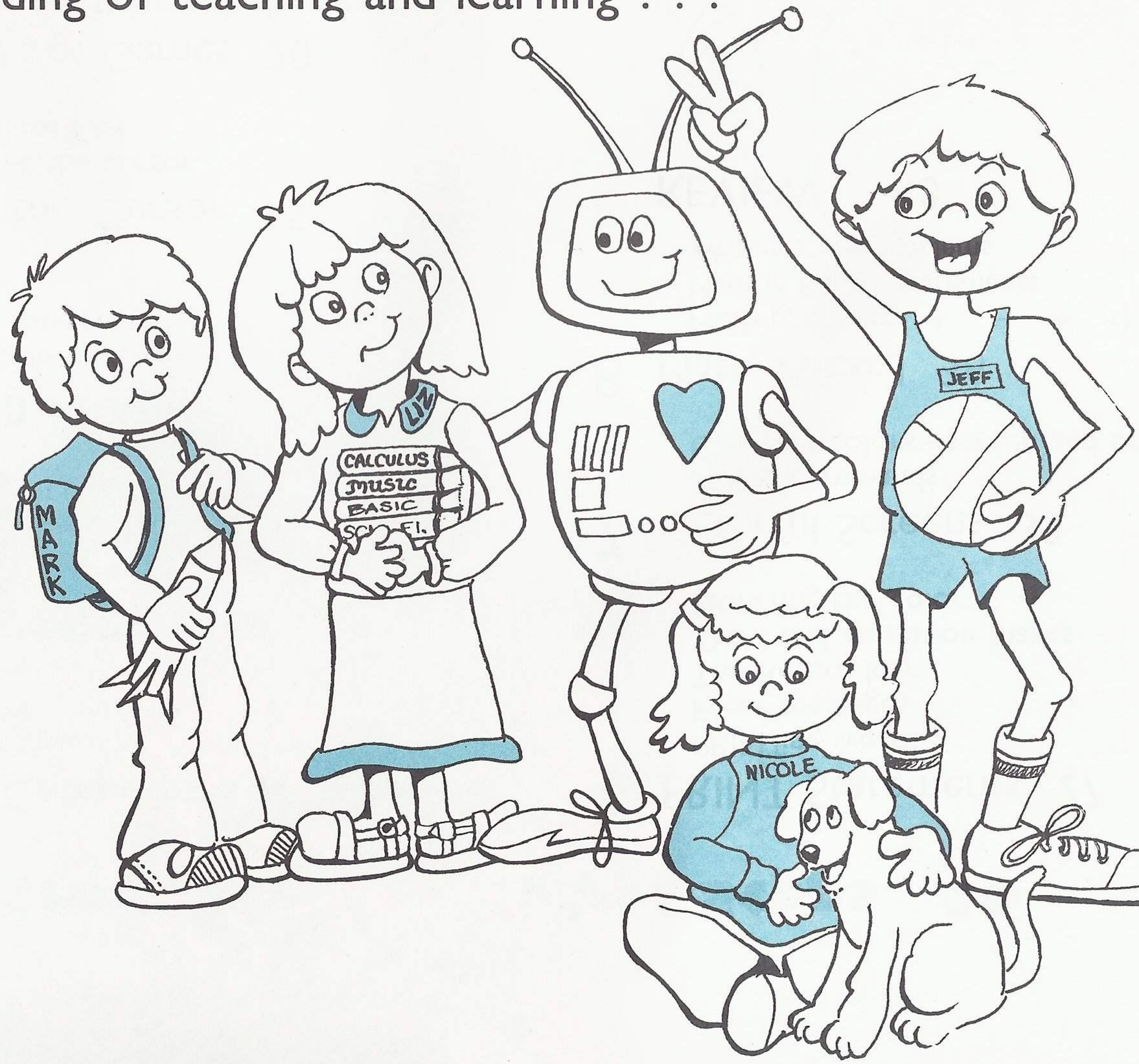
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For those *special kids* who have given us a
better understanding of teaching and learning . . .



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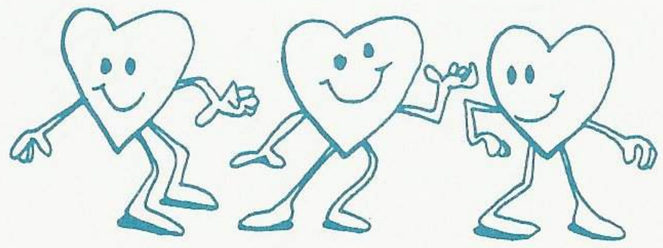
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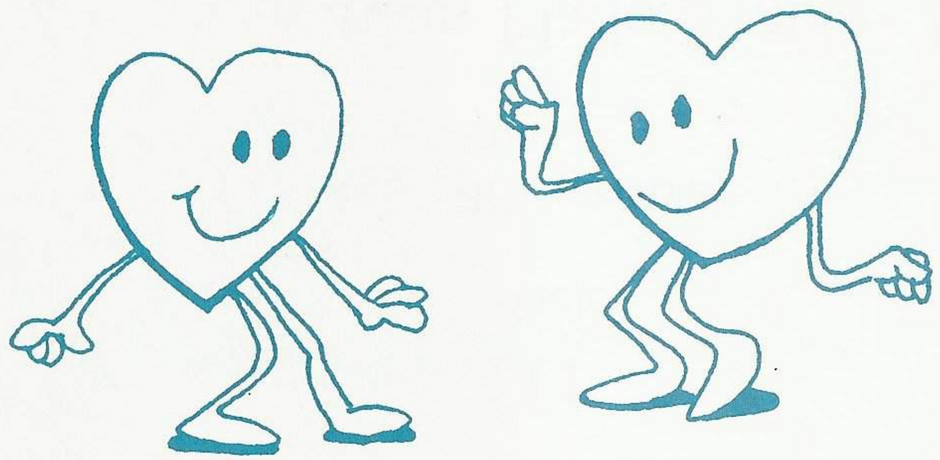
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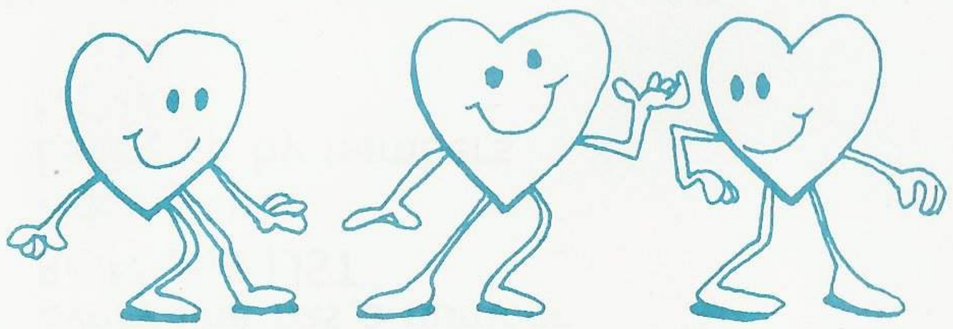
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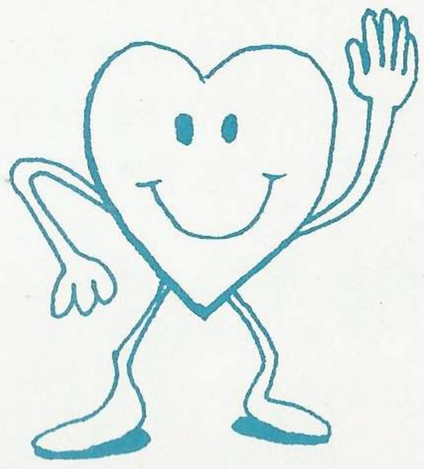
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Preface

HI!! Let's blast off into the world of computers! Exciting times await you when you *Power Up!* your Commodore 64. If you're new to computers, this book is just perfect for you. You'll feel comfortable working with the computer *right away*. We wrote this book so you could have *fun* while you learn. Each lesson is short and easy to follow, and new ideas are given to you in bite-sized chunks.

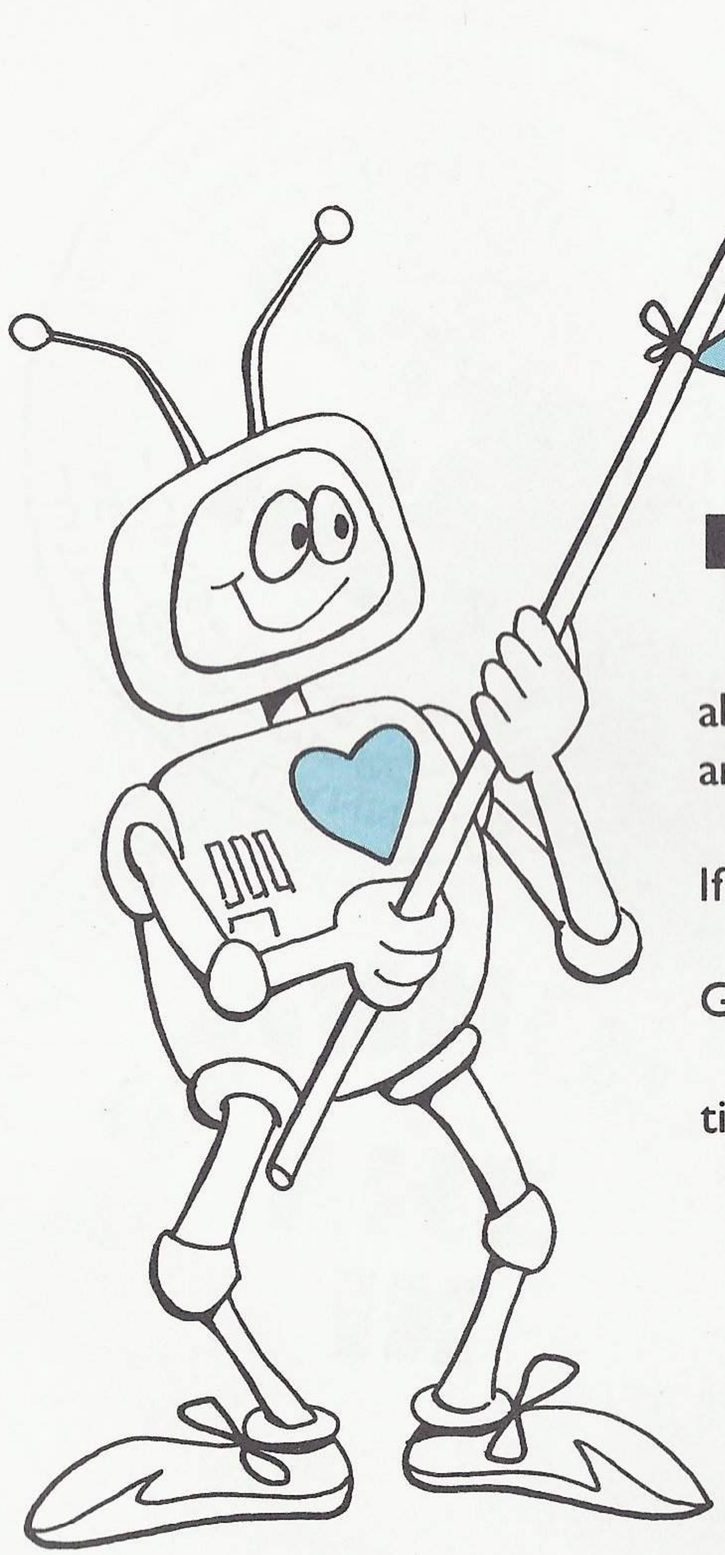
What adventures you'll have learning to explore and create with the Commodore 64's fabulous picture keys and colors! With a friendly robot and fun-looking pages, you'll find computer power comes easy.

Lots of the lessons in this book were written by kids in our classes. (Our students were nice enough to test all the lessons for you—and to suggest activities they knew you would like.) In no time at all, you will be creating your *own* activities and programs!

If you have had your computer for a while, you'll find this book is a well-organized guide to help you learn more about your machine. No matter how much time we spend with the computer, there are always surprises and discoveries.

This book is designed for you to open up and use right next to your computer. We know you like to keep your ideas flowing and your hands on the keyboard, so we won't ask you to do pencil-and-paper activities until after you are finished with a lesson.

By the end of this book, you should really be impressed with all your computer know-how. You'll be able to create clever, colorful pictures, design puzzles, make simple animated "movies," write "form letters," play number games—and be well on your way to becoming an expert programmer!



Let's Power Up!

Handy Hints!

Go at your own pace through each lesson. You'll probably find that it takes about an hour to do each one, but don't rush. Take it easy! There are lots of examples for you to try, and surprises for you to discover. Explore and have fun!

If you have problems with a lesson, go back and reread the instructions carefully. If you need some more help, ask a parent, teacher, or friend for assistance.

When you feel comfortable with the new ideas in a lesson, try the Challenge. Give yourself a big pat on the back if you figure it out!!!

When you get to the end of a whole Section, be sure to do the Review questions. (You can check your answers in the back of the book.)

Explore!! **Have Fun!!** **Create!!**

IN THE BEGINNING

~LHS STAFF~ RICK & CARLA~ ~BOBA~ ~AL & LINDA~

SPECIAL PEOPLE

~DAVE~ ~KAY~ ~TOM~ ~JON~ ~BARBARA~ ~BARI~ ~LIZ & JEFF~ ~KAREN~

SYBEX PEOPLE

BARBARA GORDON • DAVID KOLODNEY • INGRID OWEN • GAR SMITH • AMSBERRY • DAWN • VALERIE BREWSTER • & THE WHOLE "CUT 'N PASTE" TEAM

KIDS OF ORINDA

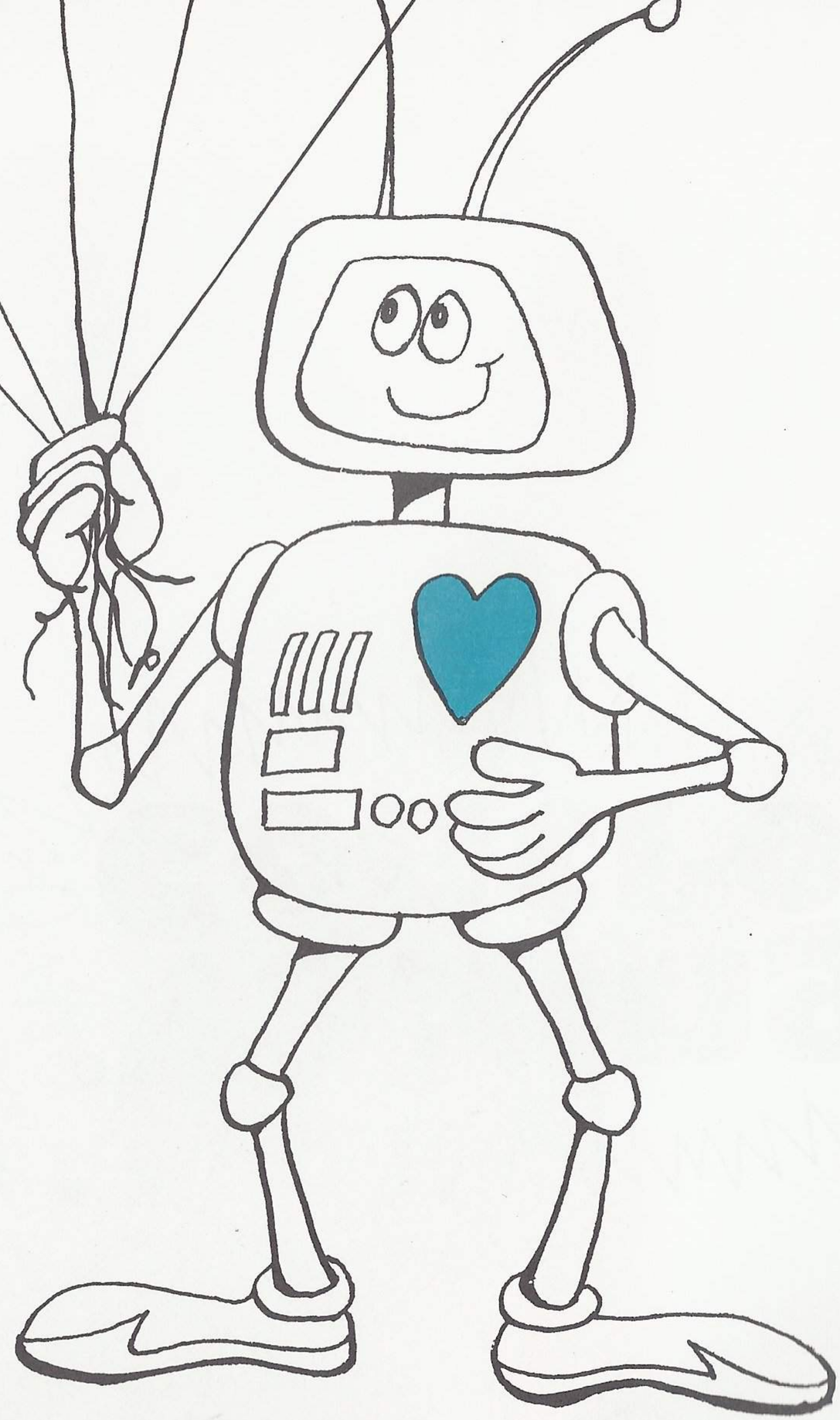
~MOLLY~ LUTHER~ KELLIANN~ BRANDON~ JOLYN~ ~MICHAEL~ GINA~ MARC~ JEFF~ MELISSA~ ~MATT~ CHRIS~ GREG~ GRANT~ DAVID~ ~IAN~ RYAN~ JAMIE~ WILL~ ~STEPHANIE~ WYNN~ ROB~ CAMERON~ ~DANNY~ ANDREA~ JED~ KEVIN~ JASON~

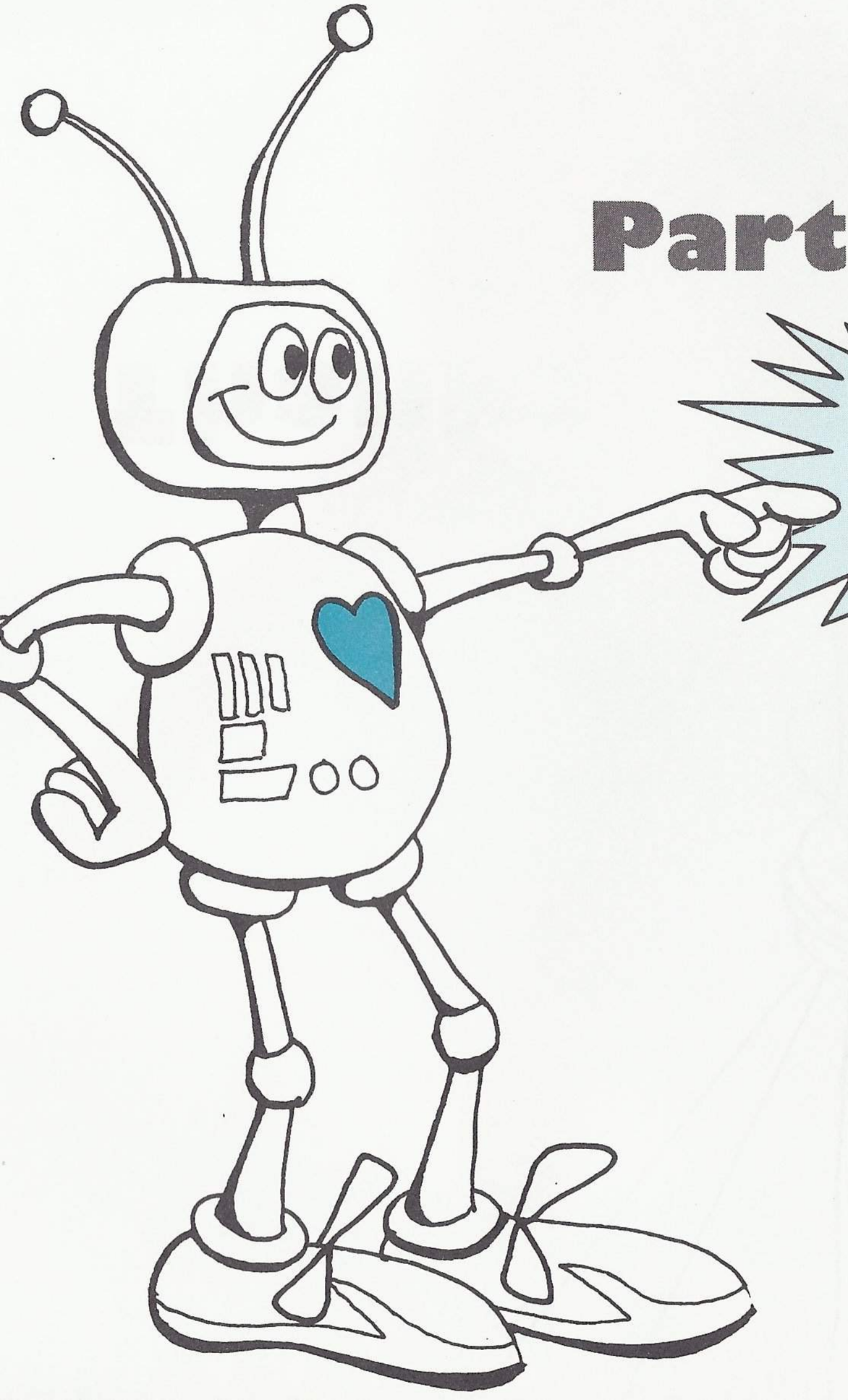
TEACHERS

~IDA~ KAY~ PATTIANN ~JIM~ MARGIE~ NANCY~ KEITH~ JOANNE~ BONNIE~ KEVIN~

Thanks

Caroline & Marty





Part 1

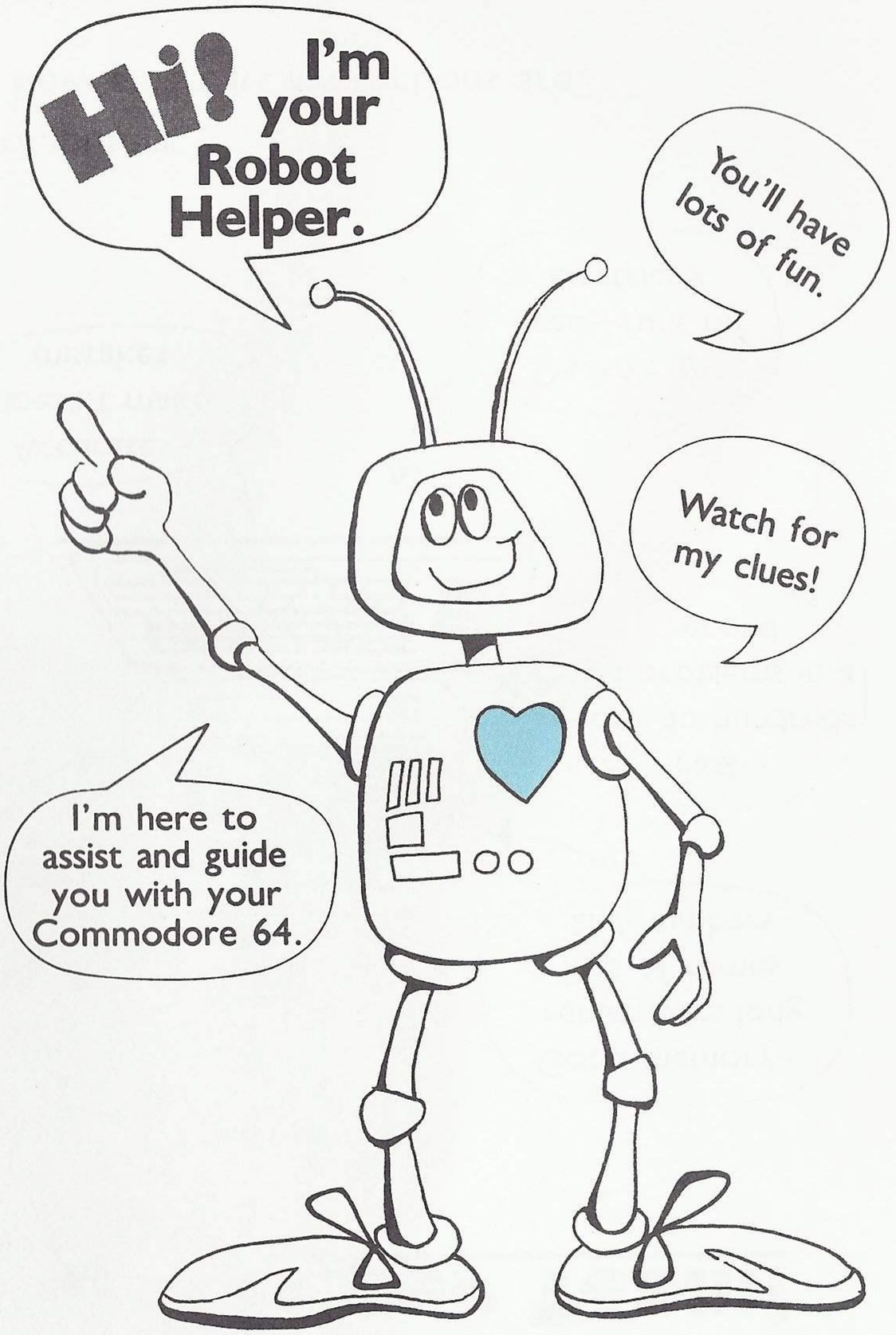
Taking Control

What Is a Computer?

It is a machine that follows instructions quickly and easily.

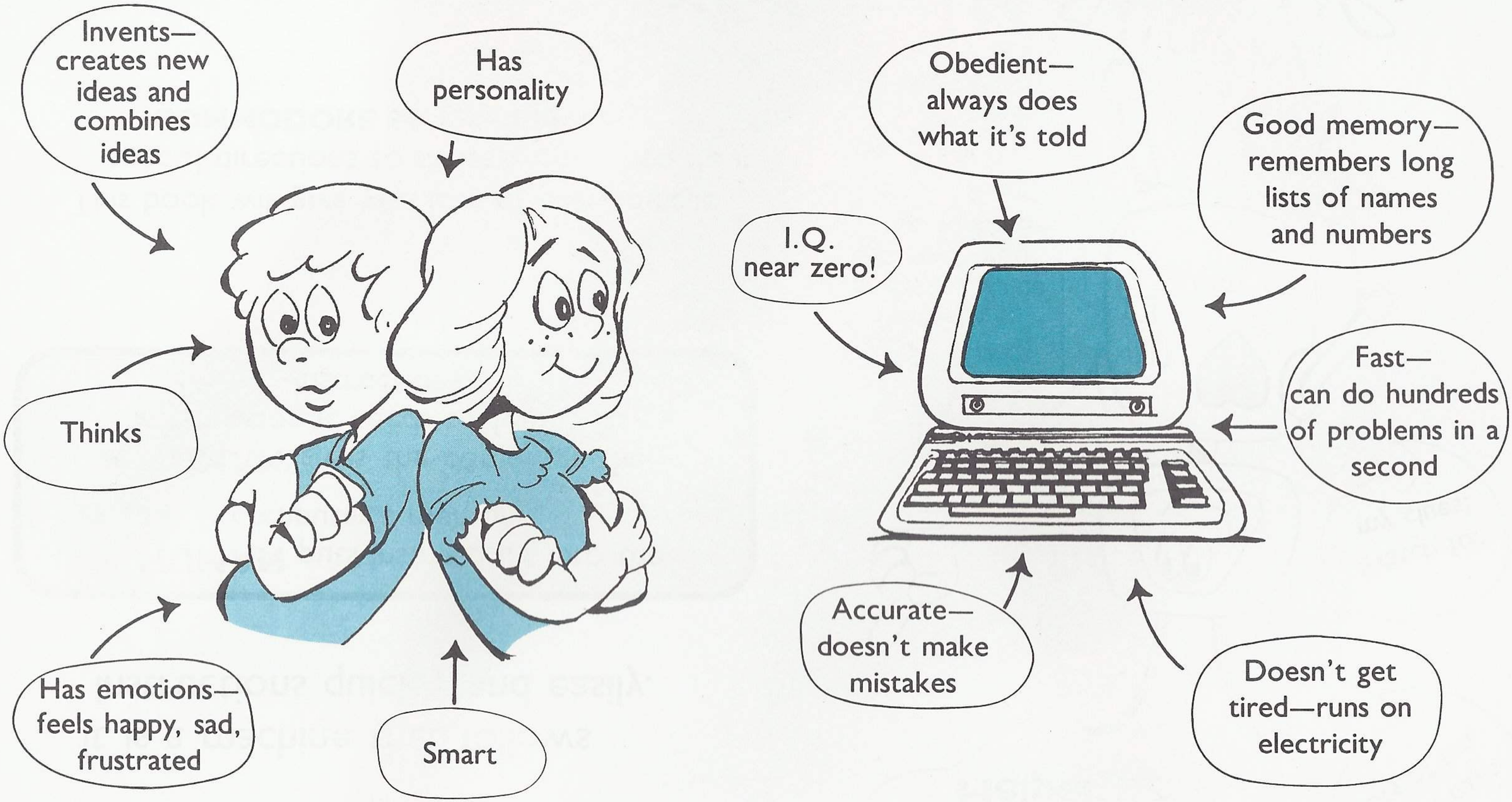
A **HUMAN** puts instructions into the computer's memory.

A **HUMAN** gives the computer the information it needs to follow its instructions.



This book will give you lots of easy-to-read, special directions to make working on your **COMMODORE 64** easy and fun.

People and Computers = Super Team!



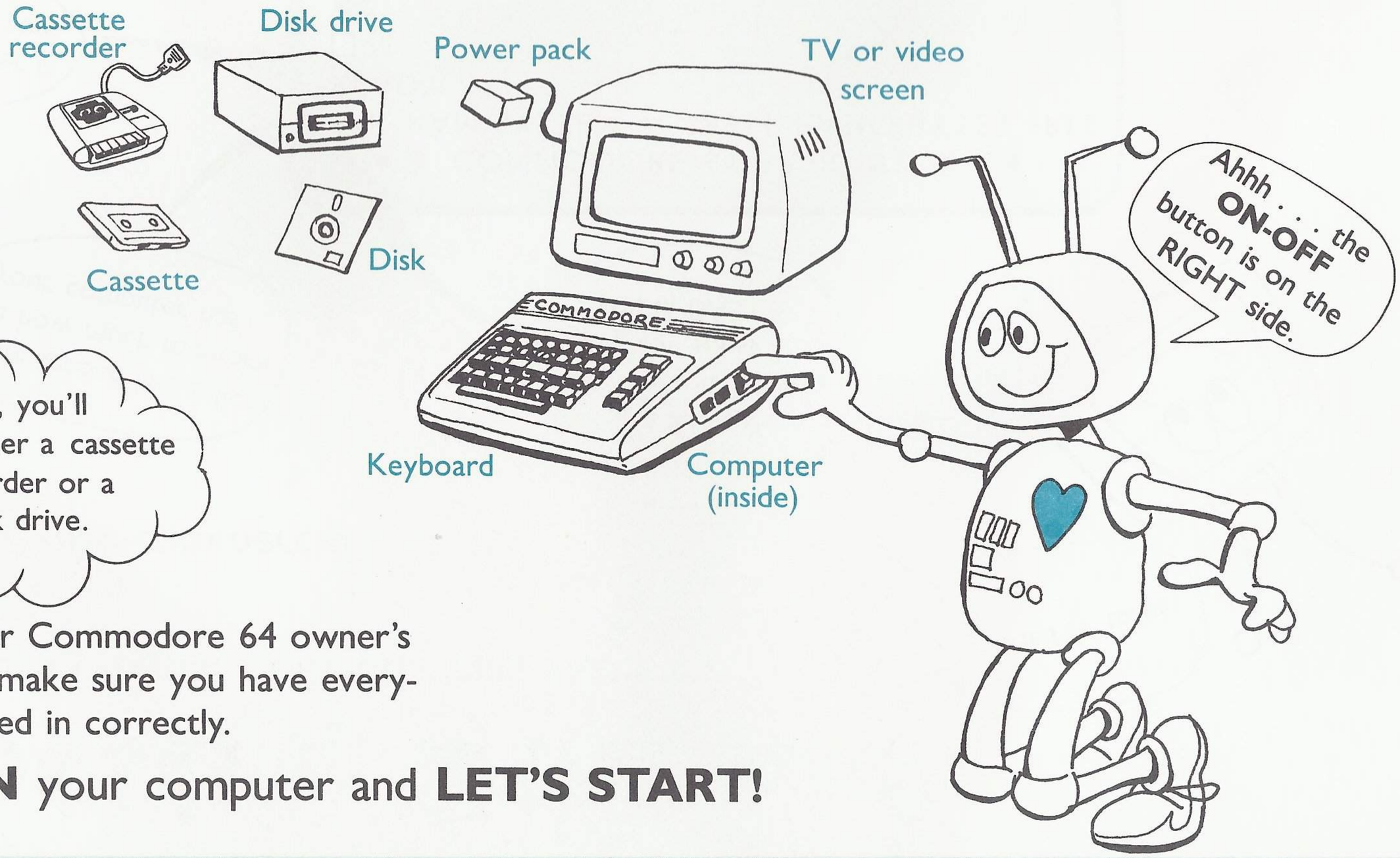
People control computers.

How "smart" a computer is depends on how smart its instructions are.

Computers are simple, easy, and fun to use!

Your Computer System

To begin with, you'll only need the keyboard containing the computer, the power pack, and the video screen.



Check your Commodore 64 owner's manual to make sure you have everything plugged in correctly.

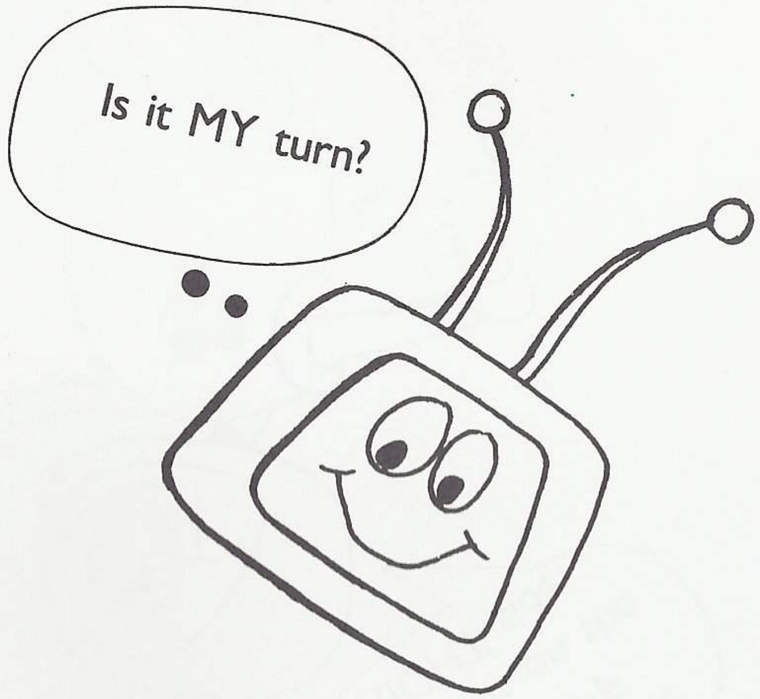
Turn **ON** your computer and **LET'S START!**

Getting Started

Turn on your computer and monitor.

Presto!

A "mini-commercial" appears!



The second line tells you how much memory your computer has.

The first line tells you that the computer is ready to "speak" to you in BASIC.

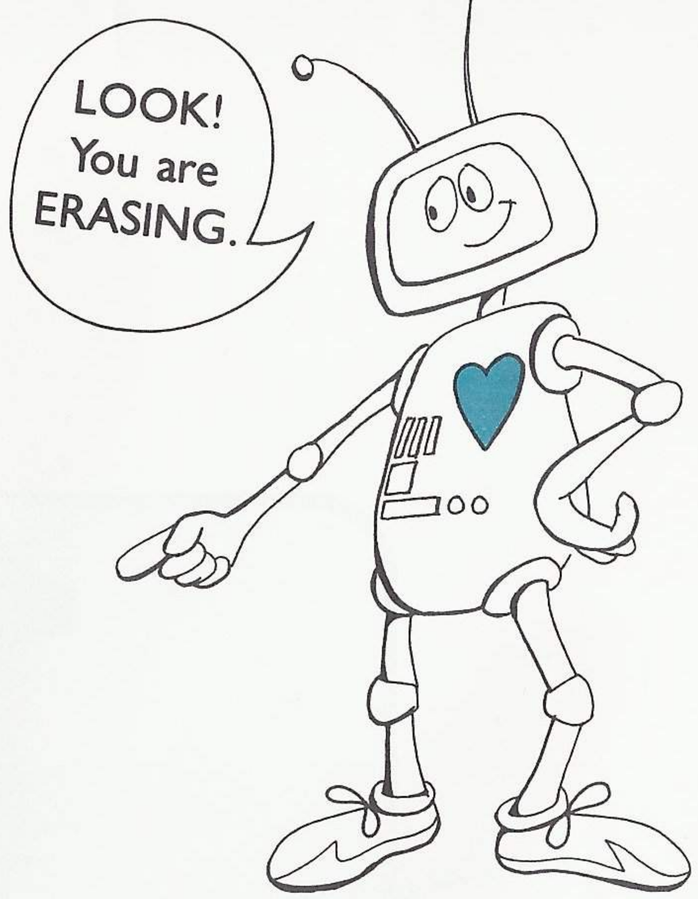
```
* * * COMMODORE 64 BASIC V2 * * *
64K RAM SYSTEM — 38911 BASIC BYTES FREE
READY
```

Your computer is READY for you!

The small blinking square is called a CURSOR. When you see the cursor blinking, it is your turn to do something.

The cursor is blinking—it's your turn . . .

Get ready — Get set — **GO!**



TYPE ⇨ COMMODORE

Find the INST DEL key and press it a few times.

COMMOD

Now make the entire word disappear.

Find the large SPACE BAR at the bottom of the keyboard.

Use it for making spaces when you type this:

TYPE ⇨ COMMODORE COMPUTERS

spaces

Use the INST DEL key to erase this message.

Can you make your full name appear on the screen?

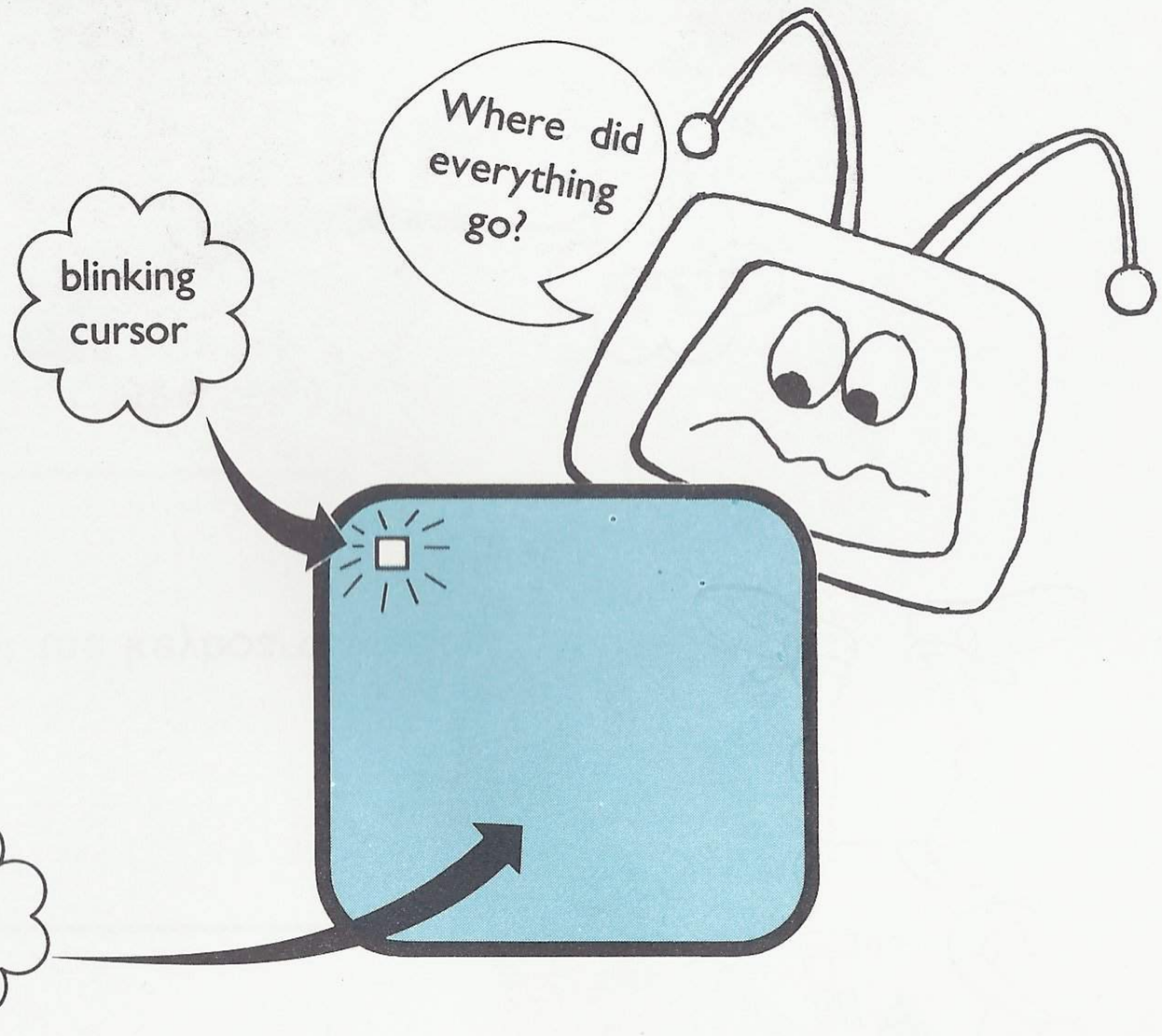
TYPE your own name ⇨ JED KURT GREENE

Now **DELETE** (erase) this message.

Type the whole alphabet— and all the numbers too!

TYPE ⇨ ABCDEFGH . . .

Now **CLEAR** your screen
and start with a "clean slate."
Just hold down SHIFT **while** you press CLR HOME .



Magic! Everything disappears!

Practice typing letters and numbers on the screen . . .
THEN make everything disappear again.

Colors!

Hold down the CTRL key and press the ! 1 BLK key.

Now type some letters . . .

What happens?

Hold down CTRL and press " 2 WHT . Type some letters.

Hold down CTRL and press # 3 RED . Type some letters.

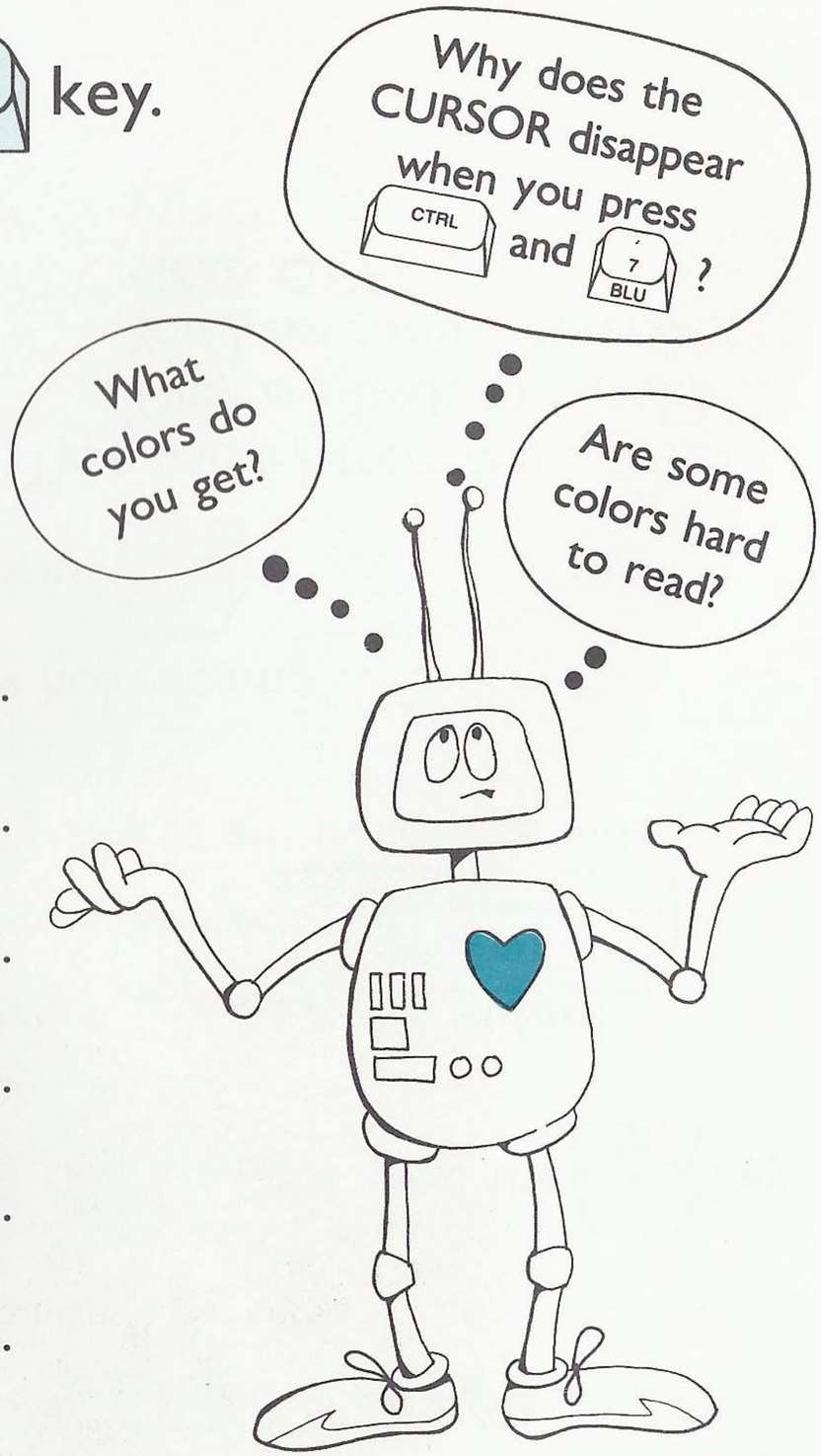
Hold down CTRL and press $ 4 CYN . Type some letters.

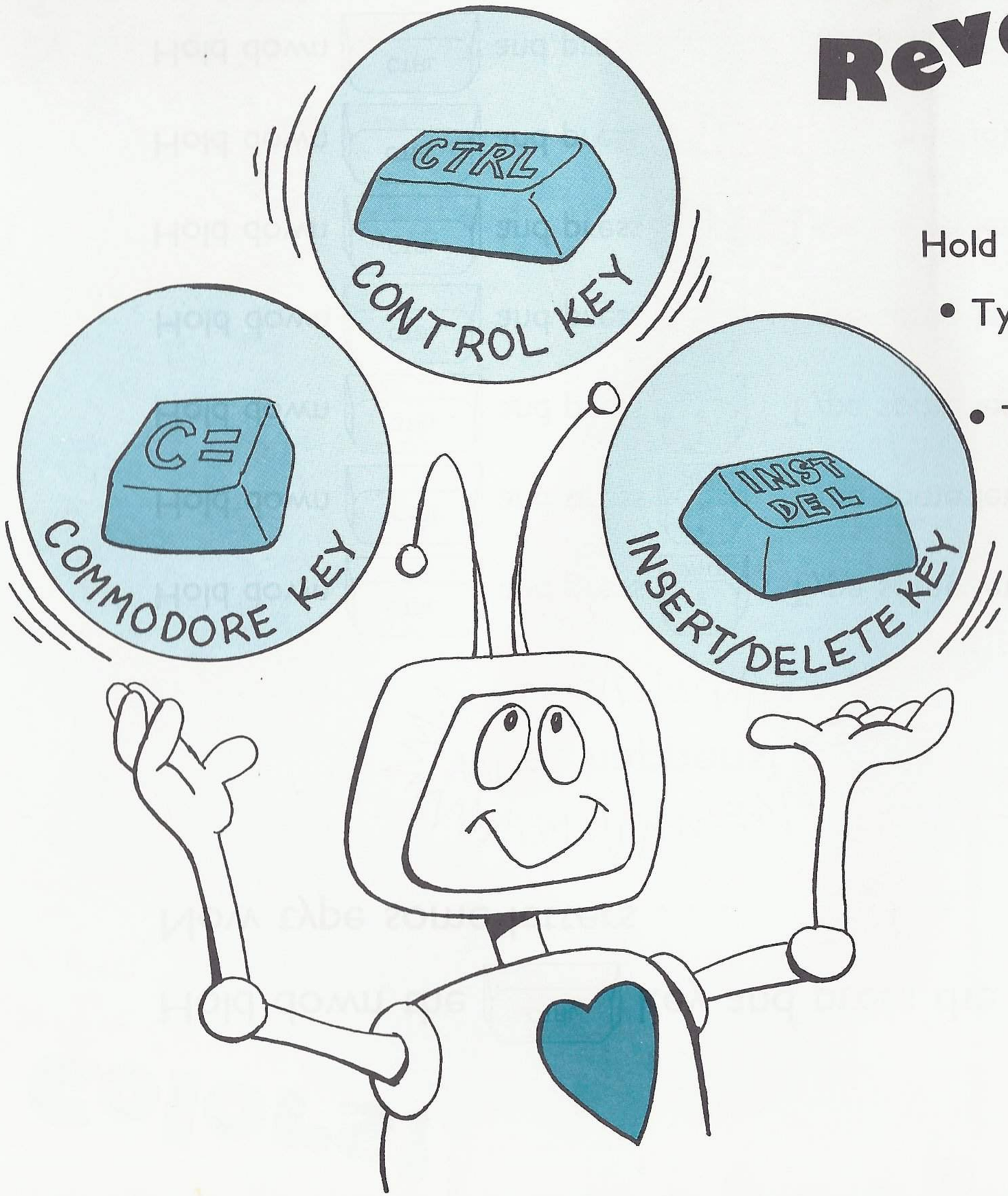
Hold down CTRL and press % 5 PUR . Type some letters.

Hold down CTRL and press & 6 GRN . Type some letters.

Hold down CTRL and press ' 7 BLU . Type some letters.

Hold down CTRL and press (8 YEL . Type some letters.





Reverse Video

Hold down CTRL and press the 9 RVS ON key.

- Type some letters.
  They are in **reverse video**!
- Try pressing the SPACE BAR.
  The spaces are in reverse video too!

Now hold down CTRL and press 0 RVS OFF.

- Type some letters and spaces.
  They are back to normal.
  You have turned reverse video **OFF**!

Turn reverse video on (CTRL and 9 RVS ON) and type some spaces.

TRY SOME DIFFERENT COLORS:

Press CTRL and & 6 GRN and type some spaces.

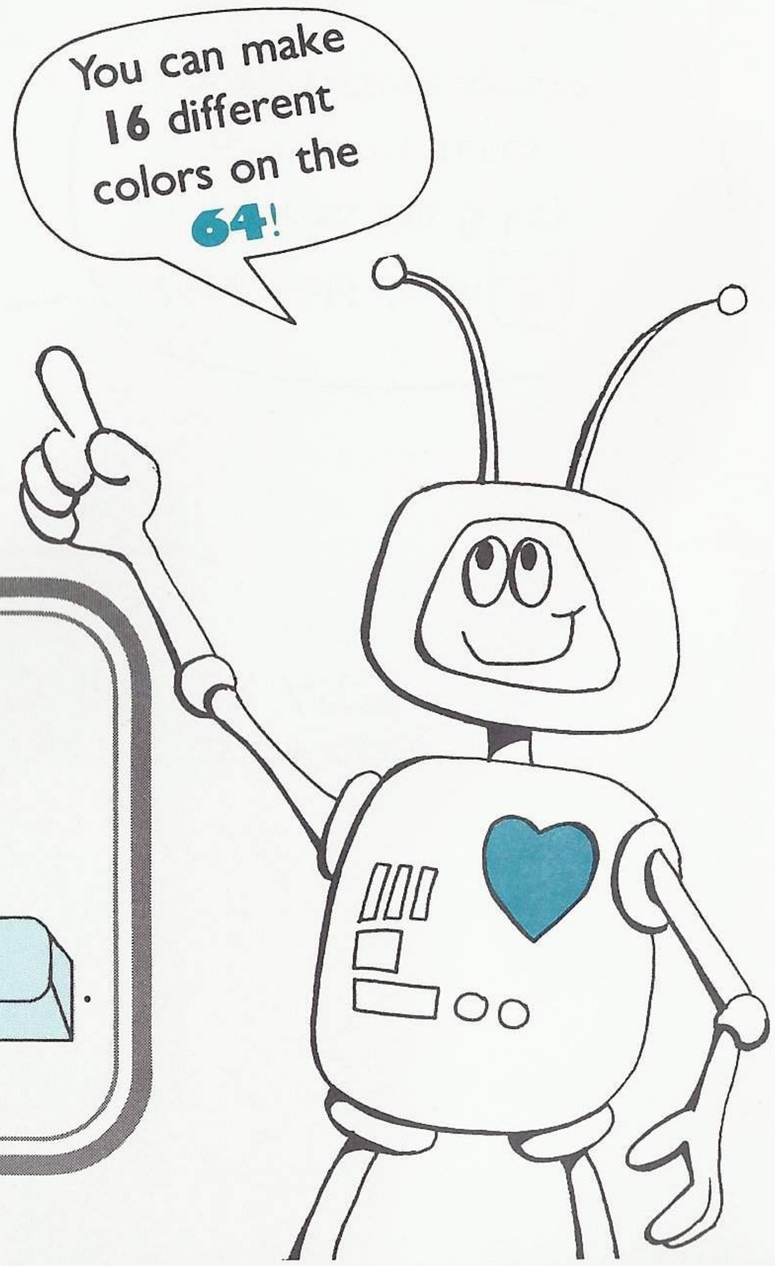
Now press C= and & 6 GRN . . . and type spaces.

A different color appears!

TRY TO FIND ALL THE COLORS:

Use each of the numbers from 1 to 8,

first with CTRL , then with C= .





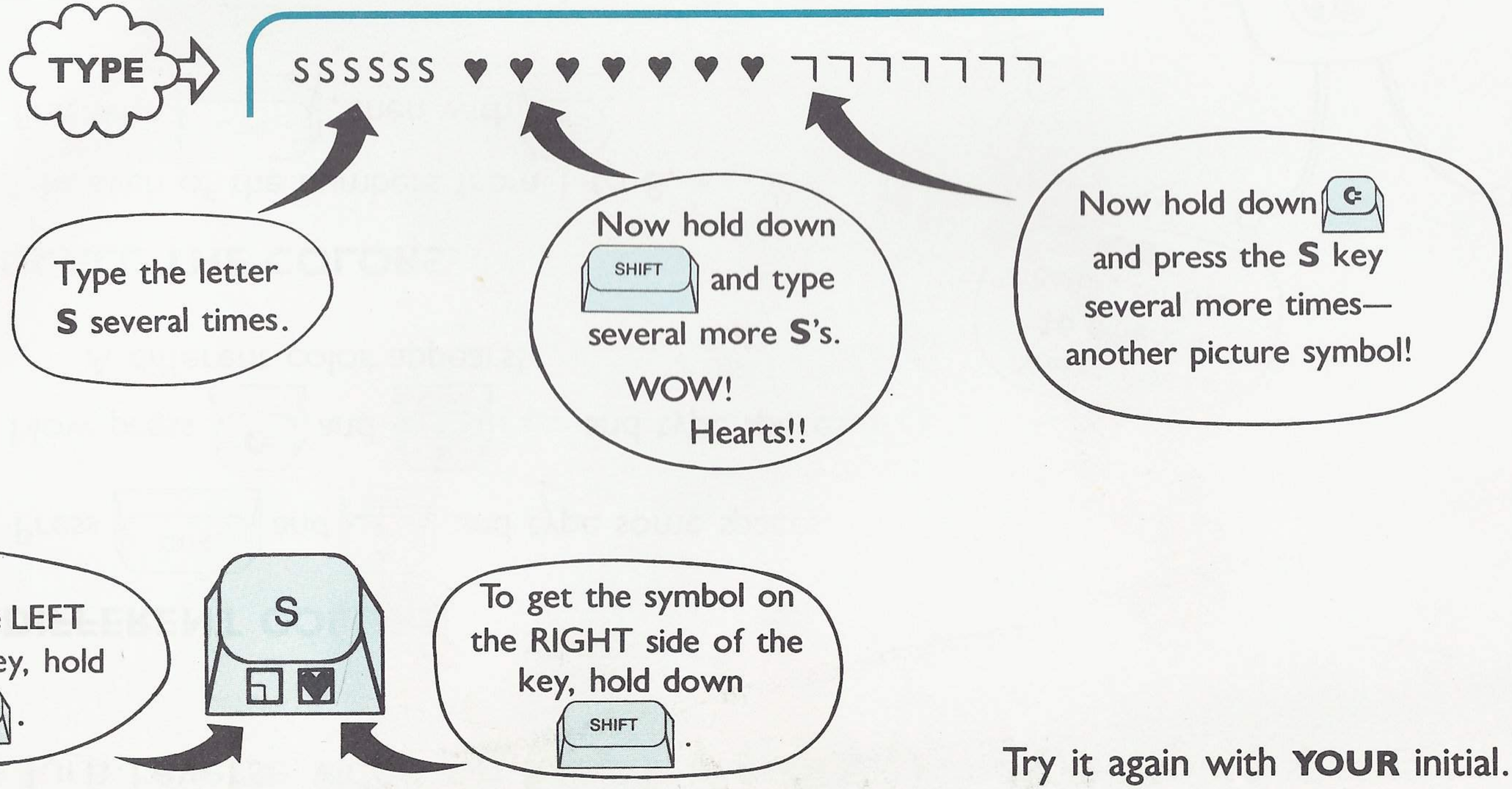
CHALLENGE

Design an interesting flag for an imaginary country.
Use at least FIVE colors.
Draw it on your computer using the SPACE BAR .

Graphics

Let's get Fancy!!

Have you noticed the **GRAPHICS** (picture symbols) on the fronts of many of the keys? We can use these to create all kinds of COMPUTER ART!



Try it again with **YOUR** initial.

UPPERCASE to lowercase

Clear your screen (press SHIFT and CLR HOME).

Type your name here

TYPE ⇨ KRISTA

Now hold down the SHIFT key and press the C= key several times.

What happens?

While your name is in uppercase (capital) letters, clear the screen again.

NOW hold down SHIFT and type your name.

TYPE ⇨ ◣¬┐♥I♠

Krista's code will look like this.

secret codes

You have written your name in "SECRET CODE"!

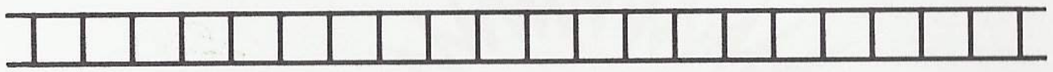
Hold down SHIFT and press the C= key a few times . . .

You have decoded your name!

While your name is in "code," CLEAR your screen (SHIFT and CLR HOME).

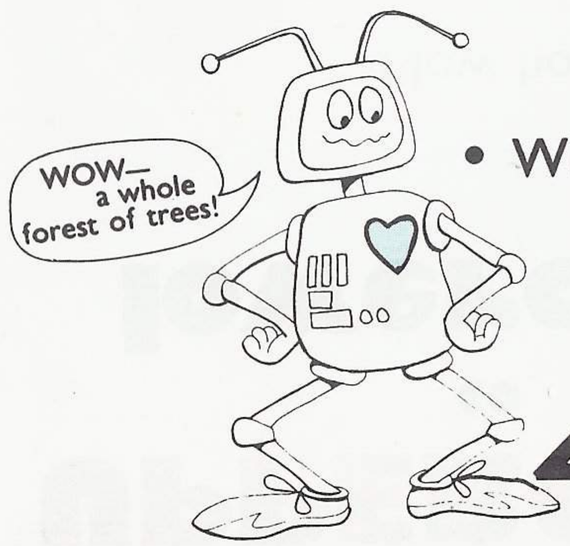
Change your CURSOR COLOR to WHITE (CTRL and " 2 WHT).

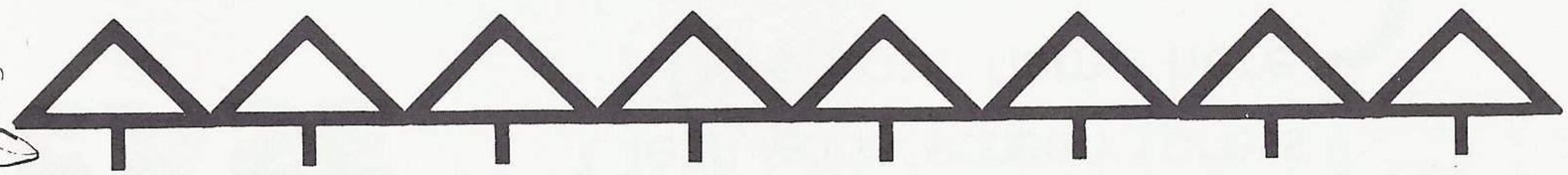
- Hold down C= and type R R R R . . .
  all the way across the screen.
- When the cursor jumps to the next line,
  hold down the C= and type E E E E . . .
  all the way across.



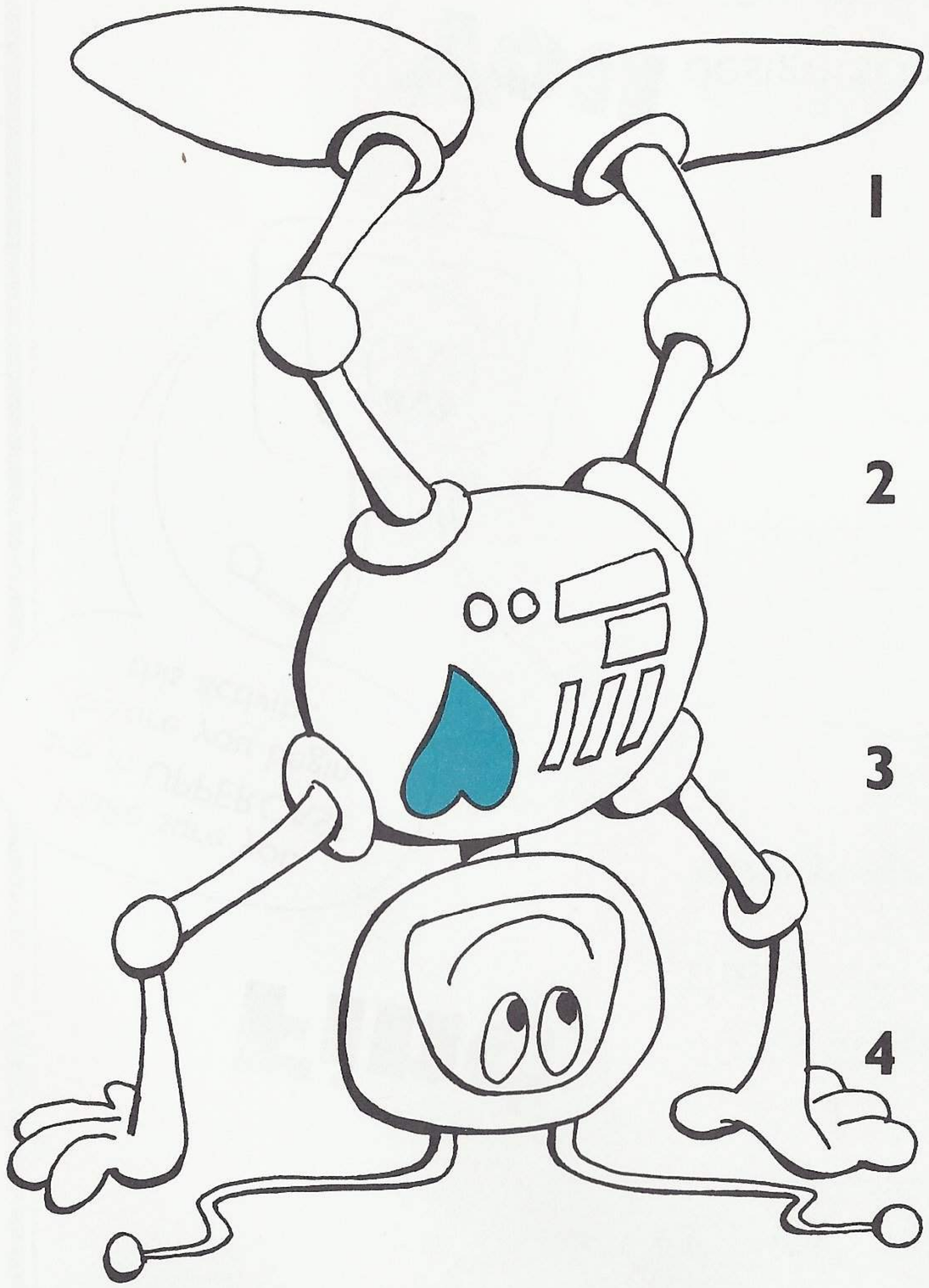
Change your CURSOR COLOR to LIGHT GREEN (C= and & 6 GRN).

- Hold down SHIFT and type N M N M N M
  . . . one after another all across the screen.
- When the cursor jumps to the next line, hold down SHIFT
  and type P O P O P O . . .





Try not to get all MIXED UP!



1 To change the COLOR of the WRITING:
Hold down CTRL *or* C= and type one of the numbers from 1 to 8.

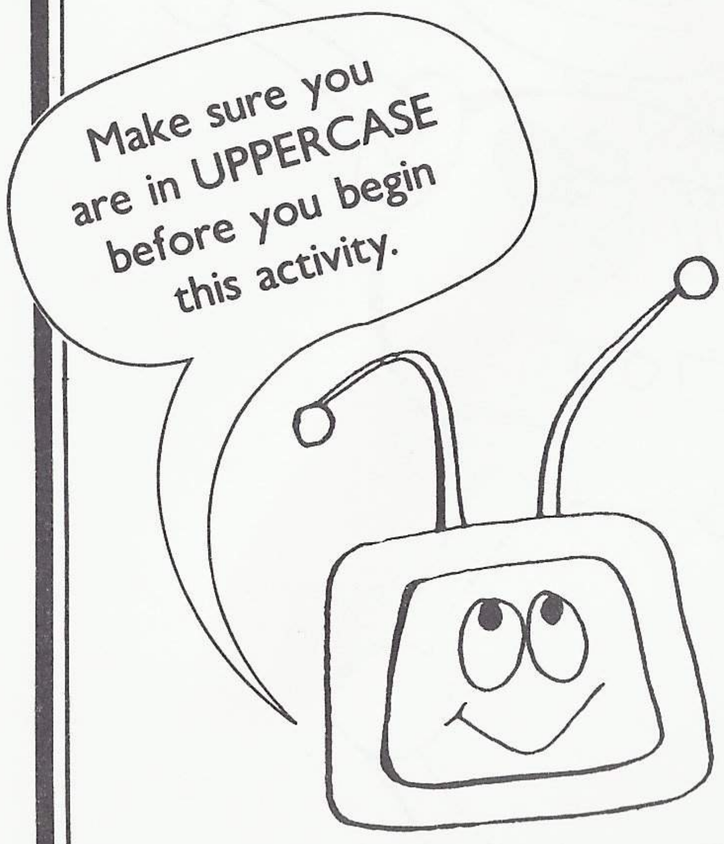
2 To make GRAPHICS (pictures):
Hold down SHIFT *or* C= and type any of the letters of the alphabet.

3 To change LETTERS from uppercase to lowercase or from graphics to uppercase letters:
Hold down SHIFT and press C= .

4 To CLEAR the screen:
Hold down SHIFT and press CLR HOME .

CHALLENGE

Find the correct graphics (picture) keys to make these border designs:







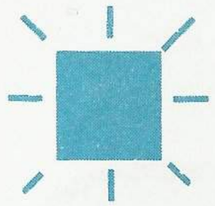


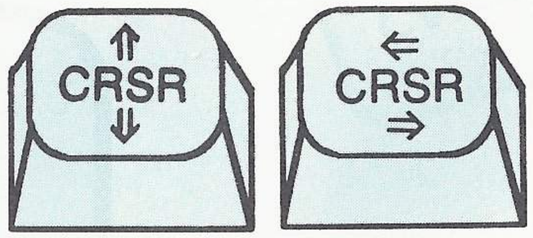


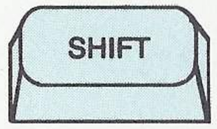


You design some fancier borders!
Can you make them different colors?

Controlling the Cursor

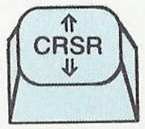


Notice these two CURSOR-CONTROL KEYS: 

Clear your screen—press 

and 

.

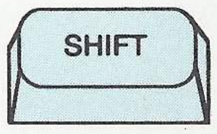
Press 

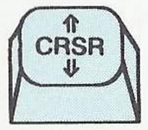
—your cursor moves **DOWN** the screen.

Press 

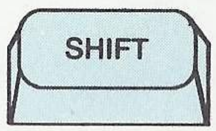
—your cursor moves to the **RIGHT.**

Now try this:

Hold down 

and press 

.

Hold down 

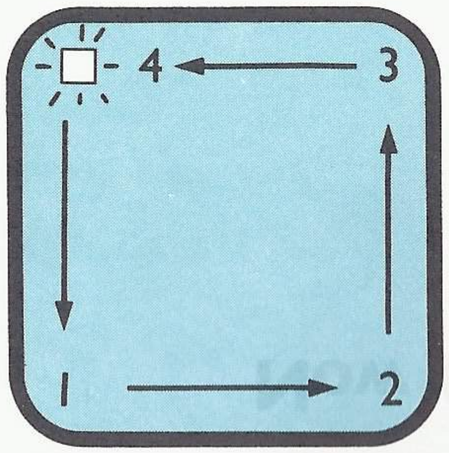
and press 

.

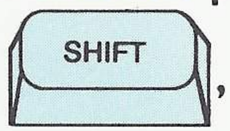
Can you make the cursor go all over the screen?

Notice that if you hold down a cursor–control key, the cursor automatically keeps on going.

How much CONTROL do you have?

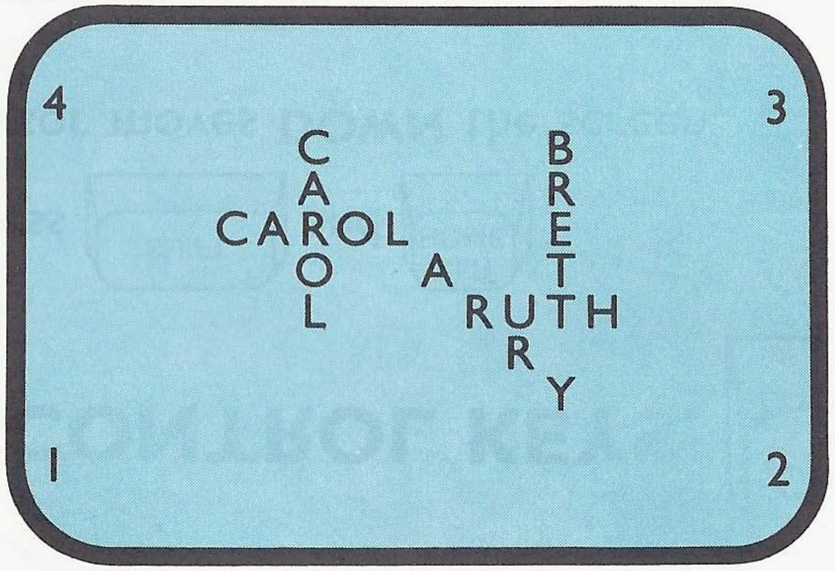


Clear the screen and start with the cursor at **HOME** position.

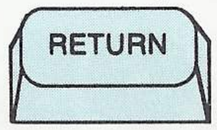
Using the CURSOR-CONTROL KEYS (and 

, when necessary), type the numbers **1, 2, 3, 4,** in each of the corners of the screen. **START** by putting **1** in the lower-left corner.

Now—can you add your name in the middle of the screen?
Be **TRICKY**—add your friends' names!





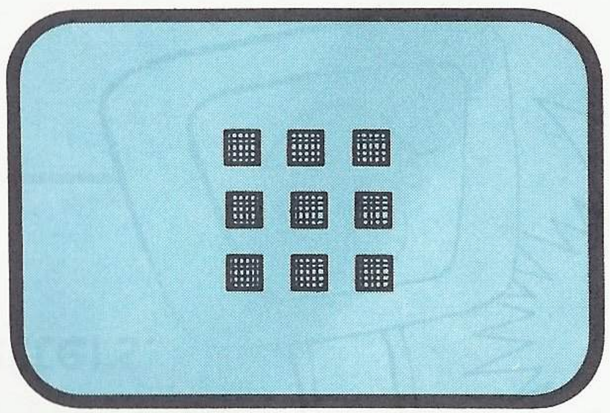
Do **not** press 

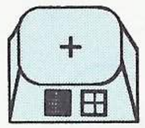
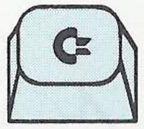
.

Tic-Tac-Toe Game

Practice using the CURSOR KEYS:

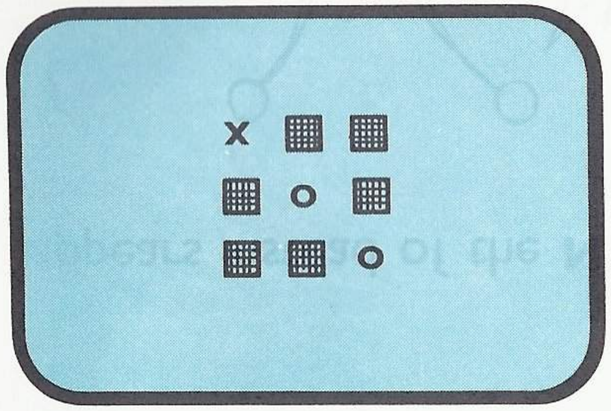
Clear your screen and set up your game like this:



Type nine boxes in the middle of your screen. (Use  with  .)
Put a space between each box.

Now find a friend and decide who is going to be **X** and who is **O**. Who goes first?

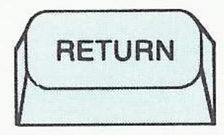
The first person will use the CURSOR KEYS to move the cursor where his or her marker will go. Type an **X** or an **O** replacing the box. Then it's the other person's turn.



WHO WINS?

Try Again!



Do **not** press 

.

Delete

We can **DELETE** (erase) letters with the INST DEL key.

Clear your screen and . . .

TYPE ⇨ WHAT A SNAP !

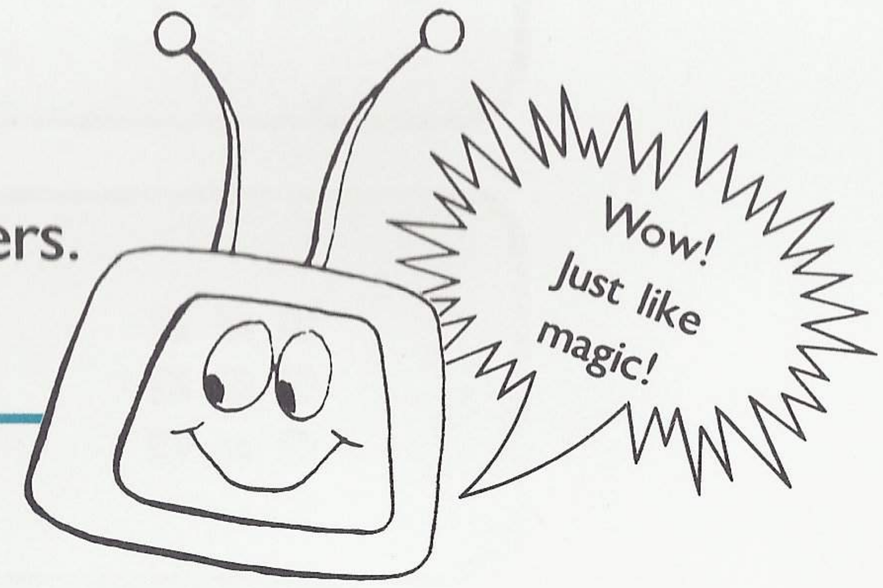
Move the cursor BACK to the **N** and press INST DEL. The **S** disappears instead of the **N**!

Now move the cursor to the letter **H**.

What do you think will disappear if you press INST DEL ?

Try it!

Were you RIGHT? **Erase** some more letters.



Erase **SPACES** too!

TYPE ⇨ SN AP

To erase a letter, move the cursor one space to the RIGHT of that letter and press INST DEL.

Move the cursor to the **A** and press INST DEL.

The space disappears and the letters MOVE OVER!

Insert

You can **INSERT** spaces **any** place on the screen by pressing SHIFT and INST DEL.

1 TYPE ⇨ A C E

2 Move the cursor **back** to the **C**. ⇨ A C E

3 Press SHIFT and INST DEL. ⇨ A C E

4 TYPE a **B**. ⇨ A **B** C E

5 Move the cursor to the **E**. ⇨ A B C E

6 Press SHIFT and INST DEL. ⇨ A B C E

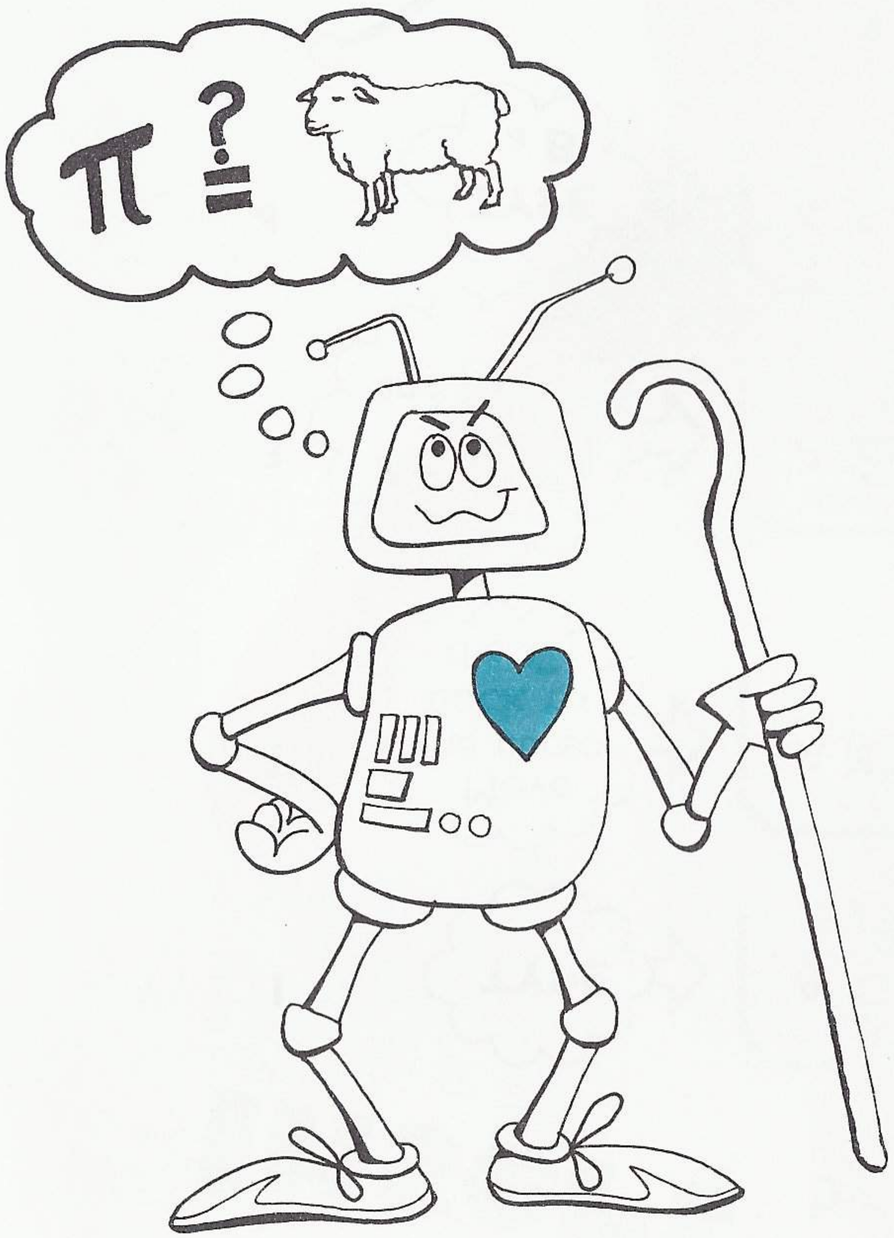
7 TYPE a **D**. ⇨ A B C **D** E



NOW try inserting letters in *another* part of the alphabet.

HIM or BEG would be good words to use!

cursor control games



Try this game:

Using your cursor keys, the color keys, and the π key (SHIFT with ↑ π), scatter 10 white "sheep" and 10 black "sheep" all over the screen.

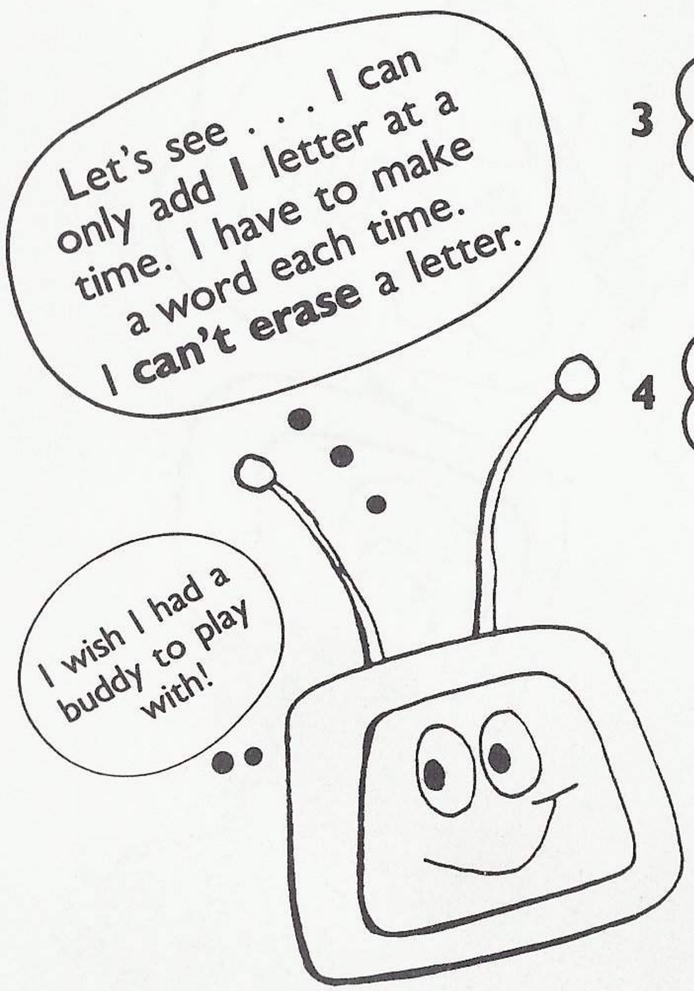
→ Have a friend use the INST DEL key to erase all the sheep of one color, but **NOT** erase any sheep of the other color.

→ **TRADE PLACES—DO IT AGAIN!**
Time each other . . . Who is the **Champ?**

CHALLENGE

Try "herding" all the remaining sheep to the **LEFT** side of the screen.
HINT: Try putting the cursor **ON** the sheep before pressing INST DEL .

Play "Build-a-Word"



1 **TYPE** → **A**

2 **ADD** a **T** → A **T**

3 **INSERT** a space → A T

4 **TYPE** an **R** → A **R** T

5 **INSERT** a space before ART → A R T

6 **TYPE** an **M** → **M** A R T

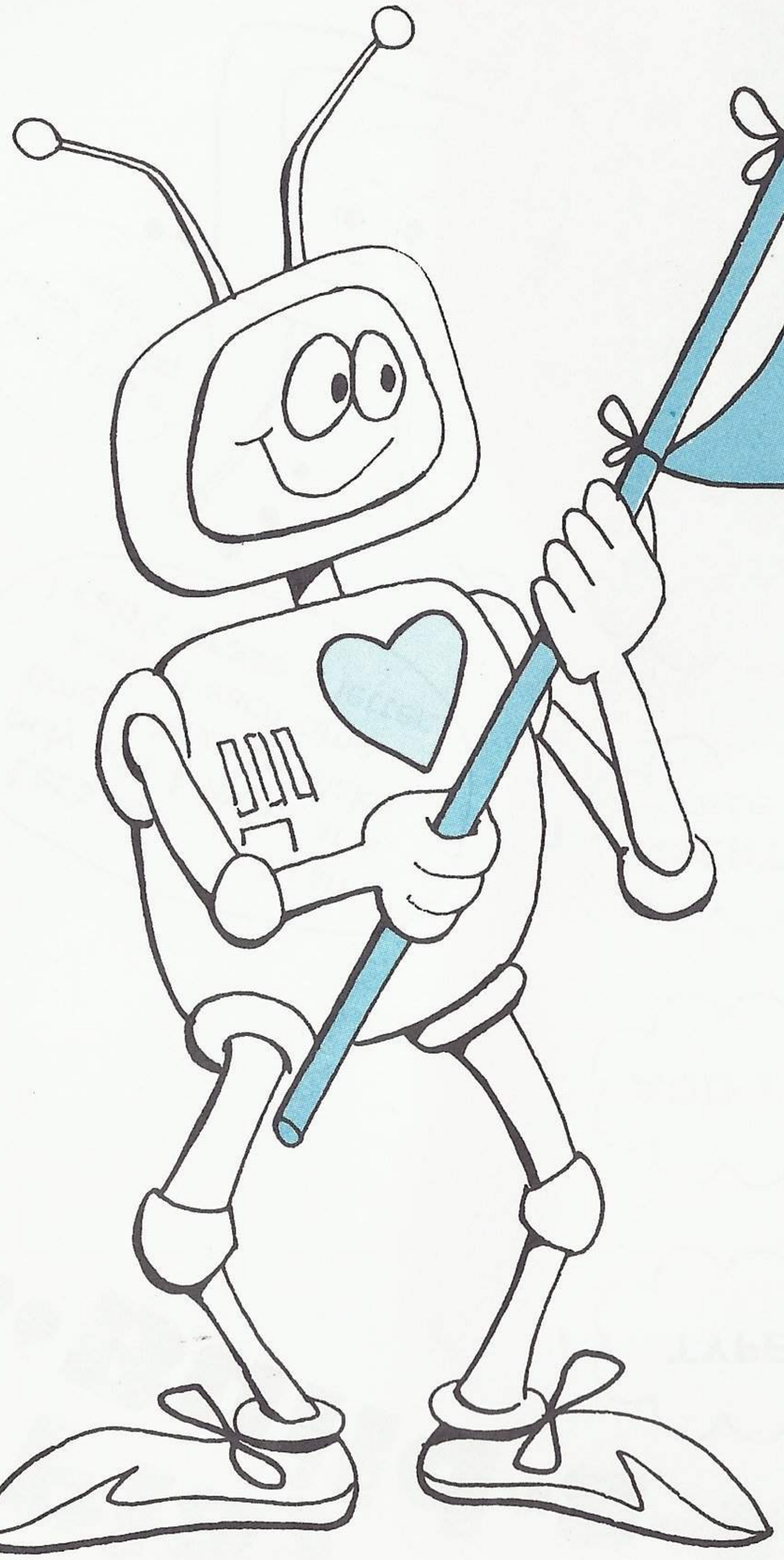
7 **INSERT** another space before MART → M A R T

8 **TYPE** an **S** → **S** M A R T

→ Now see if you are SMART enough to build another group of words. You might start with

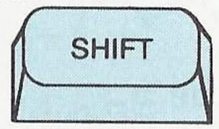
I
IN
PIN
PINE
SPINE

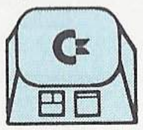
See how BIG a word you can build!



1 **GRAPHICS** is another word for:

____**a** letters and words
____**b** pictures and symbols
____**c** sounds made by a giraffe

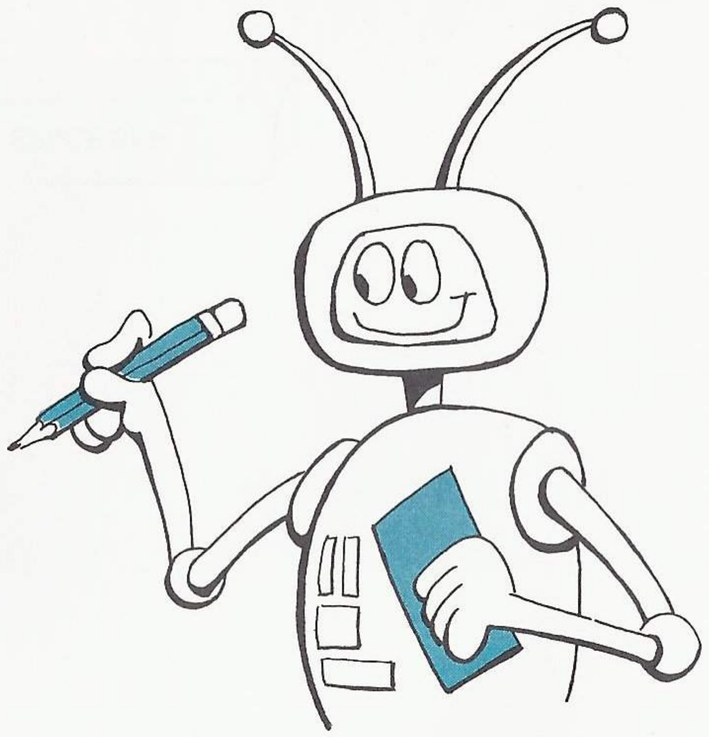
2 What "magic" happens to letters when you hold down 

and press  ? _____

_____

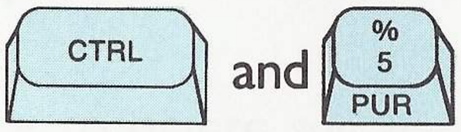
3 How many different colors can you make on the Commodore 64? ____

4 Match the computer key to the action that takes place when the key is pressed.

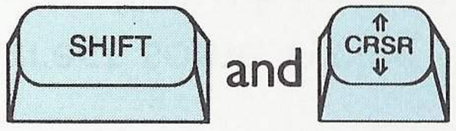


a 

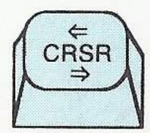
_____ Moves the cursor up

b 

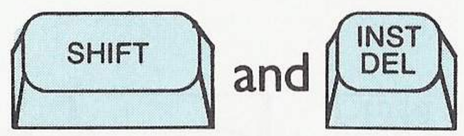
_____ Inserts a space

c 

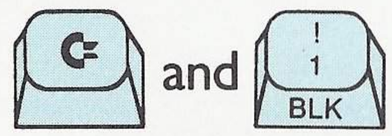
_____ Erases the letter, symbol, or space to the left of the cursor

d 

_____ Changes the cursor color to orange

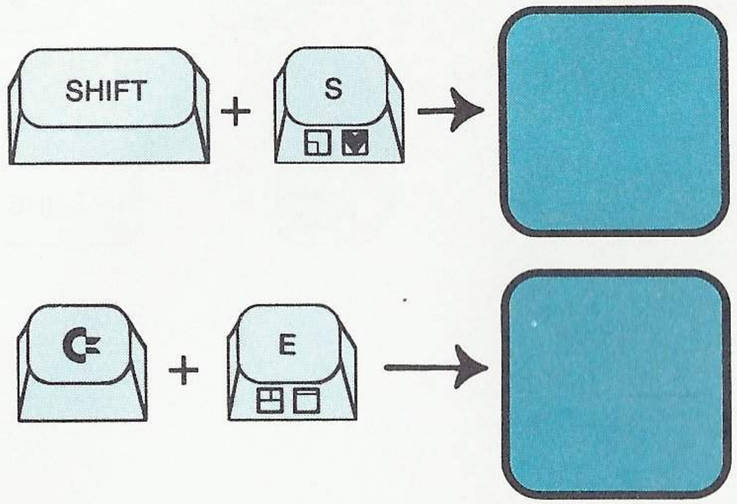
e 

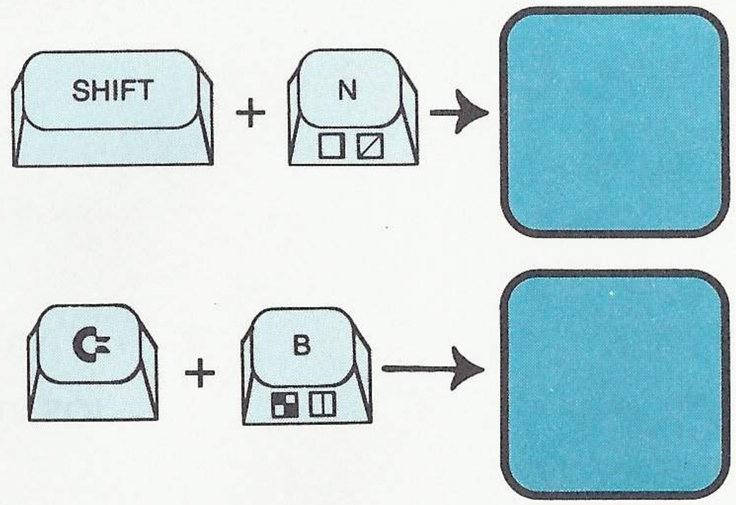
_____ Changes the cursor color to purple

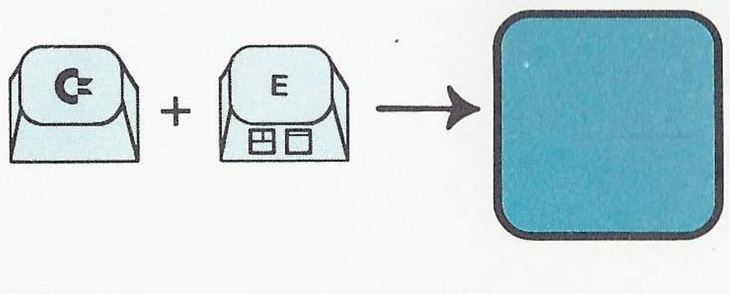
f 

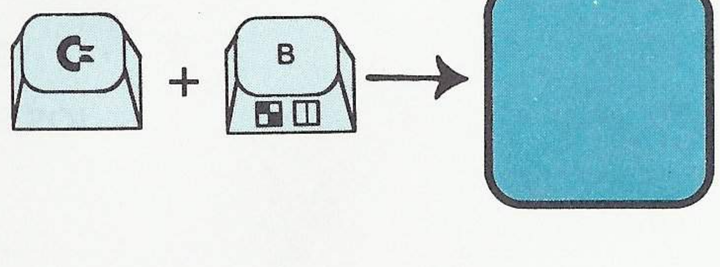
_____ Moves the cursor to the right

5 DRAW the symbol that appears on the SCREEN when you press the following pairs of keys:

a 

b 

c 

d 

6 OOPS! Correct some typing errors:
Draw a cursor (□) where it needs to be

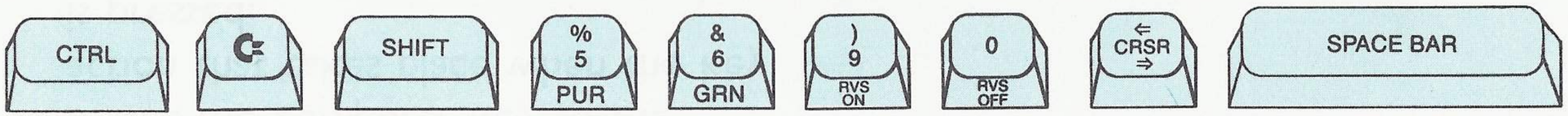
a to delete the extra letter:

MY KCAT CHASES RATS.

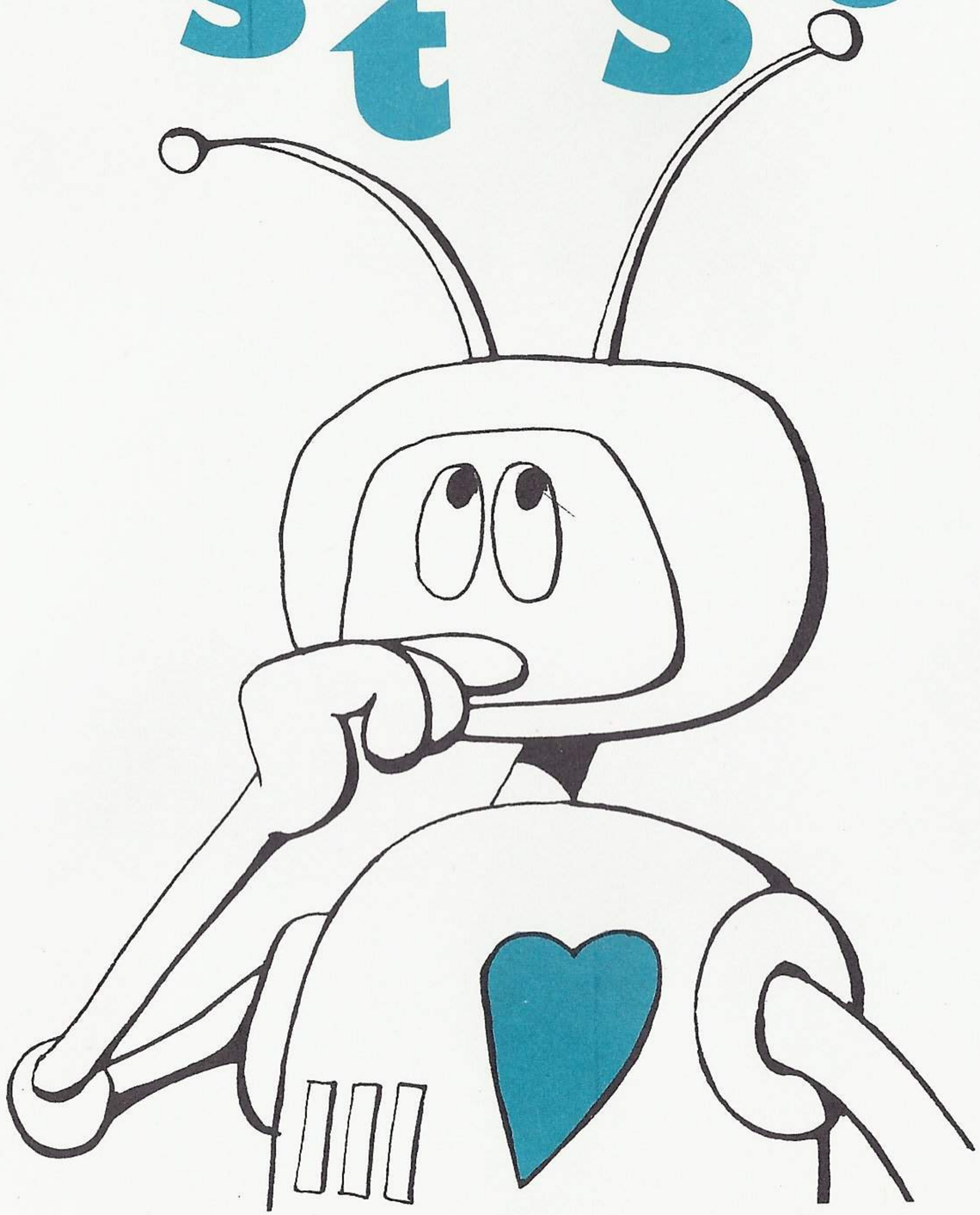
b to insert the missing space:

MY DOG HASFLEAS!

7 Circle all the keys you need to press to draw solid purple bars on the screen:



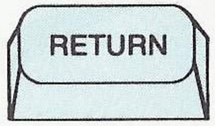
First steps



Part 2

Change the cursor to a color you like.

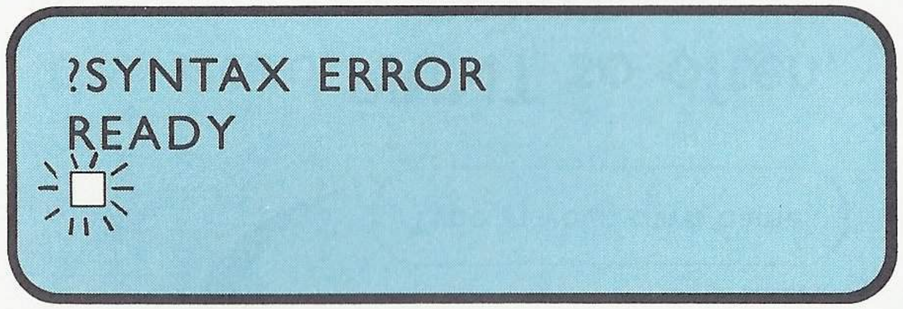


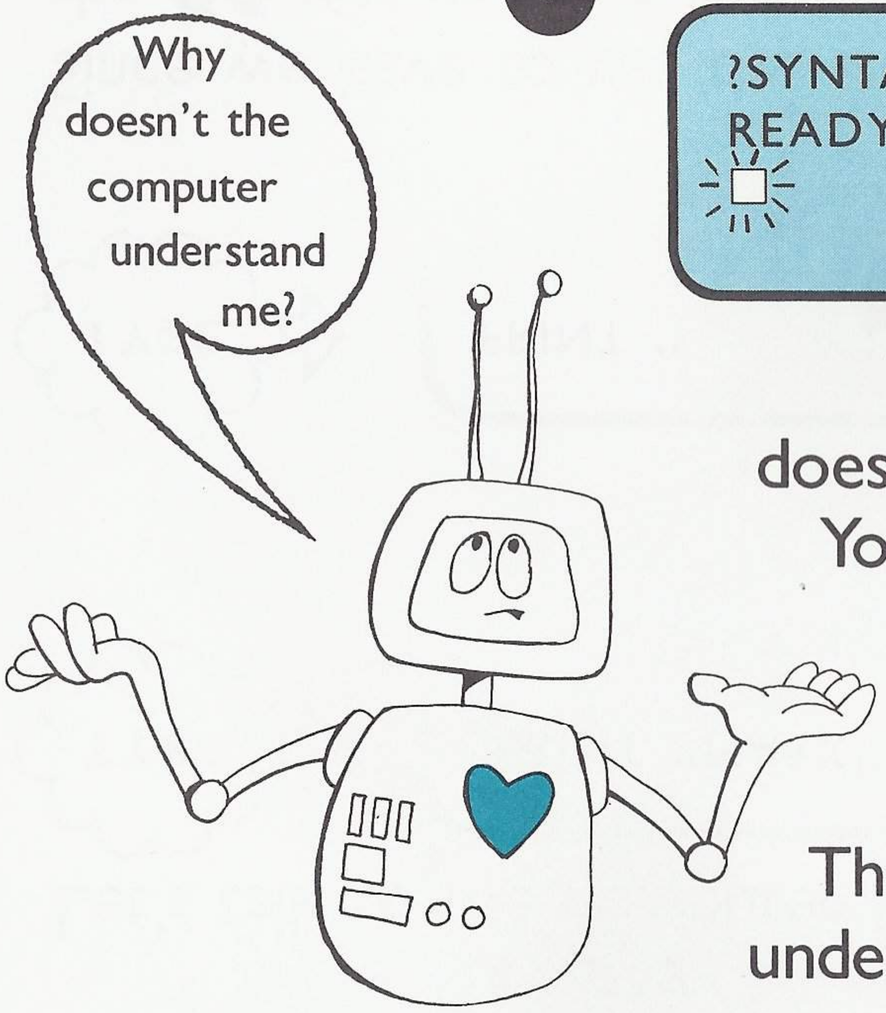
(Find the 

key and press it.)

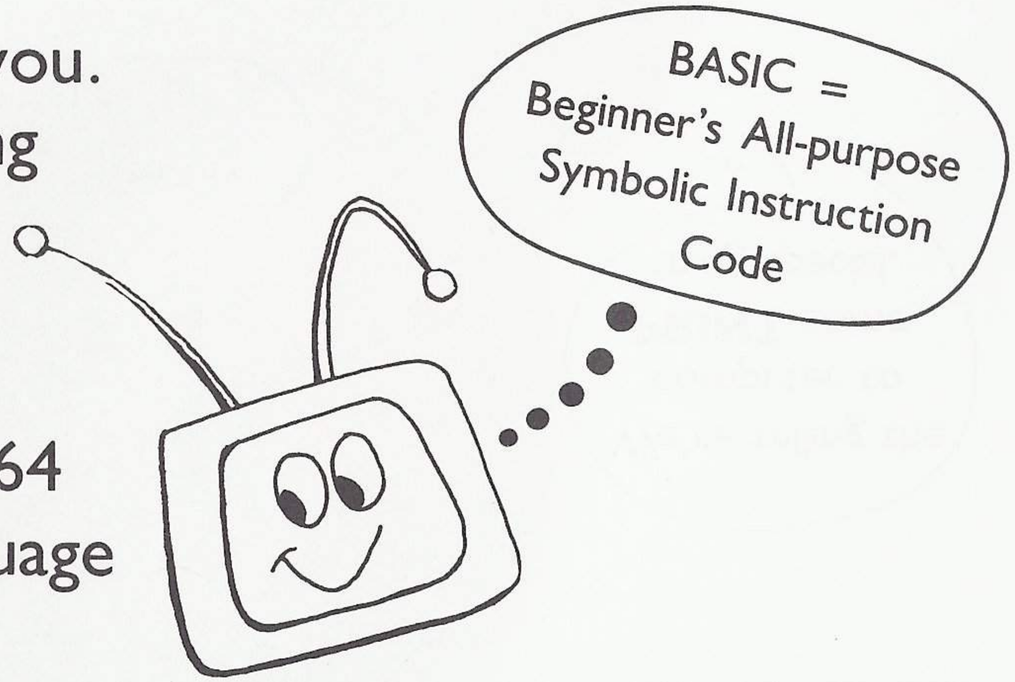
PRINT Statements

oops!





Your computer doesn't understand you. You're not speaking its **language**!



The Commodore 64 understands the language called BASIC.

When the computer is turned on, the BASIC language is in its memory.
It is **EASY** to understand . . . and **EASY** to use.

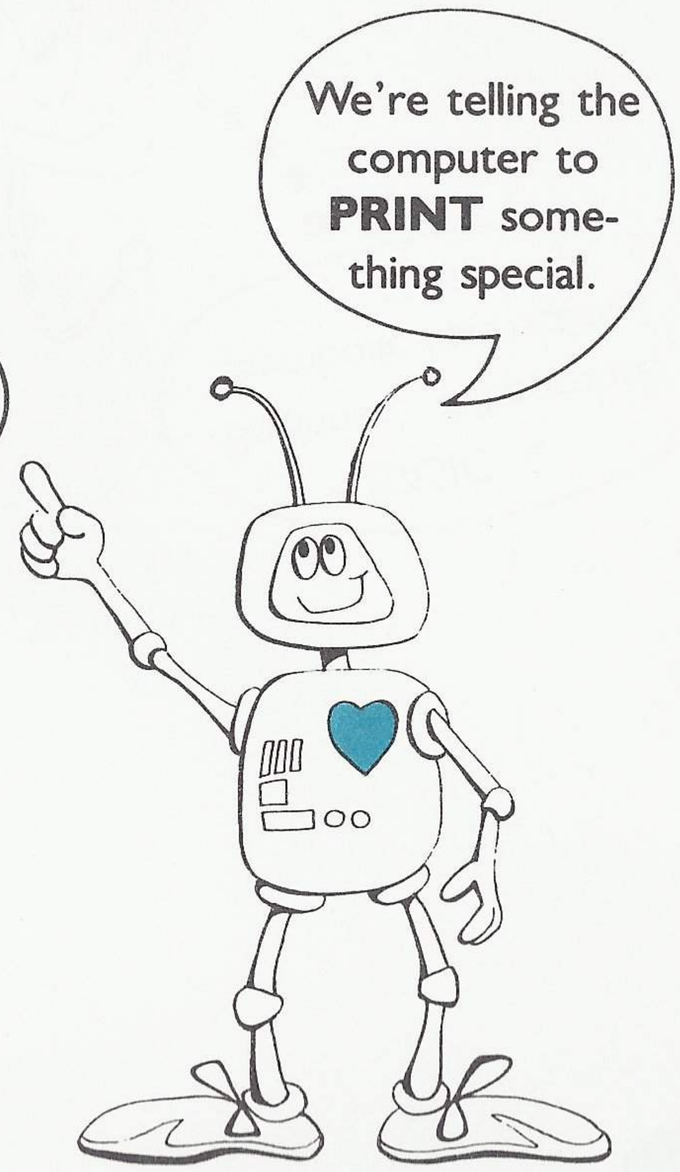
Let's talk to the computer in BASIC:

TYPE ⇨ PRINT "MARK" Press RETURN

Press SHIFT and 2 " WHT to type QUOTATION MARKS

TYPE ⇨ PRINT " " Press RETURN

Type in your **own** name.



Since we have to use the word PRINT so often, the **64** lets us use a **shortcut** for PRINT.

TYPE ⇨ ?"THIS IS FUN!" Press RETURN

Use a QUESTION MARK (? /) and SHIFT) **instead** of the word PRINT.

TYPE ⇨ ?"I AM SPEAKING BASIC" Press RETURN

Add some **Color** to your statements!



TYPE

?" [E] FLUFFY WHITE CLOUDS"

Press RETURN

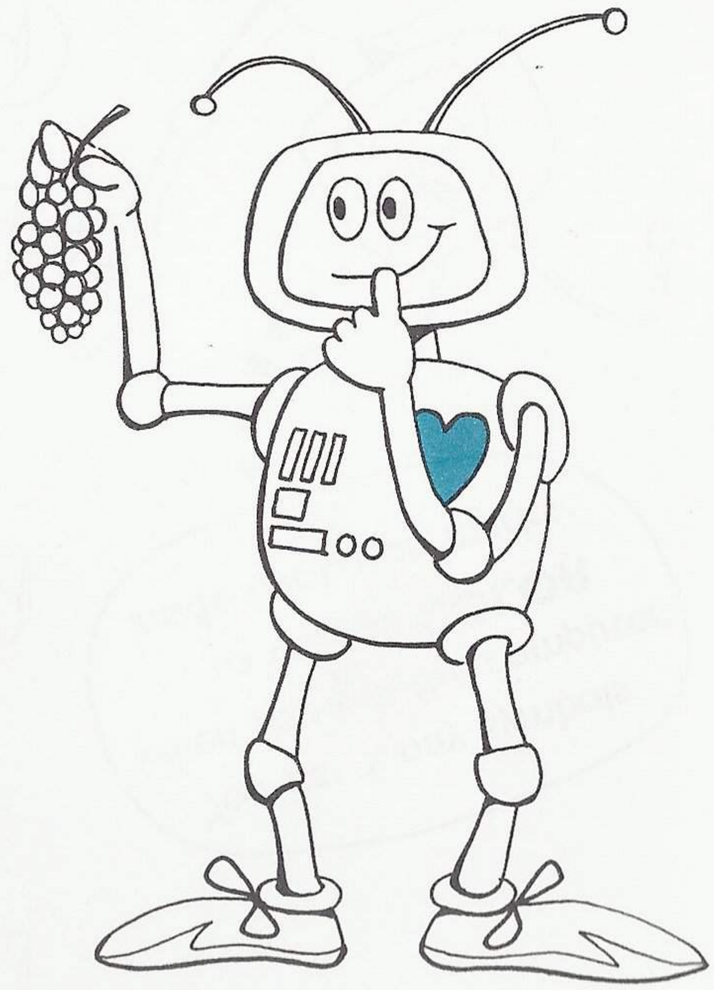
Press CTRL and " 2 WHT to tell the computer to PRINT in white. A funny symbol will appear.

TYPE

?" [ ] PURPLE GRAPES"

Press RETURN

Press CTRL and % 5 PUR to tell the computer to PRINT in purple . . . another funny symbol.



TYPE

?" [T] BRIGHT YELLOW SUN"

Press RETURN

CTRL and (8 YEL

TYPE

?"EVERY CLOUD HAS A [ ] SILVER LINING"

Press RETURN

[G] and % 5 PUR

More color!!

TYPE

?" [HOLLY] [BERRIES"

Press CTRL and 6 GRN

Press C= and 3 RED

RETURN

TYPE

?" ●●●● ●●●●"

C= and 1 BLK

C= and 7 BLU

RETURN

TYPE

?" ♥ ♥ ♥ RYAN ♥ ♥ ♥"

C= and 3 RED

CTRL and 2 WHT

C= and 3 RED

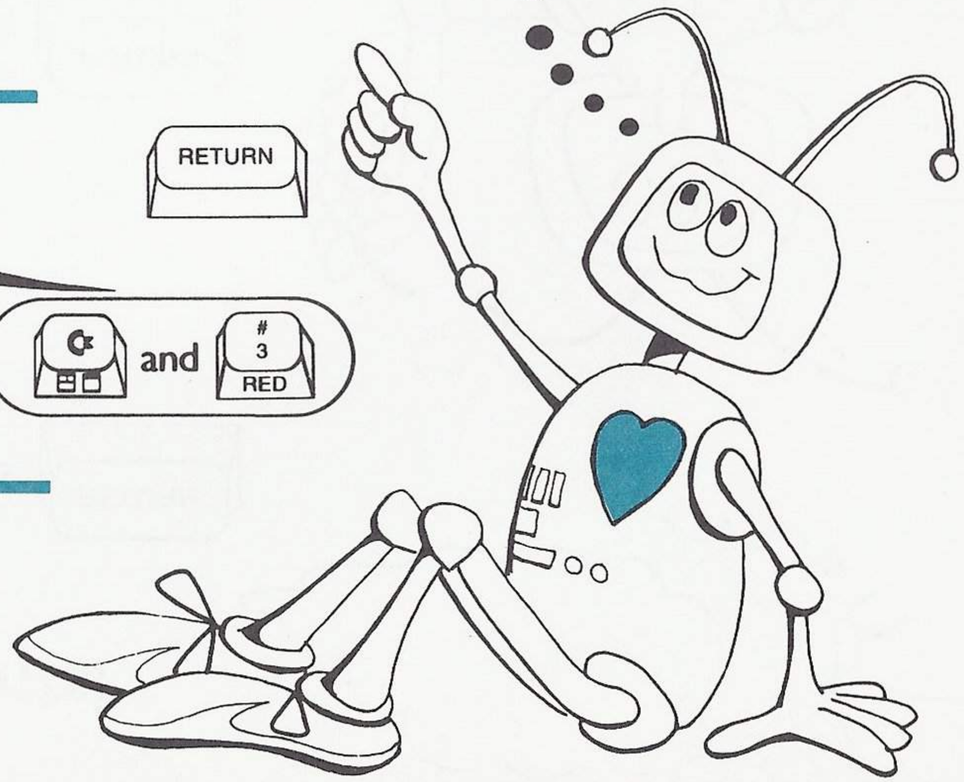
RETURN

TYPE

?"_ _ _ _ _ _ _ _ _ _ _ _"

(YOU write a message in COLOR!)

You get funny symbols when you tell the computer to change **COLOR** inside quotation marks.



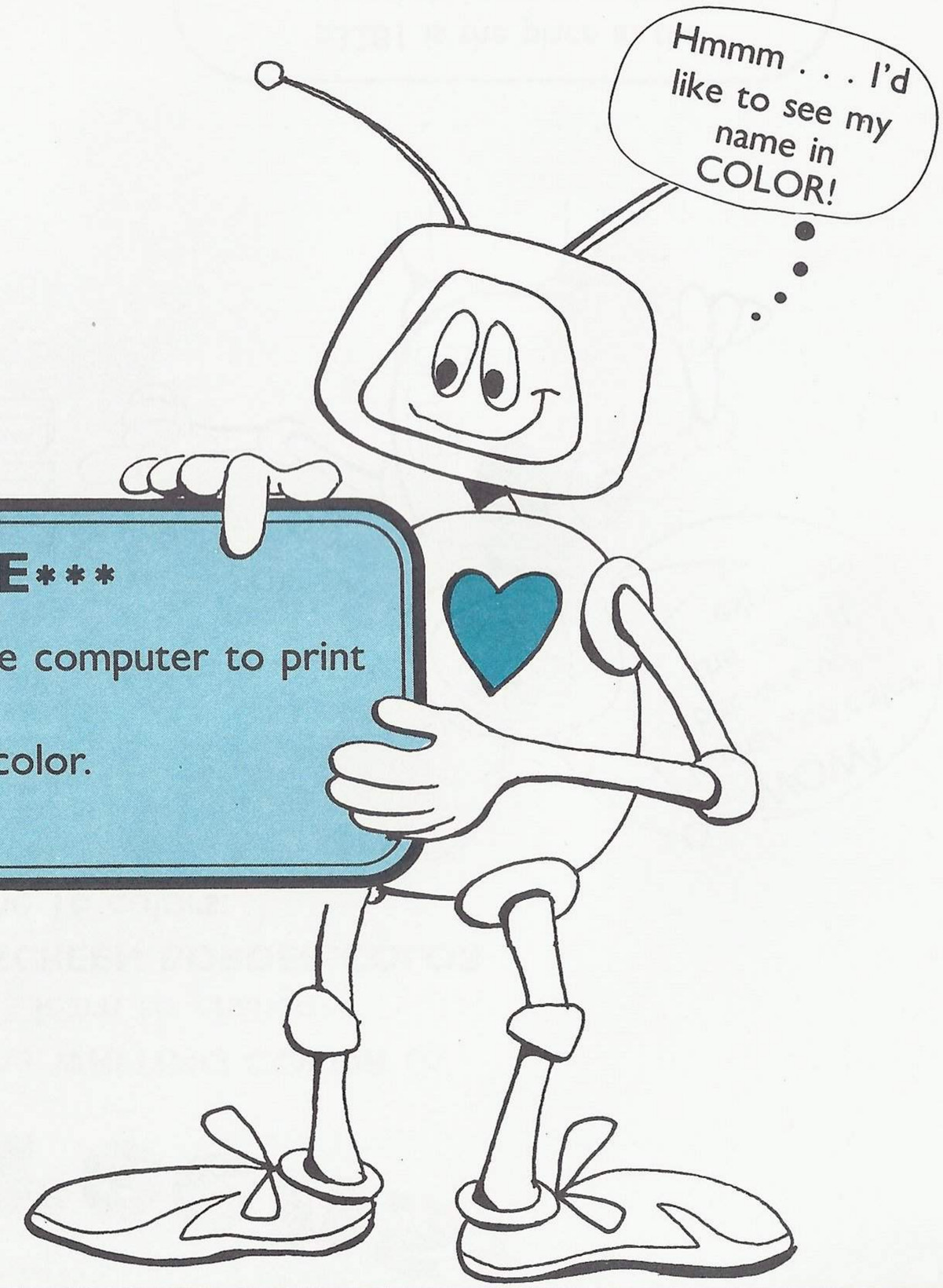
Anything typed within quotation marks is called a **string.**

?"JENNIFER"

String

?"♥●○♦▬"

String



CHALLENGE

Use a PRINT statement that tells the computer to print your whole name . . .
BUT make each letter a **different** color.

Colorful Screens

You have learned to change the **WRITING COLOR** to 16 possible colors. Let's learn to change the **SCREEN COLOR** and the **SCREEN BORDER COLOR** to any of the same 16 colors:

TYPE

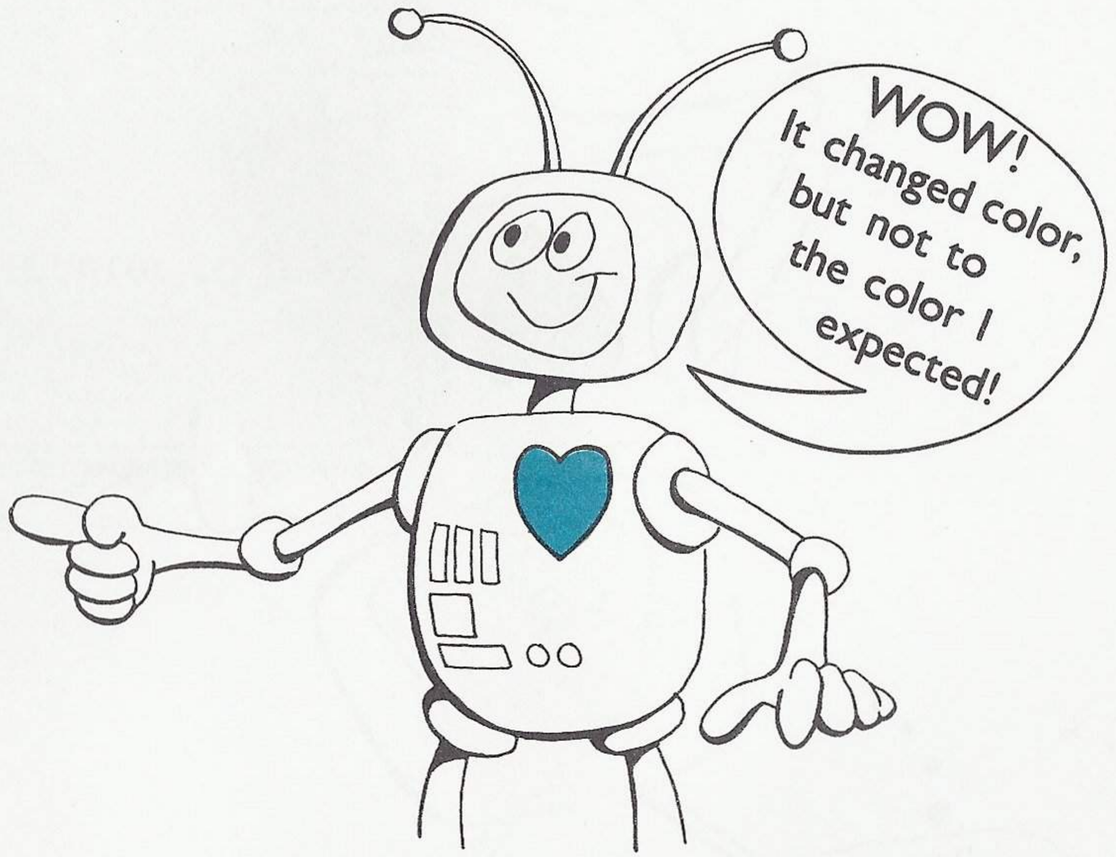
```
POKE 53281,1
```

RETURN

TYPE

```
POKE 53281,2
POKE 53281,3
POKE 53281,4
```

RETURN RETURN RETURN



Try ALL the numbers: 0–15.

53281 is the place in the computer's memory where it "remembers" the **screen color.**

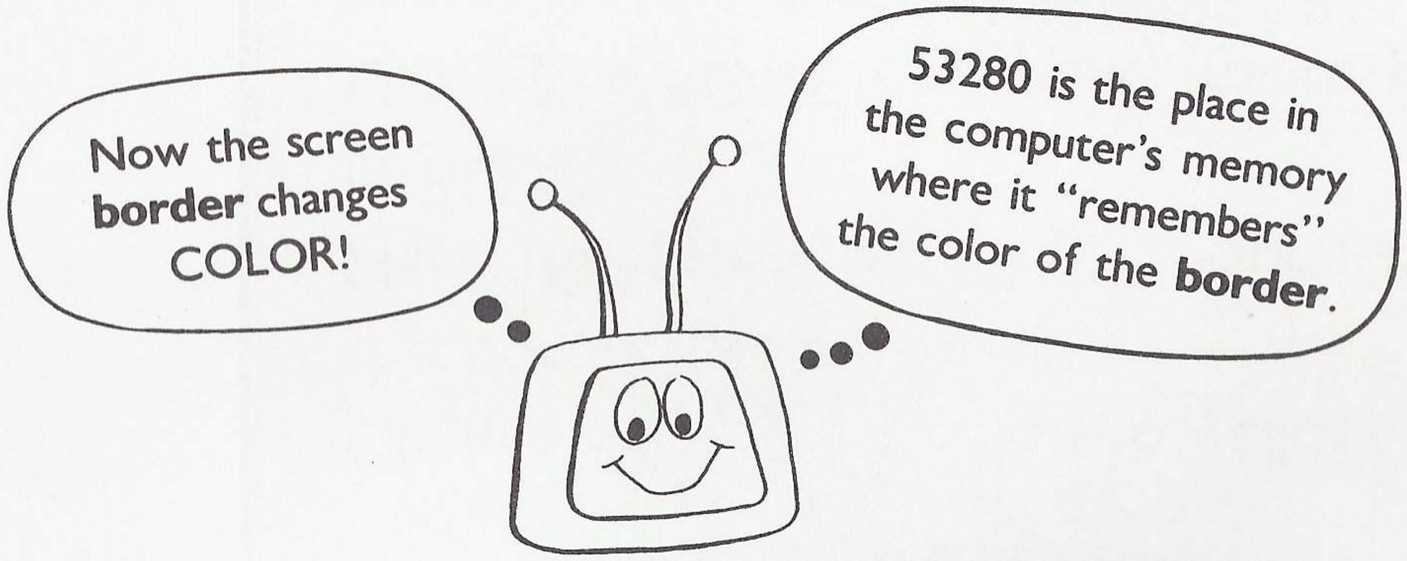
Change the screen color *and* the writing color (Lesson 2) several times.

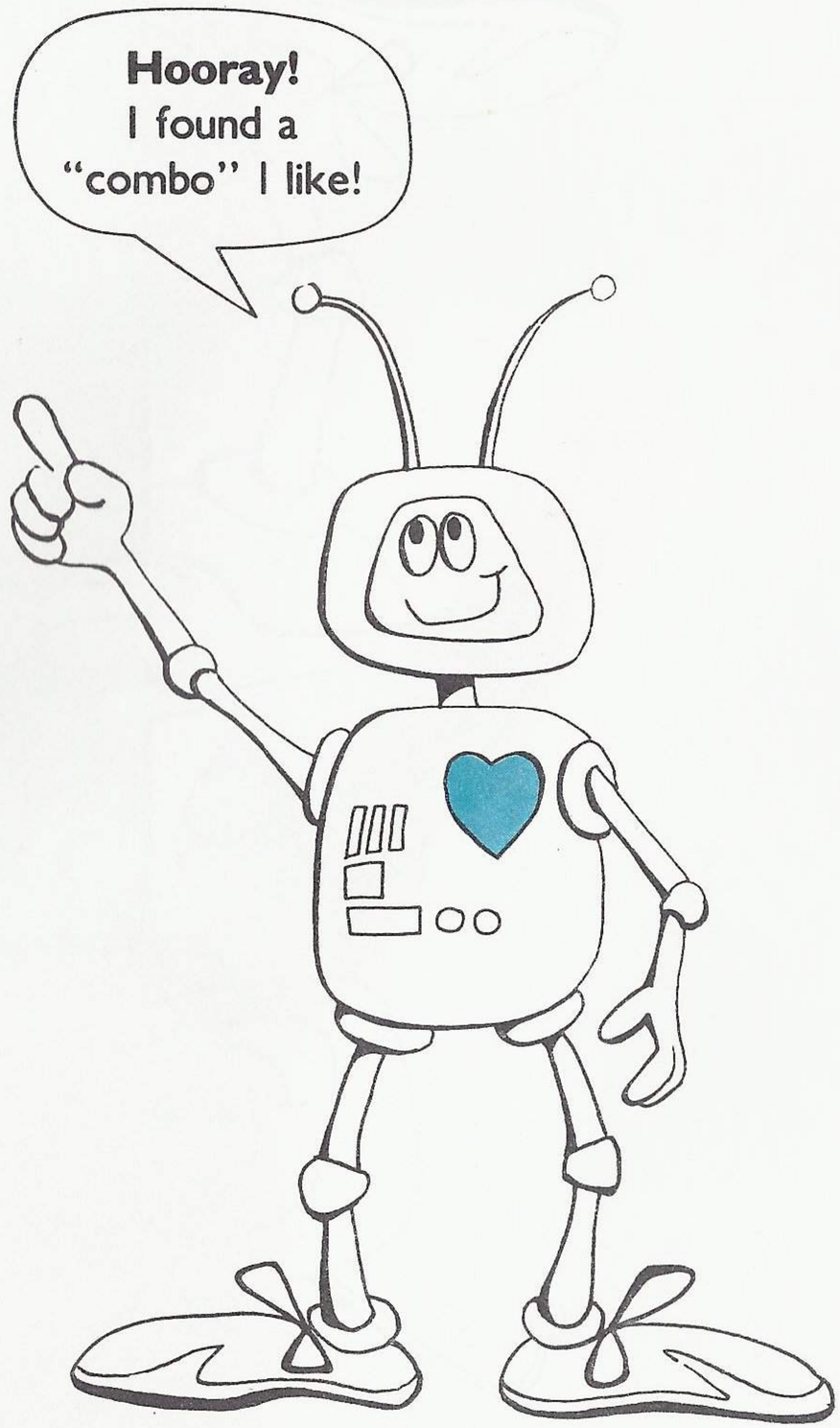
→ Keep track of combinations that are EASY to read and combinations that are AWFUL!

TYPE

```
POKE 53280,1
```

RETURN





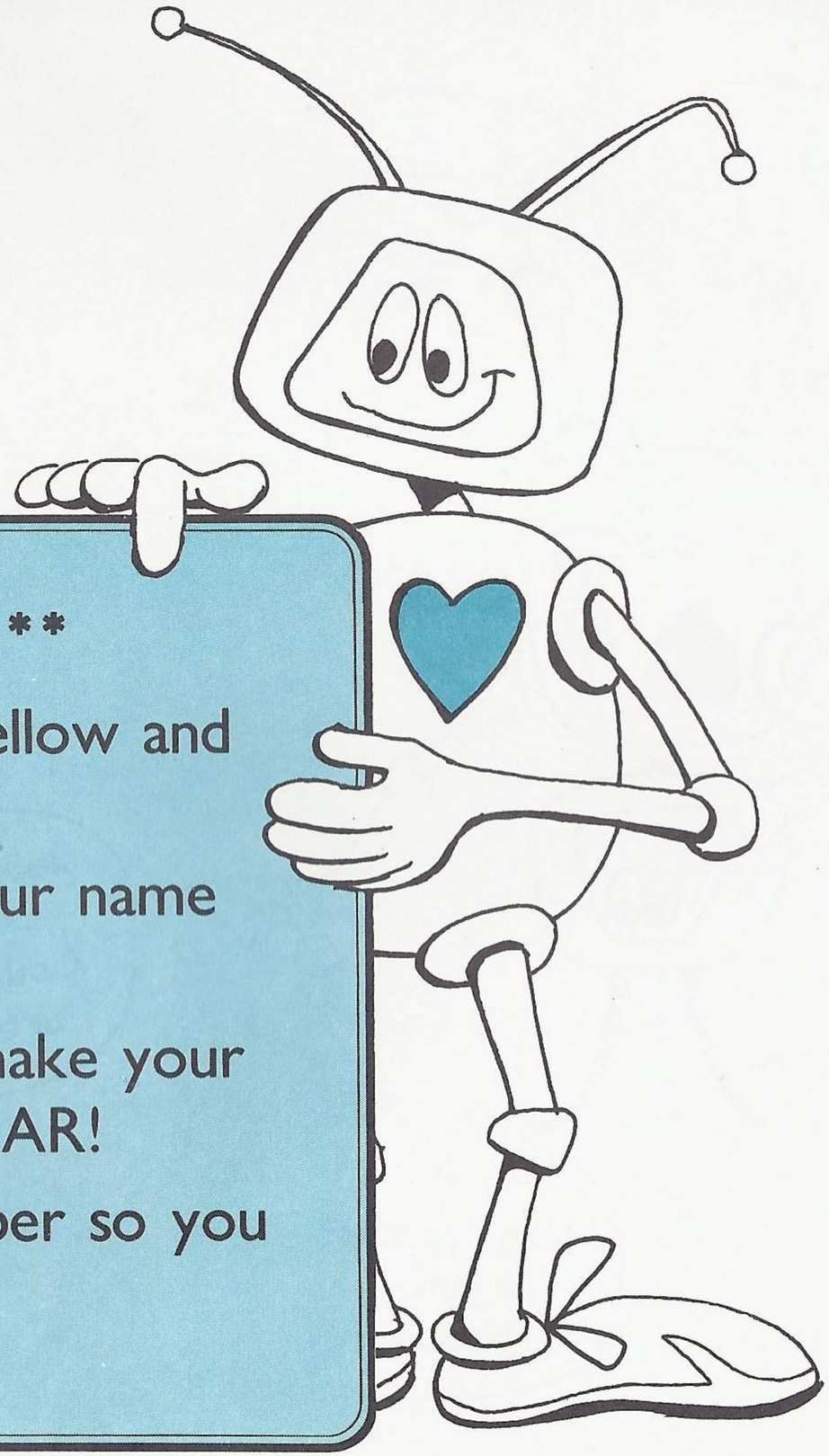
TYPE

```
POKE 53280,0
POKE 53280,2
POKE 53280,3
```

RETURN
RETURN
RETURN

→ Try ALL the numbers: 0–15.

You can look at the
chart on the next page
whenever you need to figure
out how to change to a certain color.

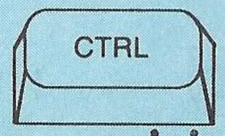


CHALLENGE

Change the screen color to yellow and the border color to blue.

Have the computer PRINT your name in BLUE.

Using one POKE command, make your name and the cursor DISAPPEAR!

Now press 

and a number so you can see your writing again.

Color Chart

To change **writing** color:

Press two keys

Color Keys: for *writing* colors	COLORS	Color Numbers: for *screen* and *border* colors
CTRL and 1 BLK	Black	0
CTRL and 2 WHT	White	1
CTRL and 3 RED	Red	2
CTRL and 4 CYN	Cyan	3
CTRL and 5 PUR	Purple	4
CTRL and 6 GRN	Green	5
CTRL and 7 BLU	Blue	6
CTRL and 8 YEL	Yellow	7
C= and 1 BLK	Orange	8
C= and 2 WHT	Brown	9
C= and 3 RED	Light red	10
C= and 4 CYN	Gray 1	11
C= and 5 PUR	Gray 2	12
C= and 6 GRN	Light green	13
C= and 7 BLU	Light blue	14
C= and 8 YEL	Gray 3	15

To change **screen** color:

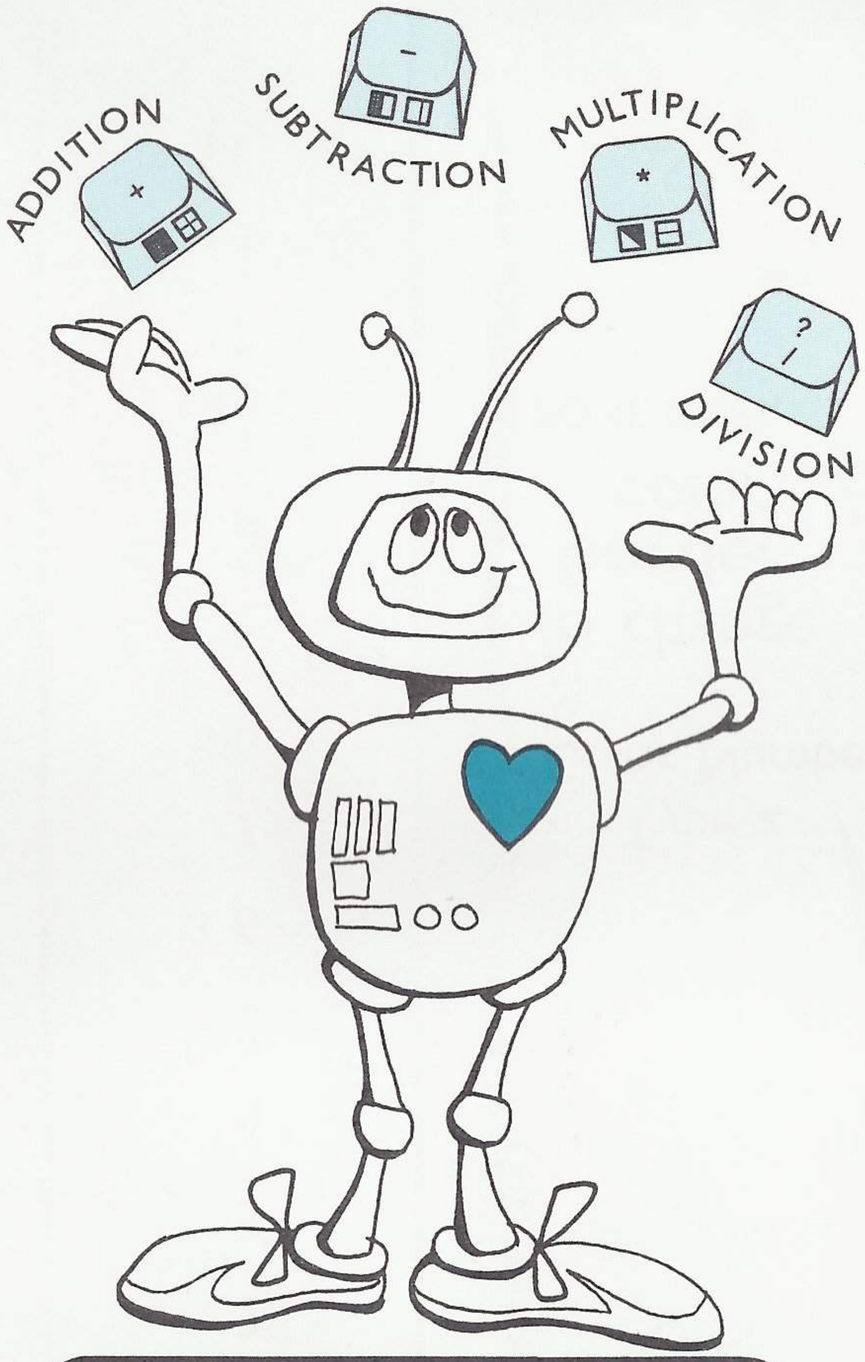
POKE 53281, ____

Type a Color Number

To change **border** color:

POKE 53280, ____

Math wizard



The **64** is also a MATH WIZARD!

TYPE

```
? 4 + 3
? 6 - 2
? 3 * 4
? 8 / 2
```

RETURN RETURN RETURN RETURN

Try some more problems on your own.

NOW try this:

TYPE

```
? 5 + 2
? "5 + 2"
```

RETURN RETURN

Notice the difference:

Which way "says" the problem?
Which way "does" the problem?
Which one is a **STRING**?

NUMBERS: 0 RVS OFF, ! 1 BLK

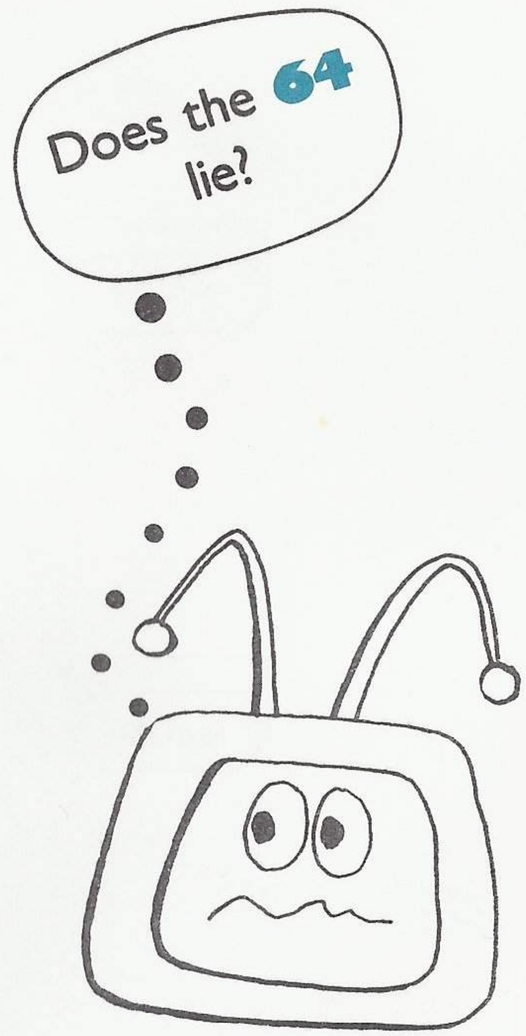
LETTERS: O, I, L

Try some math sentences.

TYPE

```
? "5 + 2 = " 5 + 2
? "12 - 5 = " 12 - 5
? "3 × 4 = " 3 * 4
```

RETURN RETURN RETURN



Let's TRICK the computer!

TYPE

```
? "2 + 2 =" 2 + 3
```

RETURN

The **64** is VERY, VERY fast at doing math calculations, but it doesn't know how to *think*. The computer will always do *exactly* what it is told to do.

In this case, WE told the **64** to print **2 + 2 =** and then to do the problem **2 + 3.**

The **64** does not realize that 2 + 2 = 5 is **silly!**

YOU made the **64** "tell a lie"!

Notice:

If you type this . . .

```
?"5 + 2 = "        5 + 2
```

message calculation

the computer will print out this . . .

```
5 + 2 = 7
```

message answer

Let's Be Tricky

1 How many legs do five dogs have?

TYPE

```
?"FIVE DOGS HAVE" 5 * 4 "LEGS!"
```

message calculation message

RETURN

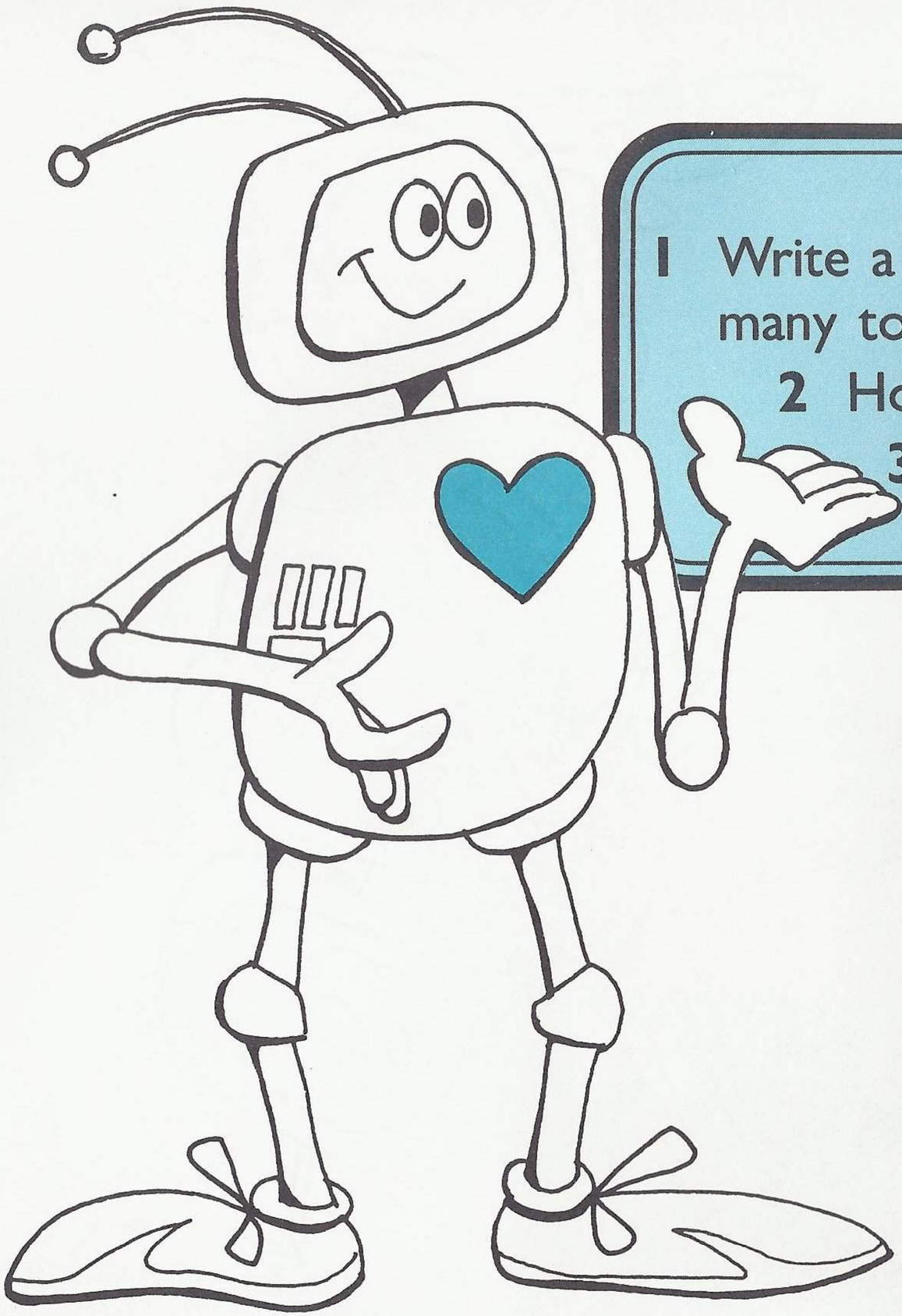
2 Today is Jan's birthday. She is 15 years old.
How many *DAYS* old is Jan?

TYPE

```
?"JAN IS" 15 * 365 "DAYS OLD TODAY."
```

RETURN

Now make up your *own* story problems!

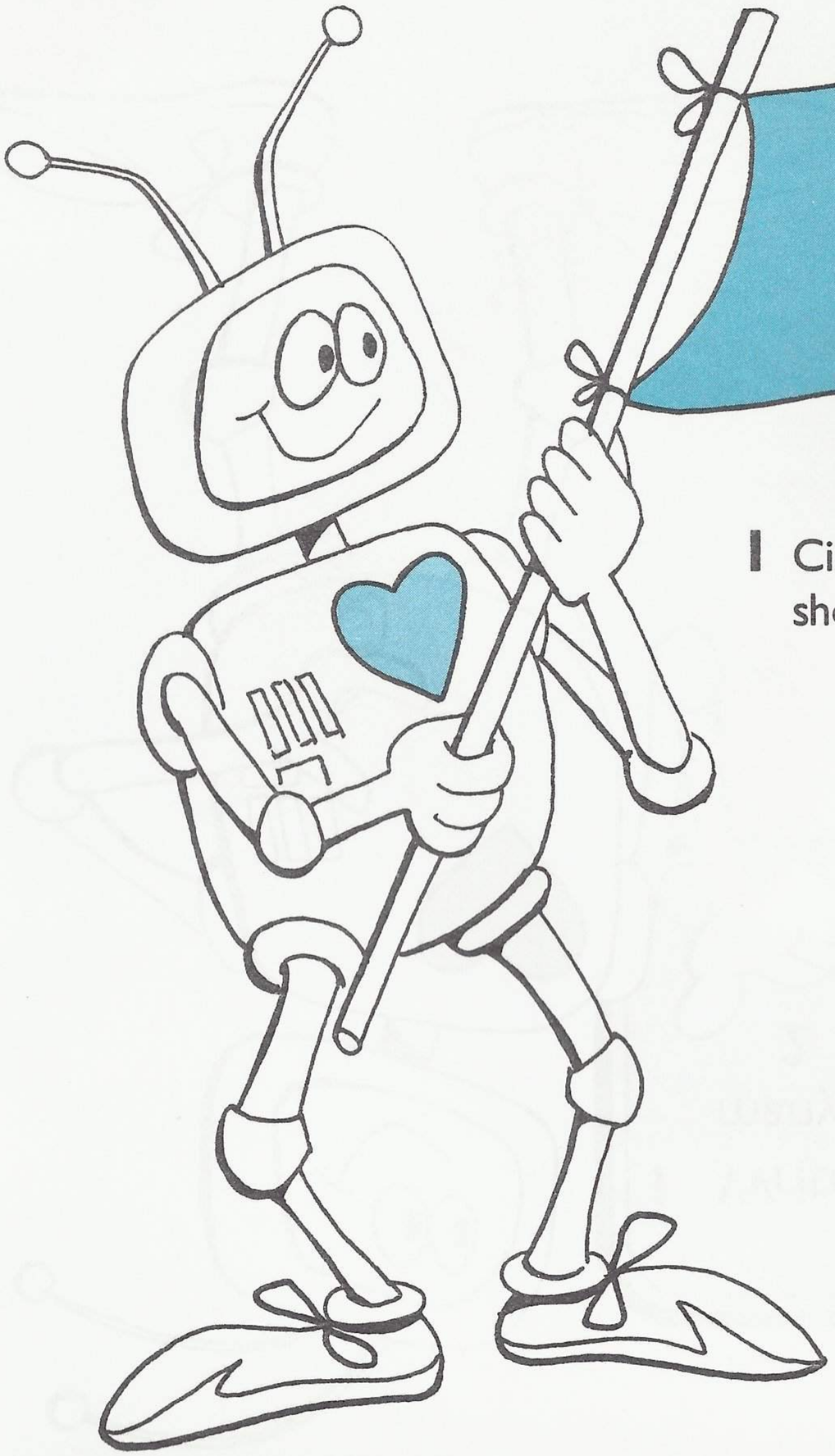


CHALLENGE

1 Write a math story problem that figures out how many toes are in your classroom.

2 How many ears are in your family?

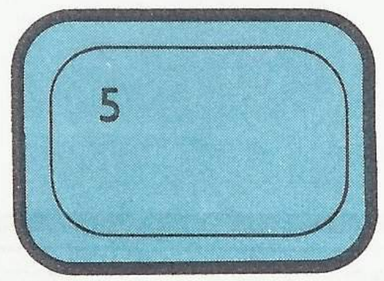
3 How many seconds are there in one hour? In one recess? In one school day?



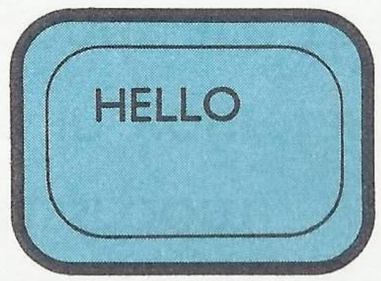
Review

1 Circle the PRINT statement that gives the output shown on the computer screen:

a
```
?"2 + 3 = 5"
? 2 + 3
? "2 + 3"
```

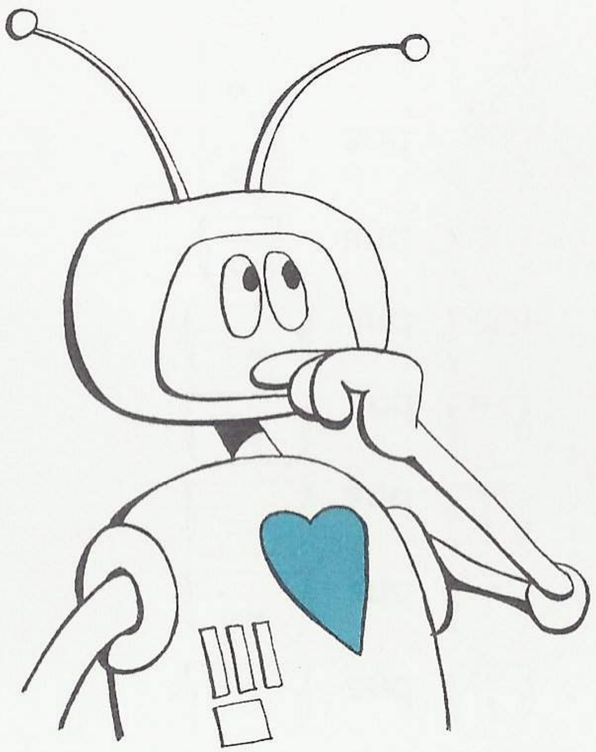


b
```
"? HELLO"
? HELLO
?"HELLO"
```



c
```
PIRNT "COMPUTERS"
PRINT "COMPUTERSS"
PRINT "  COMPUTERS"
```





2 What language is in the Commodore 64's memory when you turn it on?

____English ____Pig Latin ____BASIC ____French

3 Check the symbol used as a "shortcut" for PRINT?

____? ____! ____# ____♥ ____P

4 Fill in the blanks:

a POKE 53281, ____ gives you a green screen.

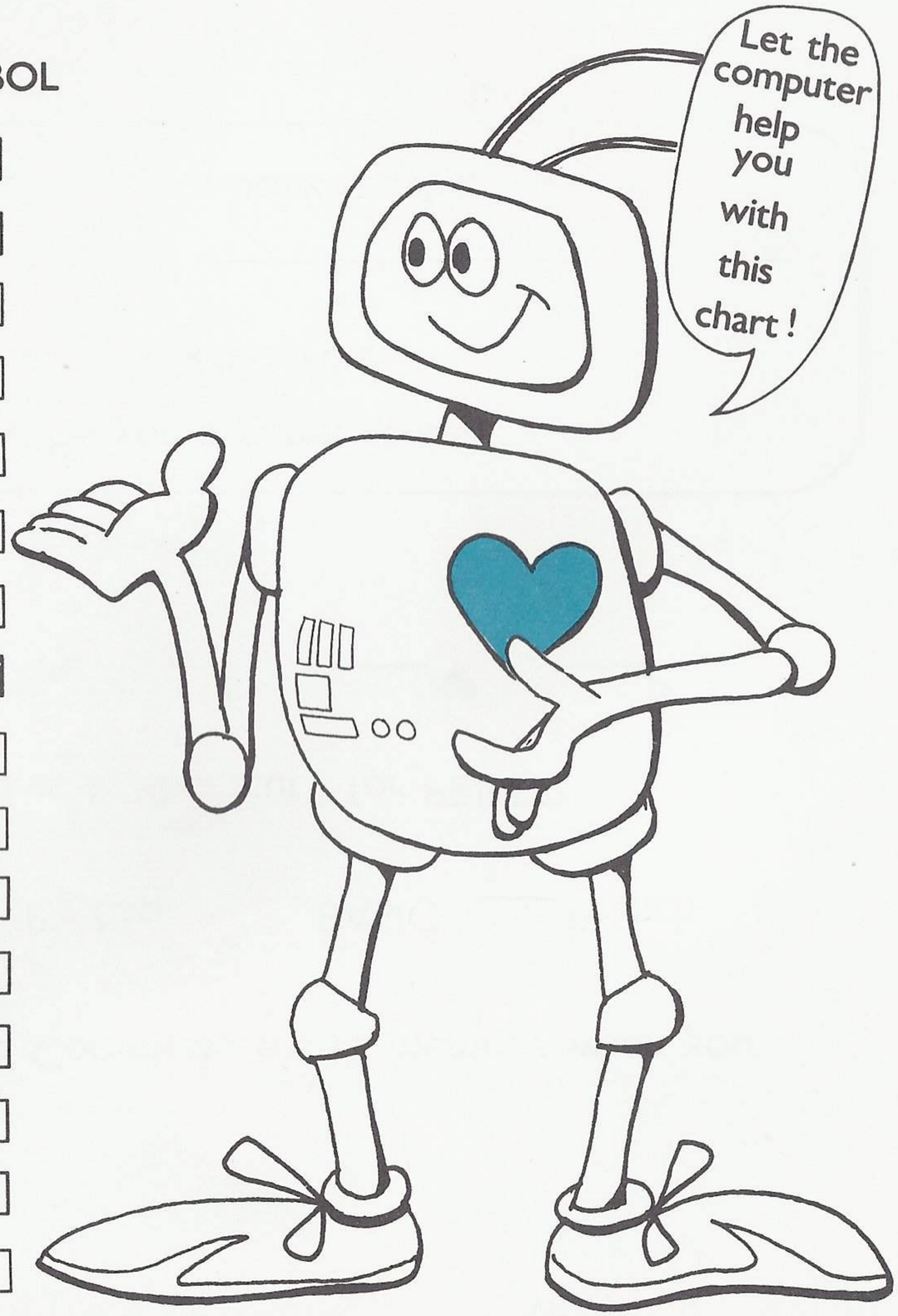
b _____, 6 gives you a blue screen.

c POKE 53280, 8 gives you an _____.

d POKE 53280, ____ gives you a black border.

5 Make a chart which shows all the FUNNY SYMBOLS that appear when you change **COLOR** inside quotation marks:

KEYS	COLOR	SYMBOL
CTRL and ! 1 BLK	Black	■
CTRL and " 2 WHT	White	□
CTRL and # 3 RED	Red	□
CTRL and $ 4 CYN	Cyan	□
CTRL and % 5 PUR	Purple	□
CTRL and & 6 GRN	Green	□
CTRL and ' 7 BLU	Blue	□
CTRL and (8 YEL	Yellow	▥
C= and ! 1 BLK	Orange	□
C= and " 2 WHT	Brown	□
C= and # 3 RED	Light Red	□
C= and $ 4 CYN	Gray 1	□
C= and % 5 PUR	Gray 2	□
C= and & 6 GRN	Light Green	□
C= and ' 7 BLU	Light Blue	□
C= and (8 YEL	Gray 3	□



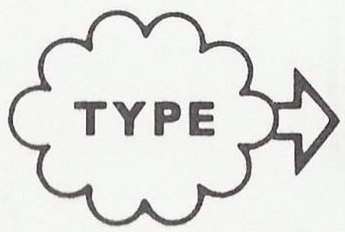
Part 3

Your Own Program

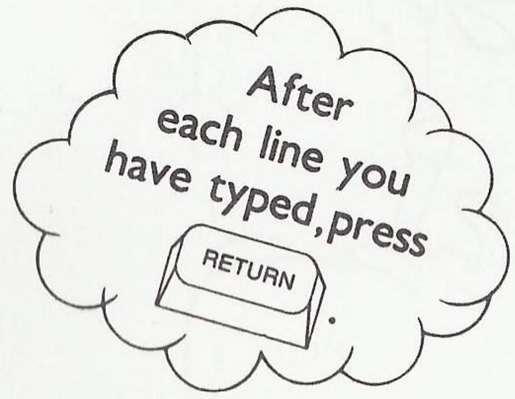


What Is a Program?

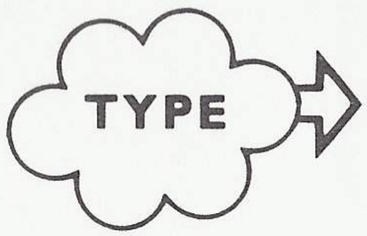
So far we have given the computer only **one** instruction at a time.
Now let's give it a whole **LIST** of things to do.
We do this by writing a **COMPUTER PROGRAM.**




```
10 ? "WOW!"
20 ? "I'M TALKING"
30 ? "TO A COMPUTER."
```

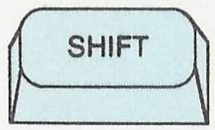


You have typed in **three** statements, but nothing happens on the screen! The **64** is **STORING** the instructions in its memory.




```
RUN
```

When you type **RUN,** the computer carries out the instructions you have given it.

Now **clear** the screen (hold down 

while you press 

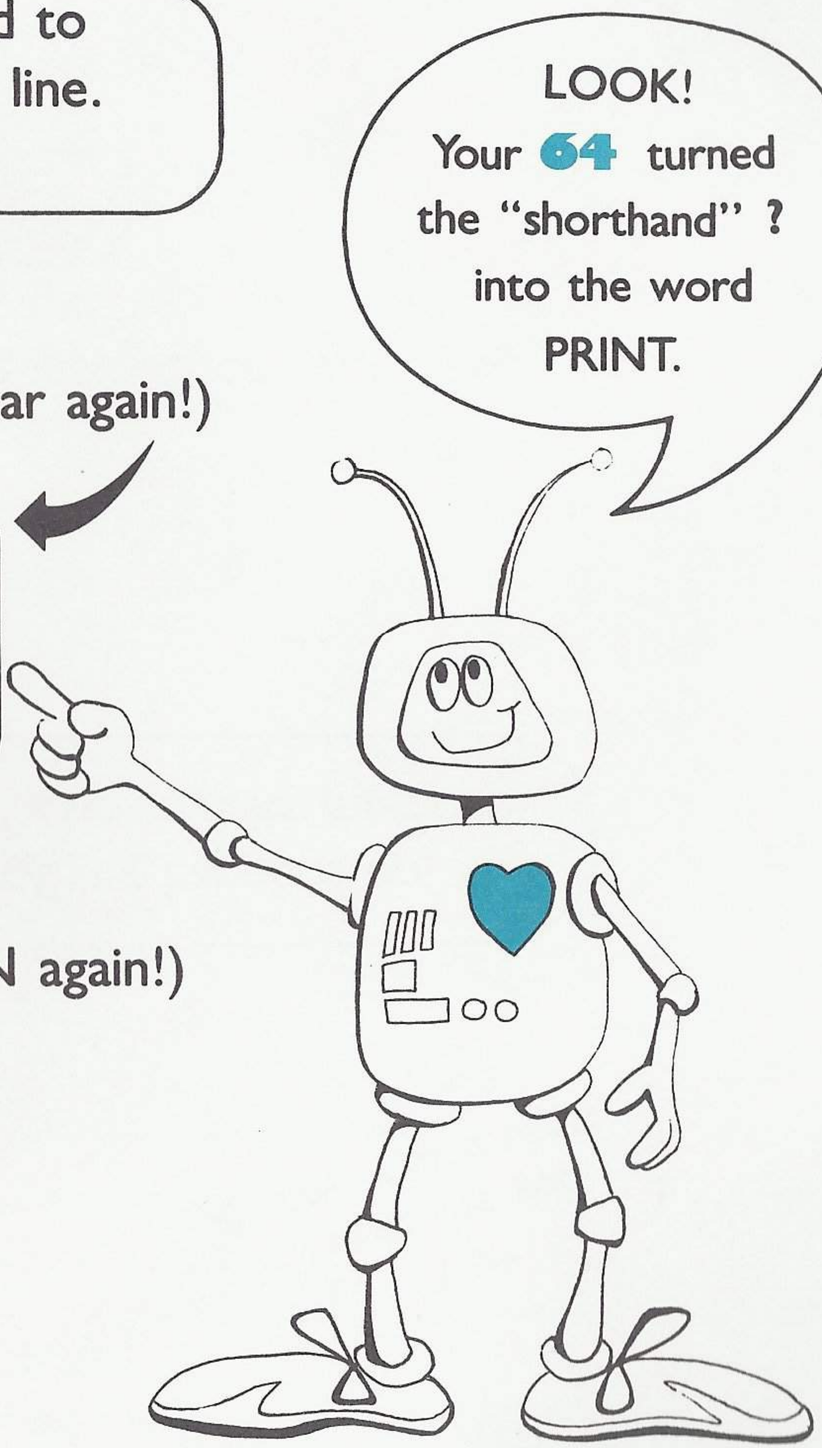
) . . .



From now on, you will not be reminded to press RETURN each time you complete a line. Remember on your own!

TYPE ⇨ LIST (and watch your program appear again!)

```
10 PRINT "WOW!"
20 PRINT "I'M TALKING"
30 PRINT "TO A COMPUTER."
```



TYPE ⇨ RUN (and watch your program RUN again!)

```
WOW!
I'M TALKING
TO A COMPUTER.
```

You can type RUN over and over again . . .
The 64 will never get tired of RUNning your program.



You can **ADD** lines to your program.

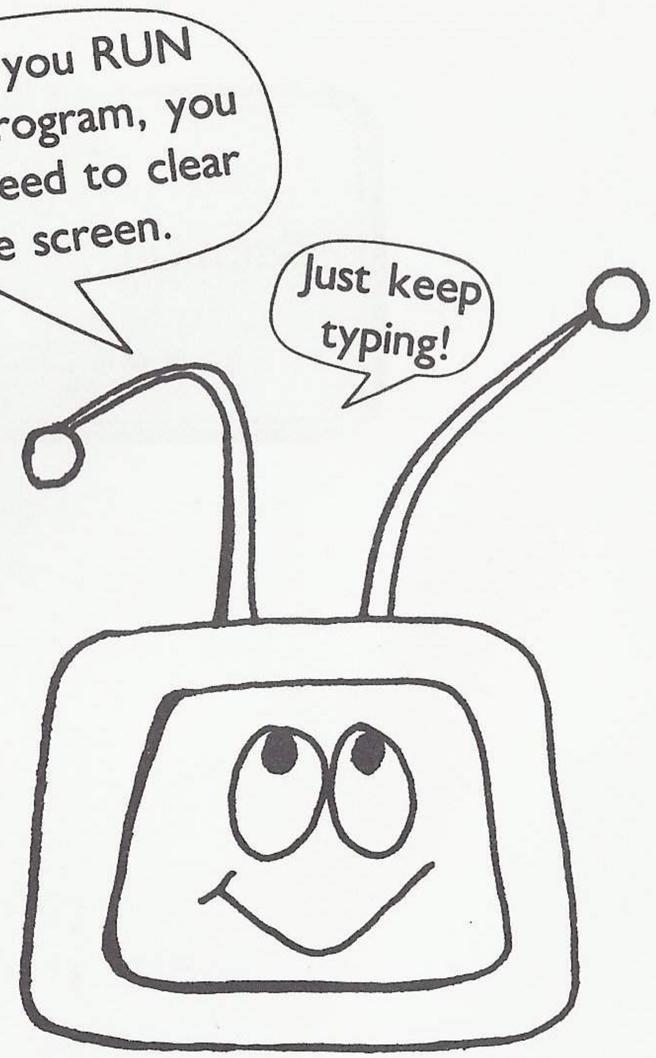
TYPE ⇨

```
40 ?"WILL IT ANSWER ME?"
RUN
```

TYPE ⇨

```
LIST
```

(and see the new program listed)



You can even add lines in the **MIDDLE** of a program.

TYPE ⇨

```
15 ? "GEE WHIZ!!"
RUN
```

TYPE ⇨

```
LIST
```

{The number **15** comes between **10** and **20**. See if the computer puts this new line where it belongs.}

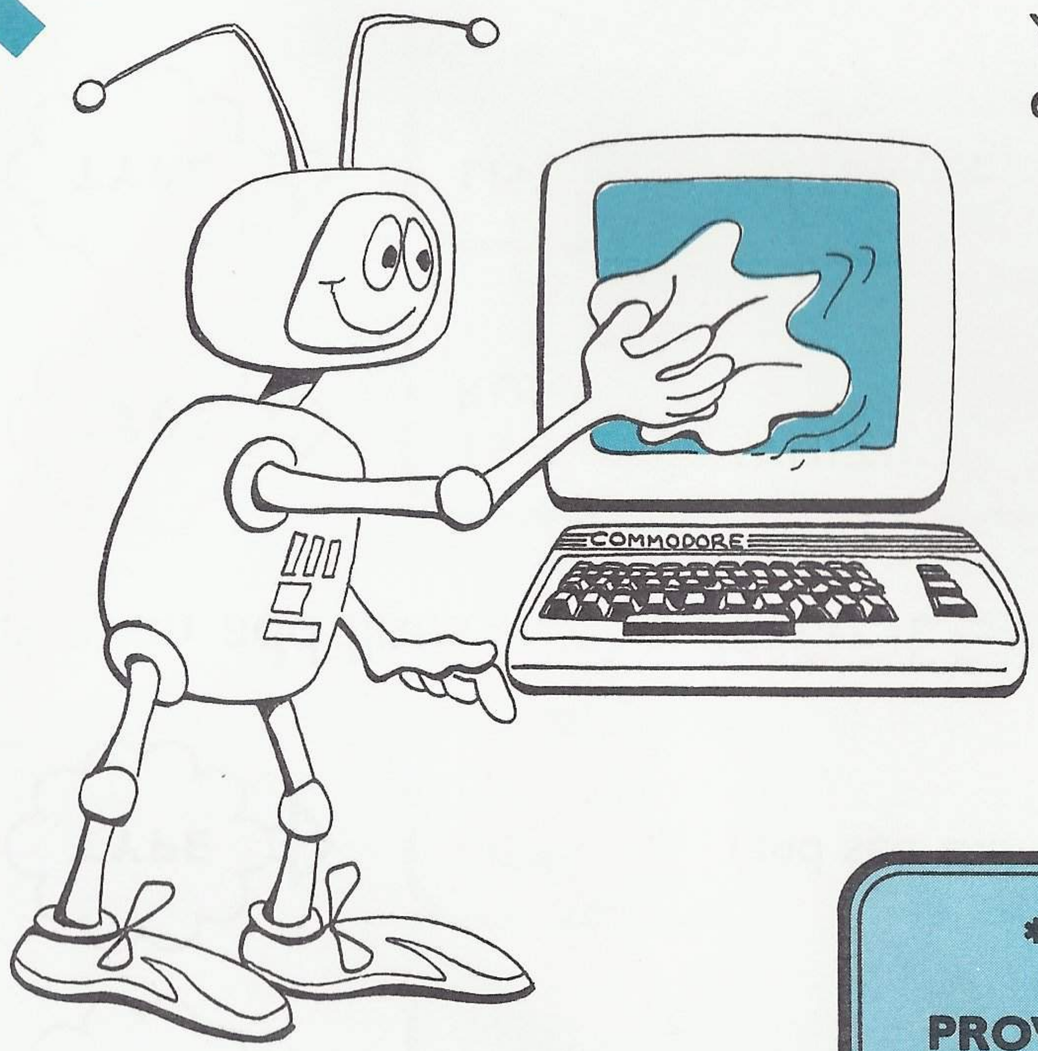
Now YOU add more lines to your program:

Add lines to the middle *and* to the end of the program.
LIST your new program.
RUN your program.

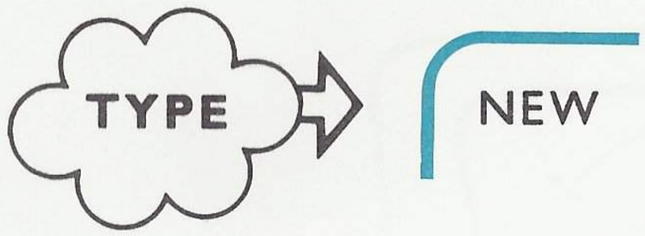
DID IT WORK THE WAY YOU EXPECTED?

The computer follows all of your directions—starting with the lowest-numbered statement and going up to the highest one.

Erase your program!



You can tell your computer to erase *everything you've typed* from its MEMORY.



*****CHALLENGE*****

PROVE you really did erase everything.
(2 ways!)

Creating a Program

REM

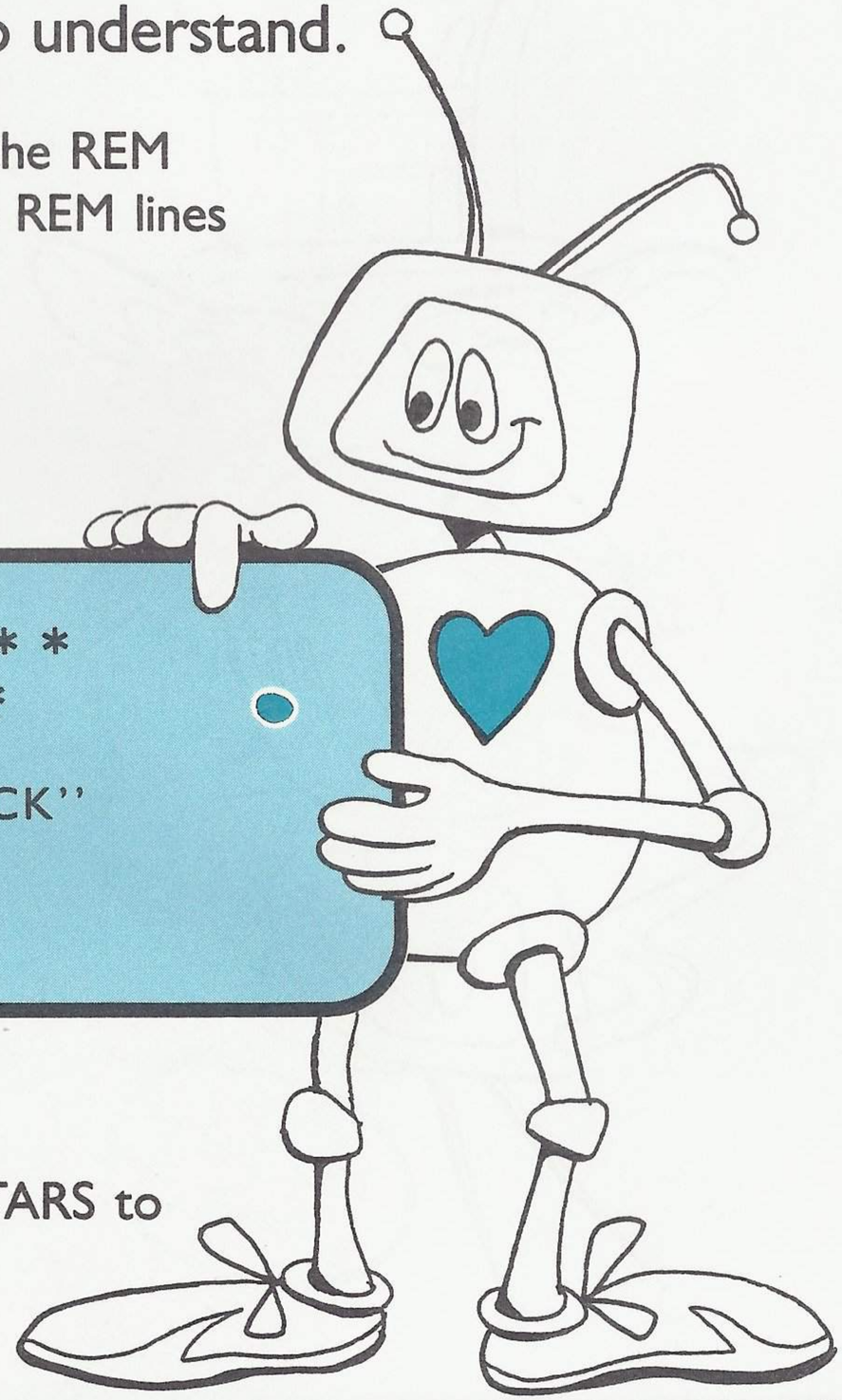
We may add REMark statements to our programs to make them easier for **people** to understand.

When the **64** *RUNs* a program it just skips the REM statements. But when it *LISTs* a program, the REM lines are shown.

No quotes are needed in REM statements.

The **64** does nothing until it gets to line 90.

```
10 REM  * * * CREATED BY JOLYN * * *
20 REM * * * DEL REY SCHOOL * * *
90 PRINT "NURSERY RHYME"
100 PRINT "HICKORY DICKORY DOCK"
:
:
:
```



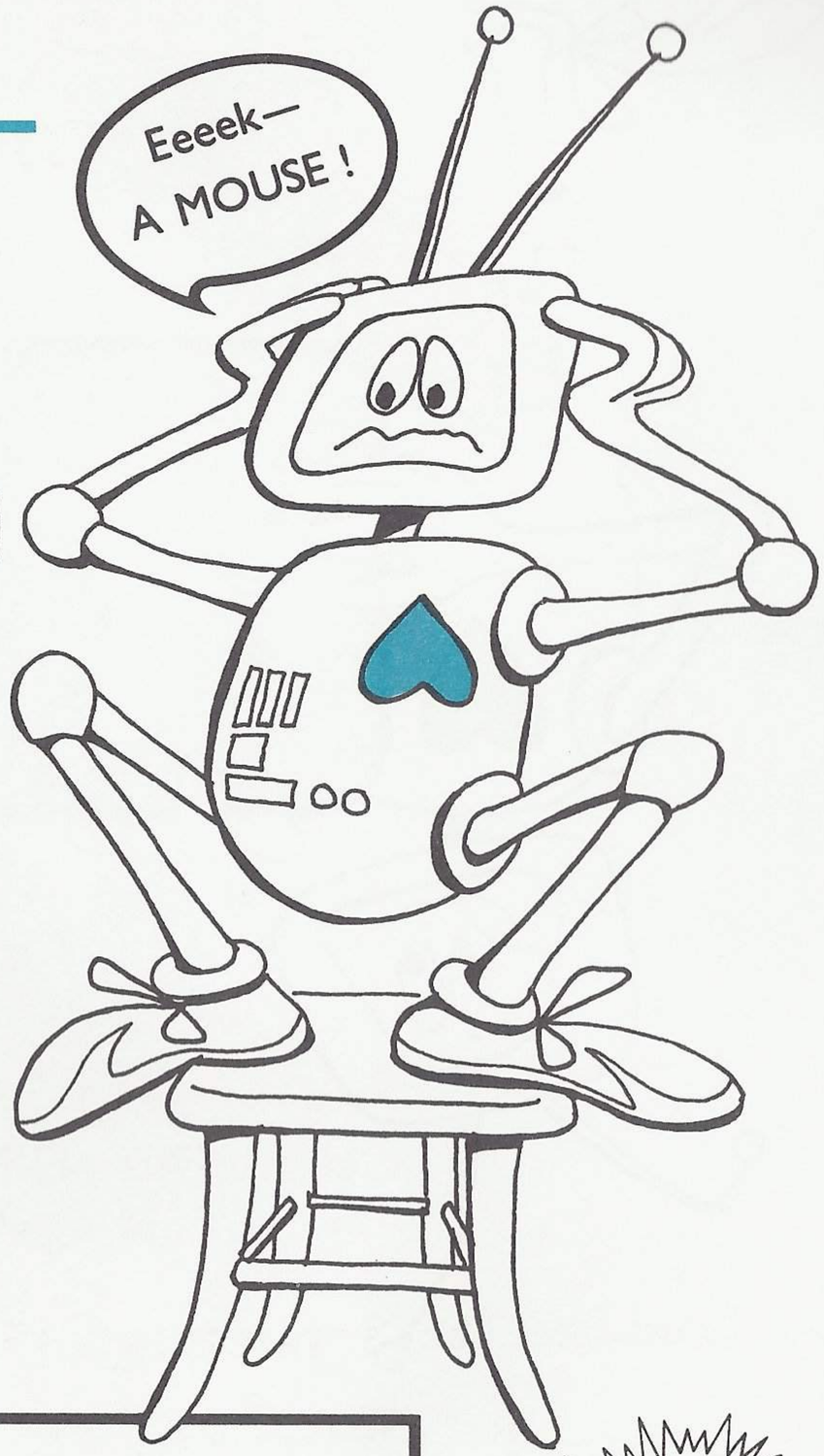
We often surround a REM statement with STARS to make it "stand out" and easy to notice.

Let's create a new PROGRAM . . .

TYPE

```
10 REM * * * CREATED BY JOLYN * * *
100 ?"HICKORY DICKORY DOCK"
110 ?"THE MOUSE"
120 ?"RAN UP"
130 ?"THE CLOCK"
```

You can type in your own name here.



Change (or **edit**) one of your lines.

Right where the cursor is blinking, type a new line 110.

TYPE

```
110 ?"A FURRY LITTLE ANIMAL"
LIST
RUN
```

Were you able to change your program?

Now **you** change line **120** so the furry little animal does something different to the clock.

KEEP GOING

You have learned that when you type ***NEW*** your whole program is erased.

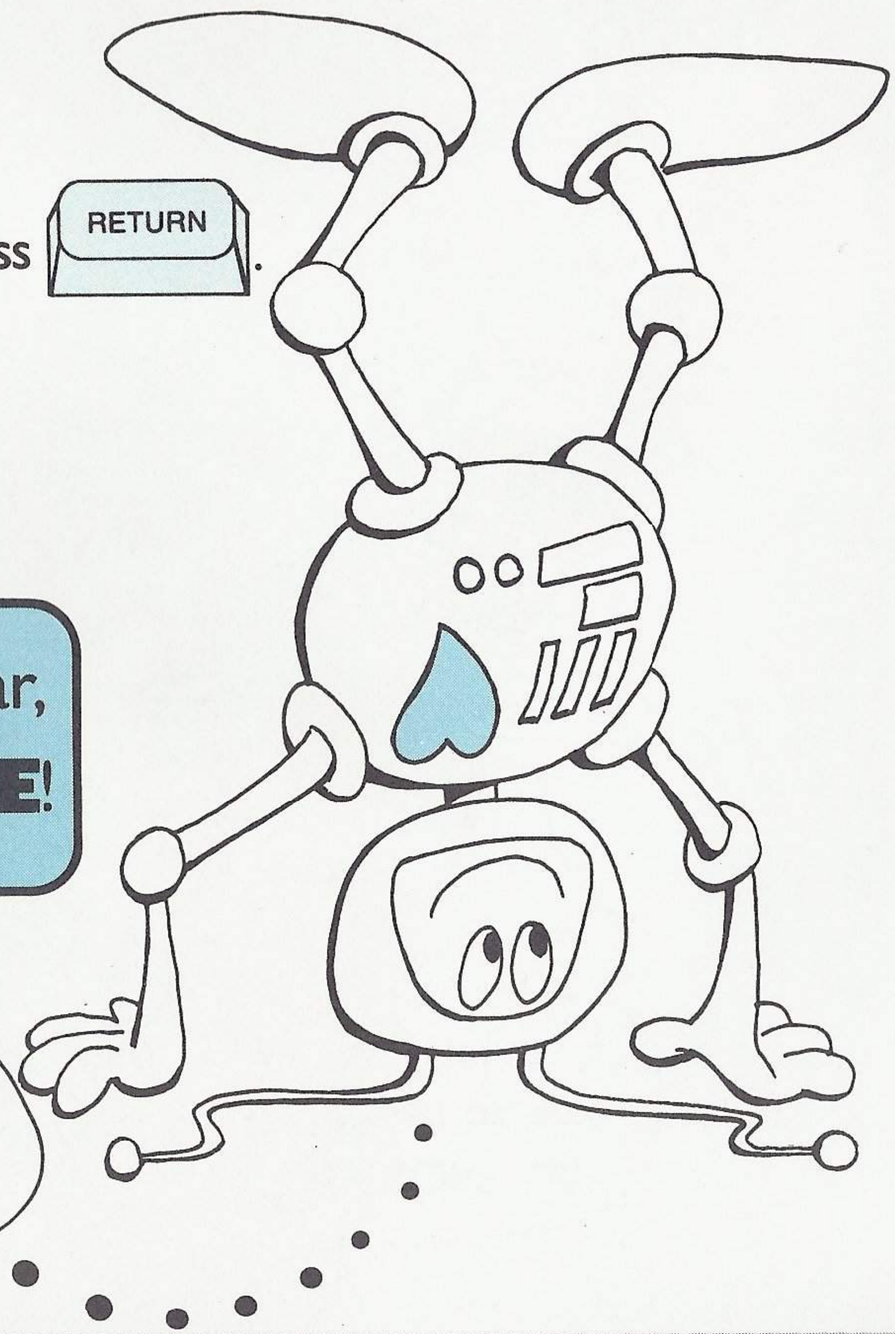
Here's a way to erase just **ONE LINE at a time.**

TYPE ⇨ LIST . . . and watch your program reappear.

TYPE ⇨ 100 . . . with nothing after it, and press RETURN.

TYPE ⇨ LIST

Your program will reappear, but line 100 will be **GONE**!

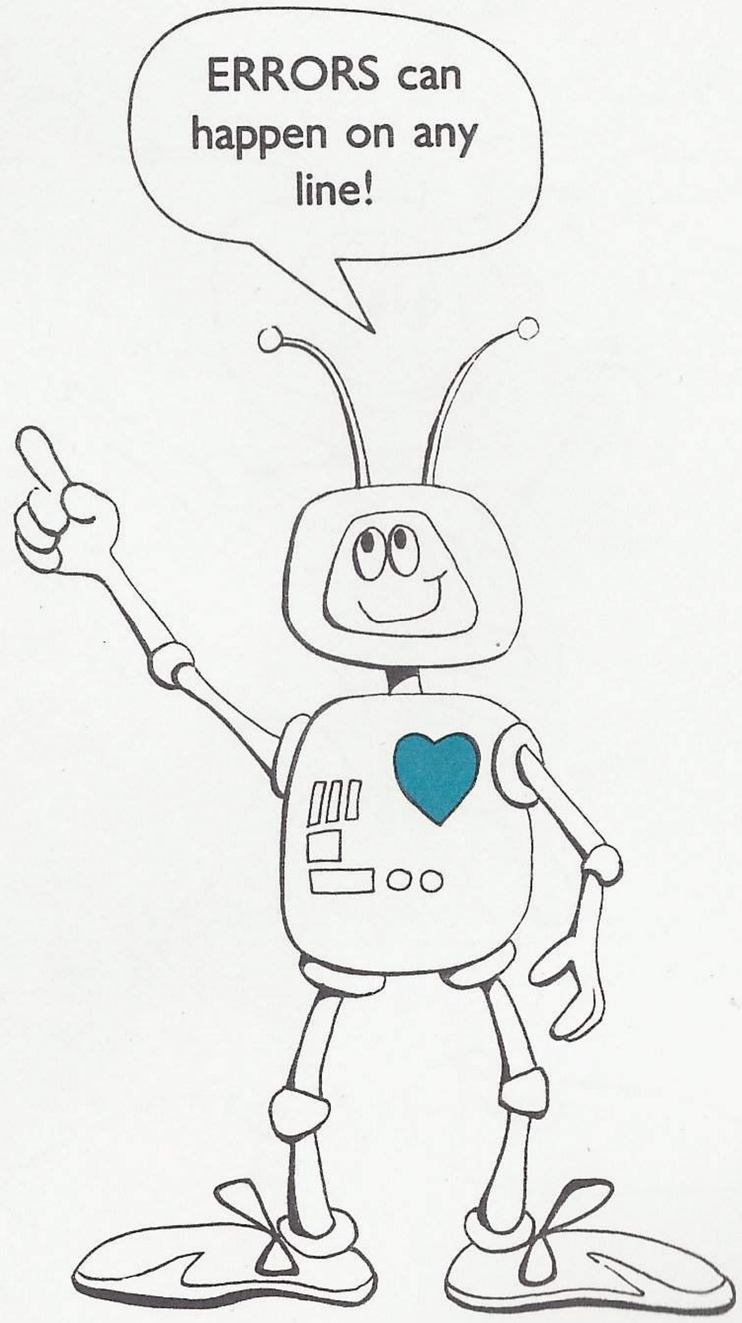


Can you DELETE (erase) another whole line?

Erase your entire program, one line at a time.

Sometimes when you RUN your program, the **64** says . . .

```
? SYNTAX ERROR ON LINE 110
```



LIST your program and look at the line it mentions.

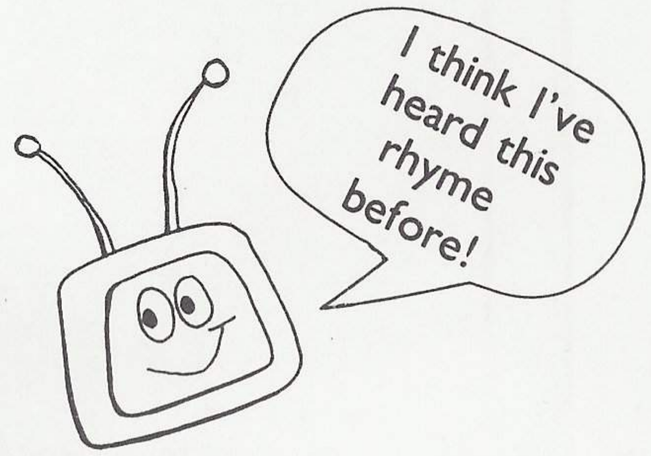
Try to find the error. It may be something left out or a misspelled word.

Practice on these SYNTAX ERRORS. How would you correct them?

Correct these ERRORS.

```
100 PRINT HICKORY DICKORY DOCK"
110 "THE MOUSE"
PRINT "RAN UP"
130 PRNT "THE CLOCK"
```

A Program to Save



TYPE

```
NEW
10 REM *** BY _____***
20 ? "ONE, TWO"
30 ? "THREE, FOUR"
40 ? "FIVE, SIX"
50 ? "SEVEN, EIGHT"
60 ? "NINE, TEN"
RUN
```

Add your name.

ADD

```
25 ? "BUCKLE MY SHOE"
35 ? "_ _ _ _ _
45 ? "_ _ _ _ _
55 ? "_ _ _ _ _
65 ? "_ _ _ _ _
```

YOU finish these lines so that the 64 says...

ONE, TWO
BUCKLE MY SHOE
THREE, FOUR
SHUT THE DOOR
FIVE, SIX
PICK UP STICKS
SEVEN, EIGHT
LAY THEM STRAIGHT
NINE, TEN
LET'S DO IT AGAIN.

RUN your program.
LIST your program.
Did the 64 put the program statements in the correct order?

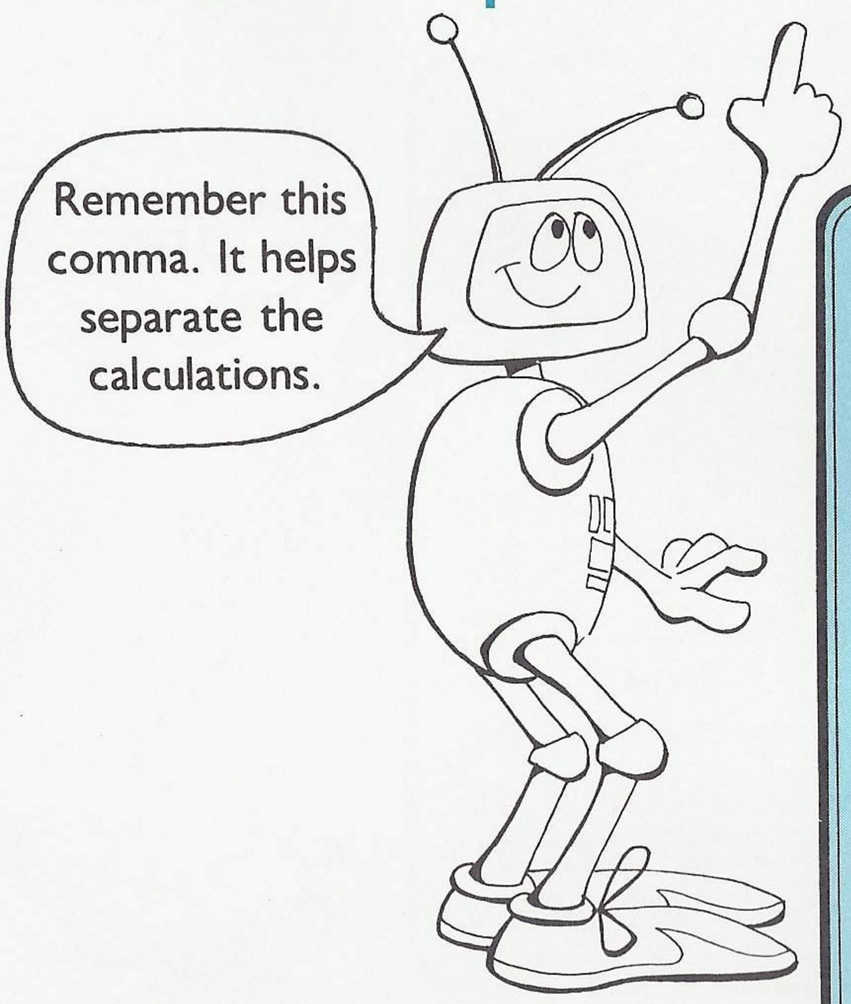
KEEP GOING

Replace line 40:

TYPE ⇨

```
40 ? 2 + 3, 3 + 3
RUN
```

{ No quotes are needed for calculations. }



CHALLENGE

Now YOU type in math calculations to replace all the number-words in lines 20, 30, 50, and 60. RUN your program . . .

Your **64** screen should look like this ⟶

```
1          2
BUCKLE MY SHOE
3          4
SHUT THE DOOR
5          6
PICK UP STICKS
7          8
LAY THEM STRAIGHT
9          10
LET'S DO IT AGAIN.
```

KEEP GOING

SAVE

We will use this program again in another lesson. So let's **SAVE** it.

If you use a **cassette recorder,** do this:

1. Put a blank cassette tape in the cassette recorder.
2. Press REWIND . When the tape stops, press STOP .
3. Type SAVE "BUCKLE MY SHOE" and press RETURN . The screen will say

```
SAVE "BUCKLE MY SHOE"
PRESS PLAY AND RECORD ON TAPE
```

4. Press the RECORD and PLAY buttons on the cassette recorder.

*Now the screen goes BLANK while the computer records your program.

After the program is SAVEd, the **64** screen will look like this:

```
SAVE "BUCKLE MY SHOE"
PRESS PLAY AND RECORD ON TAPE
OK
SAVING BUCKLE MY SHOE
READY
□
```



VERIFY your CASSETTE TAPE . . .

If you want to **MAKE SURE** your program was SAVEd correctly, do this:

1 Press STOP on the cassette recorder.
2 Rewind the tape.
3 Press STOP again.
4 Type VERIFY and press RETURN .

The screen will say:

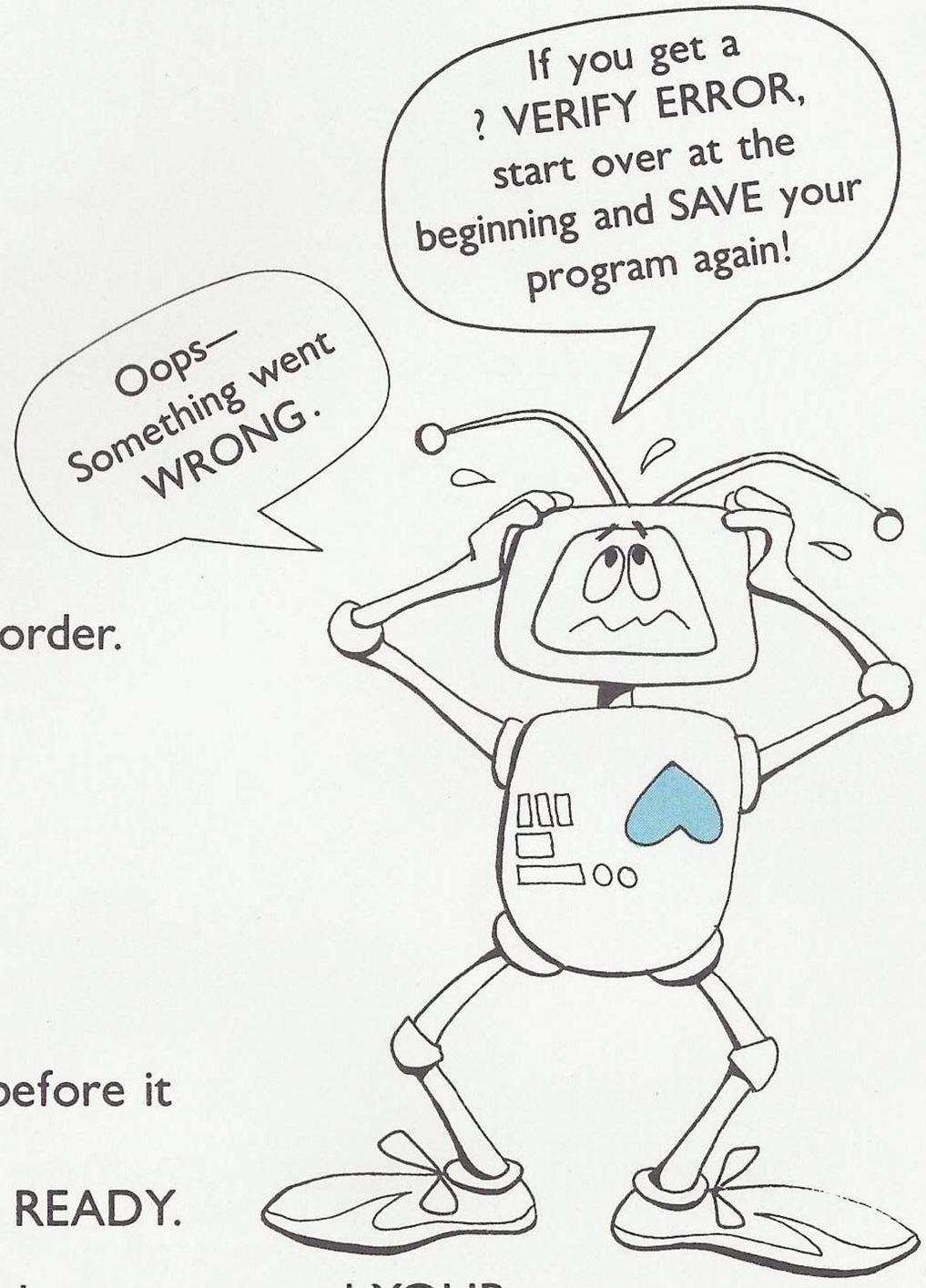
```
VERIFY
PRESS PLAY ON TAPE
```

5 Press the PLAY button on the cassette recorder.

The screen will go blank and then say:

```
OK
SEARCHING
FOUND BUCKLE MY SHOE
```

At this point, you may have to press the C= key before it checks your program.
If all goes well, the computer will finally blink that it is READY.



6 Put a LABEL on your tape with the name of the program and YOUR name.

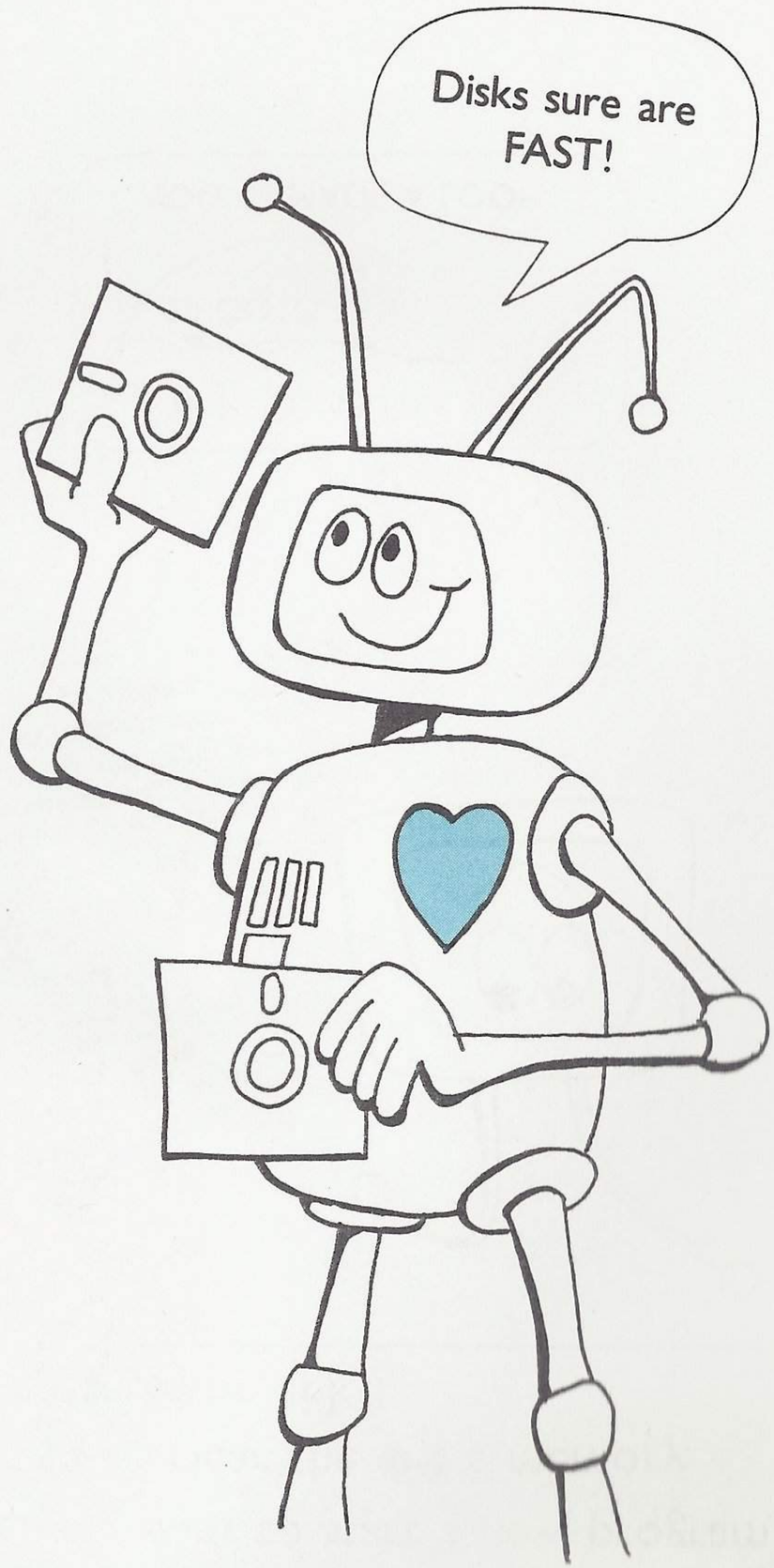
SAVE

If you use a **disk drive,** do this:

1. Turn the disk drive on. (The switch is in the back.)
2. Ask your teacher or parent for a formatted disk. Put the formatted disk in the disk drive and close the door.
3. Type SAVE "BUCKLE MY SHOE", 8 and press RETURN.

The screen will say...

```
SAVE "BUCKLE MY SHOE", 8
SAVING BUCKLE MY SHOE
READY
□
```



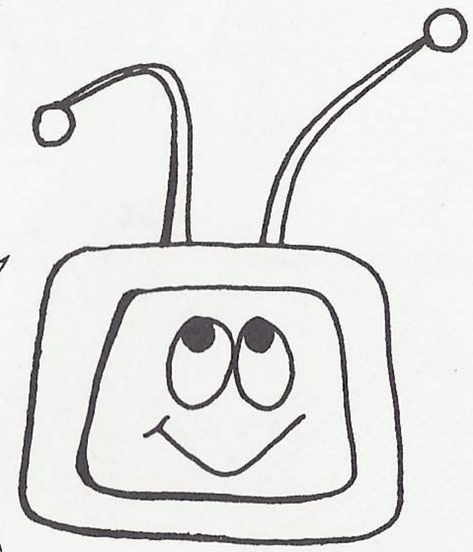
GOTO Loops

REMEMBER: Each time you want to start a new program, type NEW and press RETURN to clear the **64**'s memory. (This won't erase your cassette or disk.)

TYPE

```
NEW
10 ? "_ _ _ _ _ _ _"
20 GOTO 10
RUN
```

YOUR NAME



Line 20 instructs the computer to jump up to line 10 and begin again. This happens over and over again.

To **STOP** the program, press RUN STOP.

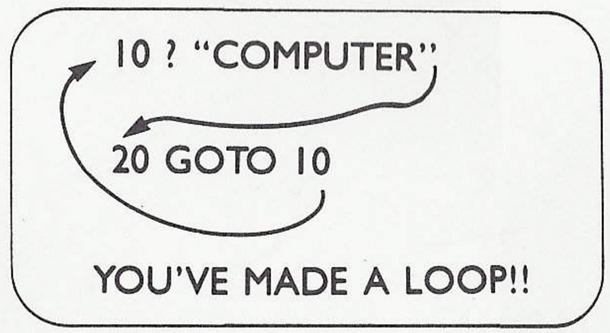
Type RUN to start your program again.

Stop and restart it several times.

Try another GOTO loop:

TYPE

```
NEW
10 ? "COMPUTER"
20 GOTO 10
RUN
```



KEEP GOING

Now STOP your program with RUN STOP.

CLEAR the screen with SHIFT and CLR HOME.

LIST your program. Make this **SMALL** change . . . (on line 10)

TYPE

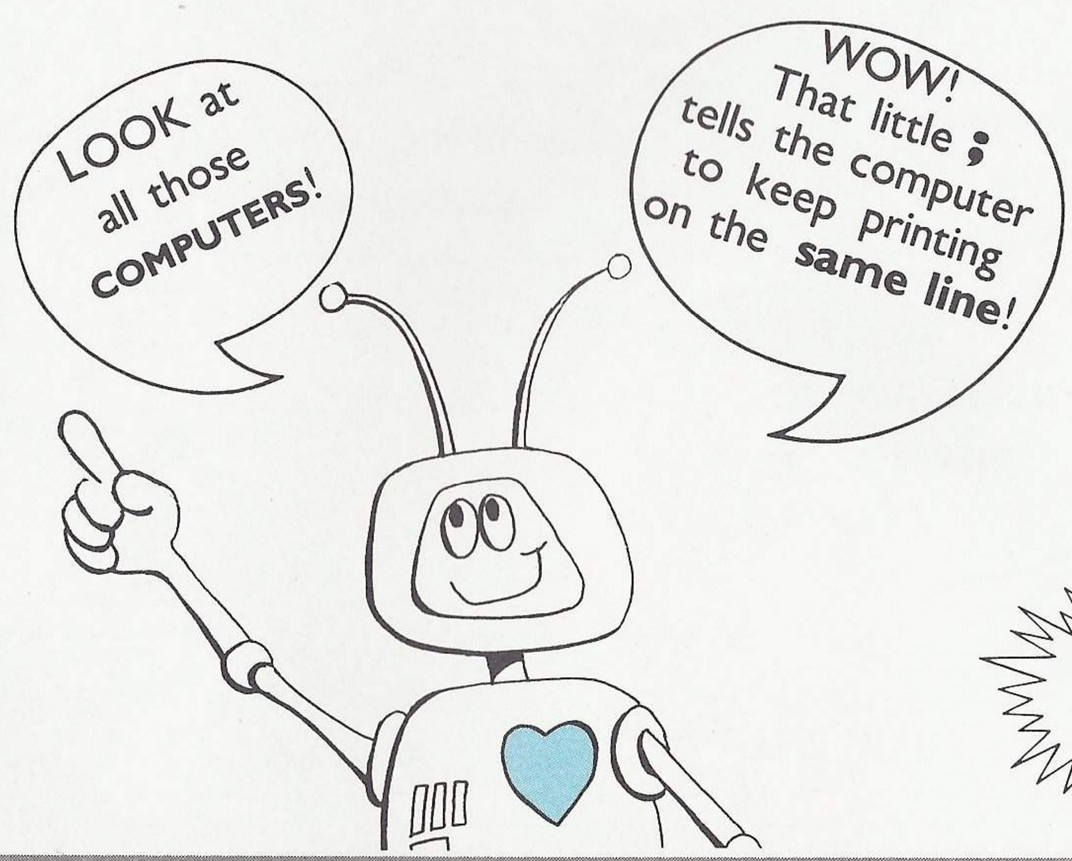
```
LIST
10 PRINT "COMPUTER"
20 GOTO 10
READY
10 ? "COMPUTER";
LIST
```

NOTICE: You just need to retype line 10. Line 20 will stay the same.

Add this semi-colon *after* the quote.

Now RUN your program:

```
COMPUTERCOMPUTERCOMPU
COMPUTERCOMPUTERCOMPU
COMPUTERCOMPUTERCOMPU
COMPUTERCOMPUTERCOMPU
COMPUTERCOMPUTERCOMPU
COMPUTERCOMPUTERCOMPU
COMPUTERCOMPUTERCOMPU
COMPUTERCOMPUTERCOMPU
```



* Press RUN STOP to stop the action!

GOTO tells the computer to **go to** a specific line.

Clear your screen. Type LIST. Make this small change:

TYPE

```
10 ? "COMPUTER _ _ _";
RUN
```

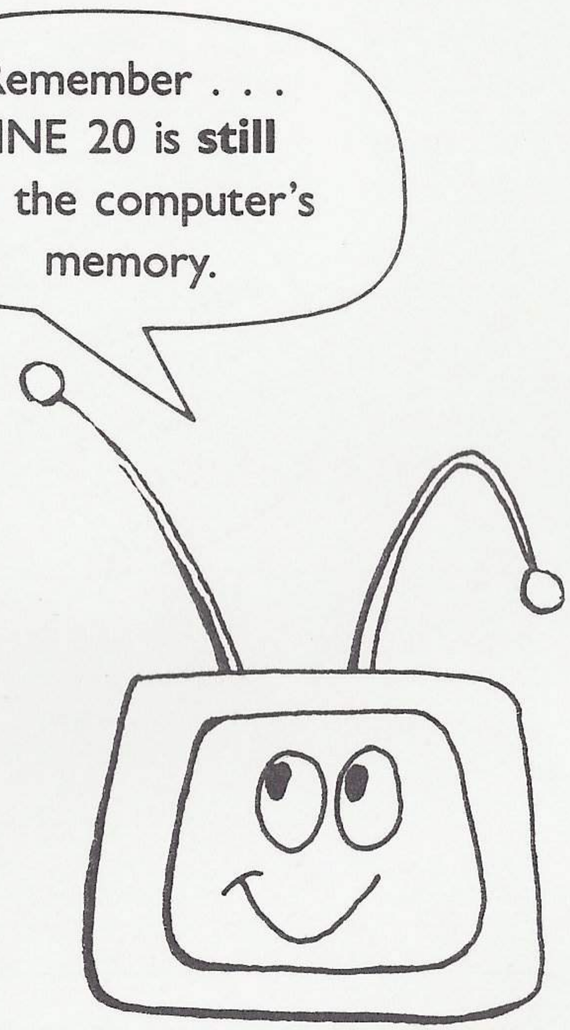
This means to put in 3 spaces.

You've created a NEW design!

TYPE

```
10 ? "COMPUTER",
```

A **COMMA** this time!



Did something slightly different happen this time?

Change line 10. Use some words or messages of different lengths . . . such as SCHOOL, HAPPY NEW YEAR, BOY.

Find the **cassette tape** or **disk** you made in Lesson 7 called "BUCKLE MY SHOE".

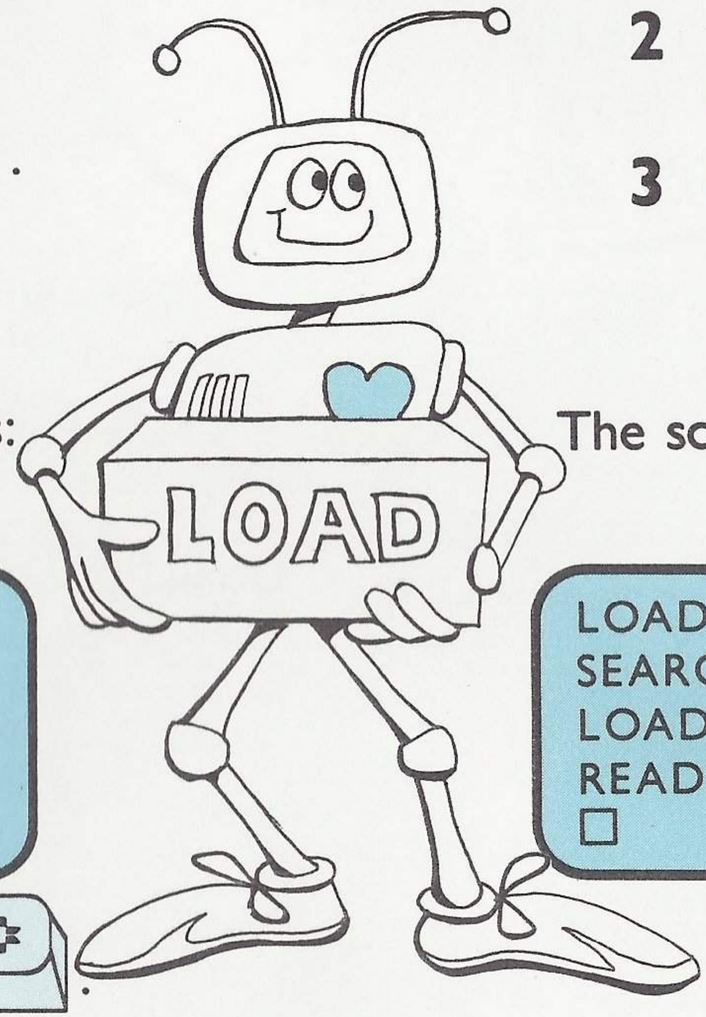
IF YOU HAVE A CASSETTE

1. Place the tape in the cassette drive and press REWIND. When tape stops, press STOP.
2. Type LOAD and press RETURN.
3. Press the PLAY button.

The screen goes **BLANK** and then says:

```
LOAD
PRESS PLAY ON TAPE
OK
SEARCHING
FOUND BUCKLE MY SHOE
```

At this time you may need to press C.
The screen will go blank for awhile . . .
And then tell you it is
READY
□



IF YOU HAVE A DISK DRIVE

1. Place the disk in the disk drive and close the door.
2. Type:
   LOAD "BUCKLE MY SHOE" , 8
3. Press RETURN.

The screen will say:

```
LOAD "BUCKLE MY SHOE" , 8
SEARCHING FOR BUCKLE MY SHOE
LOADING
READY
□
```

KEEP GOING

TYPE ⇨ RUN . . . and watch your poem appear again.

TYPE ⇨ LIST . . . and look at your program statements.

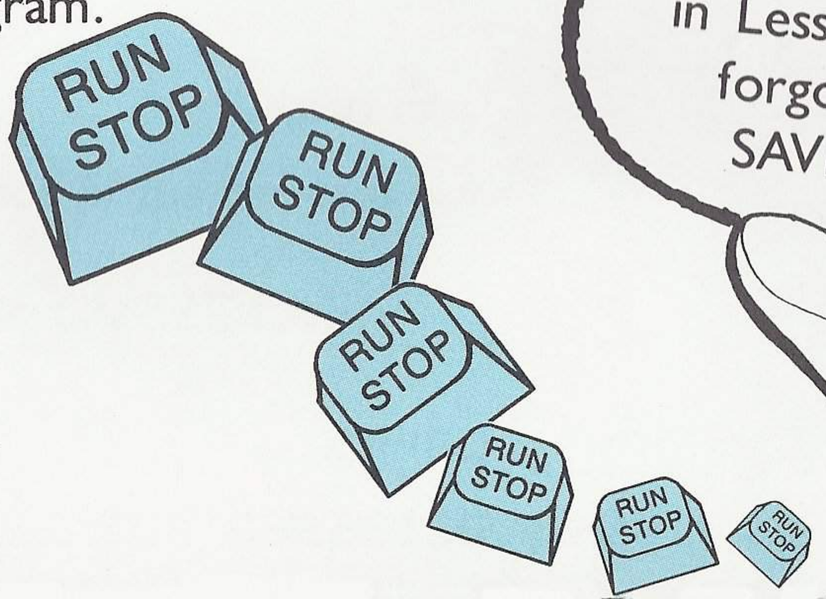
ADD ⇨ a line 70... to make the rhyme print OVER and OVER again.

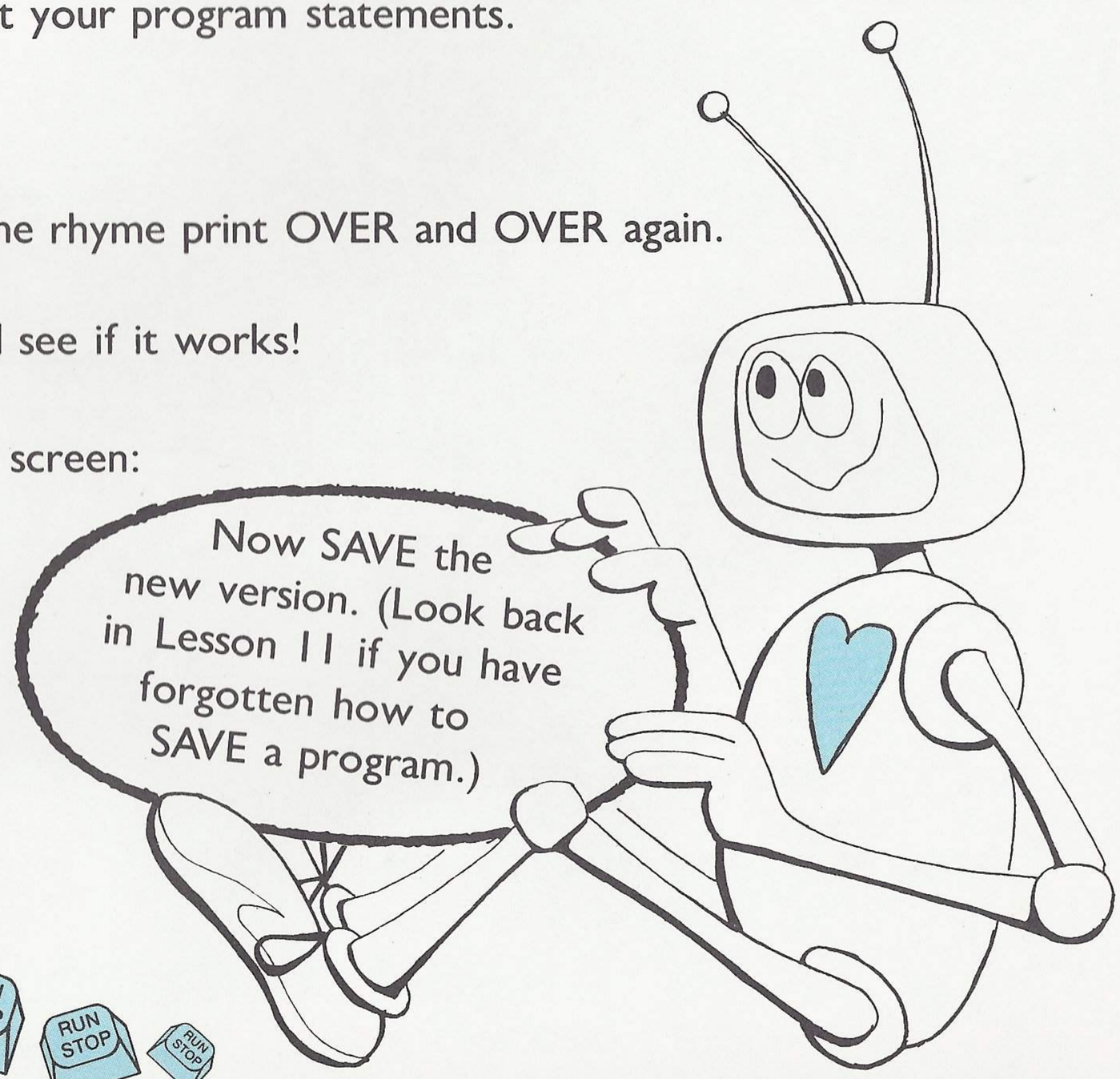
RUN your program and see if it works!

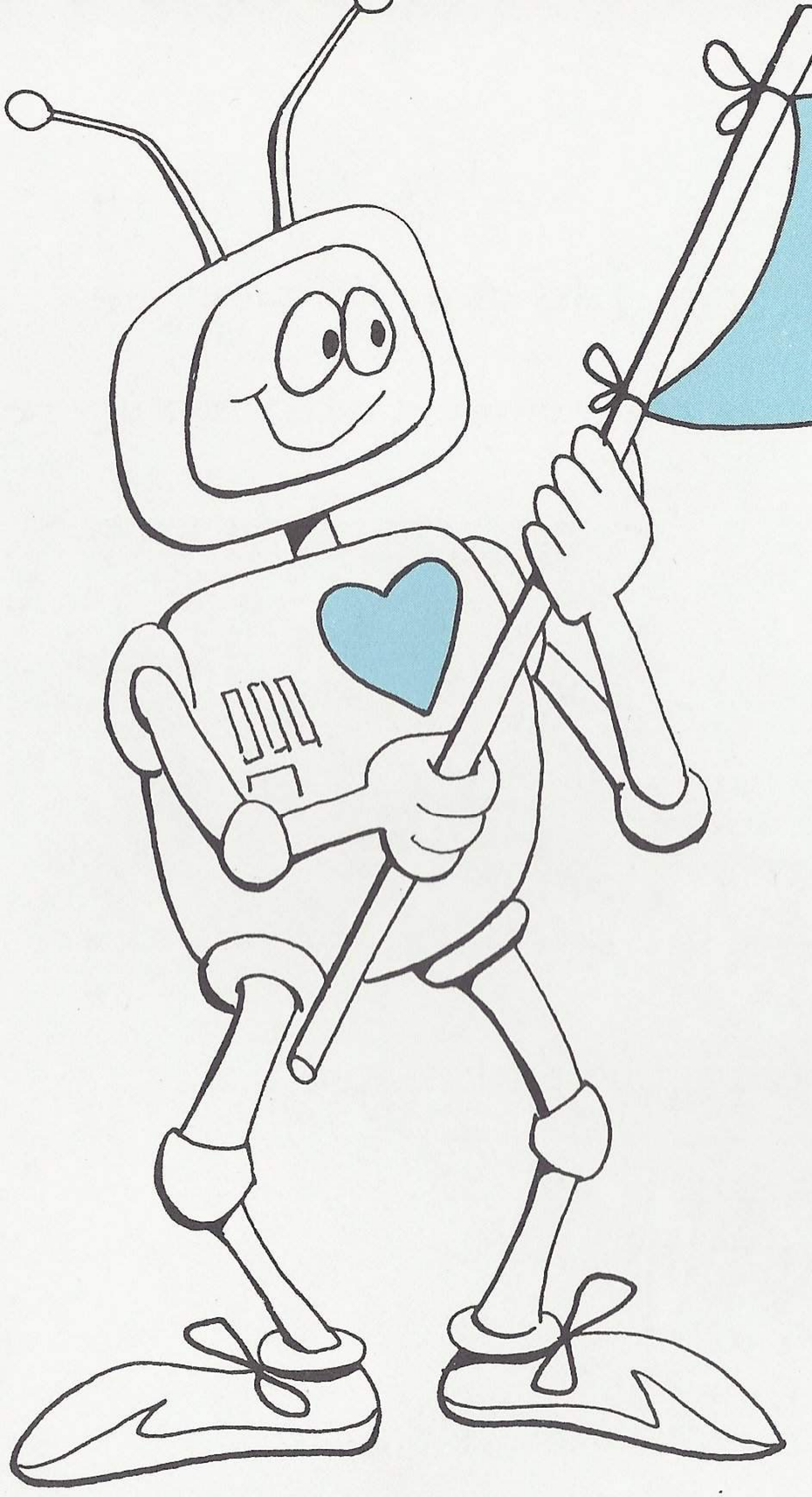
SLOW DOWN the "action" on your screen:

just hold down the CTRL key.

STOP the program.







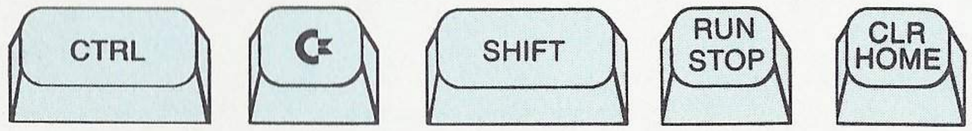
Review

1 Imagine that this program is running on the computer:

```
10 ? "WOW!!";
20 GOTO 10
```

a Put a circle around the key that STOPS the action.

b Put an X over the key that SLOWS DOWN the action.



2 If this program is already in the computer's memory, . . .

```
30 ? "MY"
40 ? "COMPUTER"
20 ? "  ♥♥♥  "
10 ? "I"
```

. . . show what happens on the screen after you type each of these commands:

a

RUN

b

LIST

c

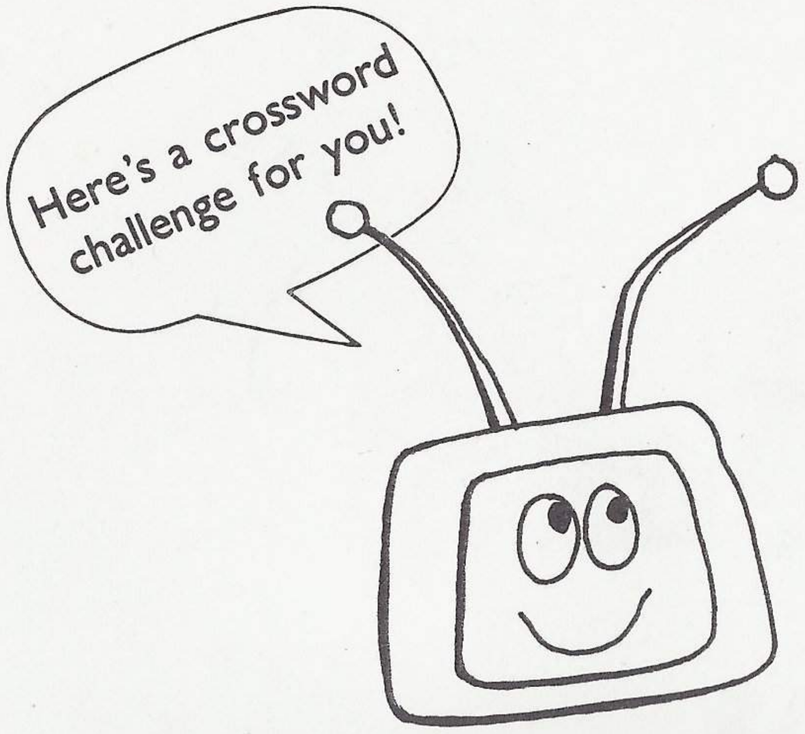
NEW

3 On this screen show how you would tell the computer to. . .

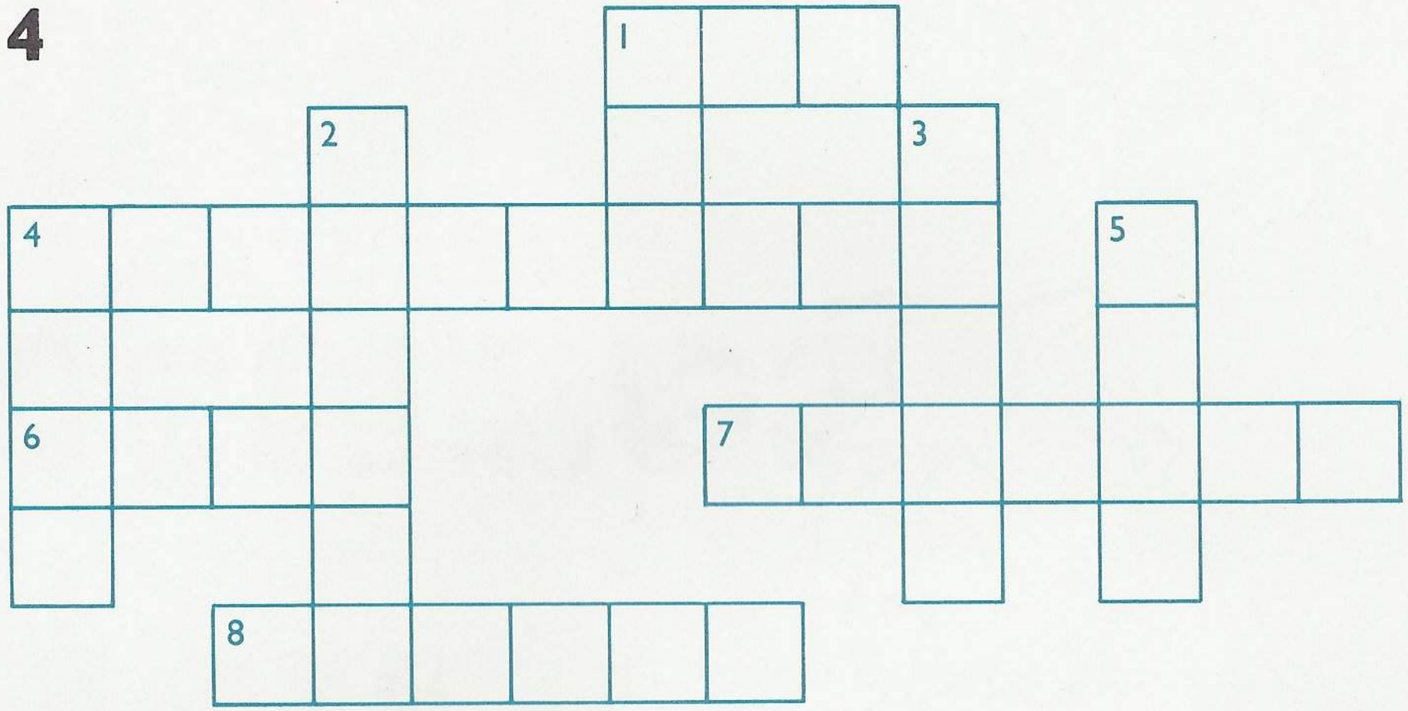
a change line 10 to say ? "BOB"

b delete line 20

```
10 ? "MARY"
20 ? "SMITH"
30 GOTO 10
```



4



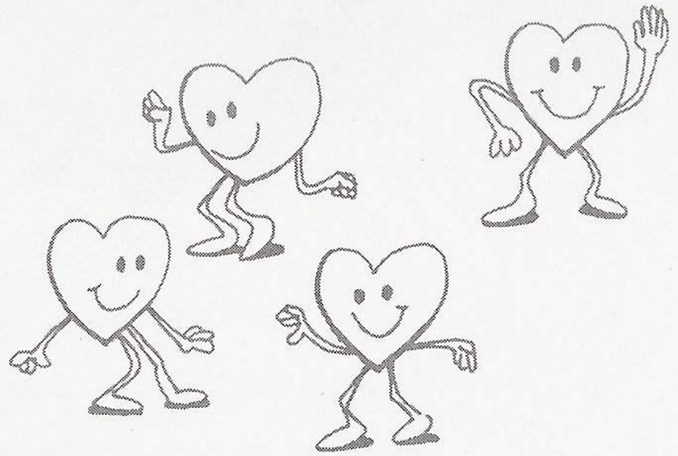
ACROSS

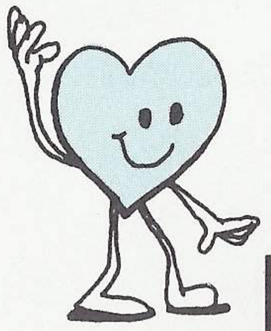
1 Command that tells the computer to carry out instructions
4 Tells the computer where each line goes in the program (two words)
6 Command that tells the computer to store the program on a cassette or a disk
7 Key that stops a program
8 Command that checks to see if a program was SAVEd correctly

DOWN

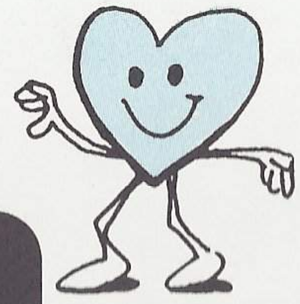
1 Command that allows the programmer to add a remark to the program
2 Erase a character from the screen
3 Statement that tells the computer to write something on the screen
4 Command that asks the computer to show the current program on the screen
5 Statement that tells the computer to move directly to a certain program line

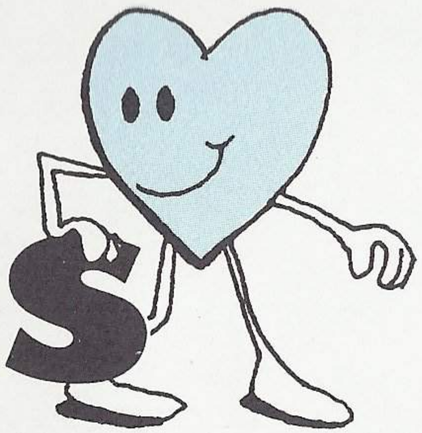
Part 4

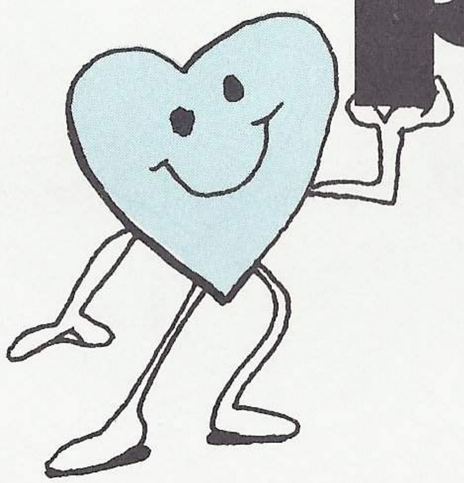




Fun with Pictures







More Graphics

REVERSE
REVERSE

You have used the 9 RVS ON key to draw colored boxes on the screen.

Now let's use it in a PRINT statement . . .

TYPE

```
NEW
100 ? "■ JEFF"
110 GOTO 100
RUN
```

To get this R in a box, hold down CTRL and press 9 RVS ON.

Stop the program and try this . . .

TYPE

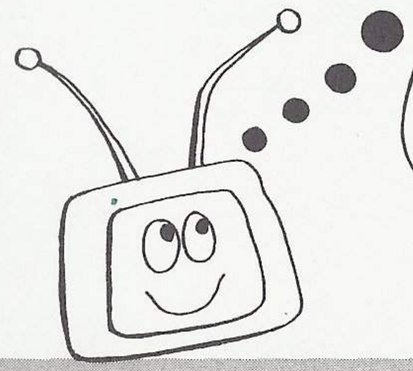
```
100 ? "JEFF■ JEFF⊟" ;
```

Notice

To get this symbol, hold down CTRL and press 0 RVS OFF.

■ tells the computer to put everything after it in REVERSE video—like the negative of a photograph.

⊟ tells the computer to turn REVERSE video off and set everything back to normal again.



The reverse of a space □ is a filled-in box ■.

Let's make some pictures—try this:

TYPE

```
NEW
100 ?" ♥♦♣ ◤ ▩ _ _ _ ";
110 GOTO 100
RUN
```

add three spaces

WOW!

You've created your own design.

Make a fancier design using the) 9 RVS ON key.

TYPE

```
100 ?" ♥●♥ ▩ ♥●♥ ▬ ";
RUN
```

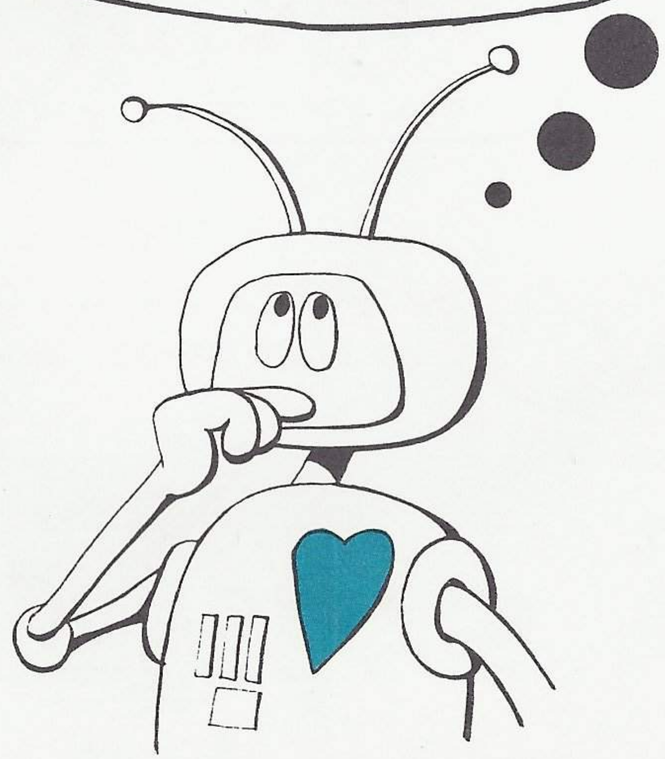
You're quite an artist!!

Now create some art of your own!
Try different-colored screens, borders, and writing.

Hmmm Color . . .

```
POKE 53281,0
POKE 53280,3
?"  "
```

Press CTRL and # 3 RED



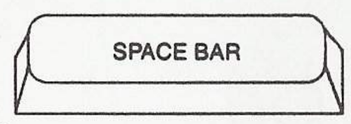
You can combine several program statements to make

Snazzy Pictures:

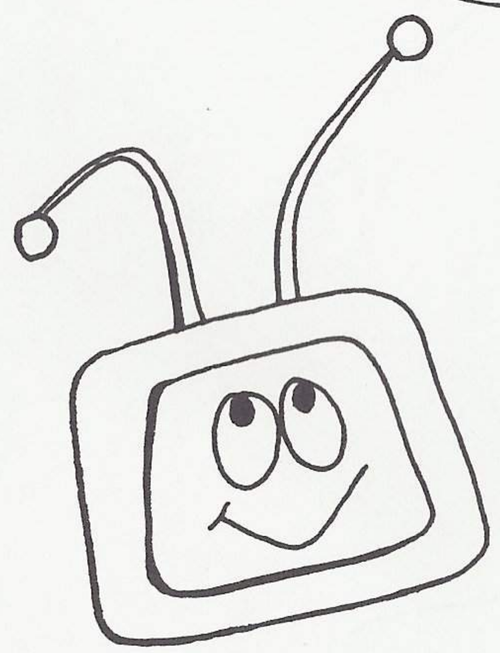
TYPE

```
100 REM * * * CREATED BY MARK D. * * *
110 ? "♥♥♥♥♥♥♥"
120 ? "♥_____♥"
130 ? "♥_*_*_♥"
140 ? "♥__O__♥"
150 ? "♥_\___/_♥"
160 ? "♥_____♥"
170 ? "♥♥♥♥♥♥♥"
RUN
```

_ means SPACE—use the

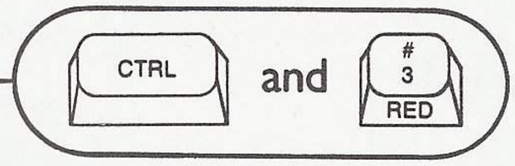


.



Add COLOR!

```
105 POKE 53281,1
106 POKE 53280,5
107 ?"■"
RUN
```



Design a **Rocket Ship!**

TYPE

```
NEW
100 REM ***A NIFTY ROCKET!***
110 ? "/ \"
120 ? "_ _"
130 ? "_ _"
140 ? "◤ ◥"
RUN
```

ADD

```
200 GOTO 100
RUN
```

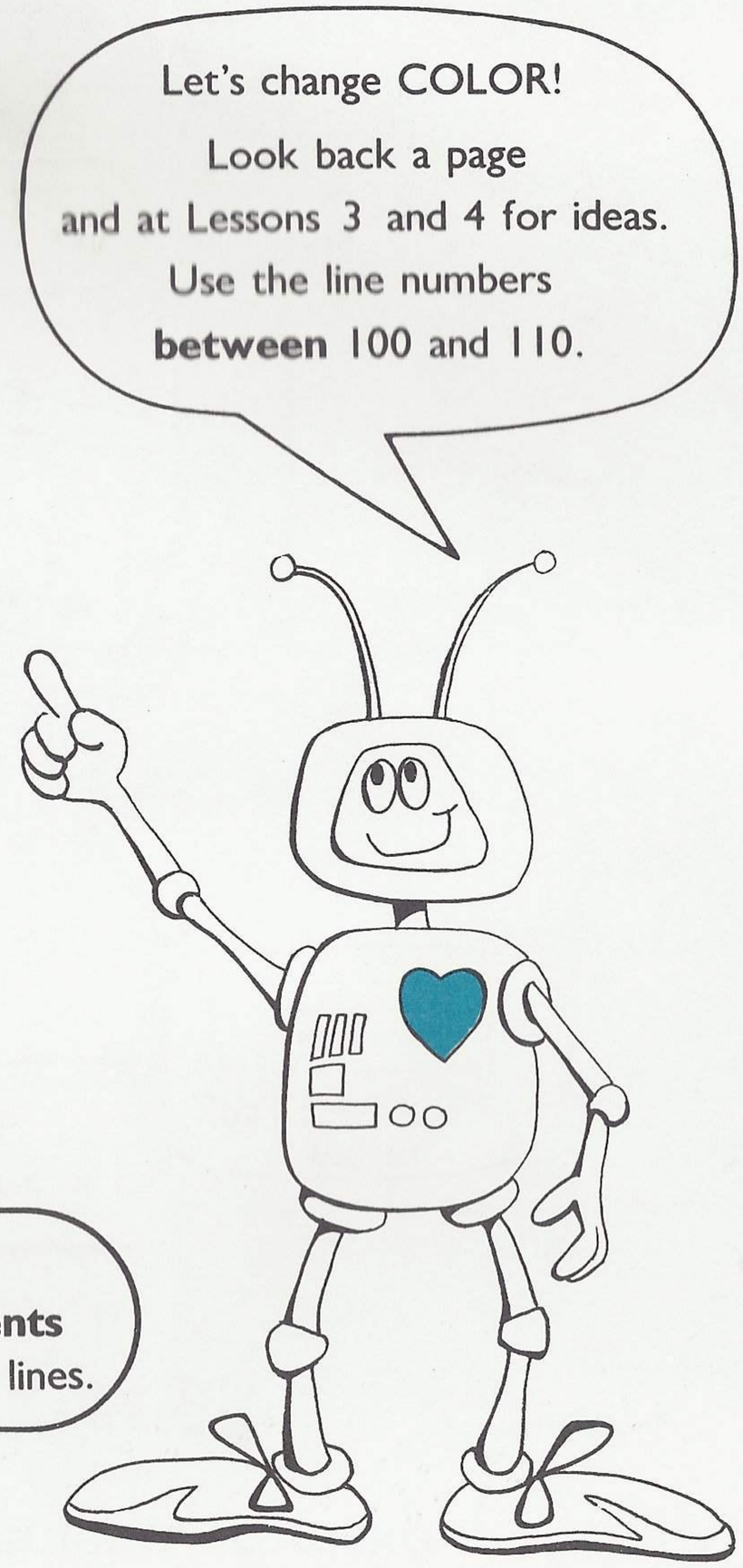
If your rockets are TOO CLOSE to each other . . .

ADD

```
150 ?
160 ?
```

We call these **empty PRINT statements** —the **64** just prints blank lines.

LIST and RUN the program.

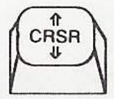


Screen Formatting

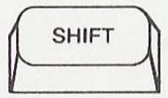
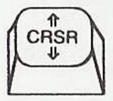
We can use the cursor-control keys **within** a command.

1 Type a question mark and a quotation mark on your screen.

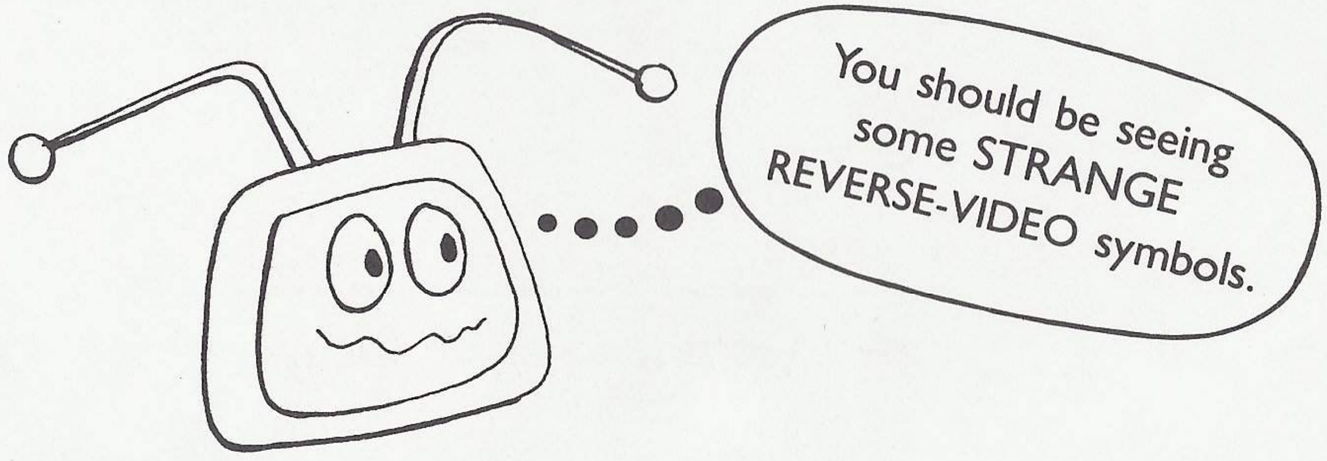
```
?"
```

2 Now press the  key and then the  key several times.

```
? "■■■■■■
```

3 Hold down  and press the  and  keys.

```
? "■■■■■■■■■■
```





1 Type a question mark and a quotation mark.

? "

2 Press the CLR HOME key several times.

? " 5 5 5

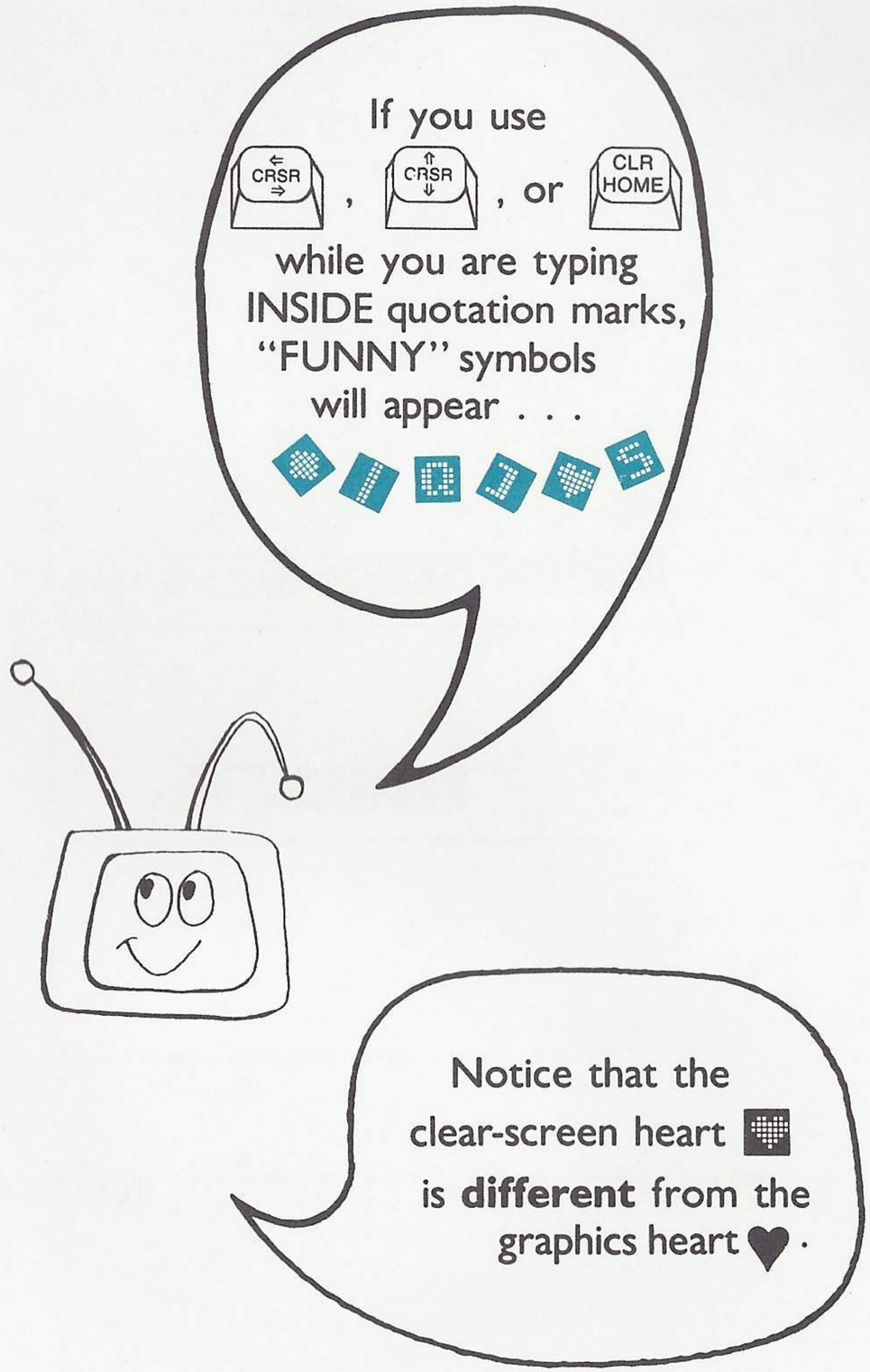
3 Hold down SHIFT and press CLR HOME a few more times.

? " 5 5 5 ♥ ♥ ♥

4 Now hold down SHIFT and press S to add some graphic hearts.

?" 5 5 5 ♥ ♥ ♥ ♥ ♥ ♥

Add a closing quotation mark.
Press RETURN. Clear your screen.



Let's use **Cursor Controls** in a program!

Clear your screen.

TYPE

```
NEW
20 ? "↓ ↓ ↓ ↓ HI PAL"
RUN
```

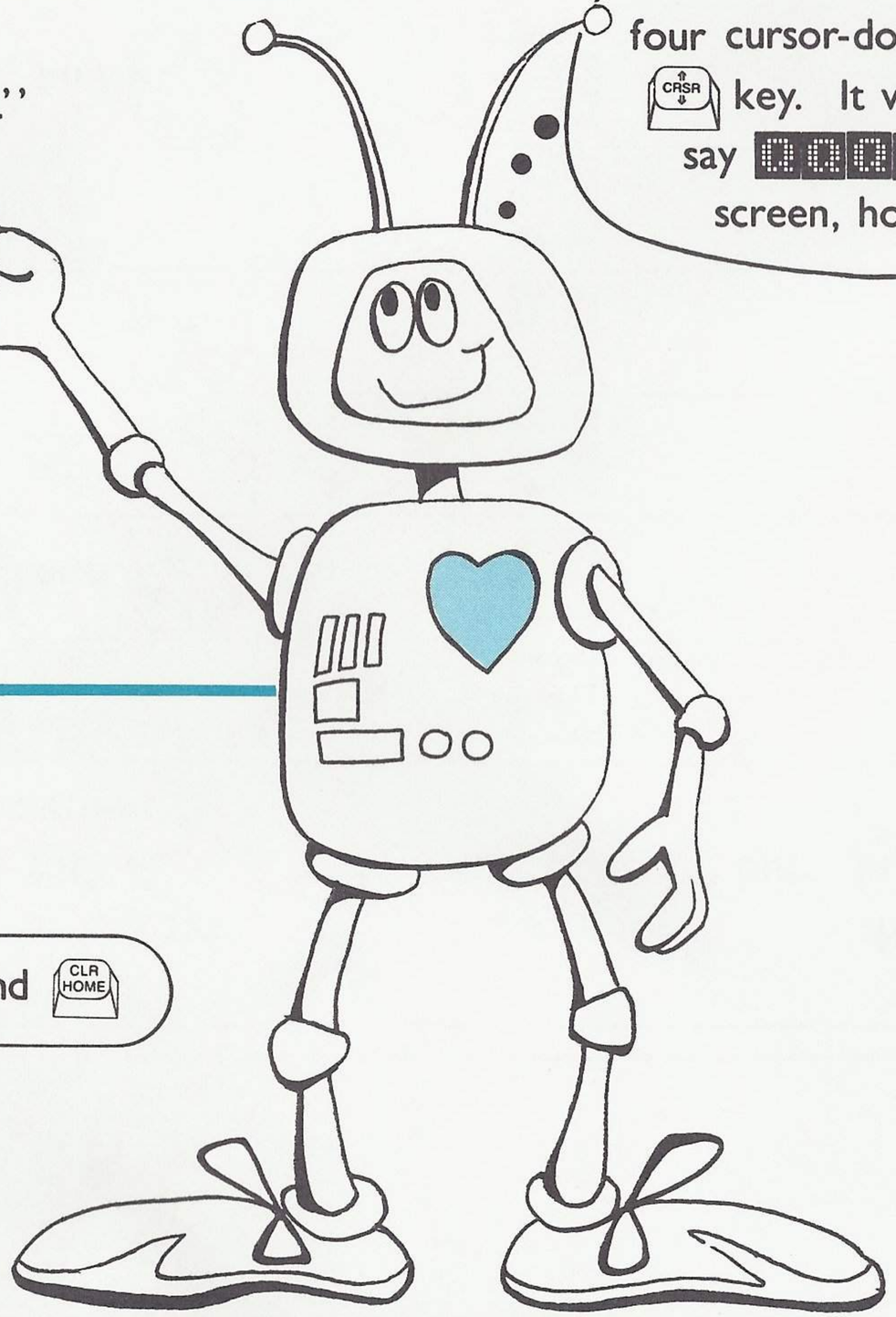
"↓ ↓ ↓ ↓" means type four cursor-downs with the CRSR key. It will actually say ▯▯▯▯ on the screen, however.

What Happened?

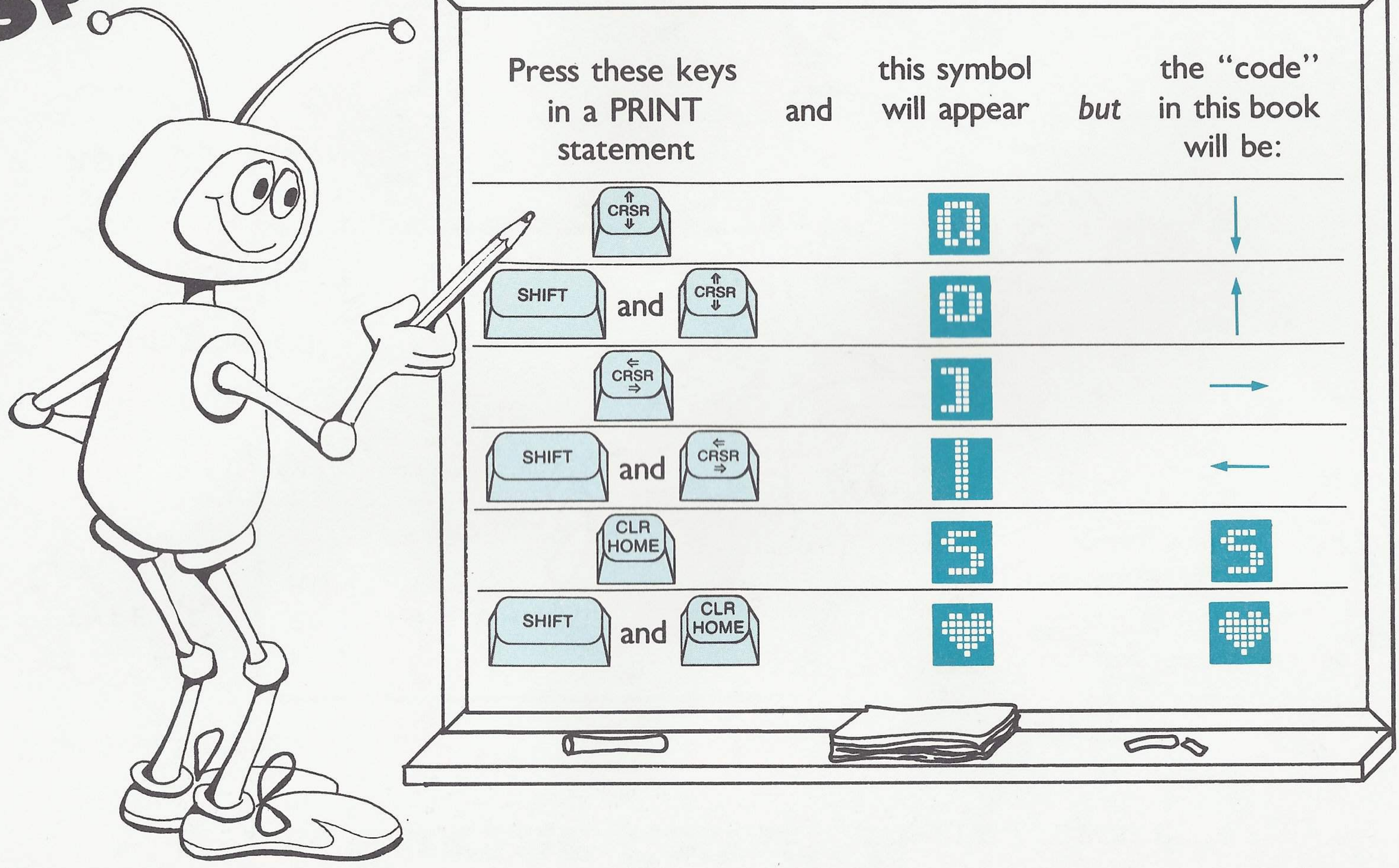
ADD

```
10 ? "♥"
RUN
```

SHIFT and CLR HOME



Special Symbols



TYPE

```
NEW
10 ? "■"
20 ? "RUN ↓↓↓ DOWN ↓↓↓ THE ↓↓↓ STAIRS";
RUN
```

ADD

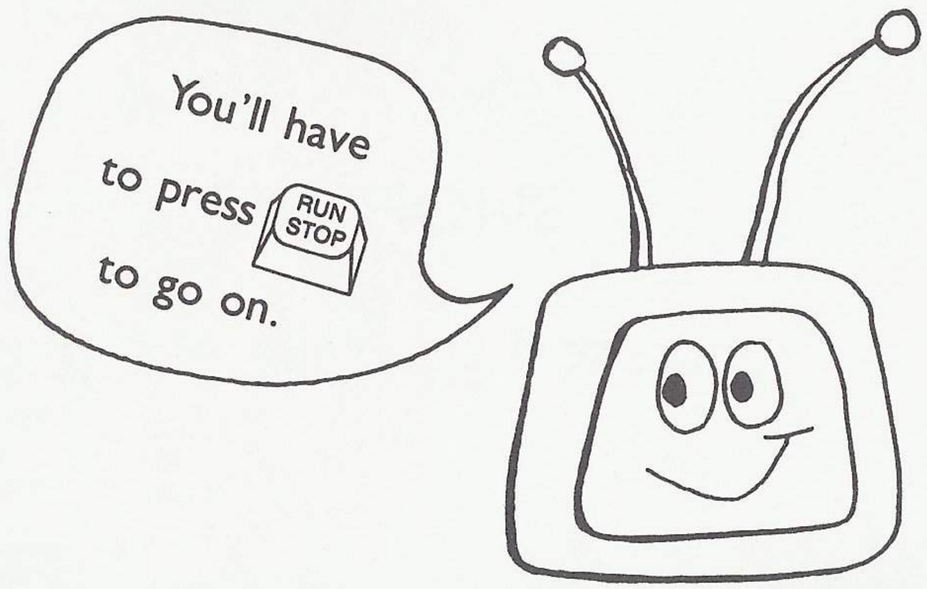
```
30 ? " → → → AND ↑↑↑ BACK ↑↑↑ UP ↑↑↑ AGAIN!"
RUN
```

To keep the READY from getting in the way, clear your screen and . . .

ADD

```
40 GOTO 40
RUN
```

This statement "TRAPS" the computer on line 40.



The upper-left corner of the screen is called the **HOME** position.

Pressing CLR HOME (with *no* SHIFT) sends the cursor HOME.

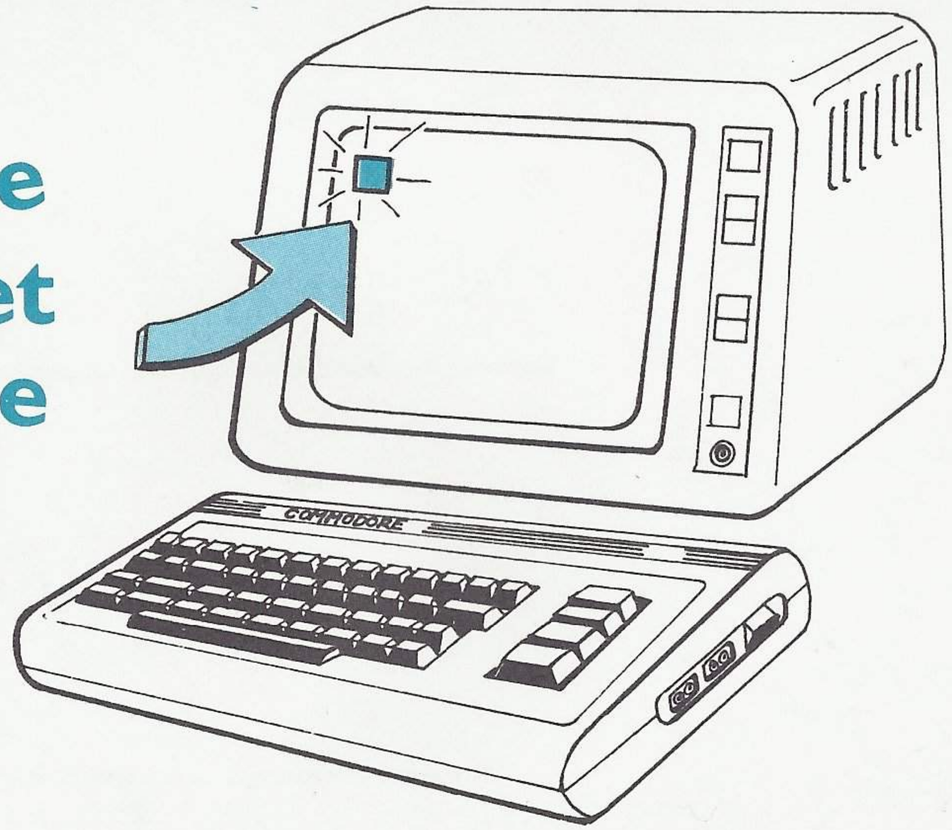
Try it!

The cursor will jump to the HOME position but the screen will **not clear**.

If you press CLR HOME in a PRINT statement, an ■ will appear:

? "■"

Home Sweet Home



BRRR!!

Check the chart on page 74 if you have forgotten how to make the special symbols.

TYPE

```
NEW
10 POKE 53281, 0
20 ? "■"
30 ? "■"
40 ? "↓↓↓↓↓↓↓↓↓↓↓↓↓→→→→→→→→ IT SURE IS
SNOWING HARD . . ."
RUN
```

CTRL and 8 YEL

DON'T STOP HERE.

ADD

```
50 ? "■"
60 ? "■ * ";
70 GOTO 60
RUN
```

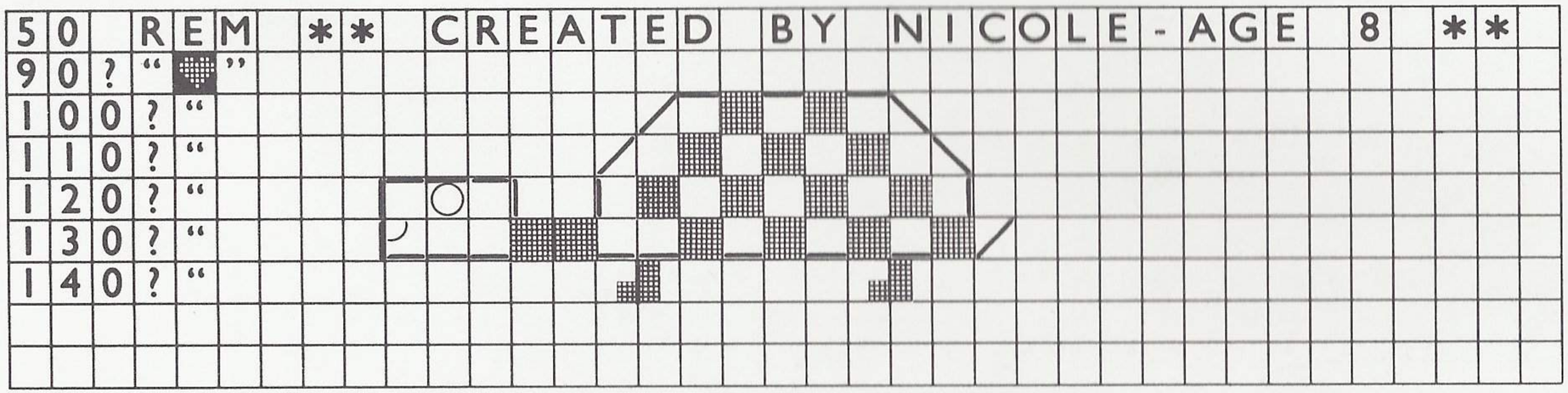
notice

CTRL and 2 WHT

Keep typing **even when the cursor jumps to the next line.** Just be sure to press RETURN at the **END** of the statement.

Computer Art

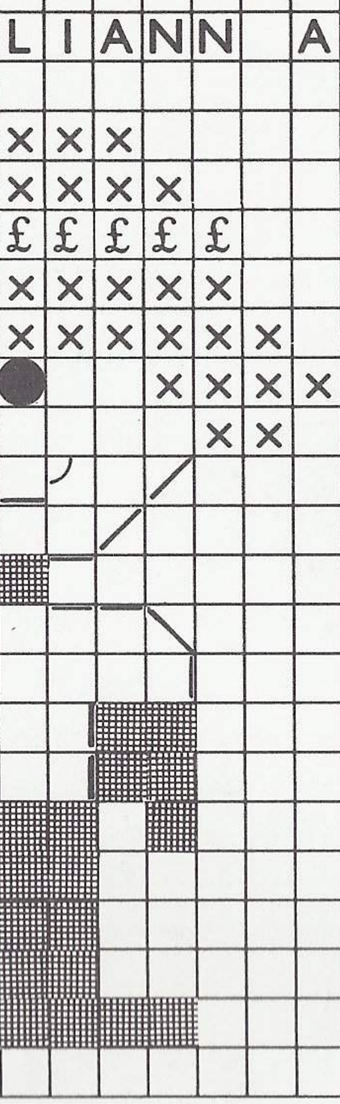
Test your skills with some of these pictures. In this lesson a variety of graphic designs are given. Pick the ones you want to try.

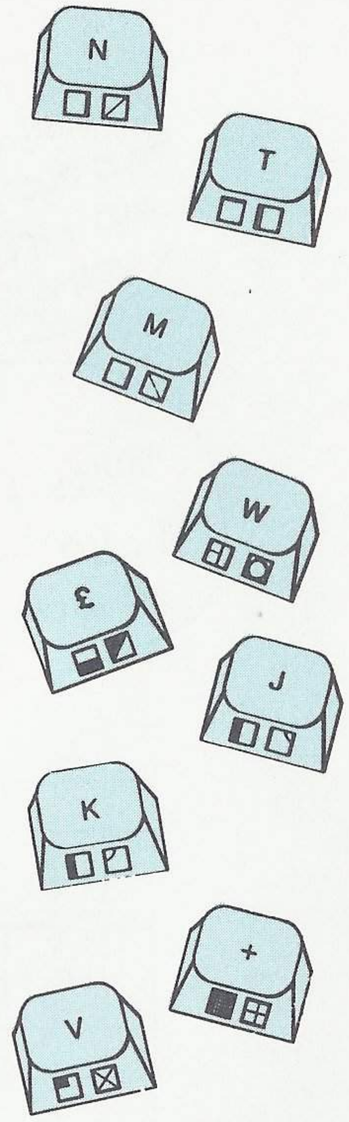


Handy Hints

1. **Look** carefully; follow directions; be mentally alert!
2. **Study** the program **before** you start.
3. Become familiar with the different graphic designs on the keyboard.
4. **Check** each line right after you finish typing it.

```
50  REM***CREATED BY KELLIANN AGE 11***
100 ? "
110 ? "
120 ? "
130 ? "
140 ? "
150 ? "
160 ? "
170 ? "
180 ? "
190 ? "
200 ? "
210 ? "
220 ? "
230 ? "
240 ? "
250 ? "
260 ? "
270 ? "
280 ? "
290 ? "
300 ? "
```





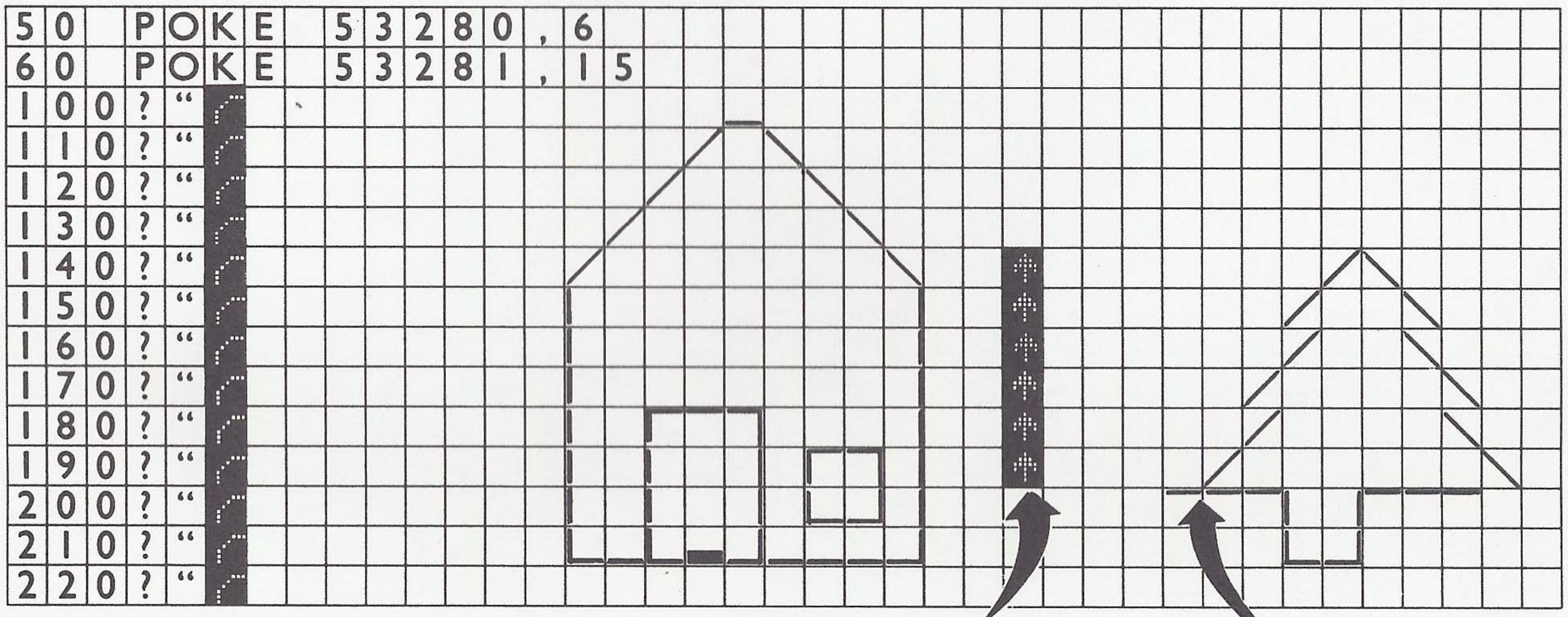
Change the printing and background to different colors!

POKE 53281,_

POKE 53280,_

Brown House and Green Tree

```
50  POKE 53280,6
60  POKE 53281,15
100 ? "
110 ? "
120 ? "
130 ? "
140 ? "
150 ? "
160 ? "
170 ? "
180 ? "
190 ? "
200 ? "
210 ? "
220 ? "
```



= BROWN → 

= GREEN → 

Because of the color symbols . . .

. . . the bottom of the tree looks "off" in the program LISTing, but . . .

. . . when you RUN the program, the tree will be just right!

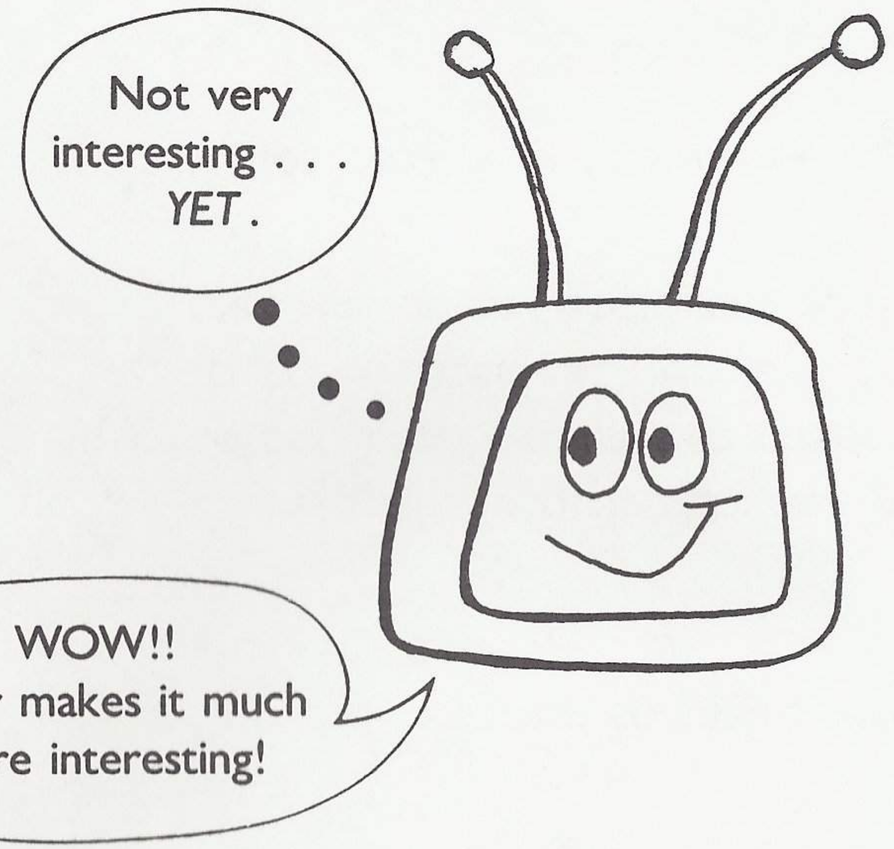
You can also **Add color** ***after*** you draw your pictures.

TYPE

```
100 ? "● ● ● ● ♥ ♥ ♥ ♥"
200 ? "♦ ♦ ♦ ♦ ♣ ♣ ♣ ♣"
RUN
```

1 LIST your program.
2 Move your cursor up and over to the first ● .
3 Press SHIFT and INST DEL —a space appears.
4 Press CTRL and & 6 GRN —a ▚ appears.
5 Move your cursor over to the first ♥.
6 Press SHIFT and INST DEL —another space.
7 Press CTRL and # 3 RED —a ▙ appears.
8 Press RETURN .
9 Move your cursor down to a blank line.

RUN your program!



NOW . . . make the diamonds and clubs different colors.
Use what you have just learned!

Happy Holidays!

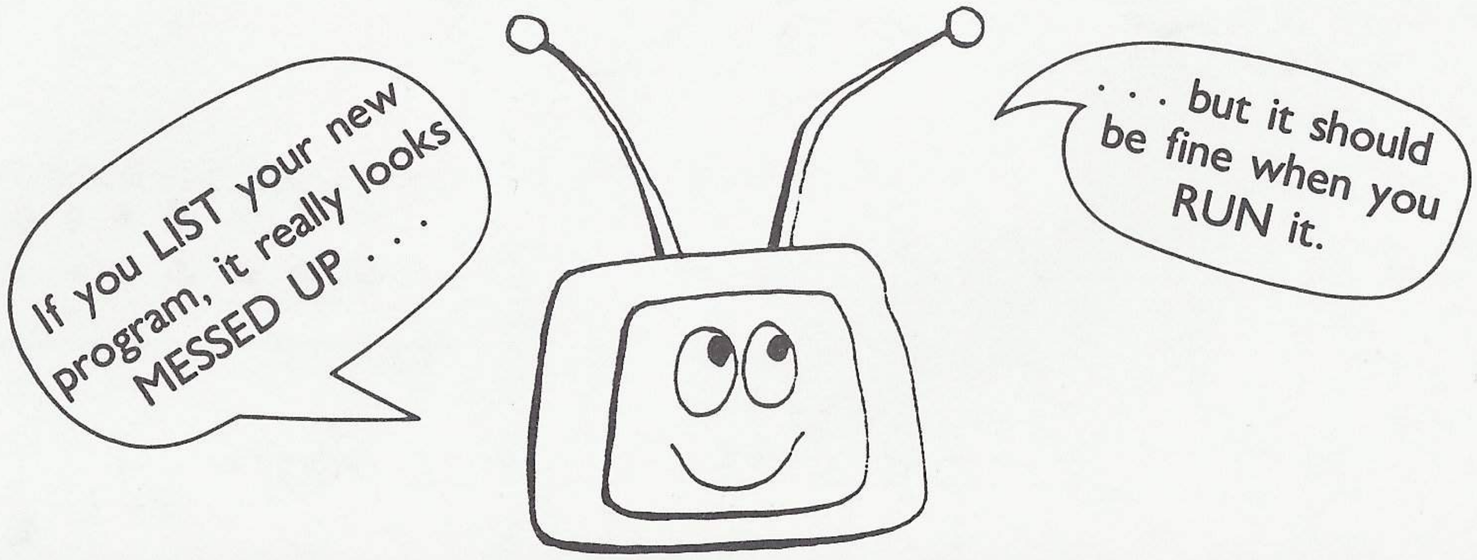
```
100 ? " ♥ "
110 ? POKE 53281,1
120 ? " ↑ "
130 ?
140 ?
150 ?
160 ?
170 ?
180 ?
190 ?
200 ?
210 ?
220 ?
230 ?
```

1 Type in the Christmas tree as it is shown here.

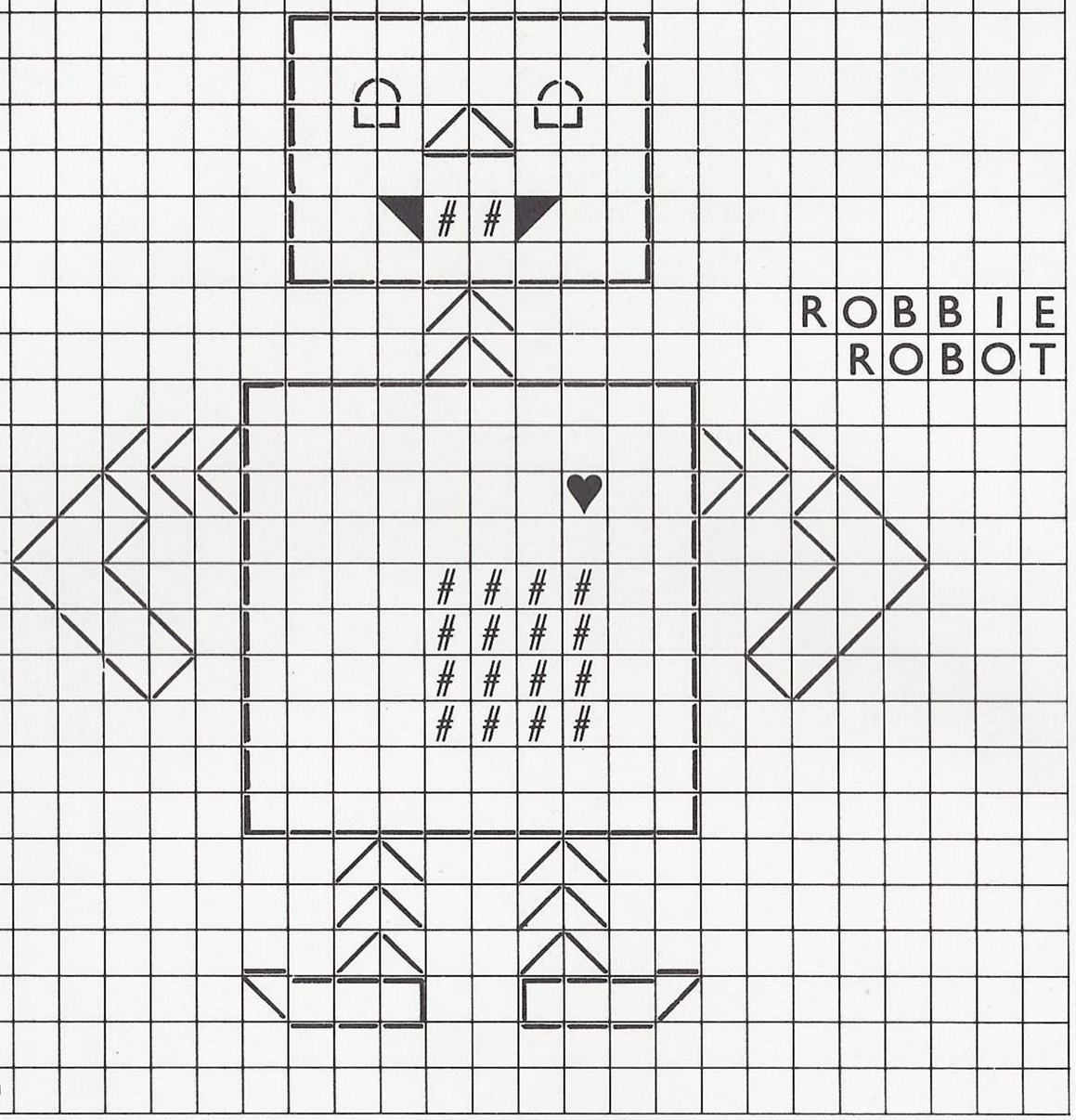
2 Run the program to make sure it works properly.

3 Change all the ornaments to pretty colors. Don't forget to change back to green after each ornament—or the tree will be multicolored, too!

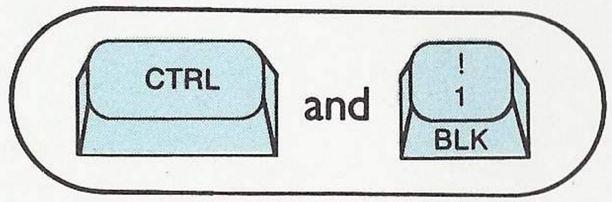
4 Color the trunk brown.



```
10  REM  ** CREATED BY LIZZIE **
80  POKE 53281,1
90  POKE 53280,4
95 ? "■"
100 ? "
110 ? "
120 ? "
130 ? "
140 ? "
150 ? "
160 ? "
170 ? "                    ROBBIE
180 ? "                     ROBOT
190 ? "
200 ? "
210 ? "
220 ? "
230 ? "
240 ? "
250 ? "
260 ? "
270 ? "
280 ? "
290 ? "
300 ? "
310 ? "
320 ? "
330 ? "
340 GOTO 340
```

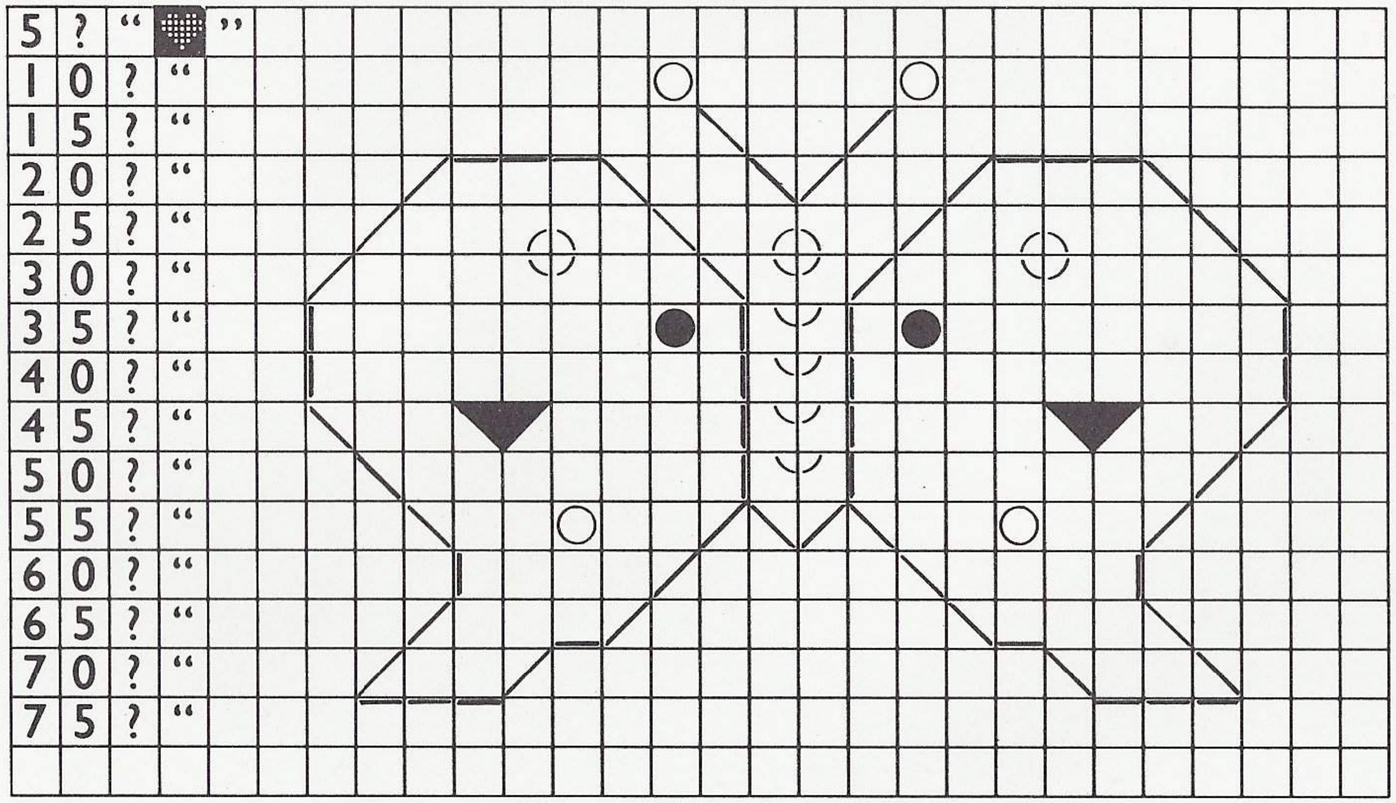


■ = BLACK



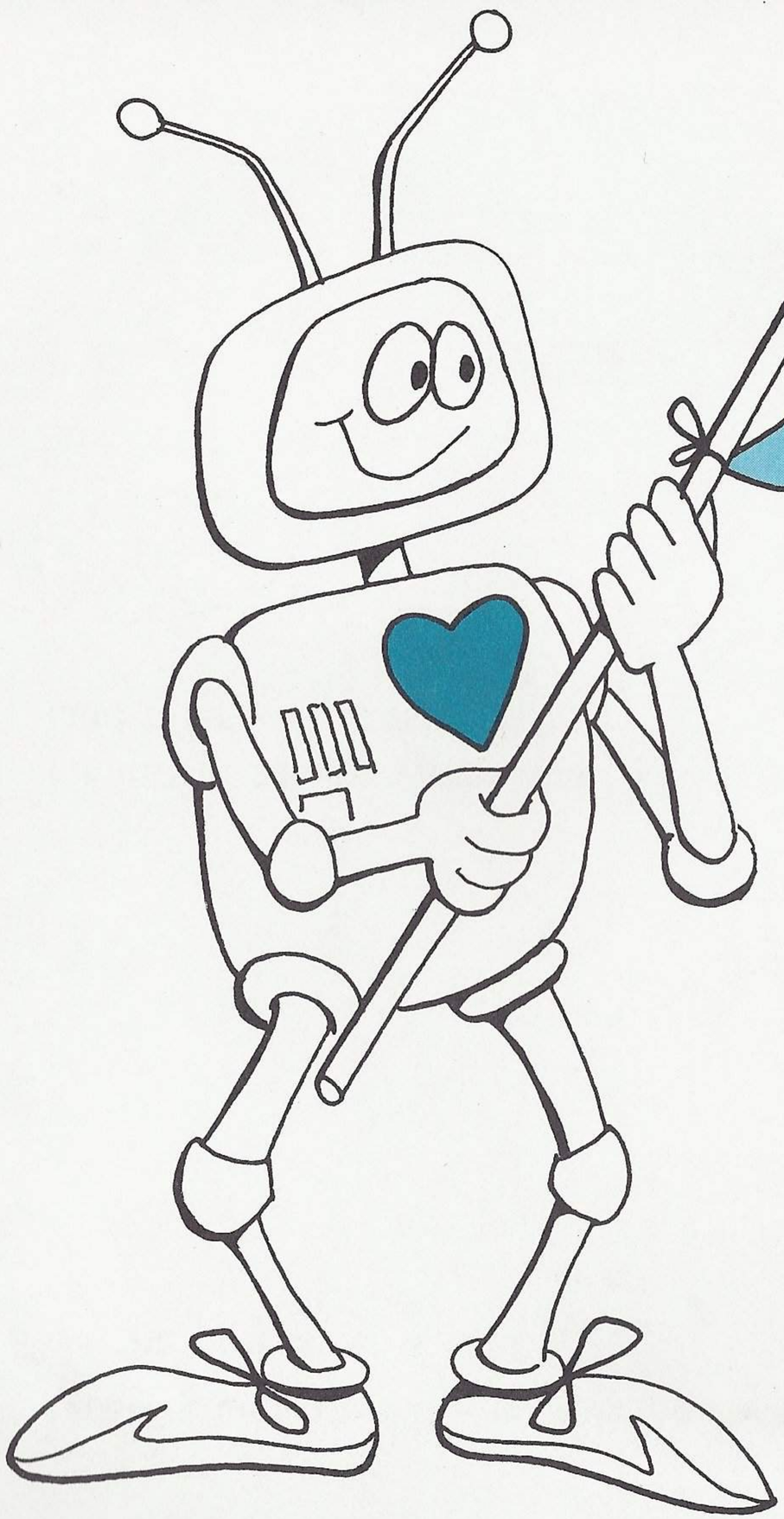
Can you change this program to make the Robot's heart RED?

Can you make his eyes BLUE but keep his nose BLACK?



CHALLENGE

Using the color-editing tricks that you have learned in this lesson, turn this **plain** butterfly into a **brightly colored** butterfly with many pretty designs on the wings.



Review

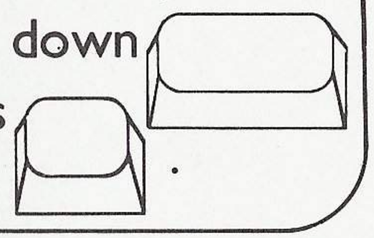
1 The BASIC statement

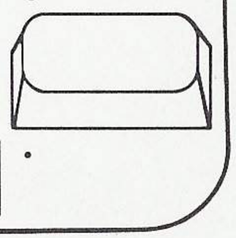
10 PRINT

makes the computer _____

_____

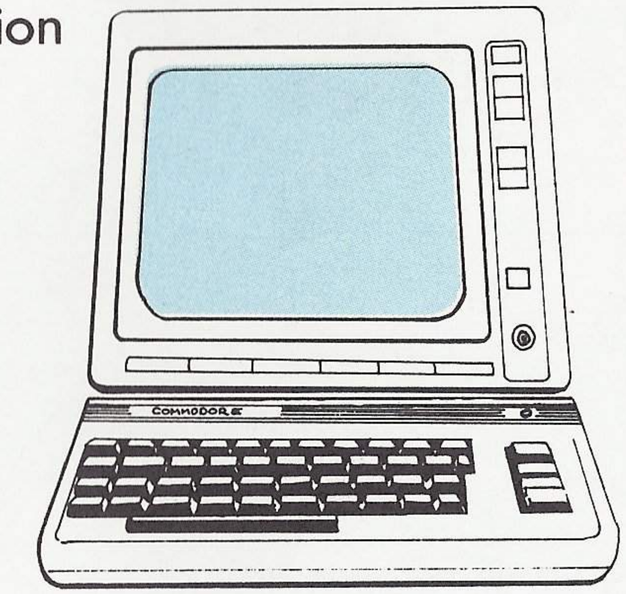
2 100 ? "● ● ● ■ ● ● ● ▬ ● ● ●"

a To get this symbol, you hold down  and press .

b To get this symbol you hold down  and press .

c What will the screen OUTPUT look like?

3 Draw a cursor in the HOME position on the computer screen.



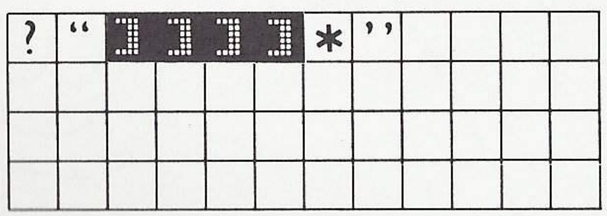
4 Fill in the square where the * will land *after* you press RETURN.

= CURSOR RIGHT

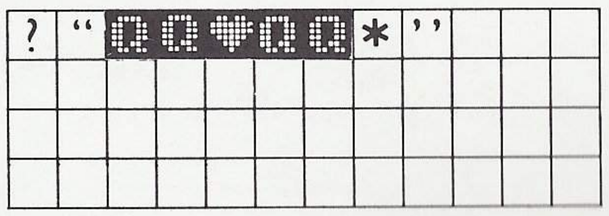
= CURSOR DOWN

= CLEAR SCREEN

a



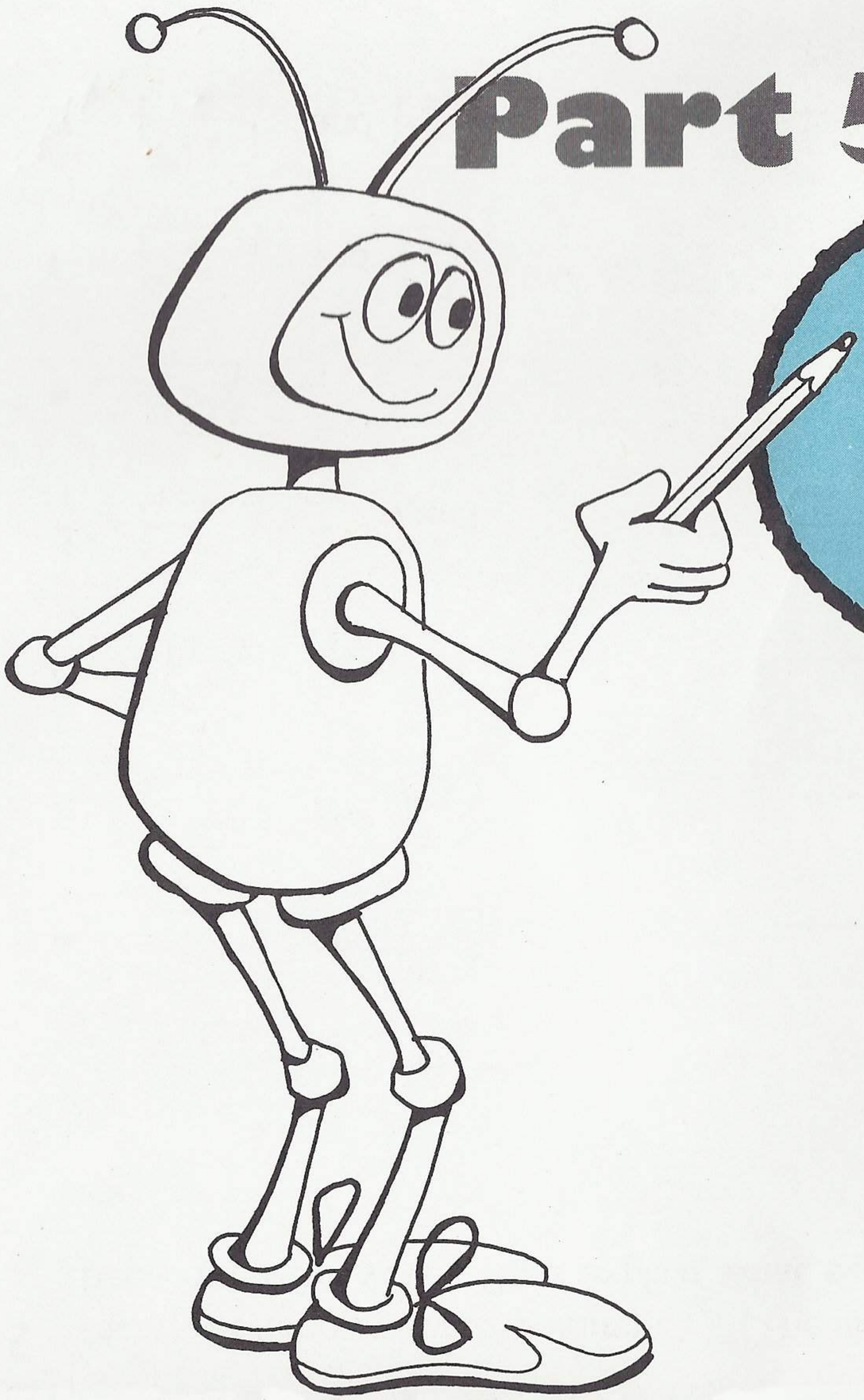
b



5 Match column (1) with column (2). (The first one has been done for you.) Then explain what each of them does.

	(1)	(2)	Explain what happens when these symbols appear inside quotation marks
a	SHIFT and CLR HOME	d ■	turns off reverse video
b	CTRL and ! 1 BLK	_____ ♥	_____
c	CRSR ⇧ ⇩	_____ ▚	_____
d	CTRL and 0 RVS OFF	_____ ▀	_____
e	CLR HOME	_____ ■	_____
f	SHIFT and S	_____ ▲	_____
g	CTRL and) 9 RVS ON	_____ ♥	_____
h	CTRL and & 6 GRN	_____ ▯	_____

Part 5

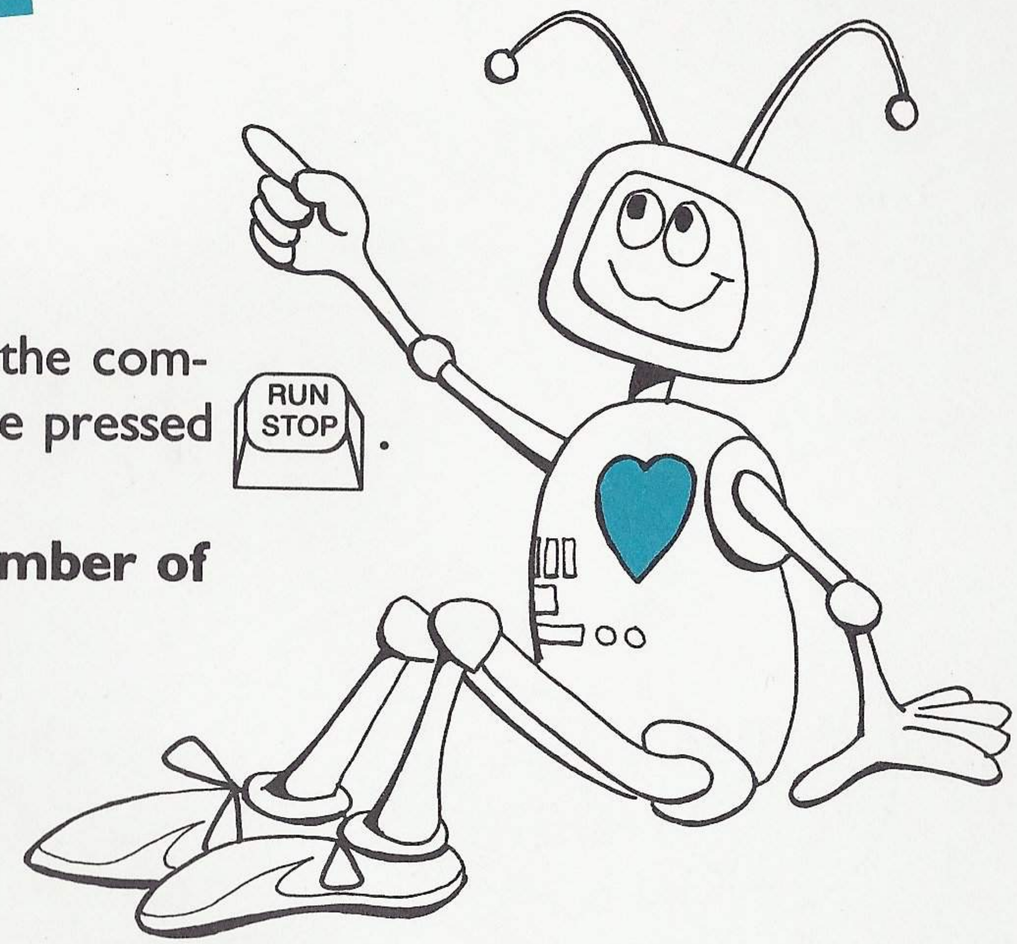


Loops that Count

FOR . . . NEXT Statements

The programs we wrote using GOTO loops made the computer **loop** and **loop** and **loop** forever—or until we pressed RUN STOP.

Sometimes we want the **64** to loop **a specific number of times**, and then do something else.



We can **set** the number of loops if we use FOR . . . NEXT statements.

TYPE

```
NEW
10 FOR N = 1 TO 4
15 ? "HI PAL"
20 NEXT N
25 ? "GOODBYE PAL"
RUN
```

KEEP GOING

When the **64** comes to a FOR it looks for a matching NEXT,
and loops back
a specific number of times
(whatever number you decide),
and then goes on with the program.

Type LIST and this should appear on the screen:

```
10 FOR N = 1 TO 4
15 PRINT "HI PAL"
20 NEXT N
25 PRINT "GOODBYE PAL"
```

Note:
This letter can be any letter you choose,
BUT it must be the same in both places.

Change line 15.

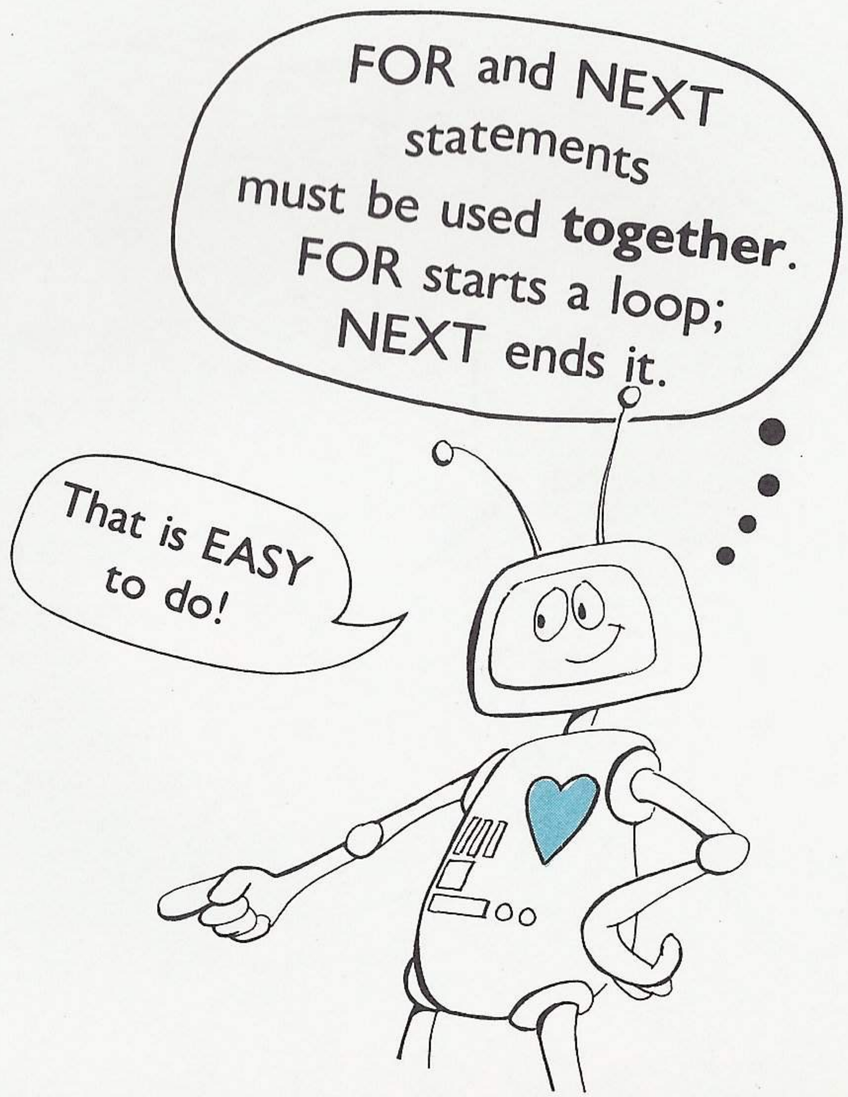
```
15 ? ". . . . . "
RUN
```

You add a message.

Now change line 10.

```
10 FOR N = 1 TO 10
RUN
```

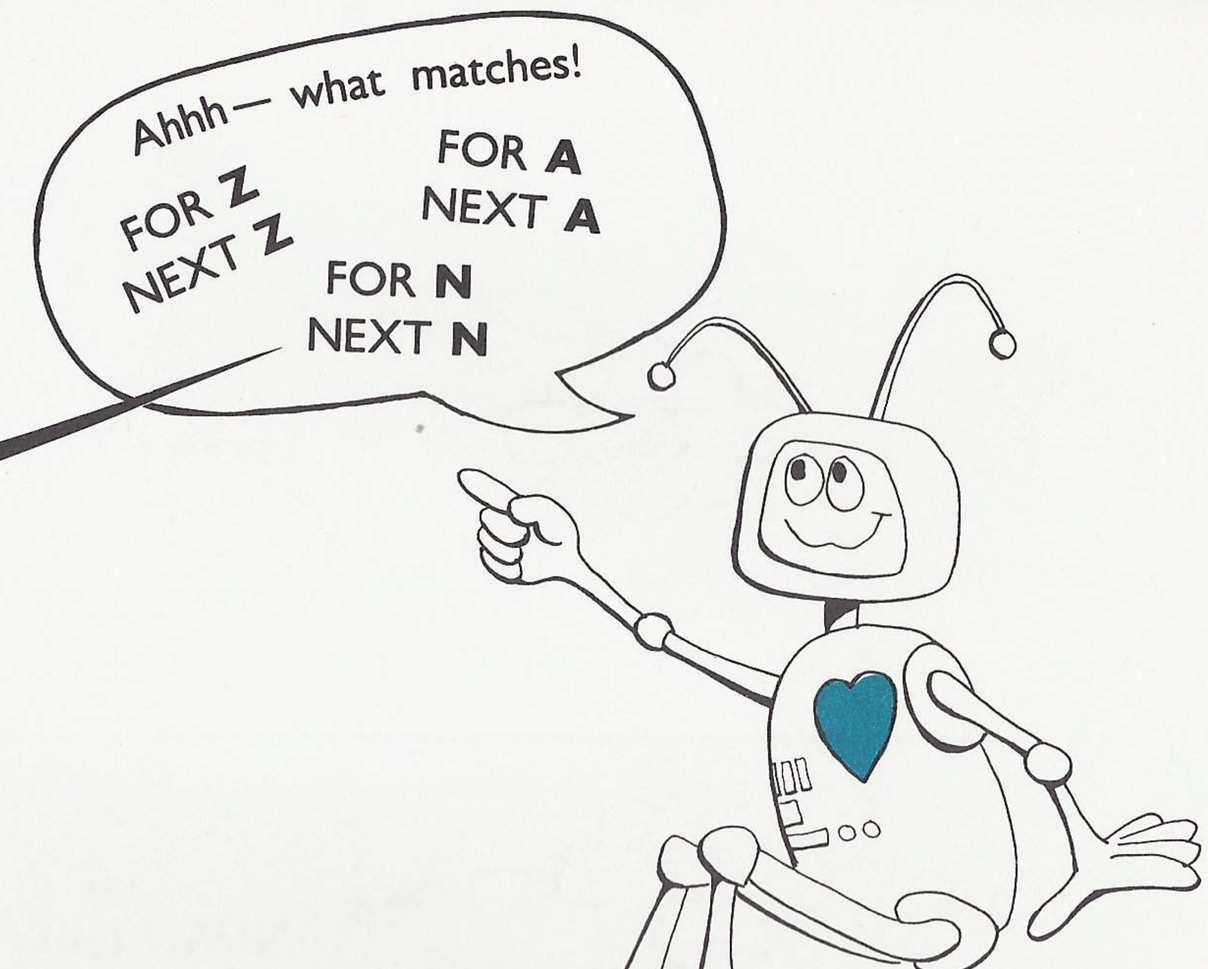
NOW make the **64** print your name 20 times!



Now try this:

TYPE

```
NEW
10 FOR Z = 1 TO 6
30 ? Z
40 NEXT Z
RUN
```



change line 30

Add quotation marks.

```
30 ? "Z"
RUN
```

Hmmmmm . . . Can you figure out why the quotation marks make such a difference?

PREDICT . . . what will happen with this change:

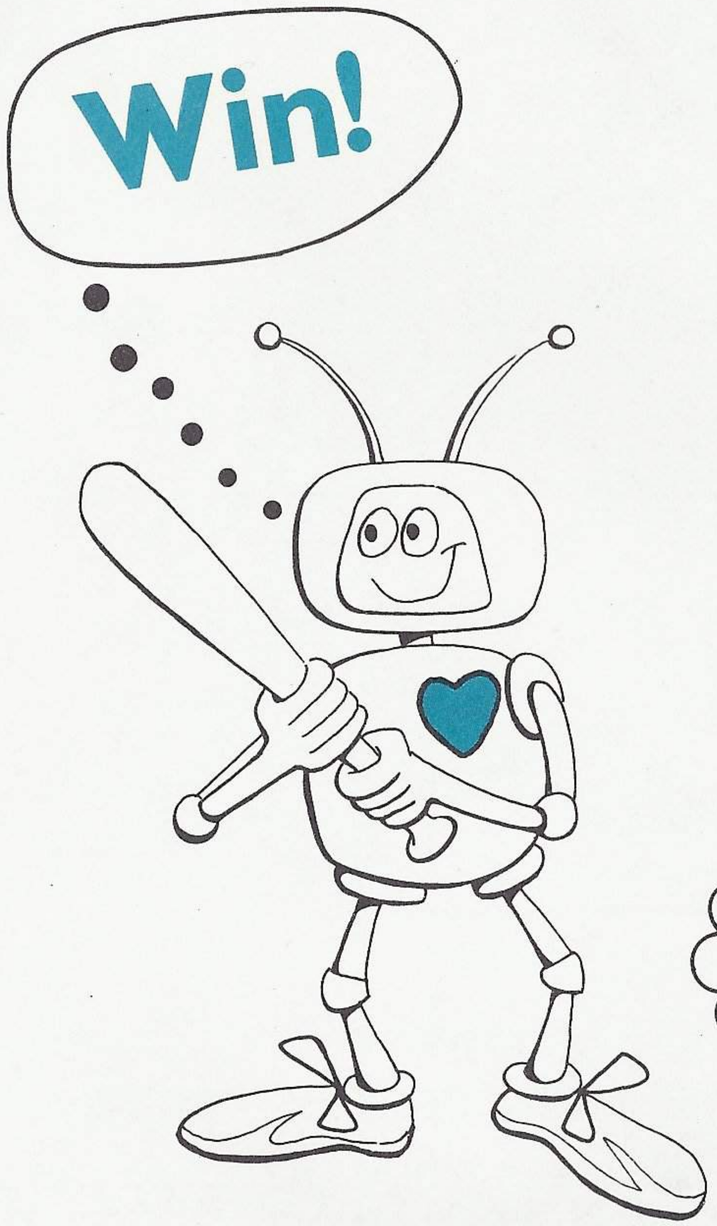
TRY

```
30 ? Z + Z
RUN
```

How about this?

TYPE

```
30 ? "Z + Z"
```



TYPE

```
NEW
10 ? "MY BASEBALL TEAM LIKES TO"
20 FOR X = 1 TO 20
30 ?"WIN!"
40 NEXT X
RUN
```

Change line 30.

```
30 ? "WIN!",
RUN
```

Add a comma.

Change lines 20 and 30.

```
20 FOR X = 1 TO 100
30 ? "WIN! _ _";
```

2 spaces.

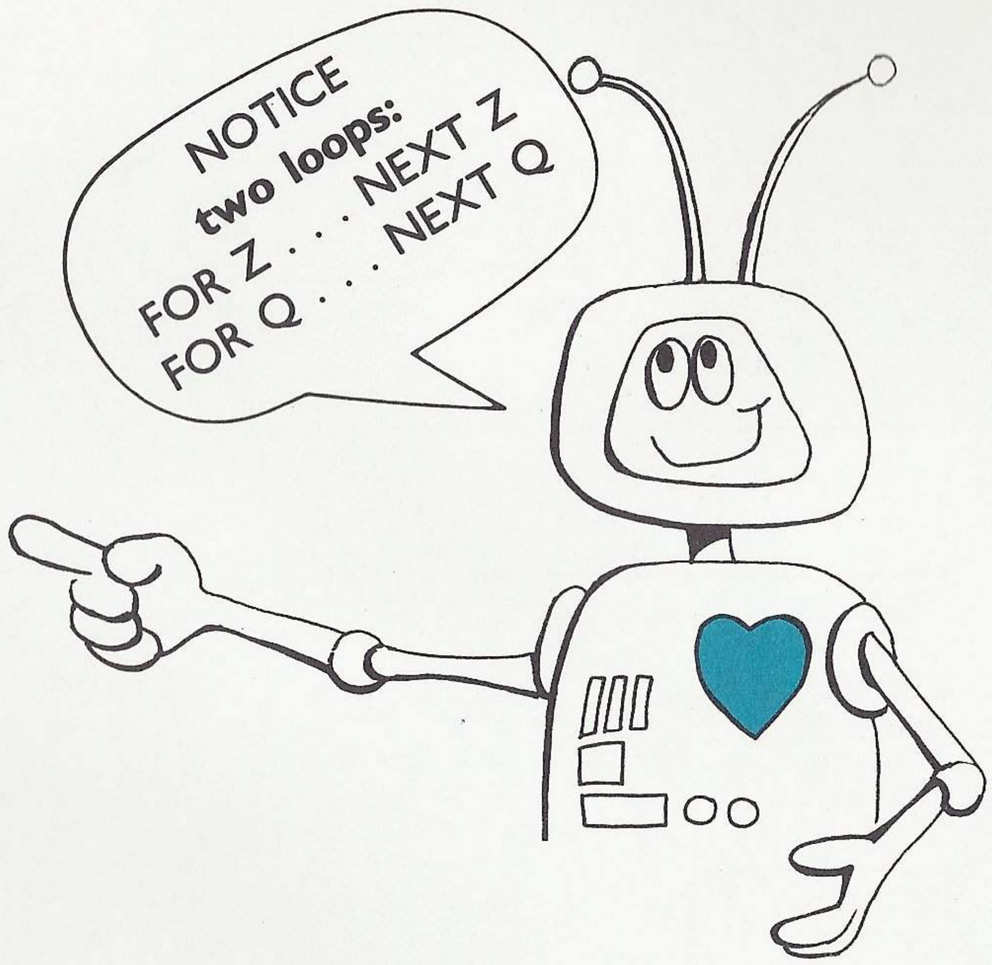
Add a semicolon.

LOOK at this program **first.**

PREDICT what word the computer will print out *before* you run the program.

STUDY . . . then **TYPE**

```
10 REM *** A PUZZLE ***
20 ? "M";
30 FOR Z = 1 TO 2
40 ? "I";
50 ? "S";
60 ? "S";
70 NEXT Z
80 ? "I";
90 FOR Q = 1 TO 2
100 ? "P";
110 NEXT Q
120 ? "I"
```



RUN the program.

Did you PREDICT the correct word?

CHALLENGE

Write a puzzle program like the one above. Have a friend try to "predict" your word. *Banana* would be a good word to try.

FOR . . . NEXT Graphics

We can use FOR . . . NEXT loops to make **Fun Pictures!**

TYPE

```
50 REM *** A BASIC BRICK BUILDING ***
60 POKE 53281,1
70 ? "  "
100 ? "  ______"
110 FOR X = 1 TO 9
120 ? "  |_|_|_|_|_|_|_|_|_|"
130 ? "  |_|_|_|_|_|_|_|_|_|"
140 NEXT X
150 ? "  ______"
RUN
```

CTRL and # 3 RED

space

C= and I

C= and E or R

C= and H

space

C= and U

C= and N

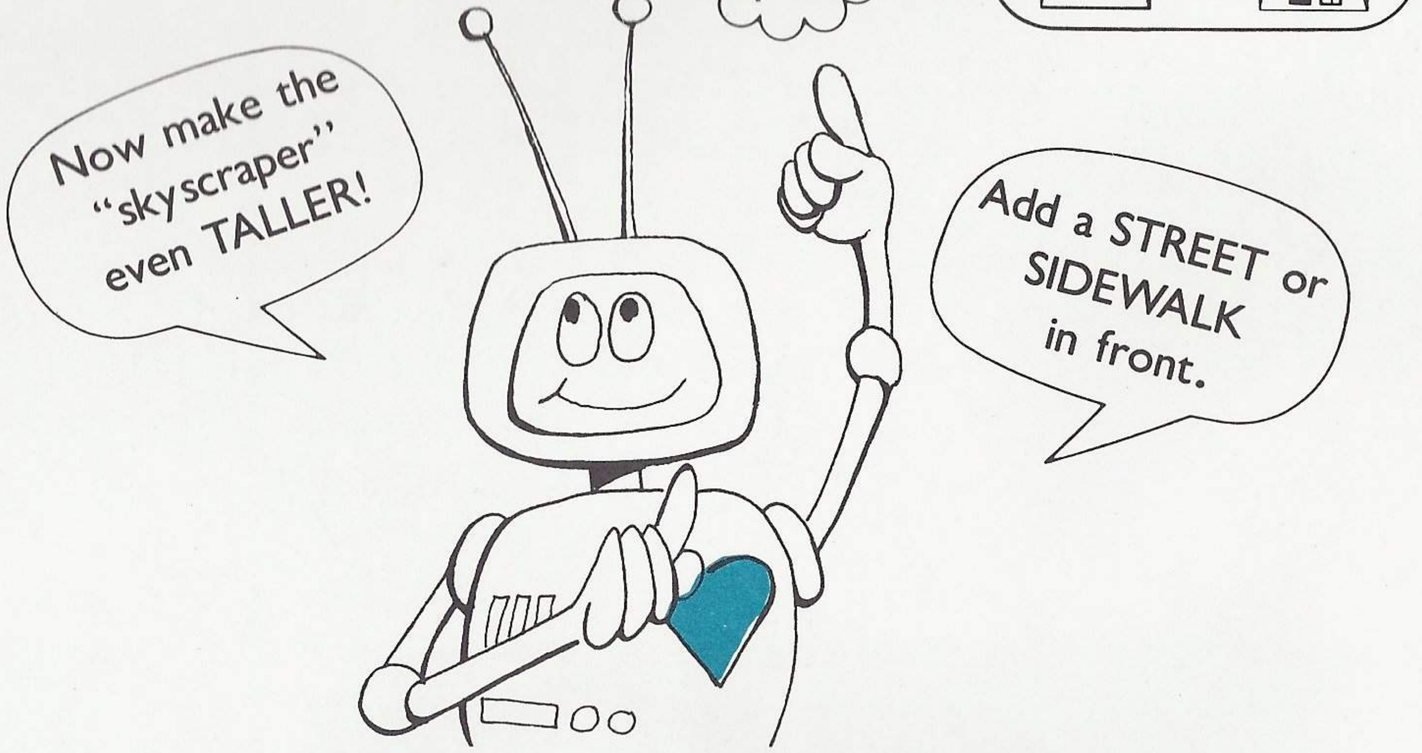
TYPE

```
NEW
10 REM ** SKYSCRAPER TO THE STARS **
20 POKE 53281,1
30 ? "■"
40 FOR S = 1 TO 12
50 ? "■■■■■■■■■■■■"
60 ? "■■■_■■■■_■■■■"
70 ? "■■■■■_■■■■_■■"
80 ? "■■_■■■■■■_■■■■"
90 NEXT S
RUN
```

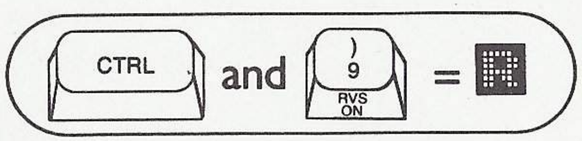
CTRL and 7 BLU

C= and +

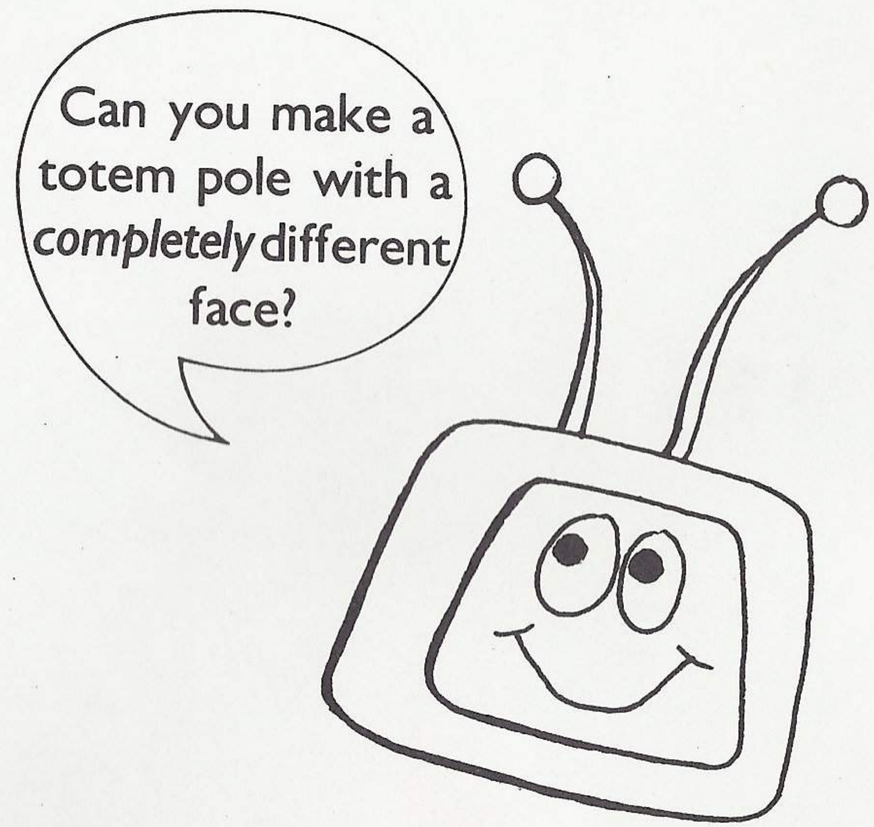
space

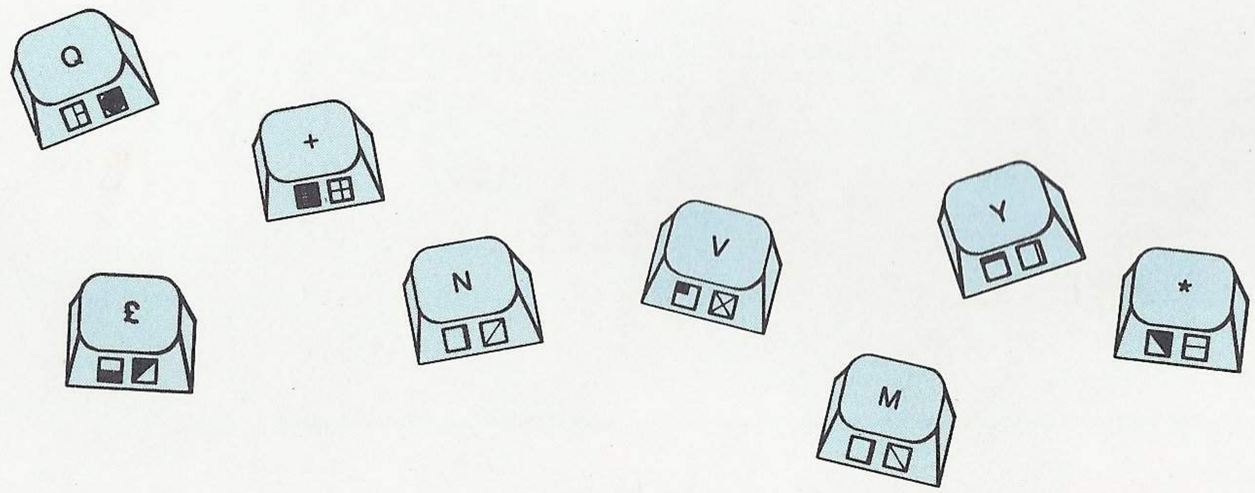


Try this




```
NEW
1 REM * * * A TERRIFIC TOTEM POLE * * *
2 ? " ■ "
3 ? " ■ "
4 POKE 53281,7
5 FOR X = 1 TO 3
10 ? "  _ _ ■ ◤ ■ ◥ "
20 ? "  * * * * * * * "
30 ? "  * _ ● _ ● _ * "
40 ? "  * _ _ V _ _ * "
50 ? "  * _ / ‾ \ _ * "
60 ? "  * * * * * * * * "
70 NEXT X
80 ? "  _ _ ■ _ ■  "
85 ? "  _ _ ■ _ ■  "
90 ? "  _ ■ ■ _ ■ ■ "
RUN
```

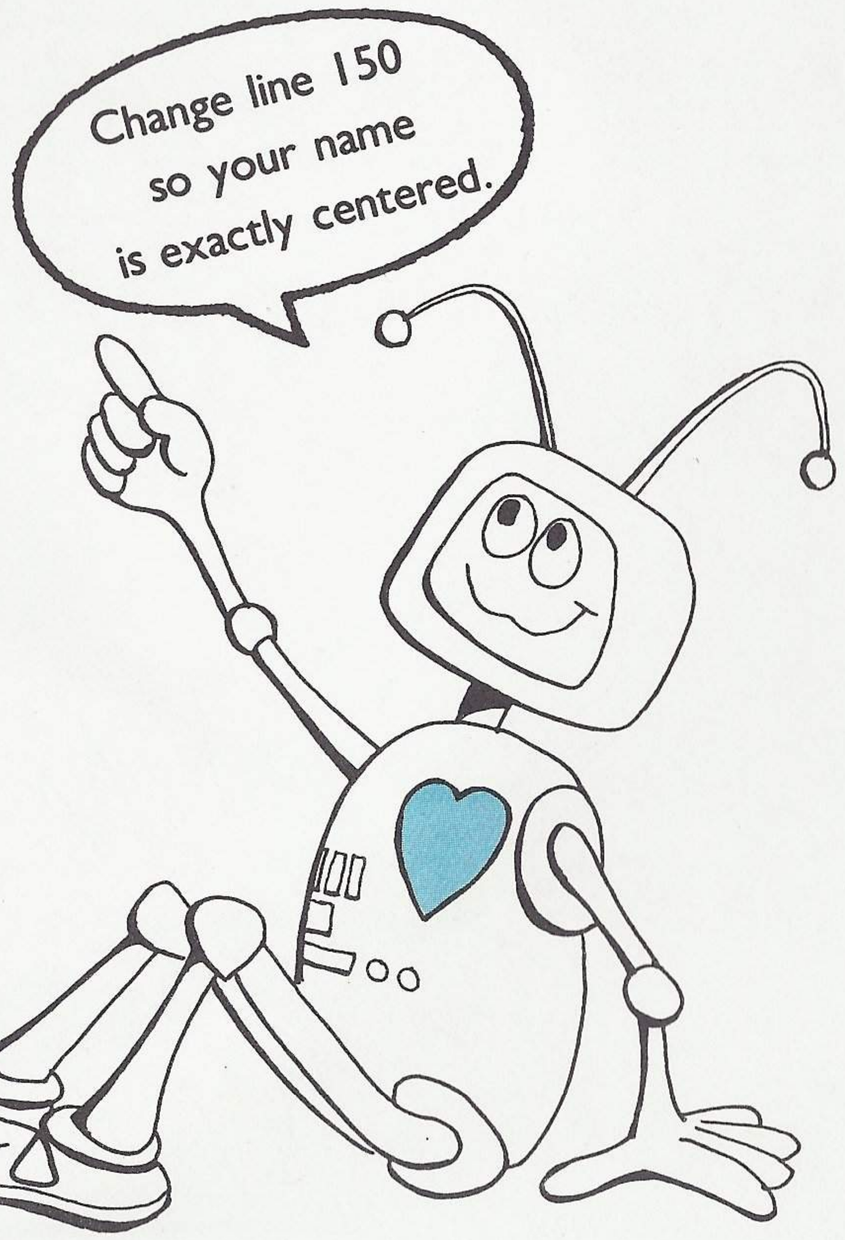




TYPE

```
NEW
100 ? " ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ "
110 FOR ROWS = 1 TO 7
120 ? " ♥ _ _ _ _ _ _ _ _ _ _ _ _ _ ♥ "
130 NEXT ROWS
140 ? " ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ "
150 ? " ↑ ↑ ↑ ↑ ↑ → → " H E N R Y "
RUN
```

Make this program fancier!




```
10 ? "♥"
160 GOTO 160
```

Clear Screen

Line 160 "traps" the computer in an endless loop. It will continue to do line 160 until you press RUN STOP.

Counting

Let's RACE the computer!

Are you an expert "counter"?

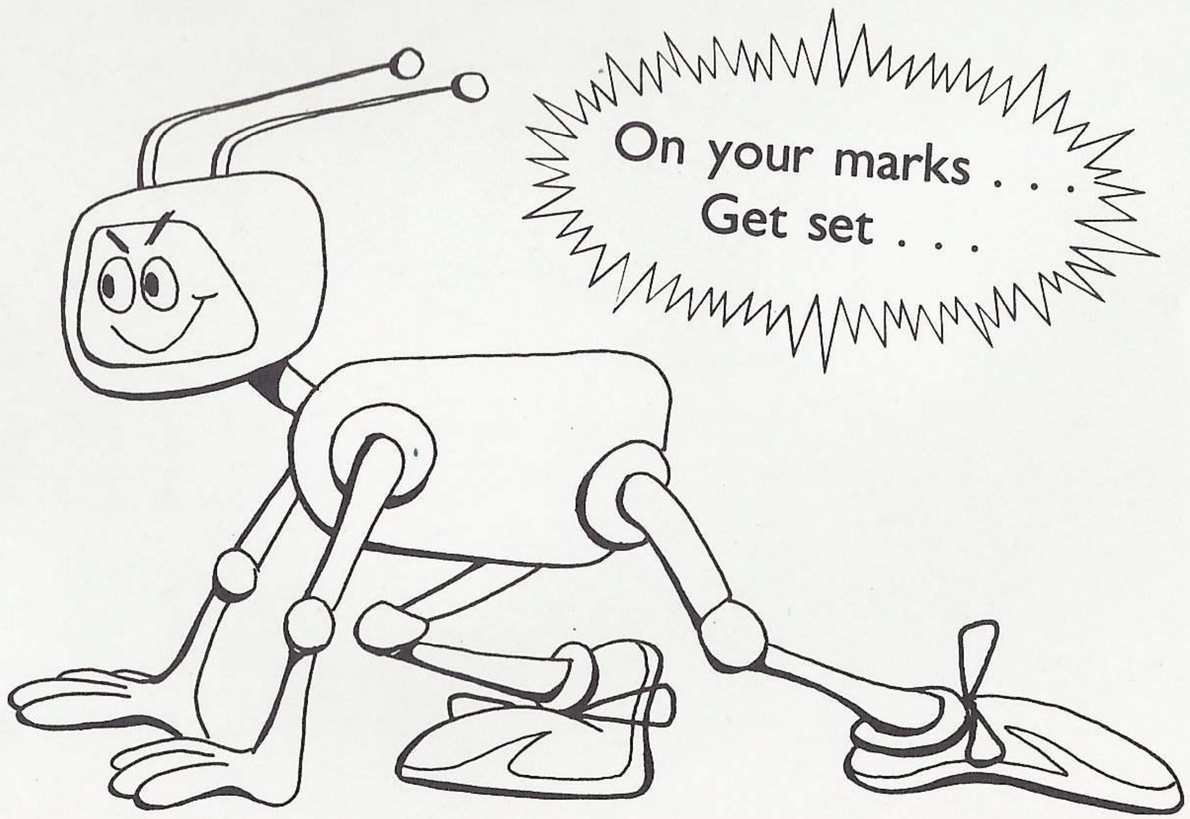
Can you beat the computer in a counting race?

PREDICT how long you think it will take for a HUMAN to write down all the numbers from 1 to 100.

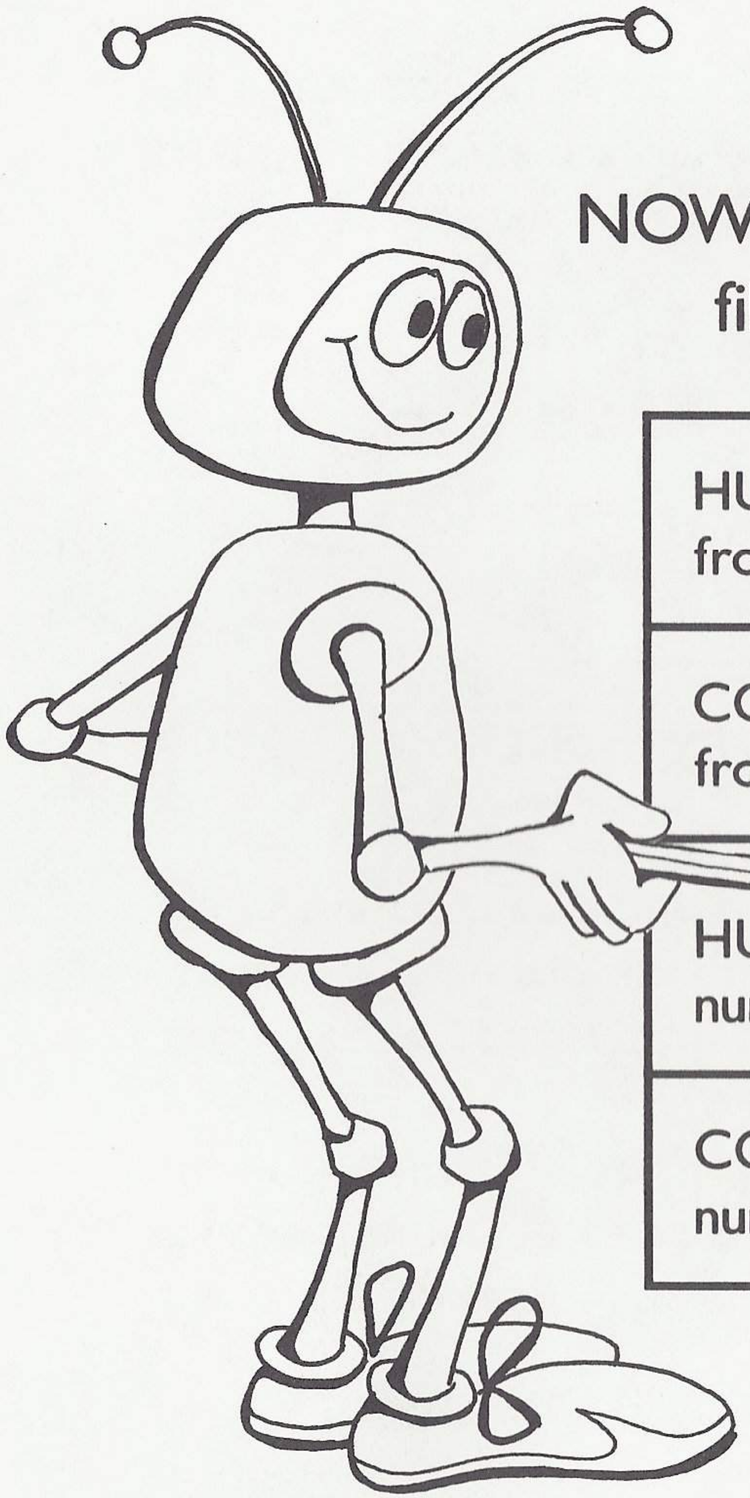
How about the COMPUTER?

PREDICT how long you think it will take for a HUMAN to count *to himself* all the numbers from 1 to 100.

How about the COMPUTER?



Human vs. Computer!



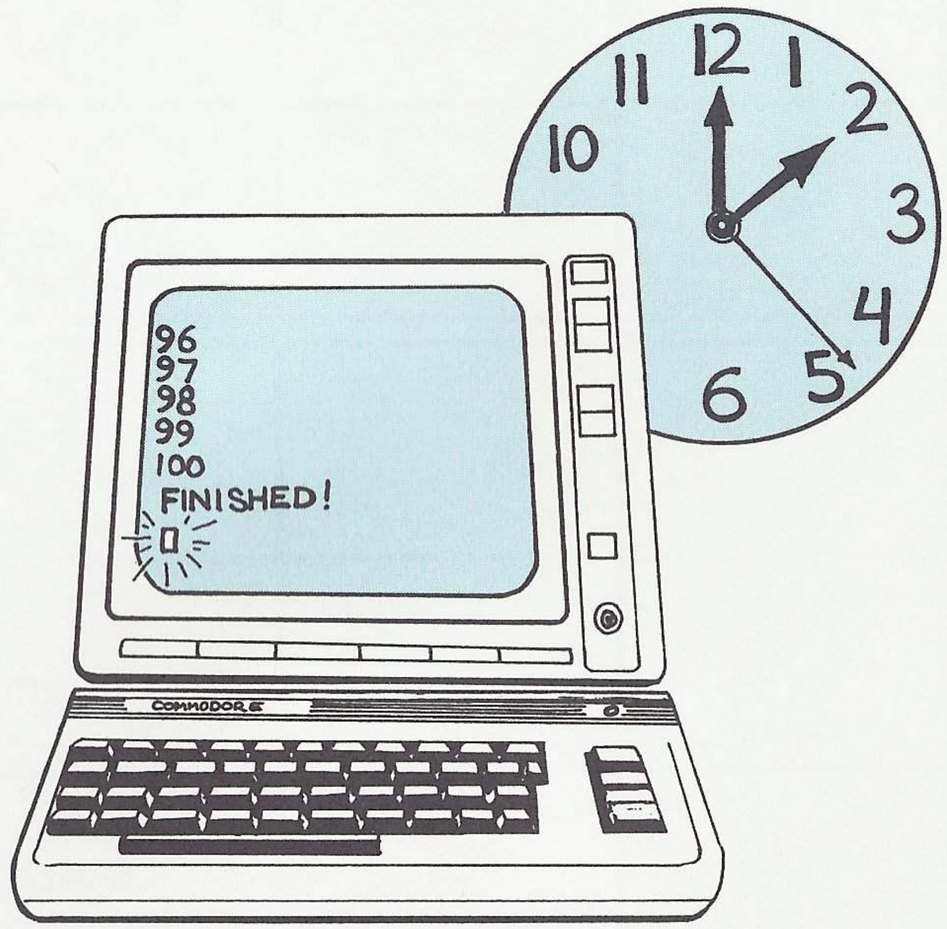
NOW on your chart,
fill in YOUR predicted times:

	PREDICTED TIME	ACTUAL TIME
HUMAN writing down all the numbers from 1 to 100		
COMPUTER printing out all the numbers from 1 to 100		
HUMAN counting to himself all the numbers from 1 to 100		
COMPUTER counting to itself all the numbers from 1 to 100		

PICK a HUMAN to enter the counting race:

Have that person **write** down all the numbers from 1 to 100.
Time the human carefully.
Fill in the time on your chart.

NOW have your human count to 100 **silently**.
Time your human again.
Fill in the time on your chart.



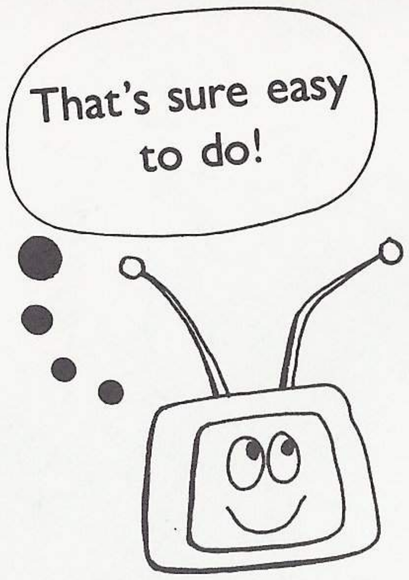
NOW let's have the COMPUTER do its part:

TYPE

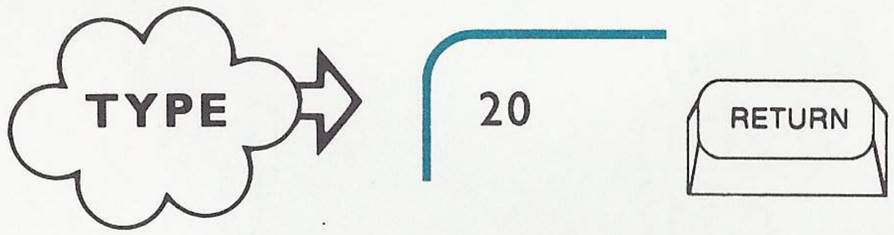
```
10 FOR X = 1 TO 100
20 ? X
30 NEXT X
40 ? "FINISHED!"
RUN
```

Did you remember to **time** the computer?
RUN the program again and see if you get the **same** time.
Fill in the computer's time on your chart.





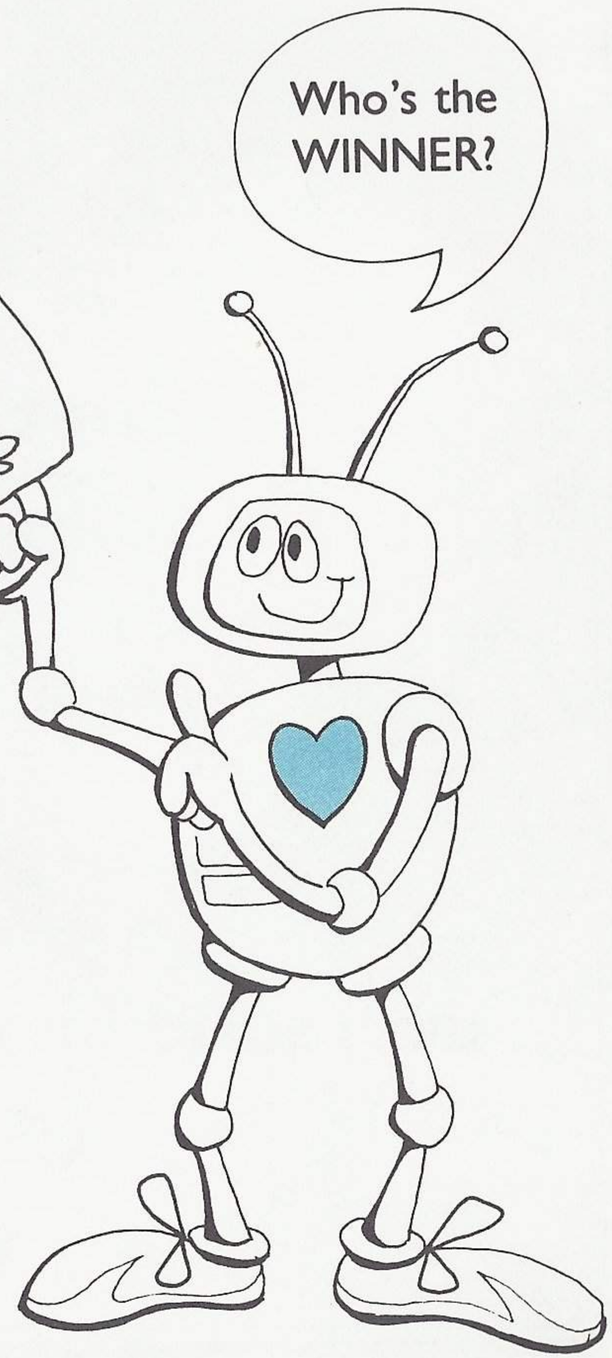
To make the computer count **to itself**,
DELETE line 20.

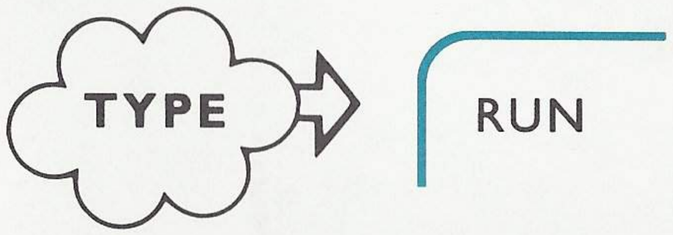


Now your program should look like this:
(Type LIST)

```
10 FOR X = 1 TO 100
30 NEXT X
40 PRINT "FINISHED!"
```





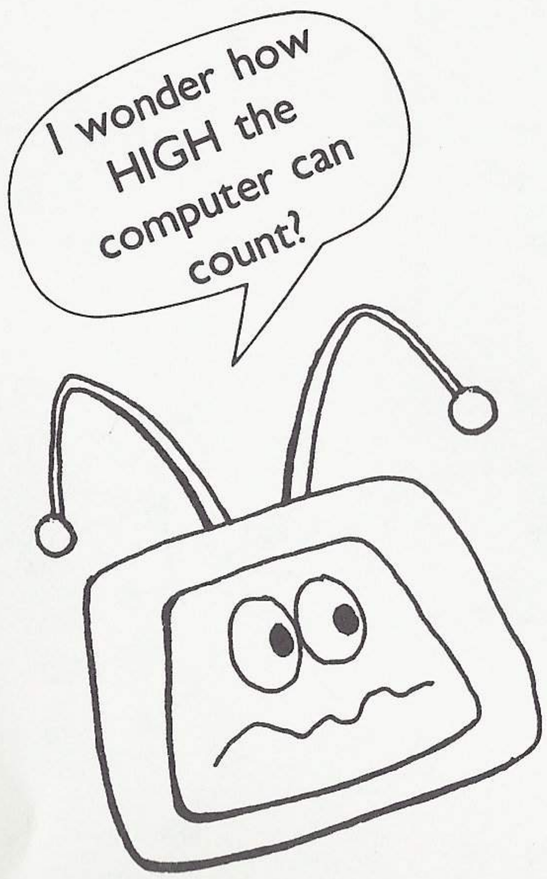


Check the time . . . **Wow!**

Dealing with

big

numbers . . .



CHALLENGE

a. How long does the **64** take to **print** from 1 to . . .

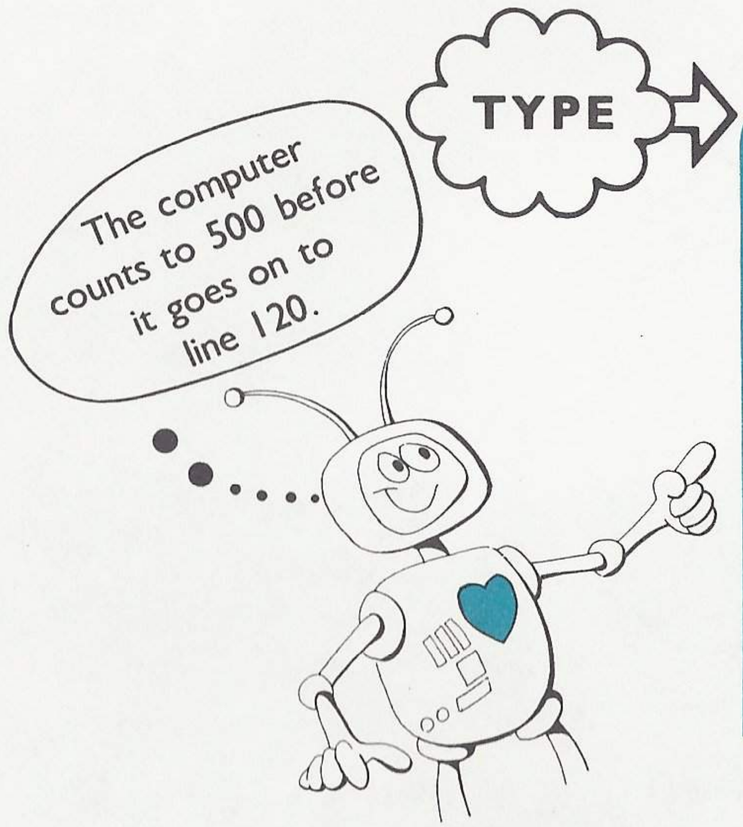
100
1000
10,000
100,000

b. How long does it take the **64** to count **to itself** from 1 to . . .

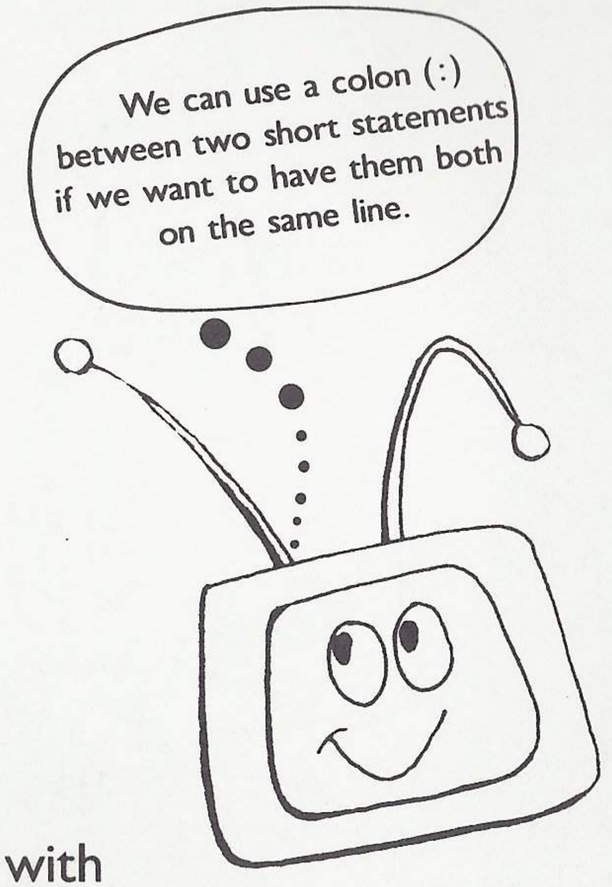
100
1000
10,000
100,000

What about ONE MILLION?

More FOR . . . NEXT




```
NEW
10 REM *** A TIME DELAY ***
100 ? "I SPEAK"
110 FOR Q = 1 TO 500: NEXT Q
120 ? "VERY"
130 FOR Q = 1 TO 700: NEXT Q
140 ? "VERY"
150 FOR Q = 1 TO 900: NEXT Q
160 ? "SLOWLY"
RUN
```



In this program, we have used FOR . . . NEXT loops with **no** PRINT statement between the FOR and the NEXT.

In this way, we are creating a **Time Delay**! The computer "counts to itself"—in this example from 1 to 500, then from 1 to 700, then from 1 to 900!

We frequently use this TRICK when we want to SLOW DOWN the computer.

Get Fancy!

TYPE

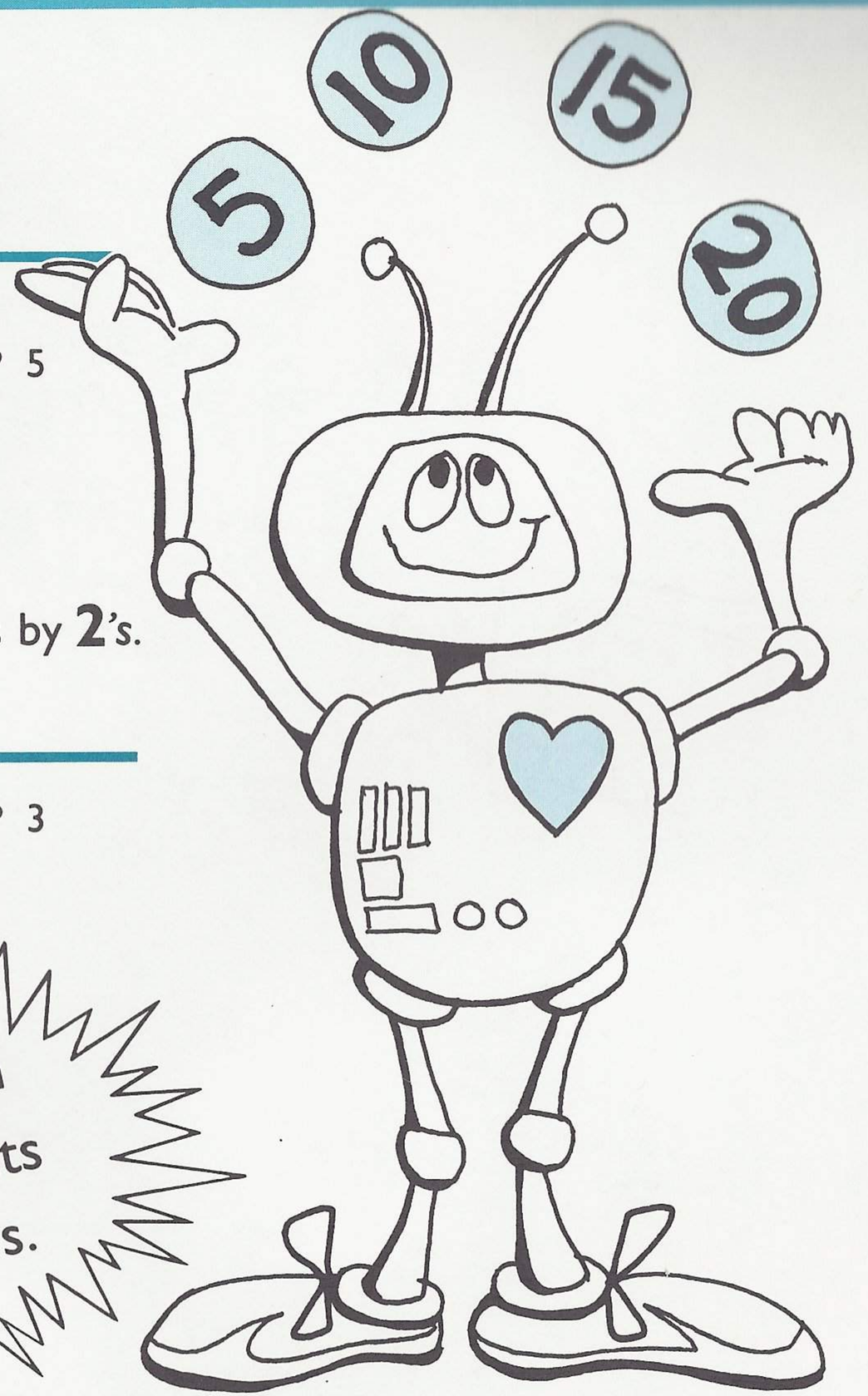
```
NEW
10 FOR P = 0 TO 100 STEP 5
20 ? P
30 NEXT P
RUN
```

Change line 10 so that the computer counts by **2**'s.

Change line 10 again

```
10 FOR P = 29 TO 60 STEP 3
RUN
```

Change line 10 **again** so that the **64** counts from 13 to 73 by 6's.



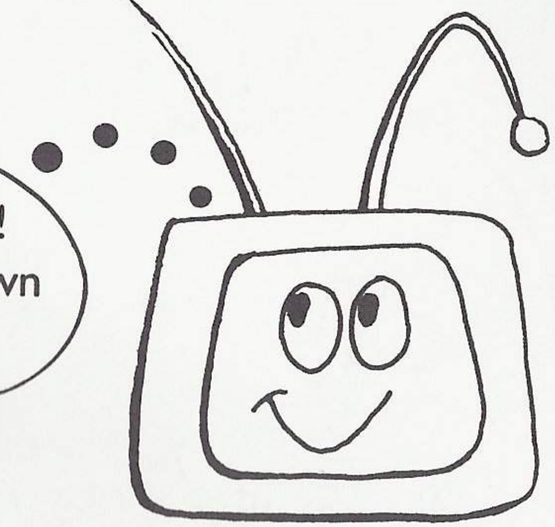
Blast off!

TYPE

```
NEW
10 REM * * * BLAST OFF! * * *
100 FOR Z = 10 TO 1 STEP -1
110 ? Z
120 NEXT Z
130 ? "BLAST OFF!"
RUN
```

The minus sign (–) tells the computer we want to count **backwards.**

Hmm . . . Too Fast! We need to slow down the "action"!



ADD

```
115 FOR M = 1 TO 500: NEXT M
RUN
```

We put another FOR . . . NEXT loop **within the first one!** So it acts as a time delay **each time around!**

Now let's look at the whole program.

TYPE

```
LIST
```

KEEP GOING

This should appear:

The computer prints each number from 10 to 1 on the screen.

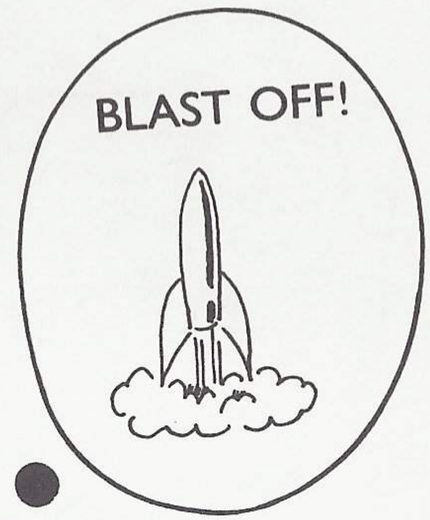
This line tells the computer to count **backwards** from 10 to 1.

```
10 REM *** BLAST OFF! ***
100 FOR Z = 10 TO 1 STEP -1
110 PRINT Z
115 FOR M = 1 TO 500: NEXT M
120 NEXT Z
130 PRINT "BLAST OFF!"
```

A TIME DELAY "counts to itself" up to 500.

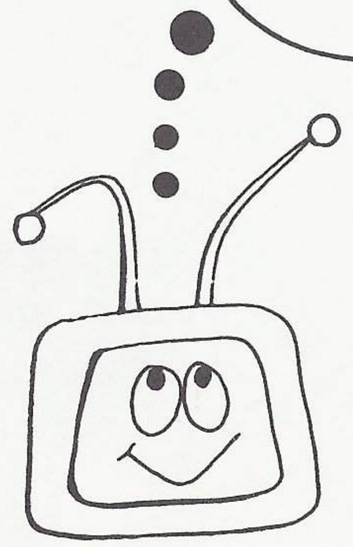
Go back to line 100 and get the next number.

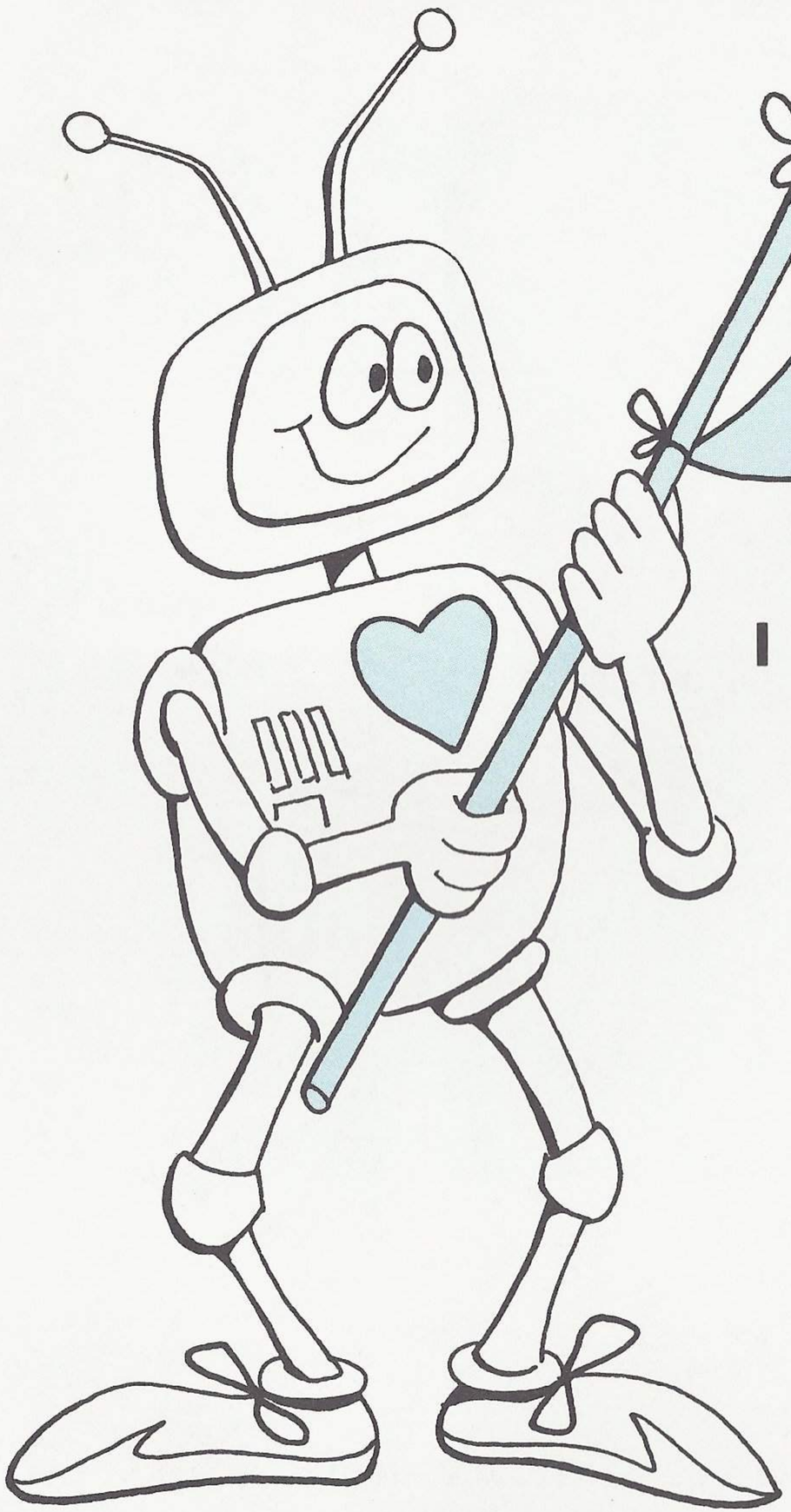
After all the numbers have been slowly printed, the computer prints **BLAST OFF!**



CHALLENGE

Write a program with a countdown followed by a stream of rockets taking off.





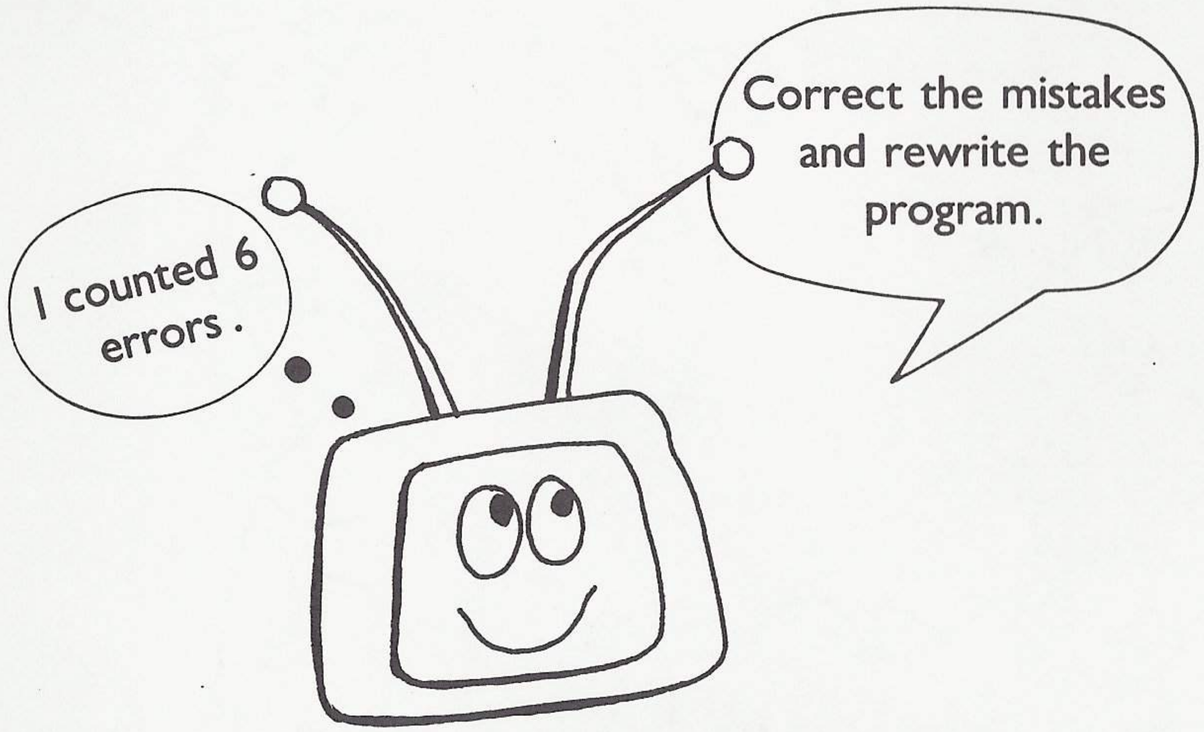
Review

1 DRAW a picture of what you predict the output will be for this program:

```
10 ? " /\ "
20 ? " /  \ "
30 FOR X = 1 TO 6
40 ? "    "
50 NEXT X
60 FOR Z = 1 TO 3
70 ? "  *  "
80 NEXT Z

RUN
```

Oops!! Debug (correct) this program so that it prints SMILE ten times.




```
10 ? FOR X = 1 - 10
20 ? SMILE''
30 FOR DELAY = 1 TO 500; NEXT D
40 NEXT Y
RUN
```

3 Complete these programs so that the computer will print . . .

a the numbers from 1 to 100

```
10 FOR X = 1.....
20 PRINT .....
30 ..... X
RUN
```

b the numbers from 100 to 50, counting backwards by 5's.

```
10 FOR N = ..... STEP .....
.....PRINT N
30 NEXT .....
RUN
```

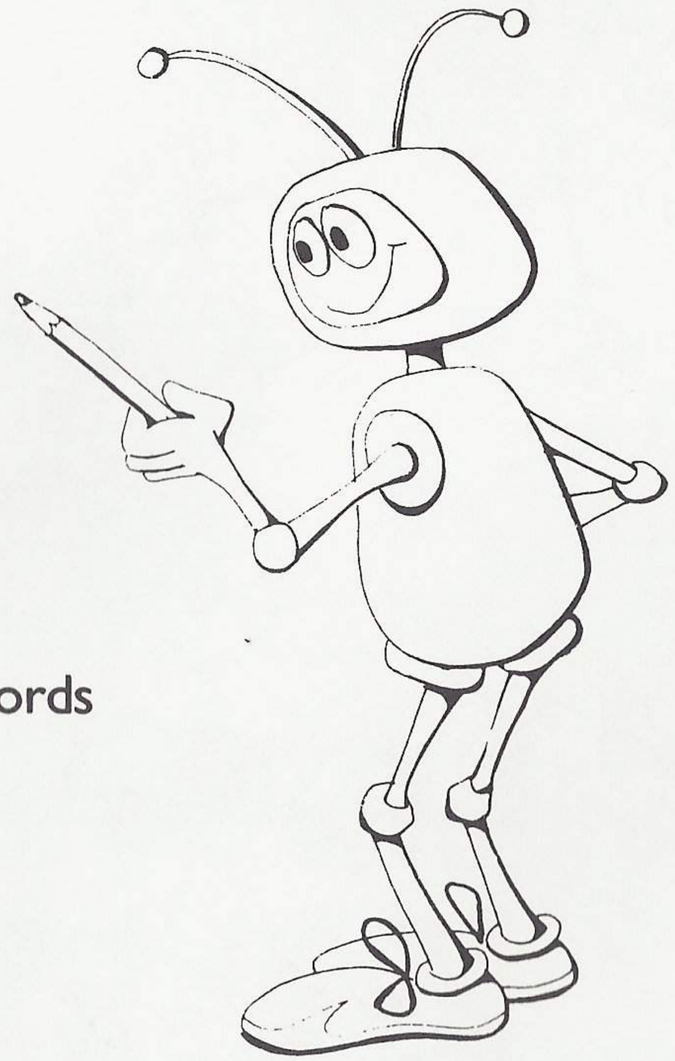
4 MATCH the program listings with the descriptions:

__ Time delay

__ Counting backwards

__ Counting forwards

__ Printing a column of words



a

```
10 FOR B = 1 TO 10
20 ? "***"
30 FOR D = 1 TO 500
40 NEXT D
50 NEXT B
RUN
```

b

```
10 FOR B = 1 TO 10
20 ? "TEN"
30 NEXT B
RUN
```

c

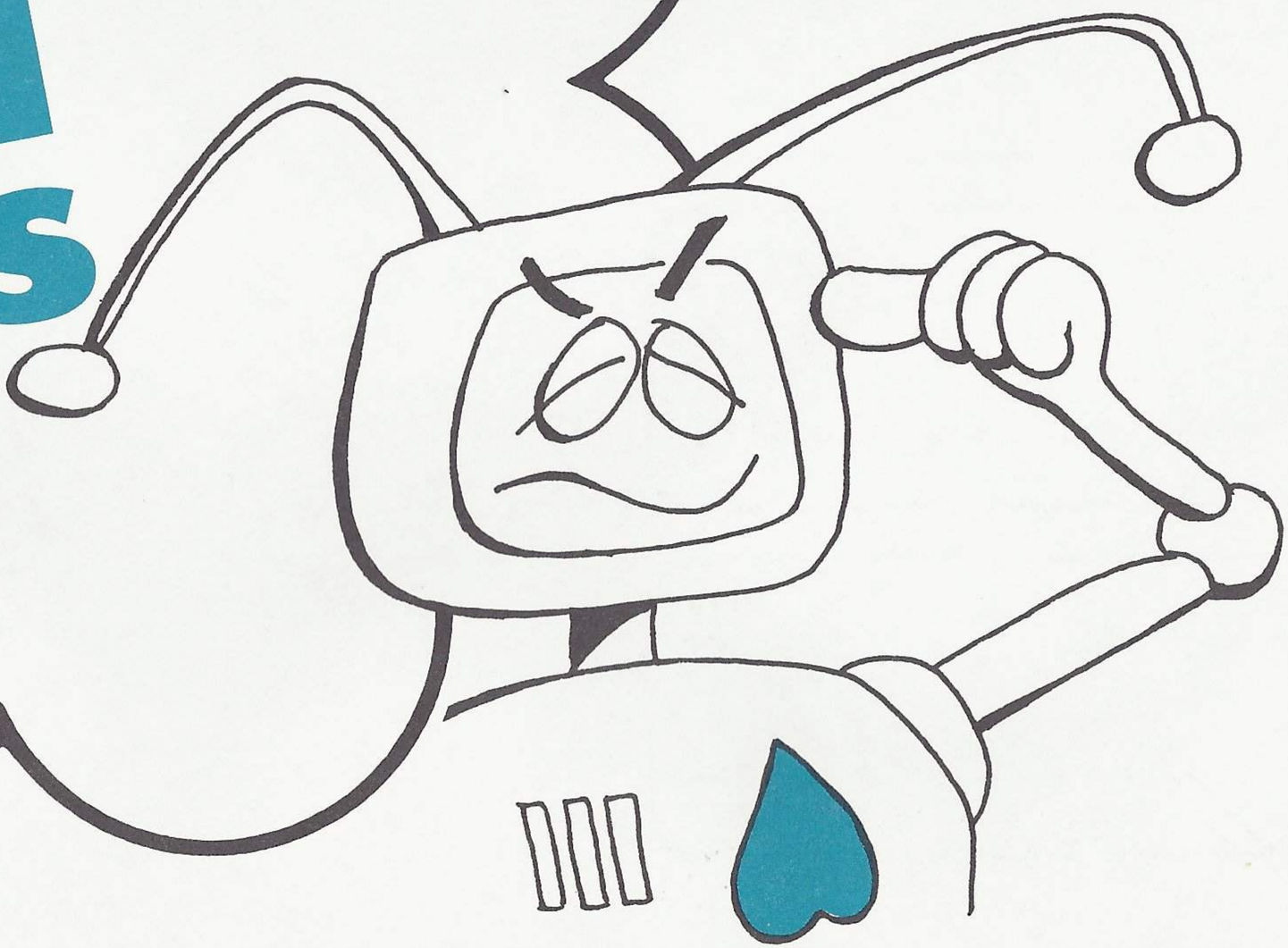
```
10 FOR B = 1 TO 10
20 ? B
30 NEXT B
RUN
```

d

```
10 FOR B = 10 TO 1 STEP -1
20 ? B
30 NEXT B
RUN
```

Naming Numbers and Words

Part 6

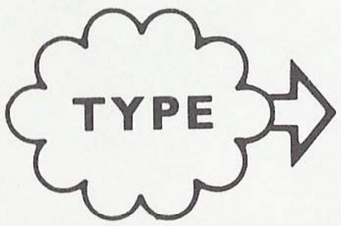


Variables

Imagine there are many small storage boxes inside the computer's memory.

We label the front of each box—like an address on a mailbox.

We can **store** numbers and words in each box.




```
NEW
10 LET M = 5
20 LET X = 10
30 LET A = 2
40 ? M, X, A
RUN
```

Don't forget the commas.

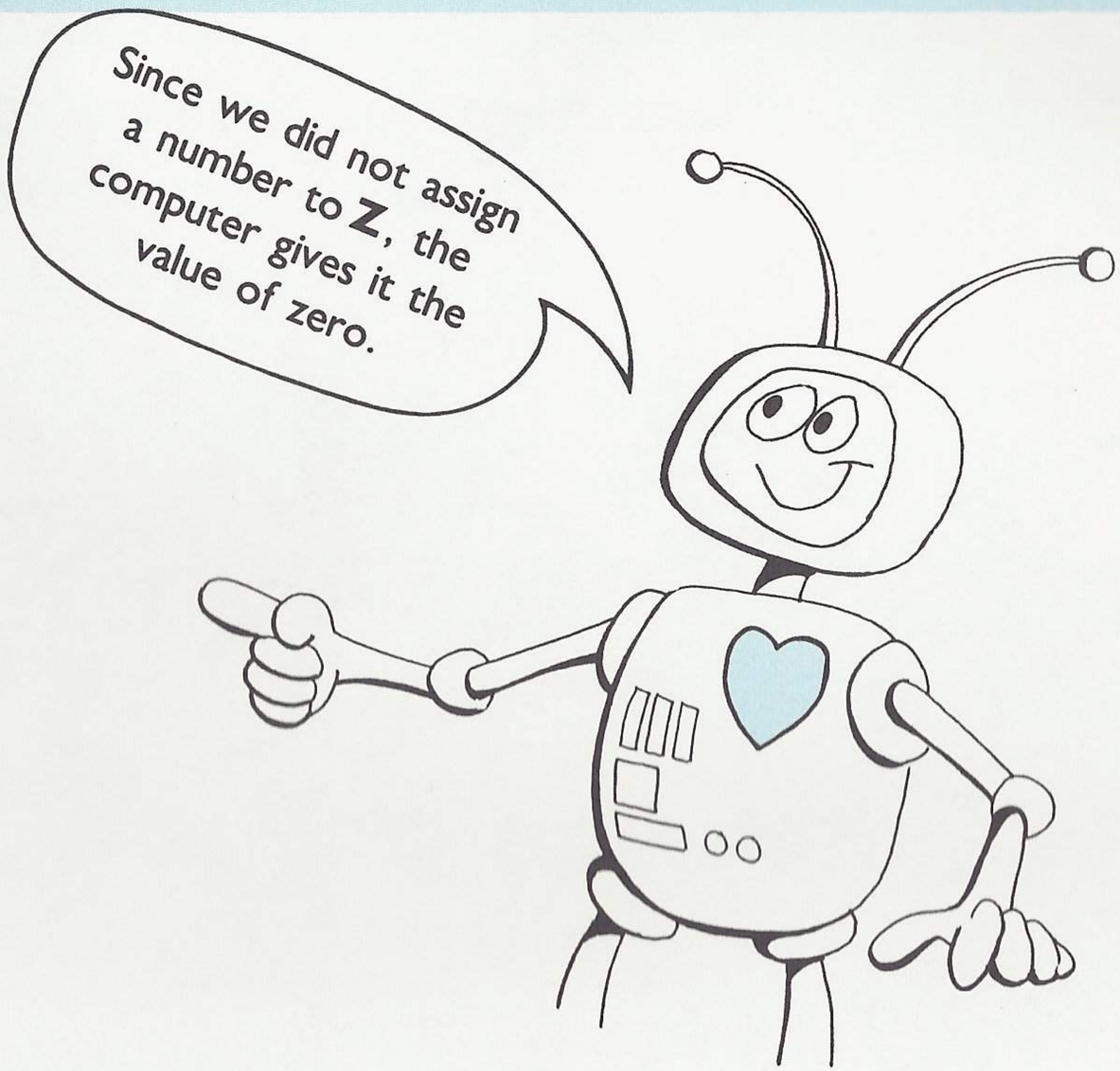
5 is assigned to the *VARIABLE* **M.**
So **M** has the value **5.**
Variable **A** has the value **2.**
Variable **X** has what value?



Now YOU store some more *values* in some other *variables*.
Tell the computer to print out the values of those variables.

Try this

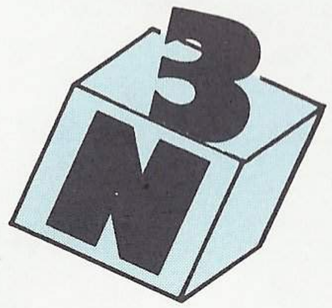
```
NEW
10 LET Q = 10
20 ? Q
30 ? Z
RUN
```



TYPE

```
NEW
10 LET N = 2
30 LET N = 3
40 ? N
RUN
```





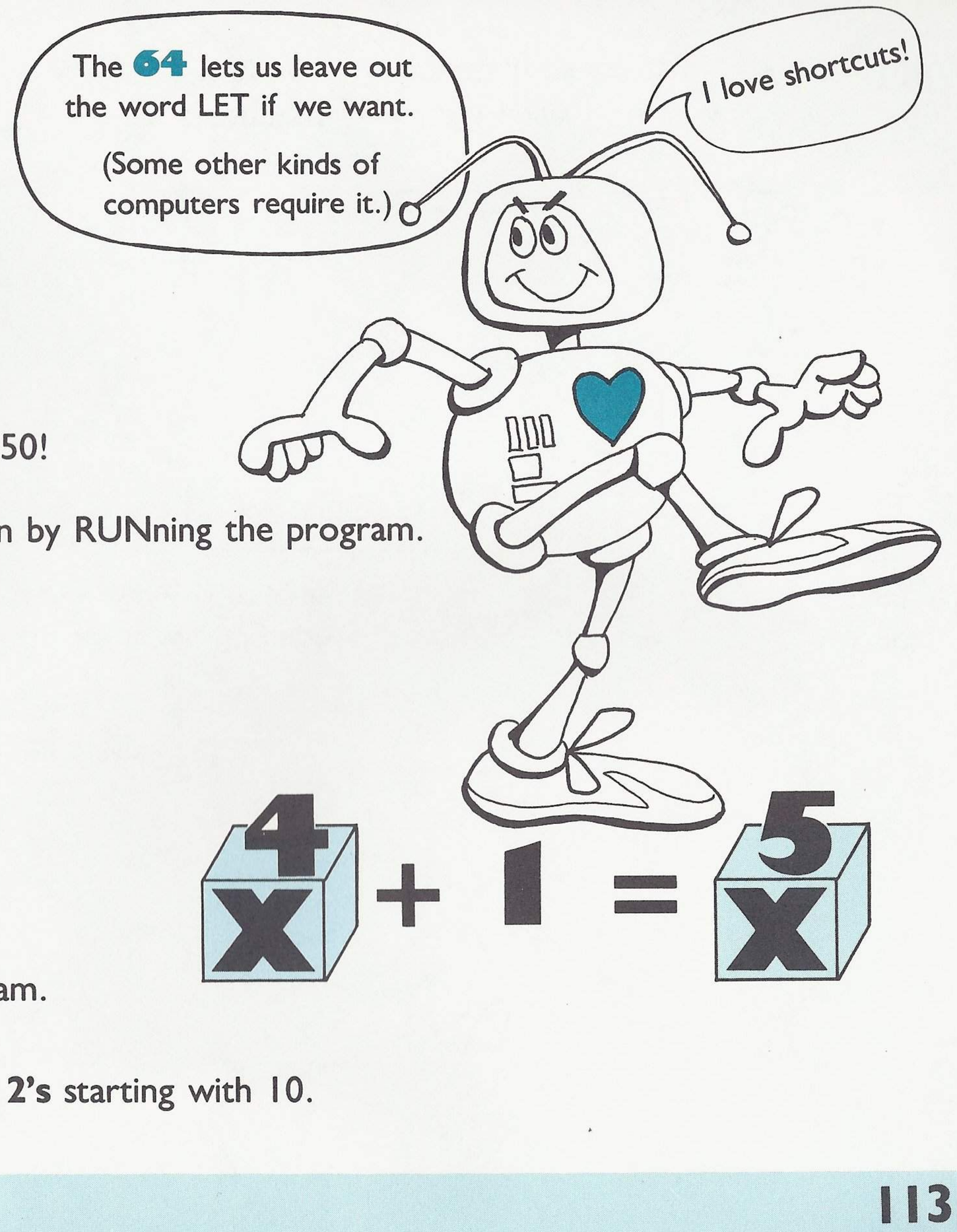


(BYE BYE!!)

N can store only one number at a time. So the **2** disappears when we assign **3** to take its place.

Try this

```
NEW
10 X = 3
20 Z = 2
30 Y = X + Z
40 X = 0
50 ? X, Y, Z
```



PREDICT the output of LINE 50!

Check your prediction by RUNning the program.

TYPE

```
NEW
10 X = 1
20 ? X
30 X = X + 1
40 GOTO 20
RUN
```

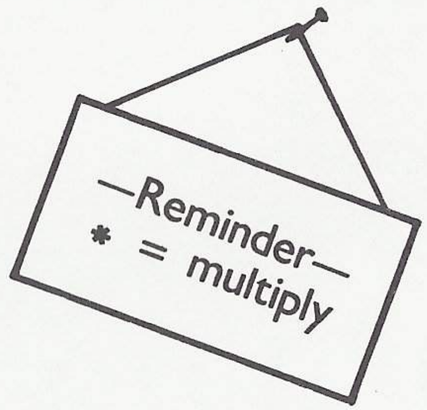
Press RUN STOP to stop your program.

Change the program so it **counts by 2's** starting with 10.

Try this one:

TYPE

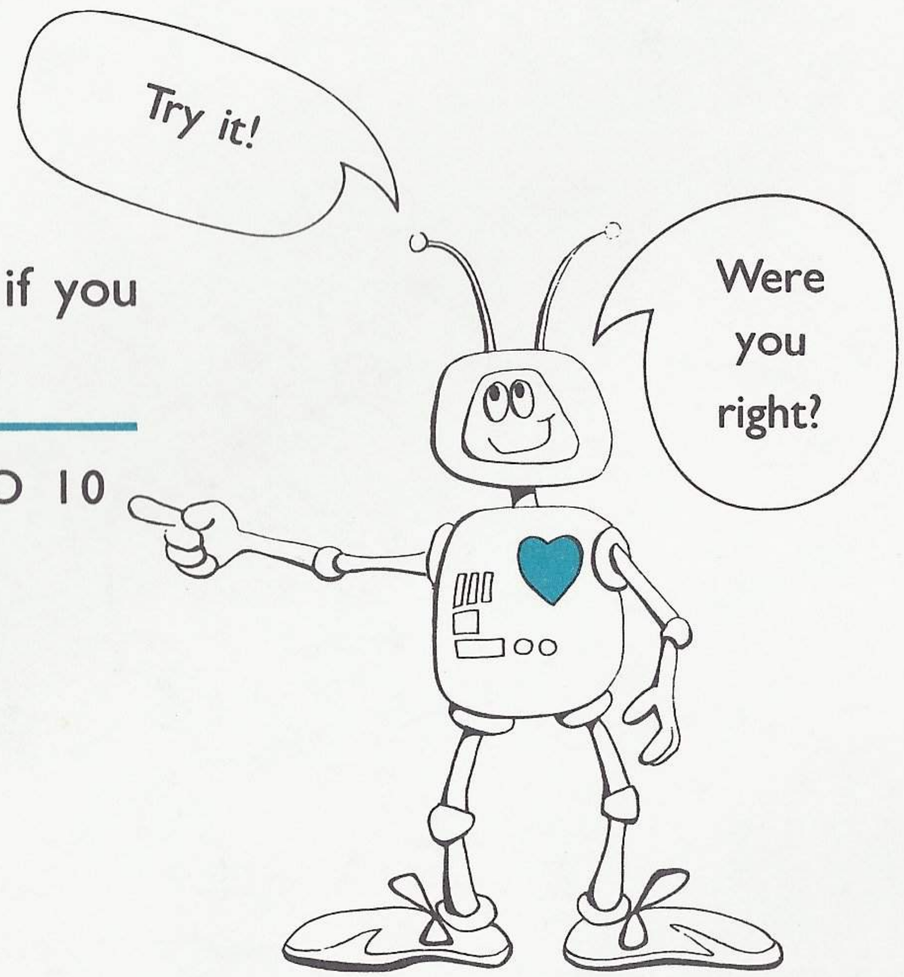
```
NEW
10 X = 0
20 ? X * X
30 X = X + 1
40 GOTO 20
RUN
```



PREDICT...

what would happen if you changed line 40 to...

```
40 GOTO 10
```



How about this one?

TYPE

```
NEW
10 X = 80
20 ? X
30 X = X - 1
40 GOTO 20
RUN
```

Change the program
so it counts **s . . l . . o . . w . . l . . y . . .**
Change it again so it counts backwards by **5's** from **100.**

Animation Made Simple



Luther's Film

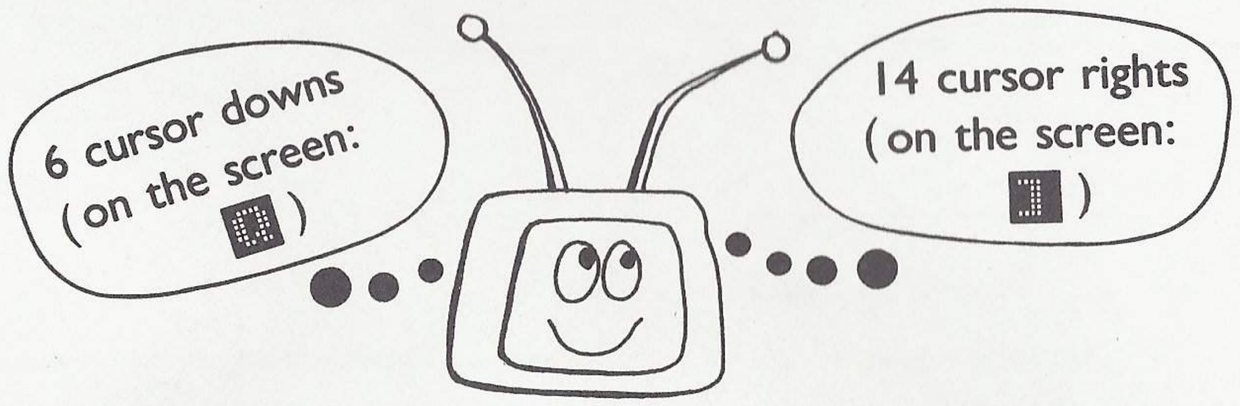
This program was written by a 10-year-old boy right after he learned how to use FOR . . . NEXT loops. Luther combined several computer pictures just as camera pictures are combined to make a movie.

TYPE

```
NEW
50 REM * * * BY LUTHER J. * * *
100 ? " [heart] "
110 POKE 53281,1: POKE 53280,5
120 ? " [cursor] "
130 ? " ↓↓↓↓↓↓ →→→→→→→→→→→→→→ BASKETBALL"
```

100: SHIFT and CLR HOME

120: CTRL and 7 BLU



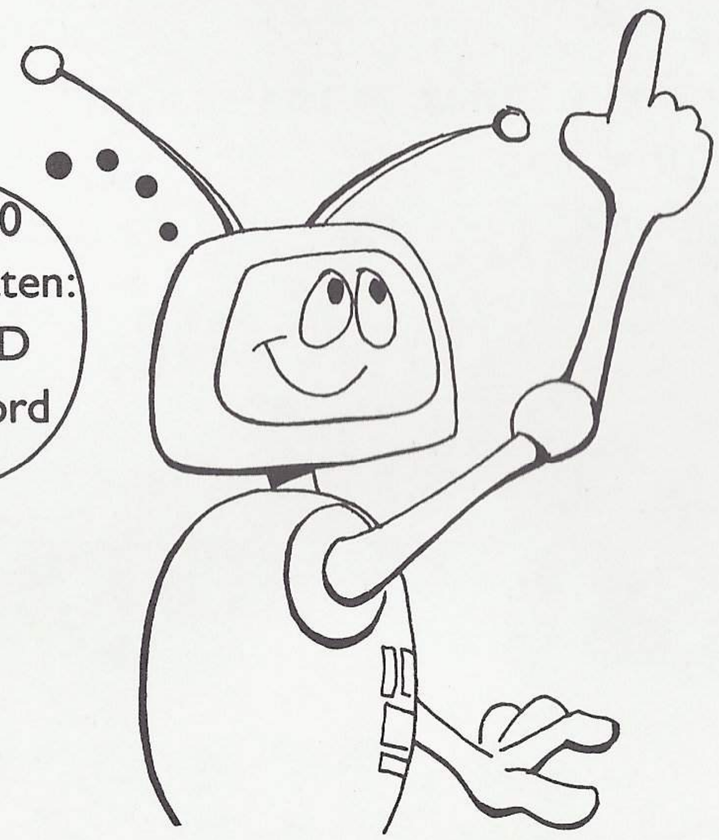
KEEP GOING

TYPE

```
140 FOR DELAY = 1 TO 500: NEXT DELAY
145 ? "■" <- CTRL and 2 WHT
150 ? "■" <- Press just CLR HOME . . . no SHIFT .
160 ? " _ _ _ ● _ _ _ _ _ _ _ _ _ ▌"
170 ? " _ _ _ ▦ / ○ _ _ _ _ _ _ W▌"
180 ? " _ _ _ ▌▌ _ _ _ _ _ _ _ _ ▌"
190 FOR DELAY = 1 TO 100: NEXT DELAY
```

You can put more than one command on the same line if they are separated by a colon (:).

On lines 140 and 190 we could have just written: FOR D . . . NEXT D instead of using the word DELAY.



The last statement FREEZES the basketball player picture on the screen for a very short time.

KEEP GOING

More **TYPING**

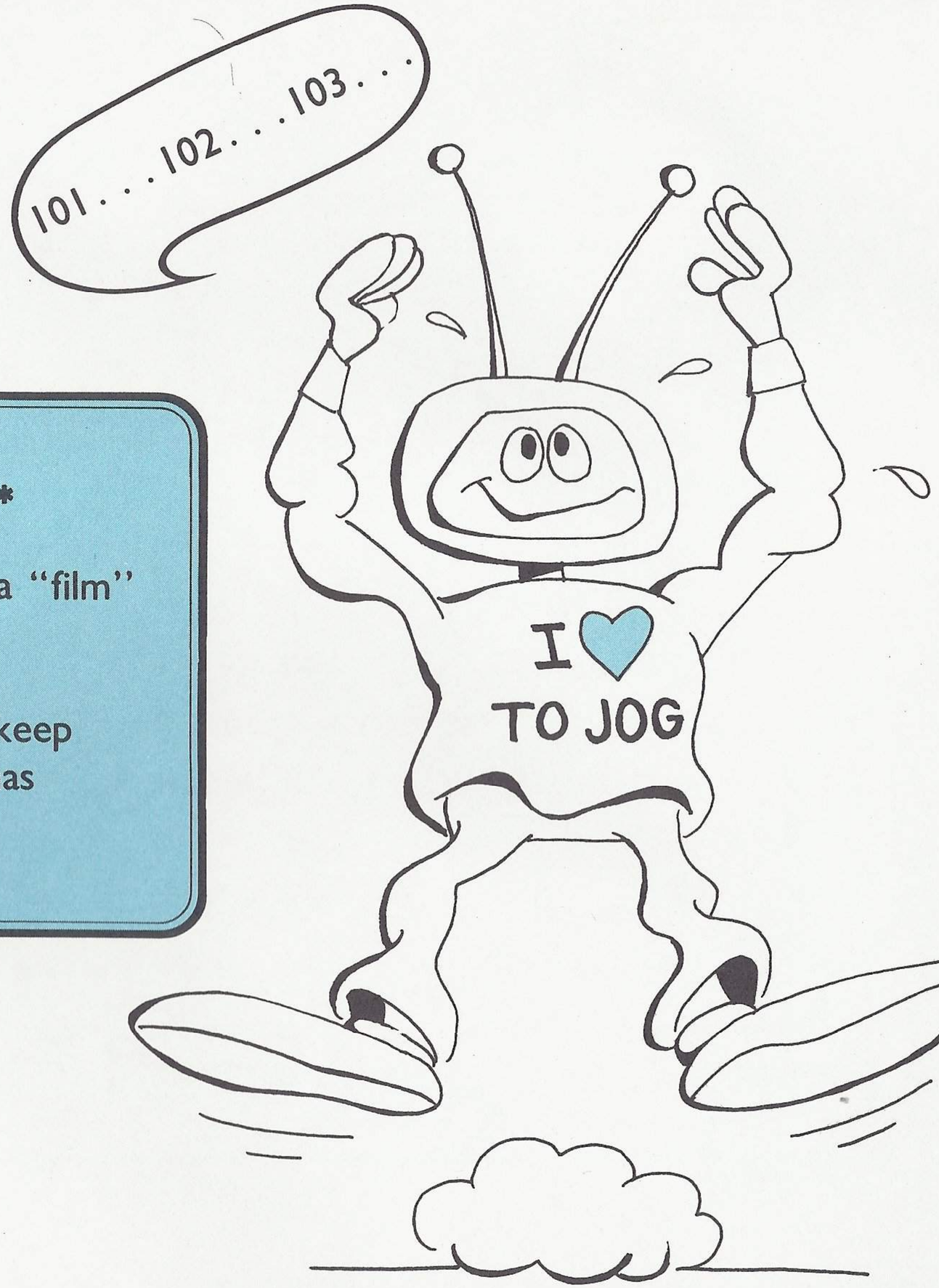
```
250 ? "[S]"
260 ? "   - - -●- - - - - - - - - -|"
270 ? "   - - -[]—○- - - - - -W|"
280 ? "   - - -|| - - - - - - - - -|"
290 FOR DELAY=1 TO 100:NEXT DELAY
350 ? "[S]"
360 ? "   - - -●- - - - - - - - - -|"
370 ? "   - - -[]\- - - - - - - -W|"
380 ? "   - - -|| ○- - - - - - - -|"
390 FOR DELAY=1 TO 100:NEXT DELAY
450 ? "[S]"
460 ? "   - - -●- ○- - - - - - - -|"
470 ? "   - - -[]/ /- - - - - - -W|"
480 ? "   - - -|| - - - - - - - - -|"
```



KEEP GOING

TYPE

```
490 FOR DELAY = 1 TO 100: NEXT DELAY
550 ? "■"
560 ? "   ---●----------○-|
570 ? "   ---▦--//-------W|
580 ? "   ---|  |---------|
590 FOR DELAY = 1 TO 100: NEXT DELAY
650 ? "■"
660 ? "   ---●----------|    ----┌----┐
670 ? "   ---▦--//-------W|   ----|    |
680 ? "   ---|  |---------○|  ----└----┘
690 FOR DELAY = 1 TO 100: NEXT DELAY
700 S = S + 2 : ? "▪"
800 ? " ↑↑↑→→→
```

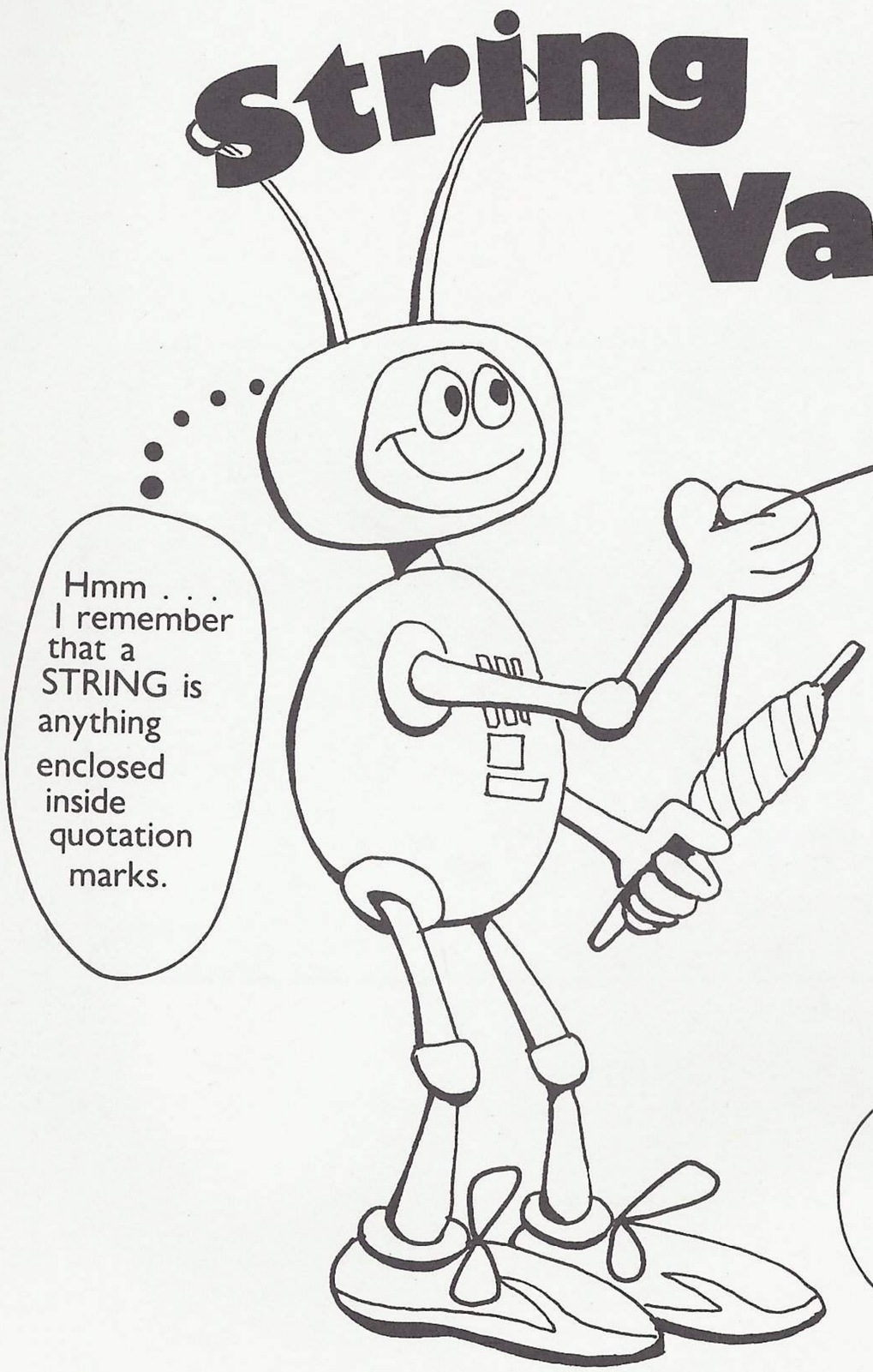


CHALLENGE

Use the same techniques to make a "film" of a person doing jumping jacks.

Can you add a "counter" to help keep track of the number of jumps he has made?

String Variables

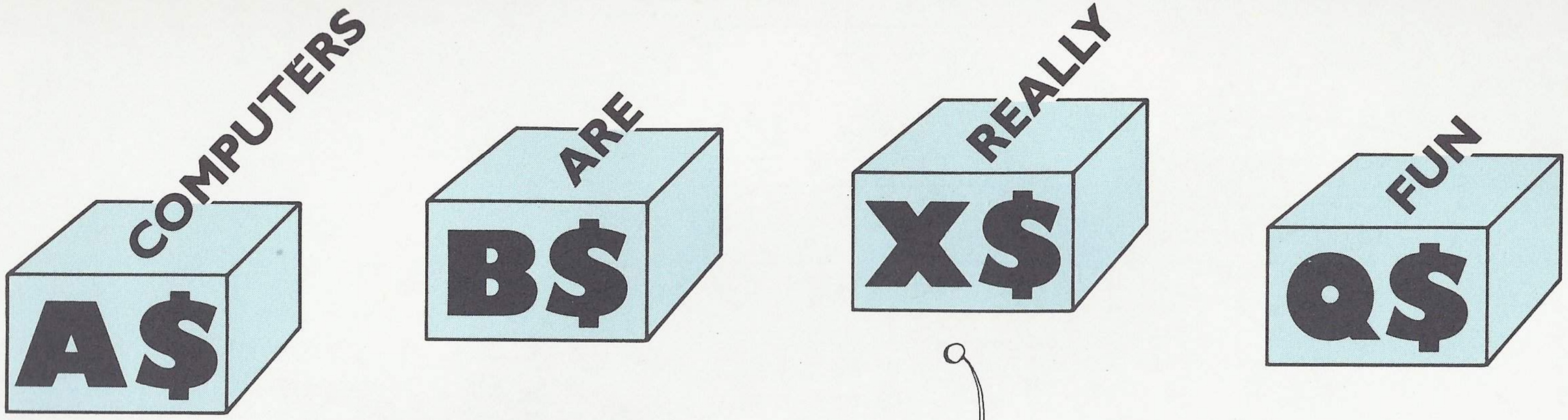


The variable "BOXES" in the computer's memory can store STRINGS too! We call these boxes STRING VARIABLES.

A$ = " ♥ COMPUTERS ♥ "

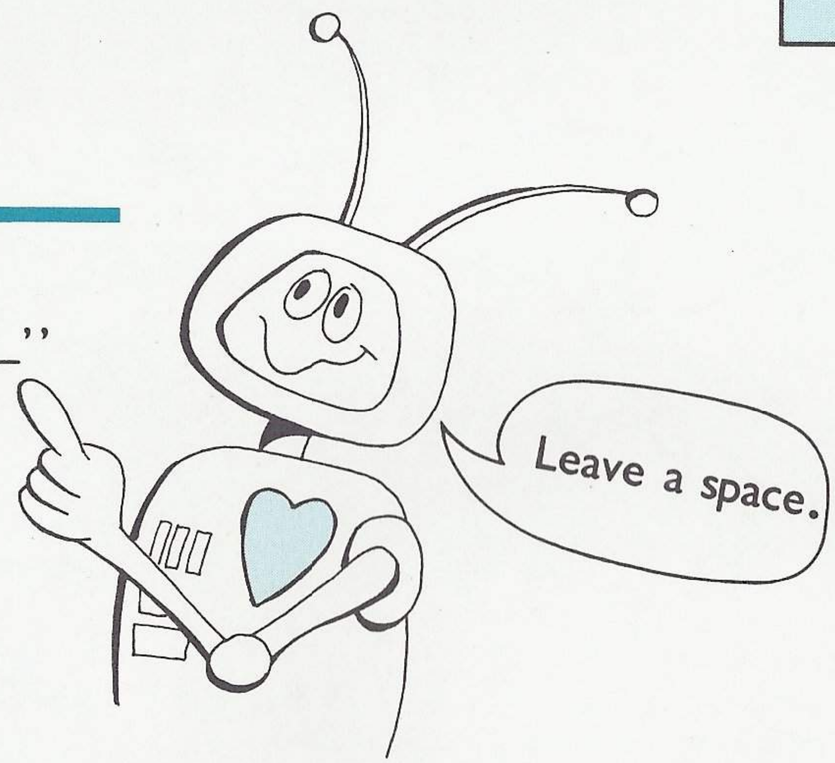
String variables must have a **$** at the end.

The string must be enclosed in quotation marks. A string can be several words—or even combinations of letters, graphics, numbers, and color symbols.



TYPE

```
NEW
10 A$ = "COMPUTERS _"
20 B$ = "ARE _ "
30 X$ = "REALLY _ "
40 Q$ = "FUN _"
50 ? A$ B$ X$ Q$
RUN
```



Change line 50

```
50 ? B$ A$ X$ X$ Q$ "?"
RUN
```

Now YOU change line 50 so the computer says:
COMPUTERS ARE FUN FUN FUN!

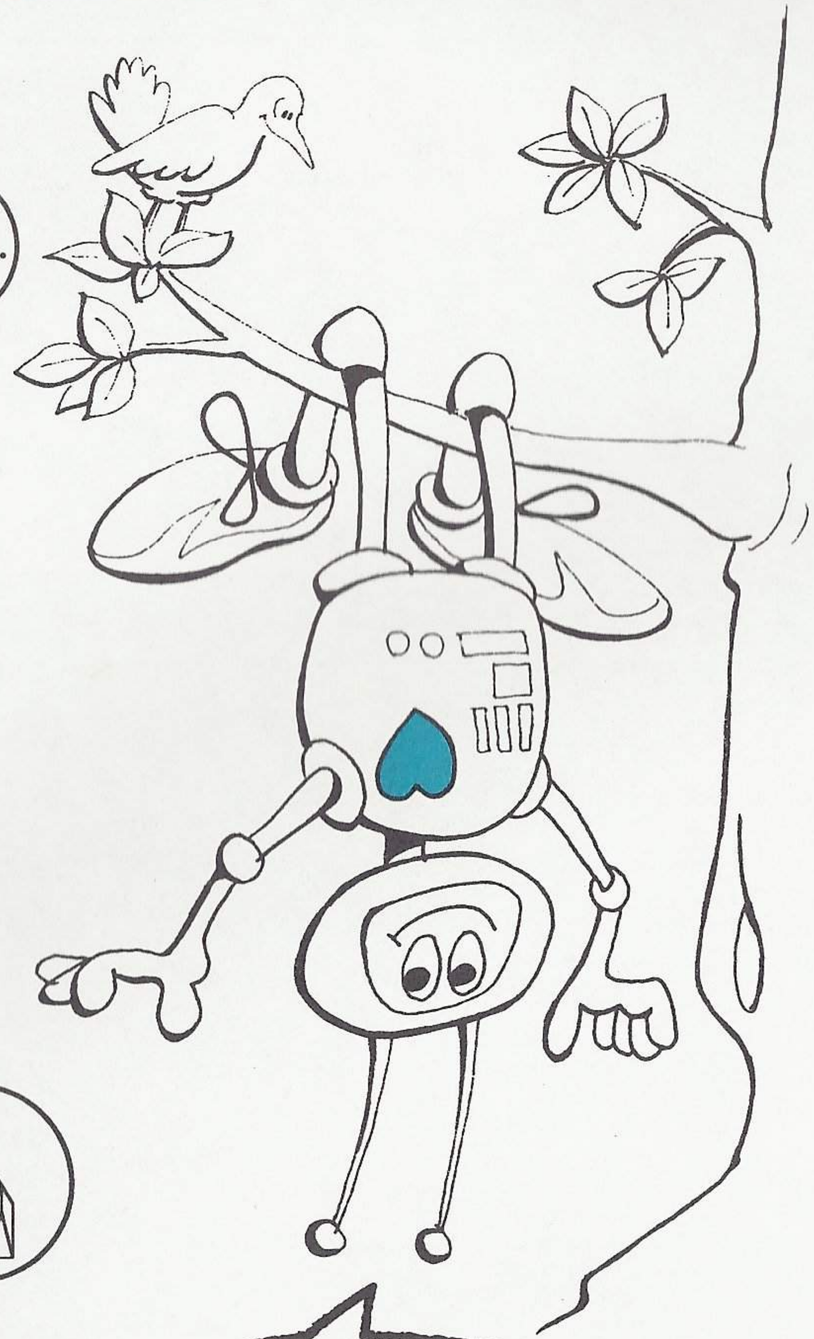
String Variables can also contain color or graphics symbols.

Press CTRL and # 3 RED for red.

TYPE

```
NEW
10 POKE 53281,0
20 L$ = "■ ♥ ♥ ♥ "
30 ? " ■ I" L$ " ■ MY COMPUTER."
RUN
```

Press CTRL and " 2 WHT to change the writing to white.



Add more string variables with more designs. Make WILD designs!

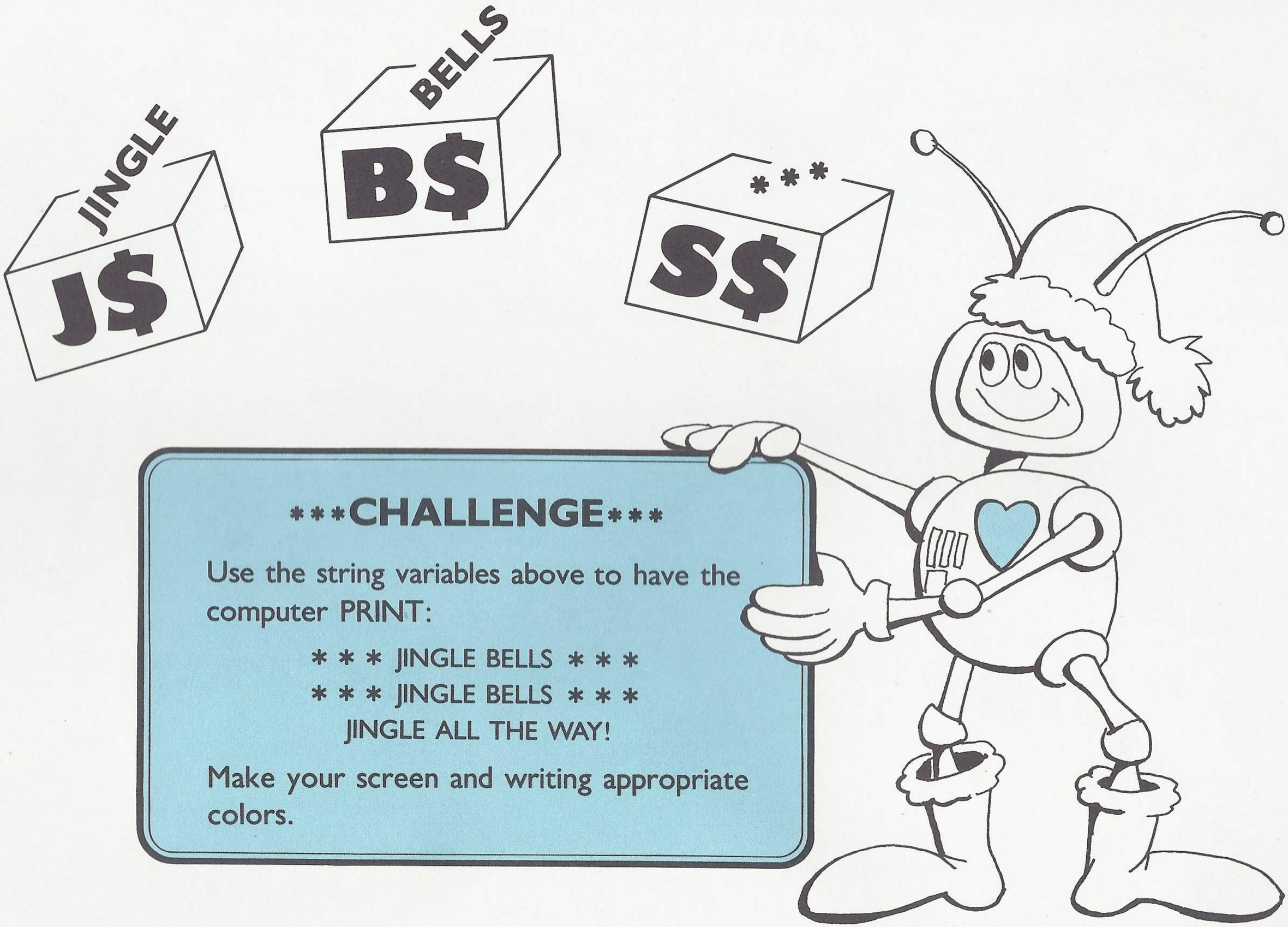
Try this one

```
NEW
10 A$ = " ■ ● ○ ● "
20 B$ = " ■ ◥ ◤ "
30 C$ = " ■ ◆ "
40 ? A$ B$ C$;
50 GOTO 40
RUN
```

■ = green
CTRL and & 6 GRN

■ = red
CTRL and # 3 RED

■ = yellow
CTRL and (8 YEL



CHALLENGE

Use the string variables above to have the computer PRINT:

* * * JINGLE BELLS * * *
* * * JINGLE BELLS * * *
JINGLE ALL THE WAY!

Make your screen and writing appropriate colors.

String Variable Graphics

Let's get Really Fancy!

TYPE

```
NEW
50 POKE 53281,0
100 REM * * A MAGNIFICENT MAN * *
110 M$ = "  _ _ ◣ ○ ↓ ← ← / ■ \ ↓ ← ← ▌ ▌ "
```

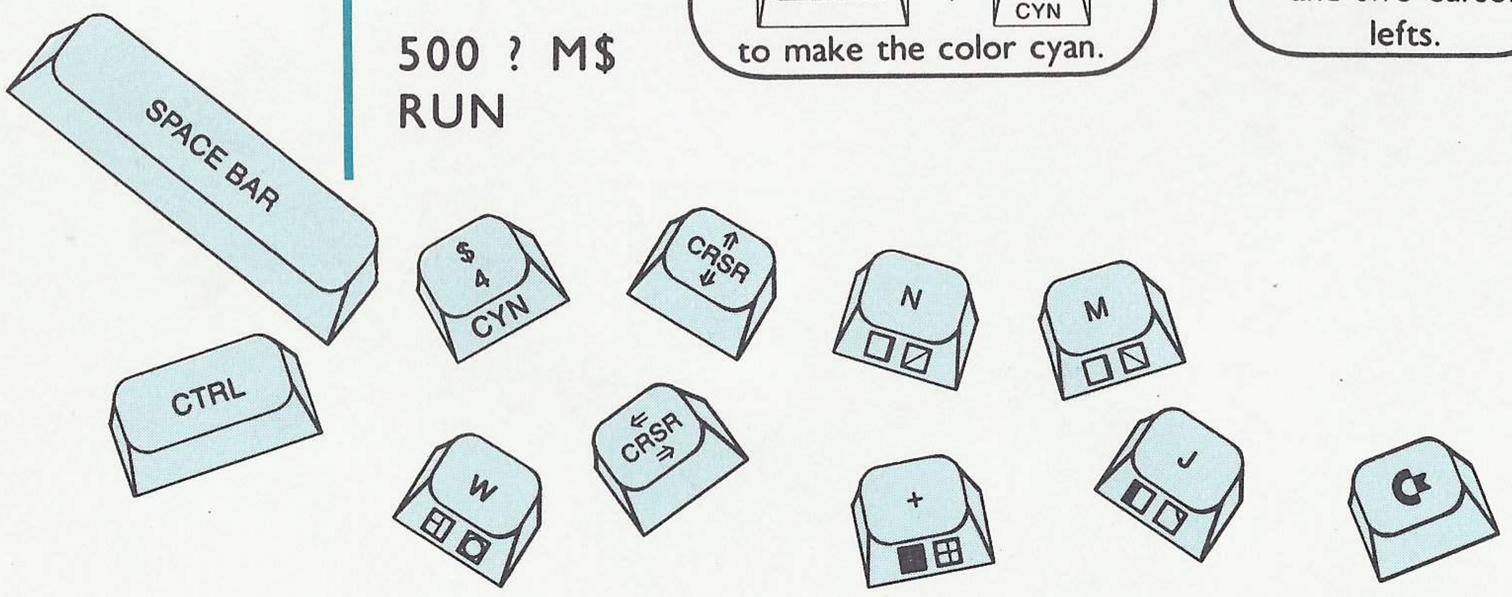
2 spaces.

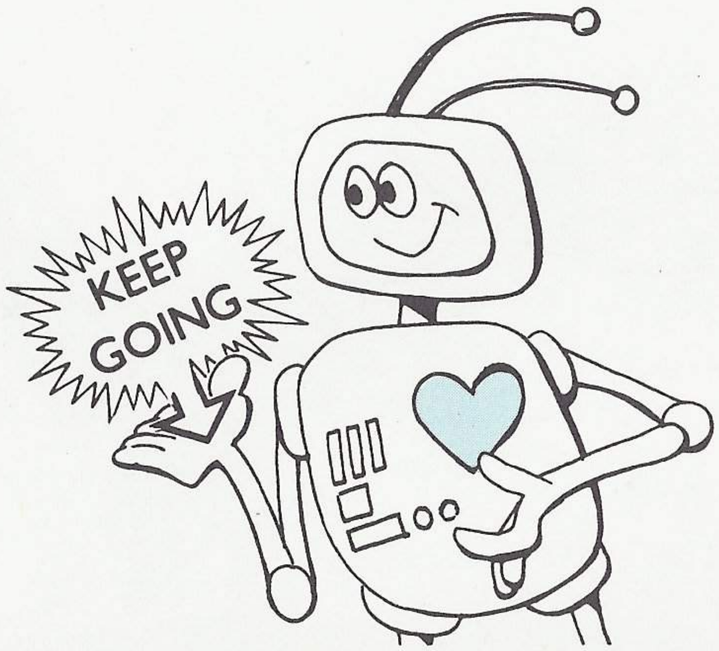
CTRL + $ 4 CYN to make the color cyan.

One cursor down and two cursor lefts.

C= + J

```
500 ? M$
RUN
```





ADD some more.

```
200 REM ** A REMARKABLE ROCKET **
210 R$ = " ■ / \ ↓ ← ← ■ ■ ↓ ← ← ■ ■ ↓ ← ← ◤ ◥ "
```

```
600 ? R$
RUN
```

Press [CTRL] and [8 YEL] to make gray.

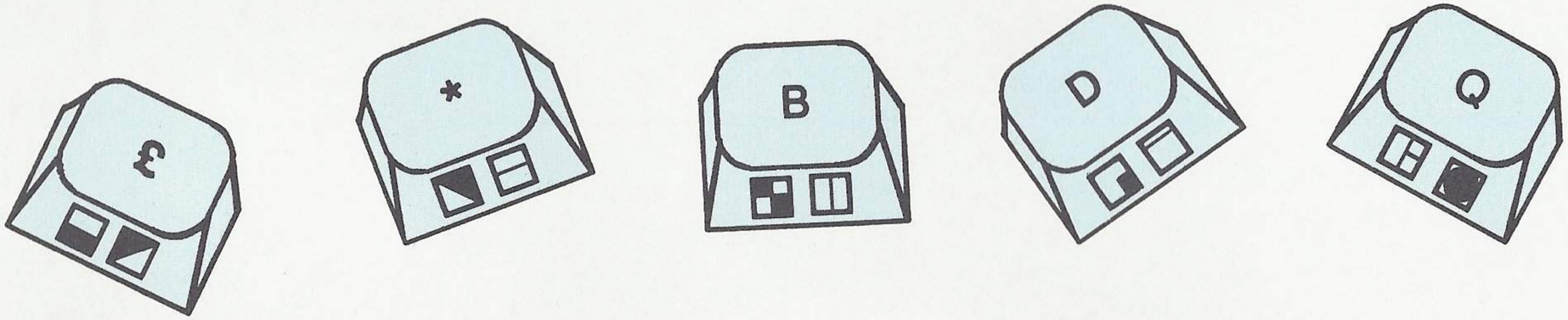
CURSOR DIRECTIONS

ADD more yet.

```
300 REM ** A SWELL SUN **
310 S$ = " ▦ \ | / ↓ ← ← ← ▬ ● ▬ ↓ ← ← ← / | \ "
```

```
700 ? S$
RUN
```

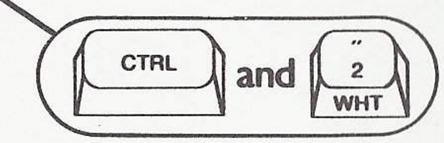
Press [CTRL] and [8 YEL] to make yellow.



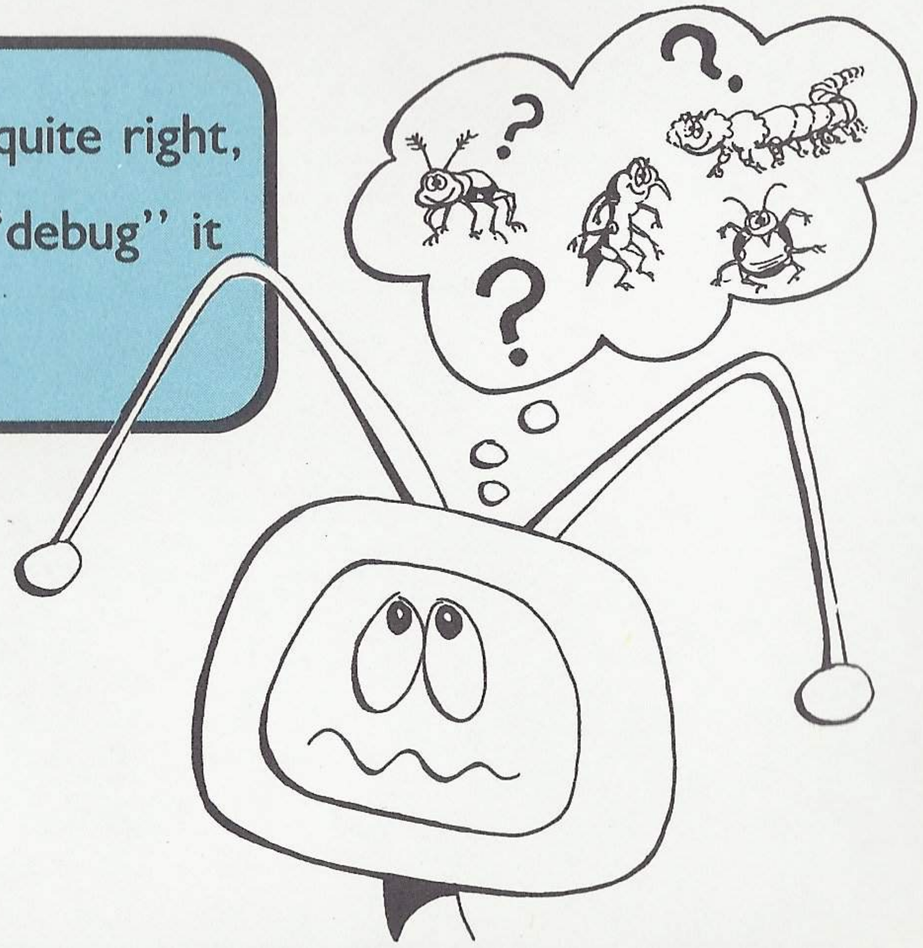
KEEP GOING

ADD
one more

```
400 REM * * TWINKLY STARS * *
410 T$ = "■  * _ _ * _ * ↓ ← ← ← ← * _ * _ * ↓ ← ← ← ← * _ * * _ * "
800 ? T$
RUN
```

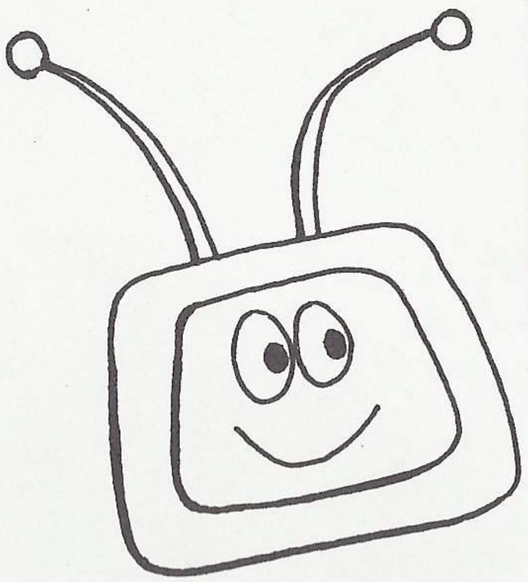


If any of your pictures doesn't look quite right, LIST your program. See if you can "debug" it (fix the mistake).



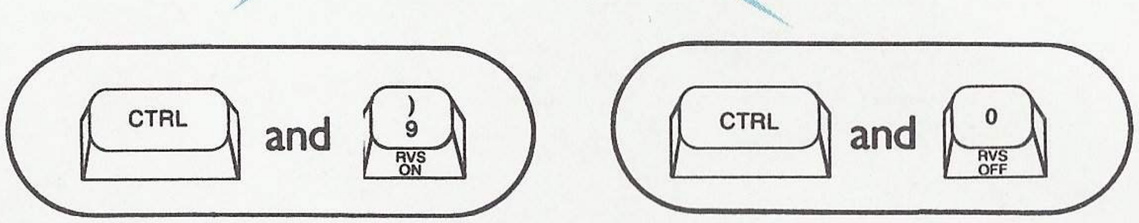
KEEP
GOING

When all your pictures look right, replace lines 500, 600, 700, and 800:



```
10 ? " ■ "
500 ? "ONE EXCITING DAY A" M$
600 ? "DECIDED TO GO FOR A RIDE IN A " R$
700 ? "THE" M$ "HEADED UP AROUND THE" M$
800 ? T$ " _ TWINKLED ALL AROUND THE" M$
900 ? "WHAT A ■ FUN FUN ■ DAY!"

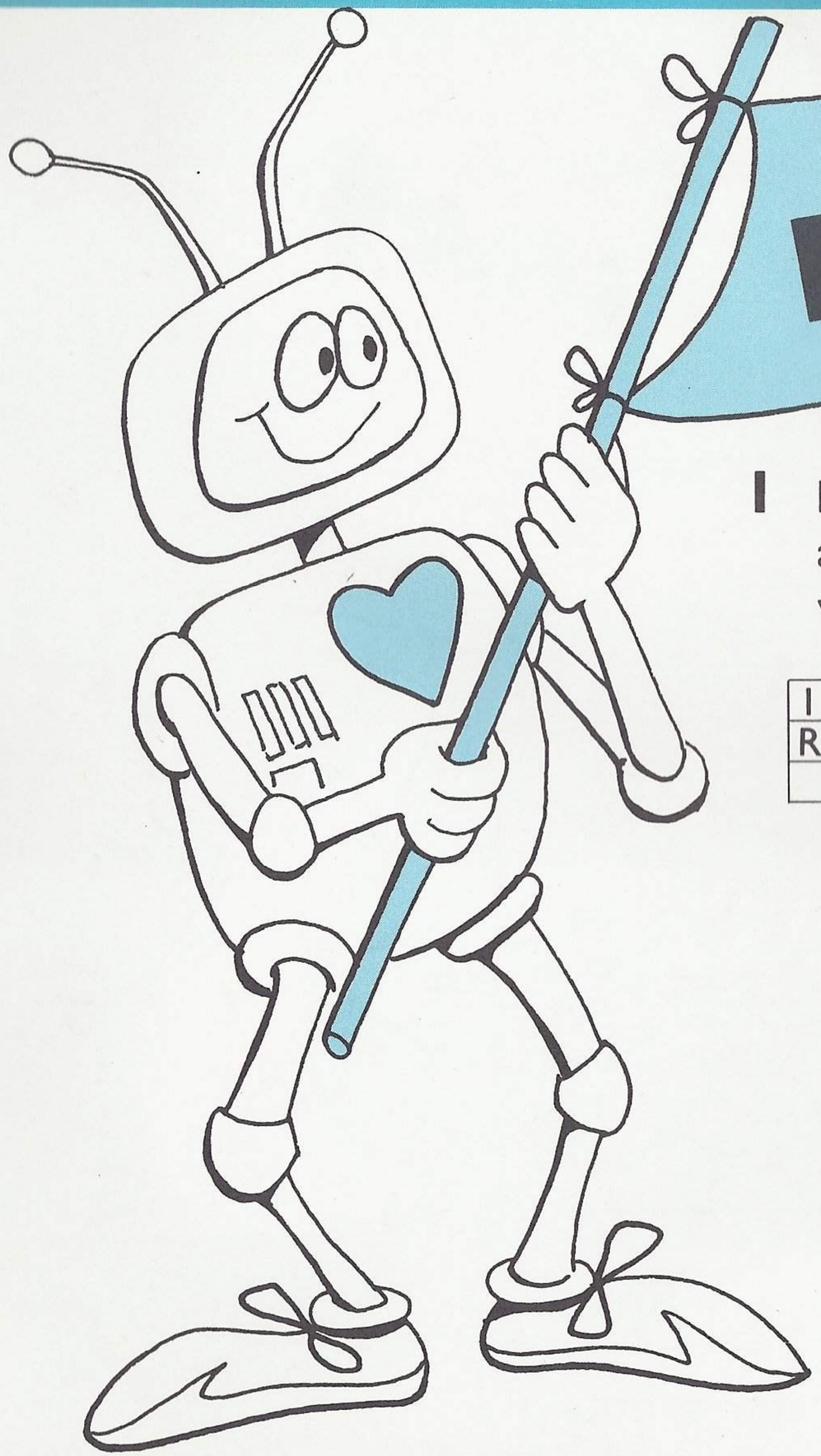
RUN
```



Now **edit** your program so that all the **text** is white.

WOW!

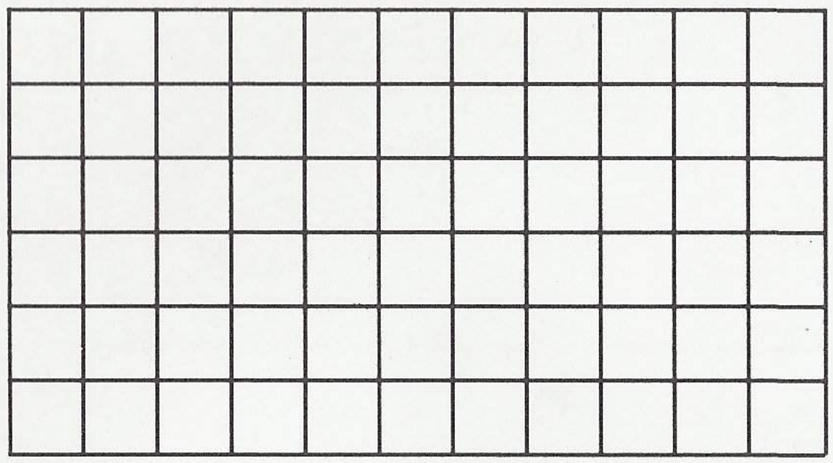
You might want to SAVE your SUPER Story!

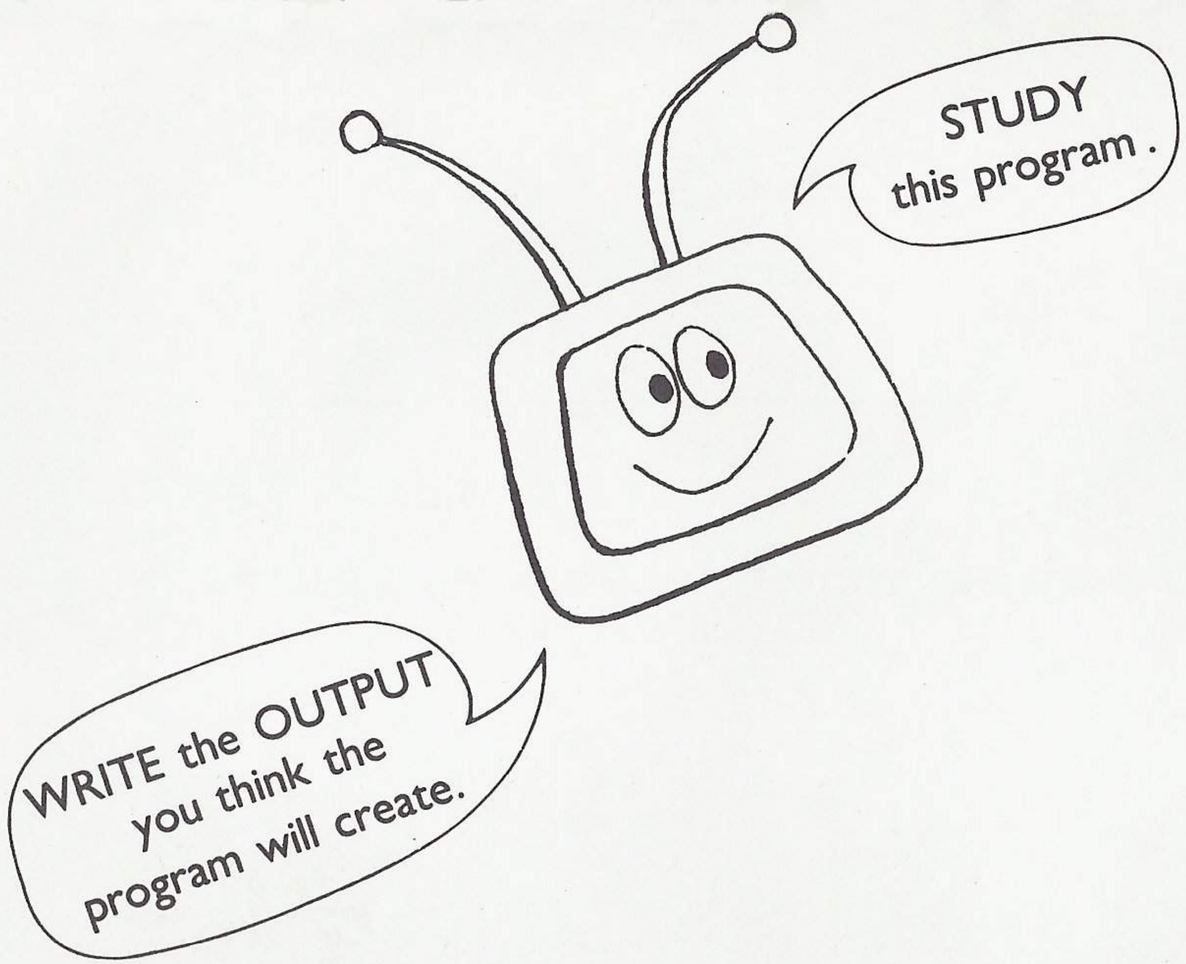


Review

1 DRAW what you predict would appear on the screen if this program were run:

```
10 ?"  ┌──┐↓←←←|  ┌──┐↓←←←←←  ●  ●  ''
RUN
```





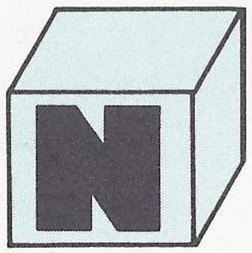
2

```
10 H$ = "HAPPY"
20 B$ = "BIRTHDAY"
30 T$ = "TO"
40 Y$ = "YOU"
50 D$ = "DEAR FRIEND"
60 FOR N = 1 TO 2
70 ? H$ B$ T$ Y$
80 NEXT N
90 ? H$ B$ D$
100 ? H$ H$ B$ T$ Y$
```

3 Fill the computer's memory boxes with the values they would hold *after* these programs have RUN.

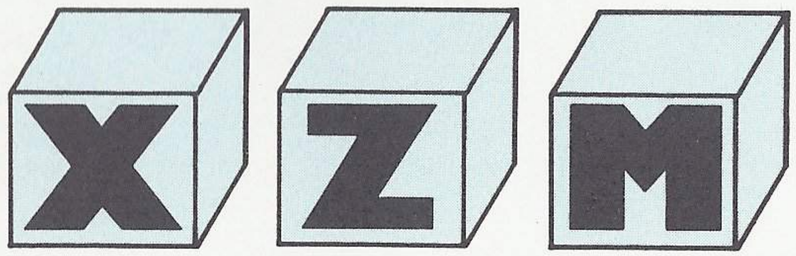
a

```
10 N = 3
20 N = N * 2
30 ? N
```



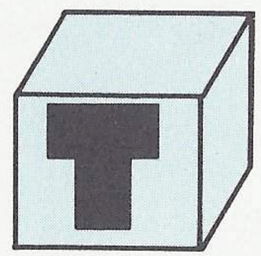
b

```
10 X = 2
20 Z = 3
30 X = X + Z
40 ? X, Z, M
```



c

```
10 T = 1
20 FOR Q = 1 TO 3
30 T = T + 2
40 NEXT Q
50 ? T
```



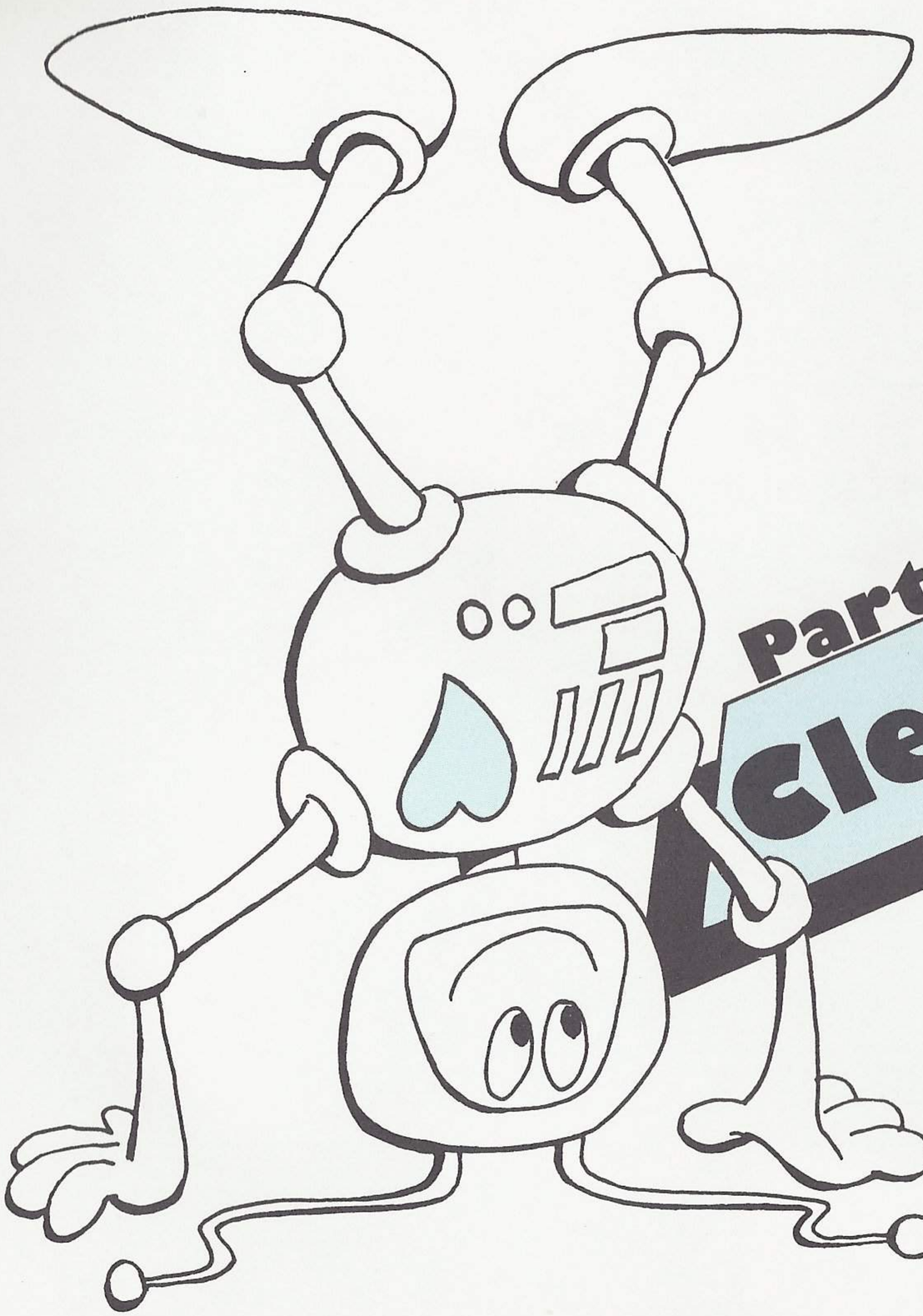
4 Complete these programs so that the computer will:

a count by 5's

```
_ _ _ _ _ _ _ _ X = 0
20 _ _ _ _ _ _ _ _ X
30 X = X + _ _ _ _ _ _
40 GOTO _ _ _ _ _ _ _
RUN
```

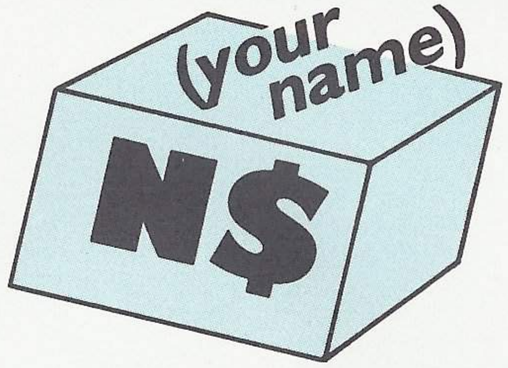
b double the value of X over and over

```
10 _ _ _ _ _ _ _ _ = 1
_ _ _ _ _ _ _ ? X
30 X = _ _ _ _ _ _ _
40 _ _ _ _ _ _ _ 20
RUN
```



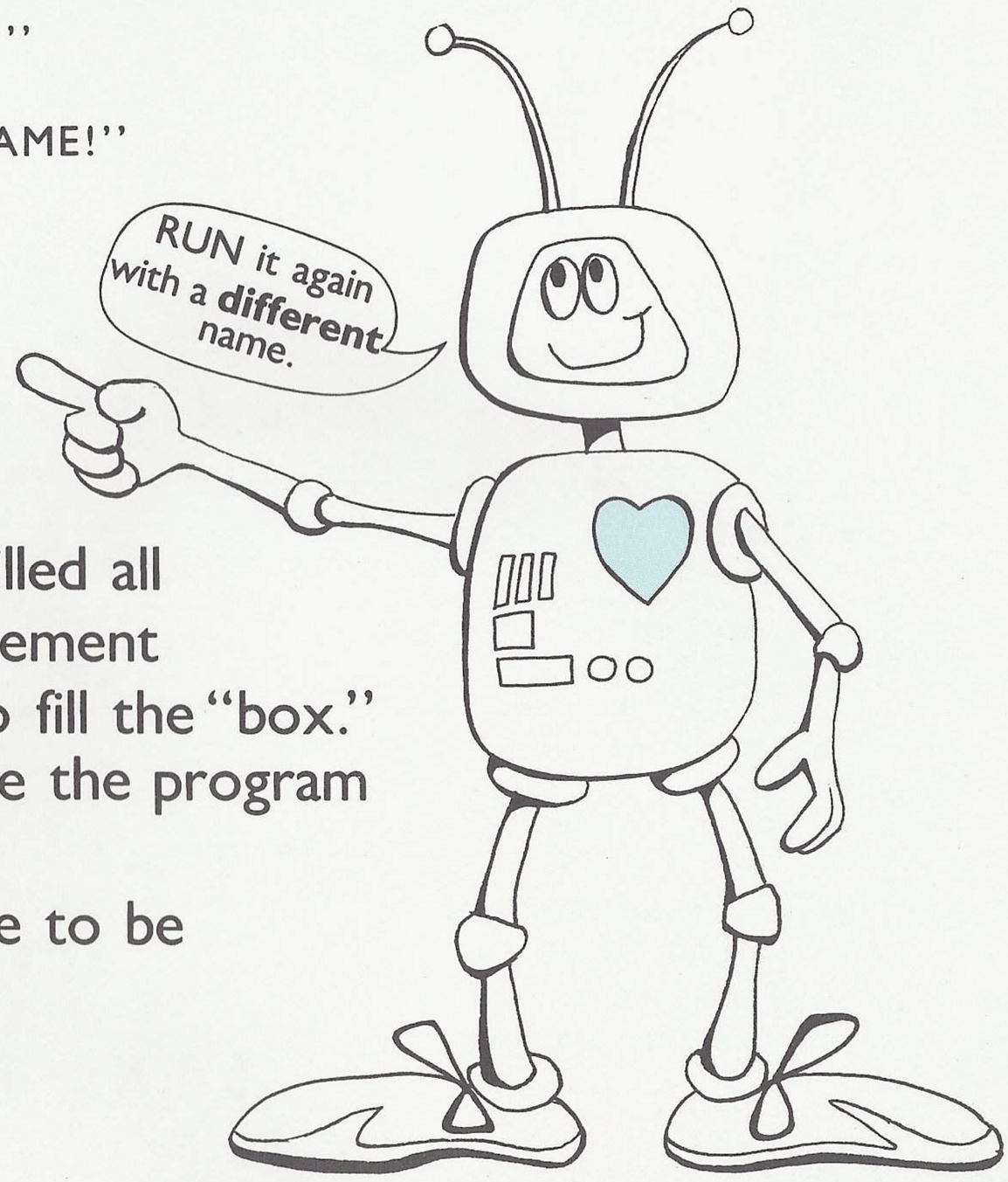
Part 1
Clever Computing

INPUT Statements



TYPE

```
NEW
100 ? "WHAT IS YOUR NAME?"
110 INPUT N$
120 ? N $ "_ IS A SNAZZY NAME!"
RUN
```

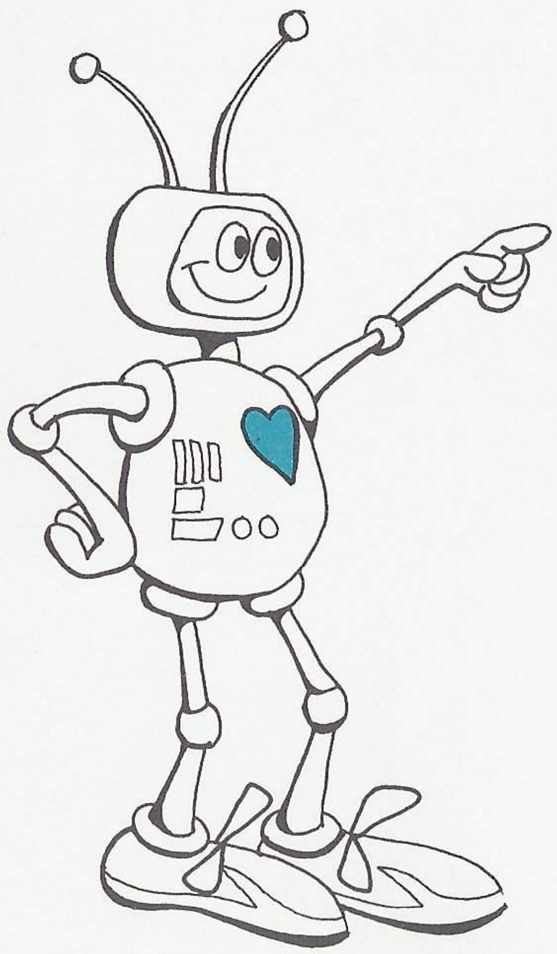


Up to now the PROGRAMMER has filled all the variable "boxes." The INPUT statement asks the person *using* the computer to fill the "box." The computer stops to ask—each time the program runs.

This program asks for a person's name to be put in a box called N$.

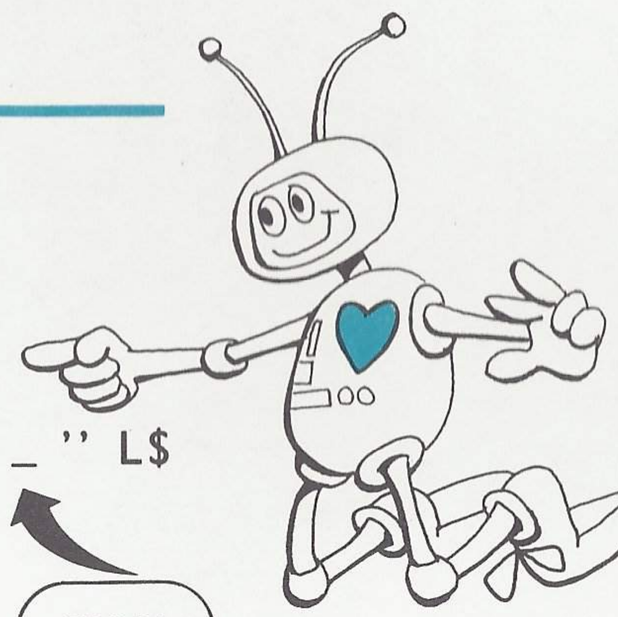
Try another one:

We need the $ because we are asking for a word (or string).



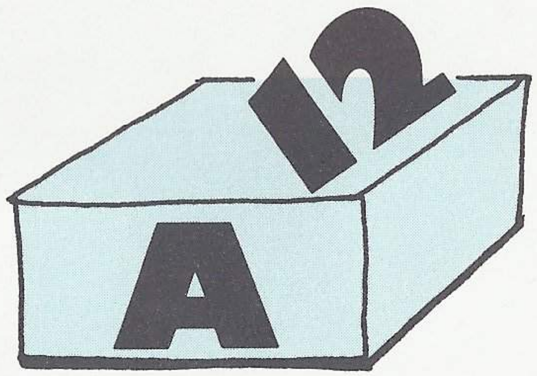
```
NEW
10 ? "WHERE DO YOU LIVE?"
20 INPUT L$
30 ? "HOW OLD ARE YOU?"
40 INPUT A
50 ? "I WONDER IF YOU HAVE LIVED IN _ " L$
60 ? "ALL" A "YEARS."
RUN
```

We don't need the $ because we are asking for a number.



space





Be a **wallpaper** designer!

TYPE

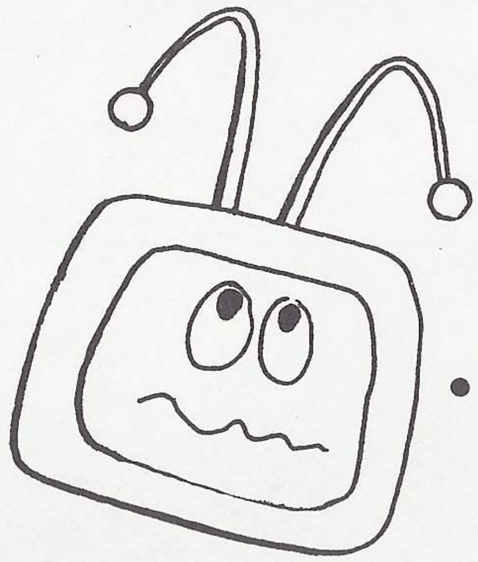
```
NEW
100 ? "LET'S DESIGN FANCY WALLPAPER!"
110 ? "WHAT 4 KEYS SHALL I USE";
120 INPUT D$
130 POKE 53281,7
140 ? "■"
150 ? "■"
160 FOR Z = 1 TO 200
170 ? D$;
180 NEXT Z
RUN
```

CTRL and 7 BLU

If we put a semicolon (;) here, the PRINTing will stay on the same line.

The question mark created by the INPUT statement will then be on this line—which is where we want it.

This semicolon (;) also tells the computer to stay on the same line. The design will be printed clear across the screen instead of in a long column.



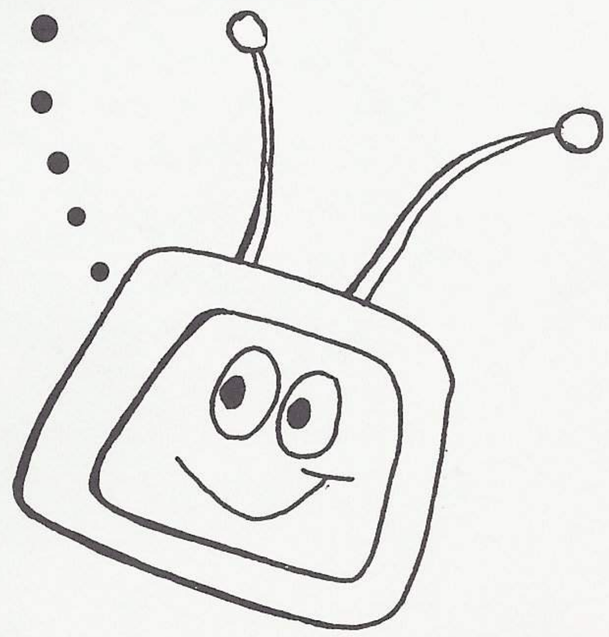
Ahhh . . .
The INPUT statement always creates a question mark.

The 64 can do your math homework for you!

TYPE

```
NEW
10 ? "WHAT IS YOUR NAME";
20 INPUT N$
30 ? " ♥ "
40 ? "HELLO _ " N$
50 ? "LET'S DO YOUR MATH HOMEWORK."
60 ? "TYPE IN TWO NUMBERS TO ADD."
70 ? "PRESS RETURN AFTER EACH NUMBER."
80 INPUT A
90 INPUT B
100 ? "THE ANSWER IS" A + B
110 FOR Z = 1 TO 1200: NEXT Z
120 ? : ? : ?
130 ? "LET'S DO SOME MORE!"
140 GOTO 60
RUN
```

To interrupt an ***INPUT*** program you must press *both* RUN STOP and RESTORE.



Change the program so that it does your *multiplication* problems.



Your Turn!

CHALLENGE

Write a program that asks:

- How many scoops of ice cream can you eat in one hour?
- How many hours a day do you eat ice cream?

so the **64** can tell you:

- You eat X scoops of ice cream a day!

ADD to your program (do *not* type NEW):

- One scoop of ice cream has 200 calories. That means you eat X calories worth of ice cream in one day!

Letter Writing

Let's use our computer to create **letters** for us.

START with a letter like one you may have written:

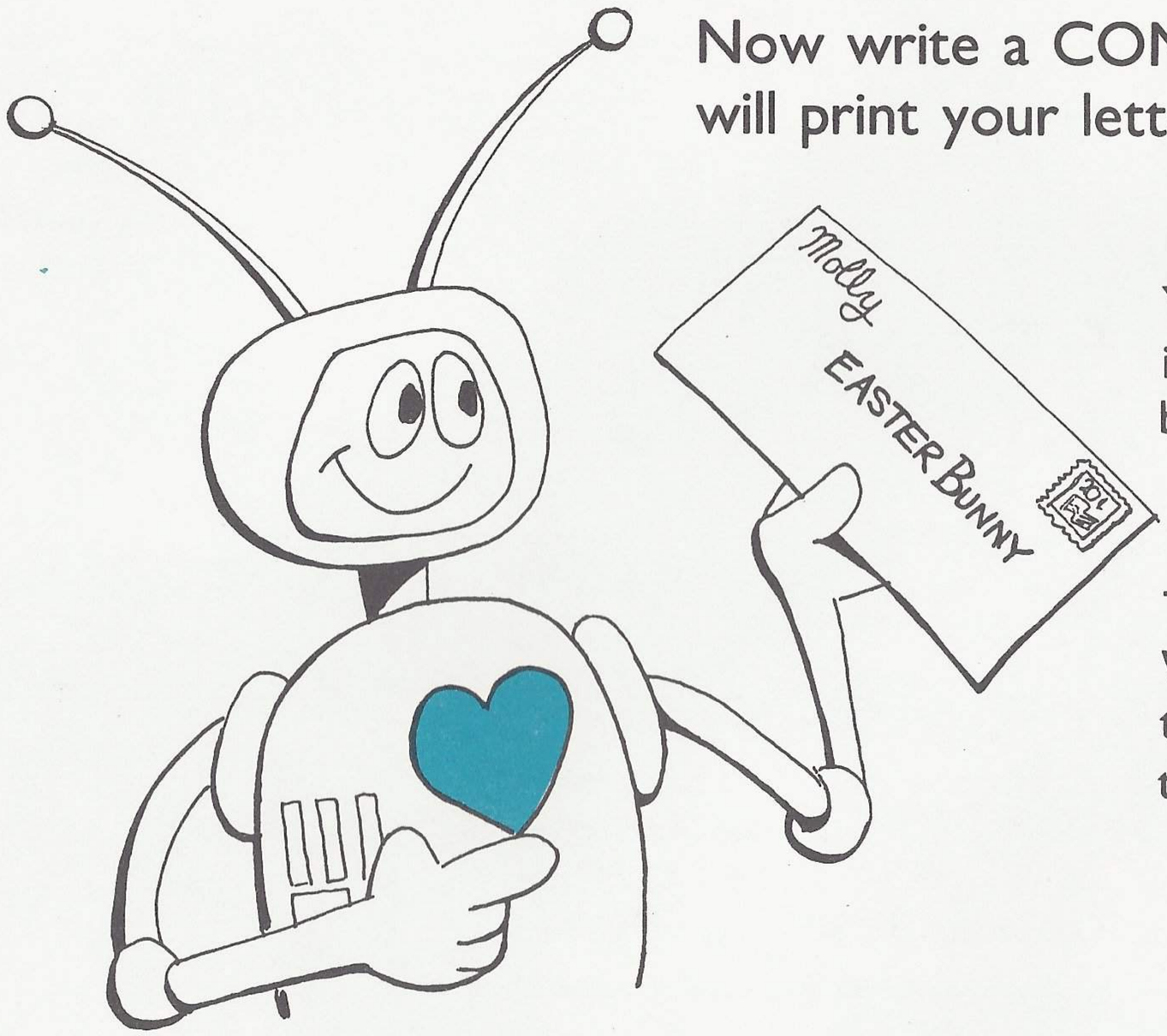
Dear Easter Bunny,
Please come to my house on Easter. I live at 123 Rosebud Road. Please bring lots of Easter Eggs.

Love,
Molly

THEN change some of the words to STRING VARIABLES:

Dear X$
Please come to my house on T$. I live at L$. Please bring lots of B$.

Love,
N$



Now write a COMPUTER PROGRAM that will print your letter on the screen.

You may peek at the next page
if you get stuck . . .
but try it all by yourself first.

Try out your letter program!
Write letters to Santa Claus,
the Tooth Fairy, Uncle John, or
the Great Pumpkin.

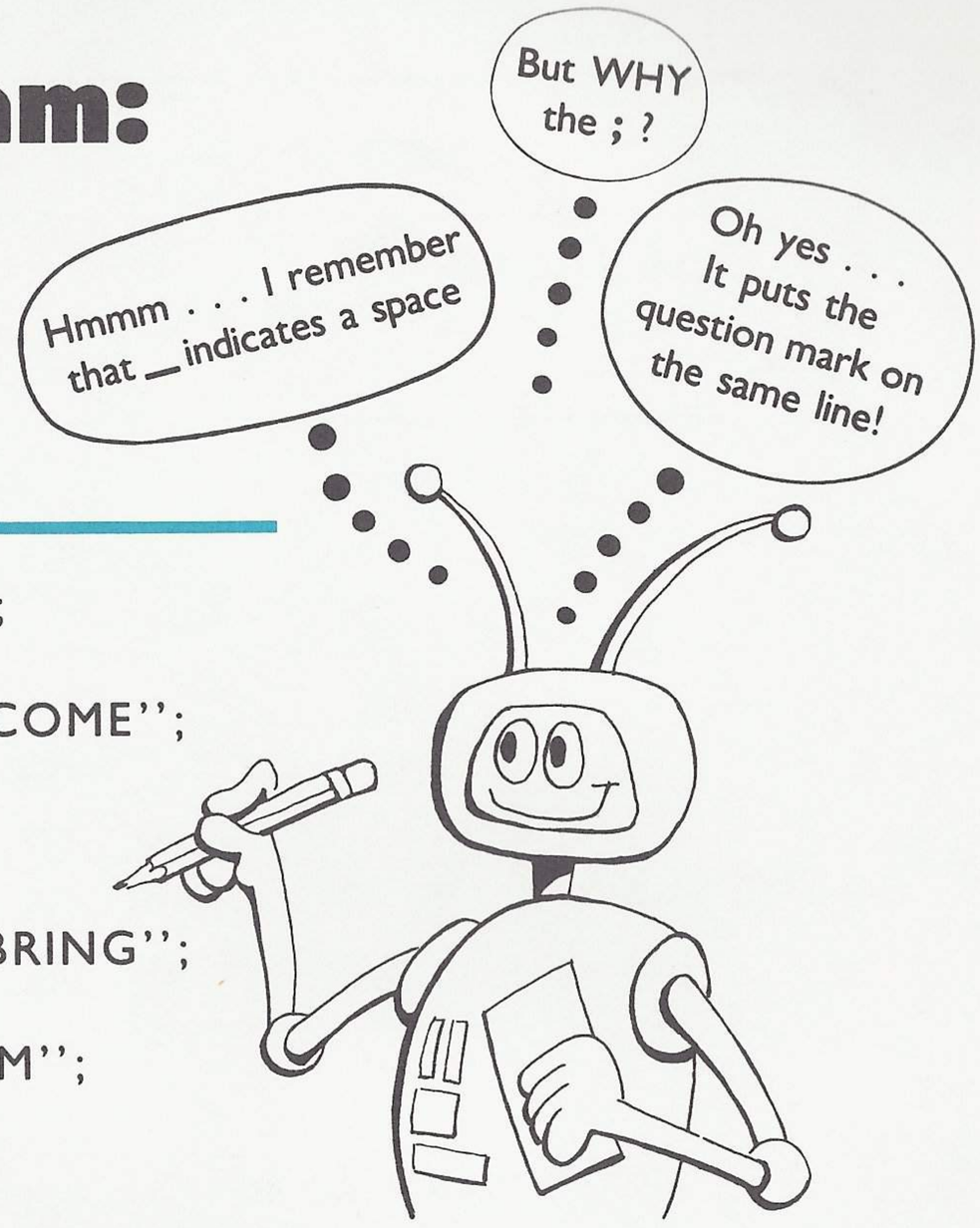
If you have a printer, you can add these lines
to print your letters on paper:

Put this line *after* the INPUT statements.

```
105 OPEN 4,4: CMD 4
1000 PRINT #4: CLOSE 4
```

Put this line at the very end.

A letter-writing program:



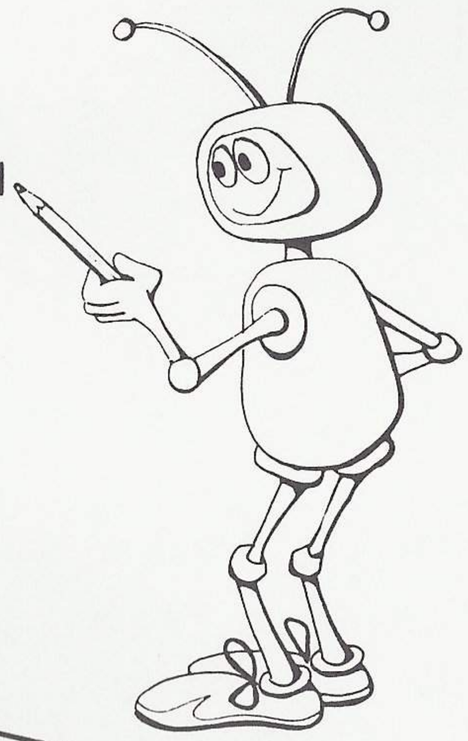
This part of the program SETS UP your letter.

This part of the program WRITES the letter.

```
10 ? "WHO IS THE LETTER TO";
20 INPUT X$
30 ? "WHEN SHOULD _ " X$ "COME";
40 INPUT T$
50 ? "WHERE DO YOU LIVE";
60 INPUT L$
70 ? "WHAT SHOULD _ " X$ "BRING";
80 INPUT B$
90 ? "WHO IS THE LETTER FROM";
100 INPUT N$
110 ? "  "
120 ? "DEAR" X$ ",";
130 ? " _ _ _ _ _ PLEASE COME TO MY HOUSE ON _ " T$ ".";
140 ? "I LIVE AT _ " L$ ". _ _ ";
150 ? "PLEASE BRING LOTS OF _" B$ "."
160 ? " _ _ _ _ _ _ _ _ _ _ _ _ _ LOVE,"
170 ? "_ _ _ _ _ _ _ _ _ _ _ _ _ _ _" N$
```

CHALLENGE

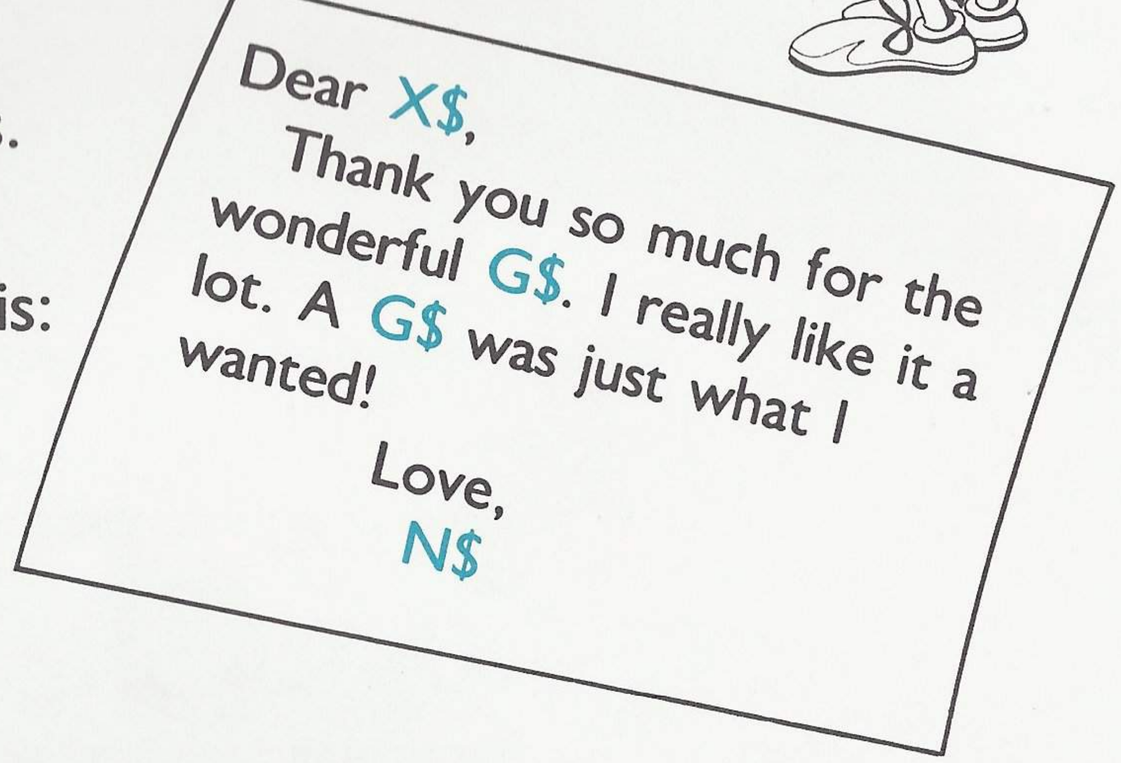
Have you ever had to write COUNTLESS thank-you notes after a birthday, Christmas, or other party?



How about a "form-letter" thank-you note!!

WRITE a computer program that will print thank-you notes to all your friends and relatives.

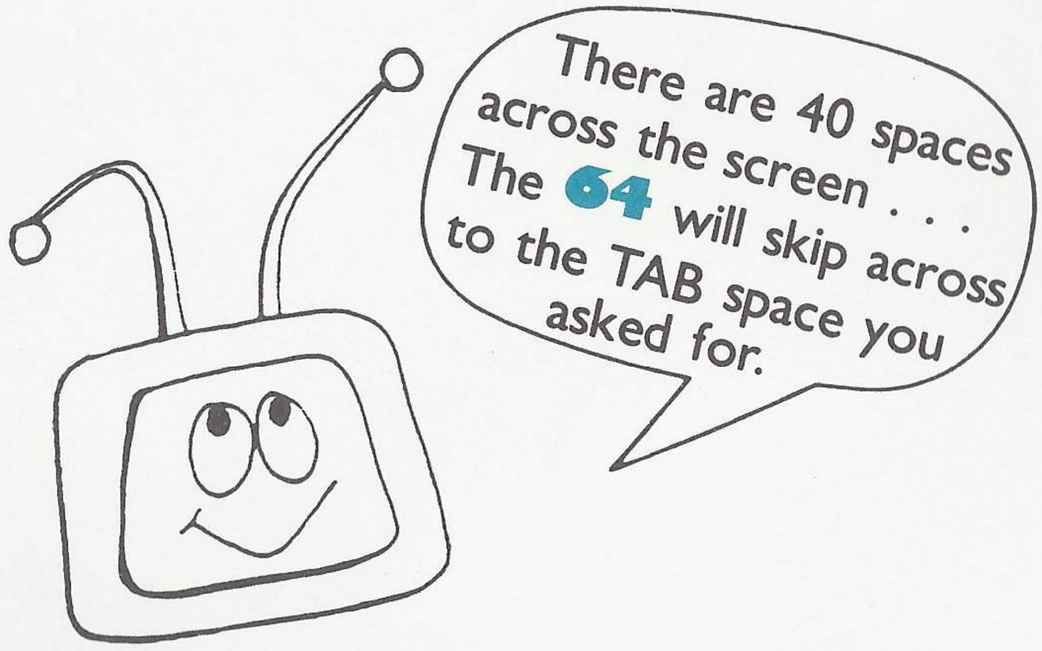
It could look something like this:



?TAB Statements

There are many ways to put words or pictures EXACTLY where you want them on the screen.

The **? TAB (PRINT TAB)** statement tells the computer to **start** printing in a certain column.



TYPE

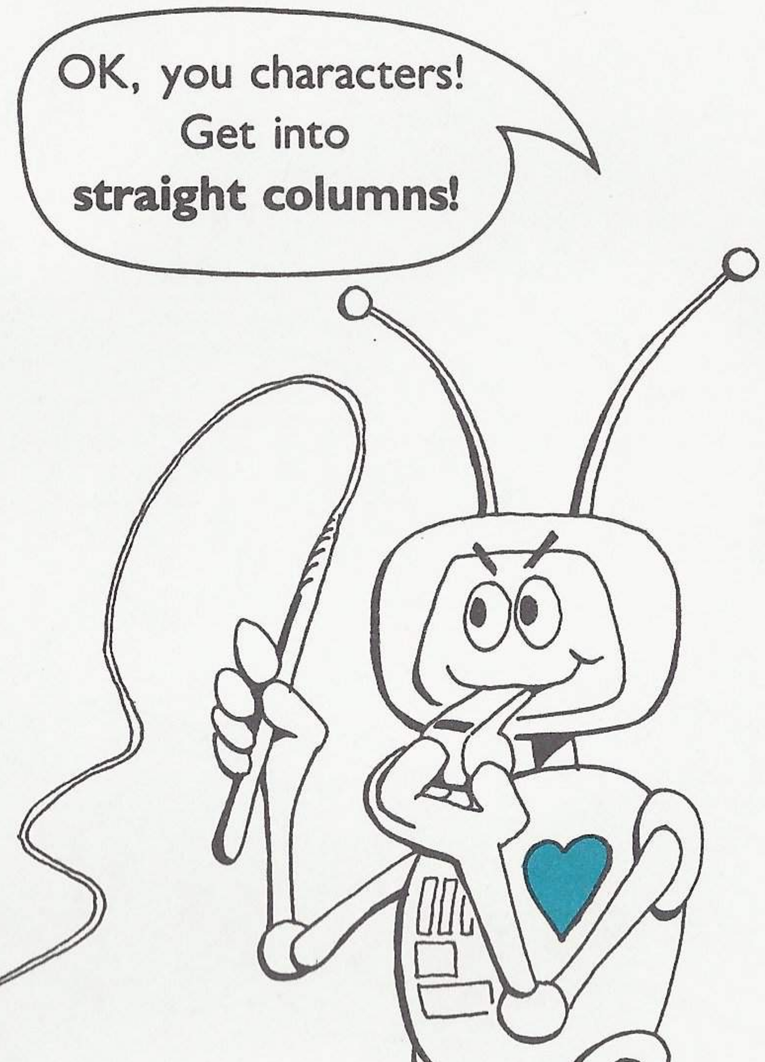
```
NEW
10 ? TAB (8) "SLIP"
20 ? TAB (16) "AND"
30 ? TAB (23) "SLIDE"
40 ? TAB (32) "DOWN"
RUN
```

```
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
                  S  L  I  P
                              A  N  D
                                          S  L  I  D  E
                                                               D  O  W  N
```

Try this:

TYPE

```
NEW
10 ? TAB (15) " ♥ " TAB (30) " ♠ "
20 GOTO 10
RUN
```



ADD color:

change

```
10 ? TAB (15) " ♥ " TAB (30) " ♠ "
```

CTRL and # 3 RED

CTRL and & 6 GRN

```
RUN
```

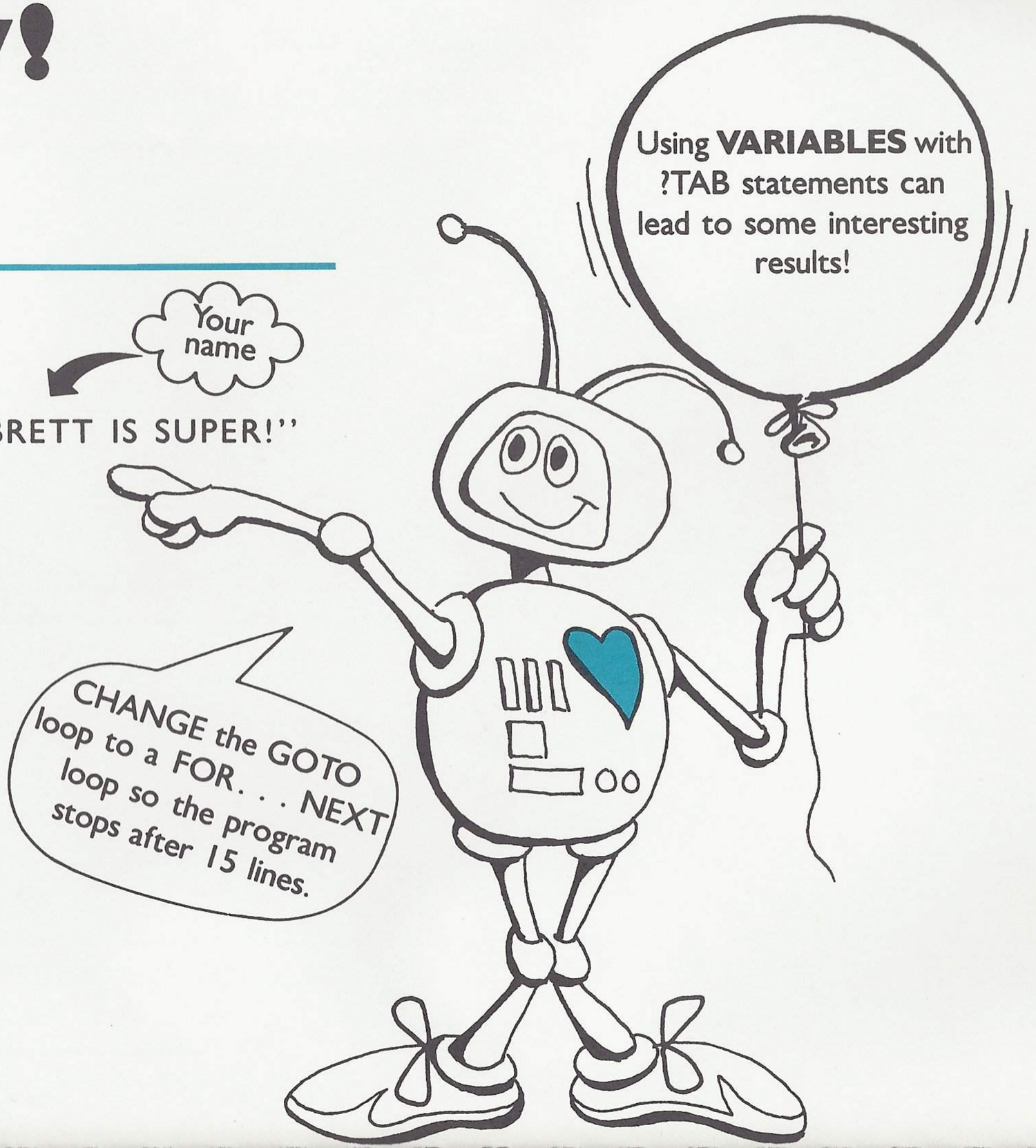
Try using a FOR . . . NEXT loop instead of GOTO, so that your design runs just 20 times. Use ?TAB statements to make your own design.

Get Fancy!

TYPE

```
NEW
10 X = 0
20 X = X + 1
30 ? TAB (X) "BRETT IS SUPER!"
40 GOTO 10
RUN
```

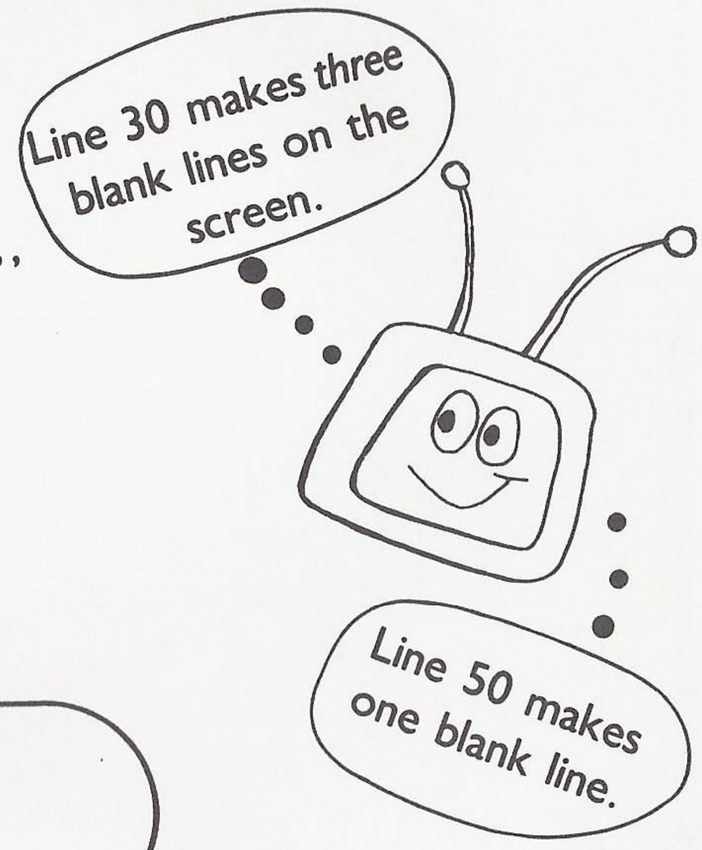
Your name



?TAB helps you make neat charts:

TYPE

```
NEW
10 ? "■"
20 ? TAB(12) "FAVORITE COLORS"
30 ? : ? : ?
40 ? "COLORS" TAB(20) "BOYS" TAB(30) "GIRLS"
50 ?
60 ? "RED" TAB(21) "53" TAB(31) "58"
70 ? "BLUE" TAB(21) "62" TAB(31) "43"
80 ? "PURPLE" TAB(21) "15" TAB (31) "44"
90 ? "GREEN" TAB(21) "25" TAB(31) "10"
```

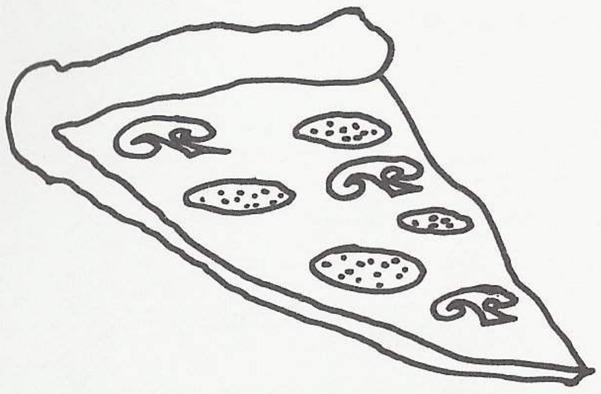


If you have a printer, you can add these lines to print your chart on paper:

```
5 OPEN 4,4:CMD 4
100 PRINT#4: CLOSE4
```

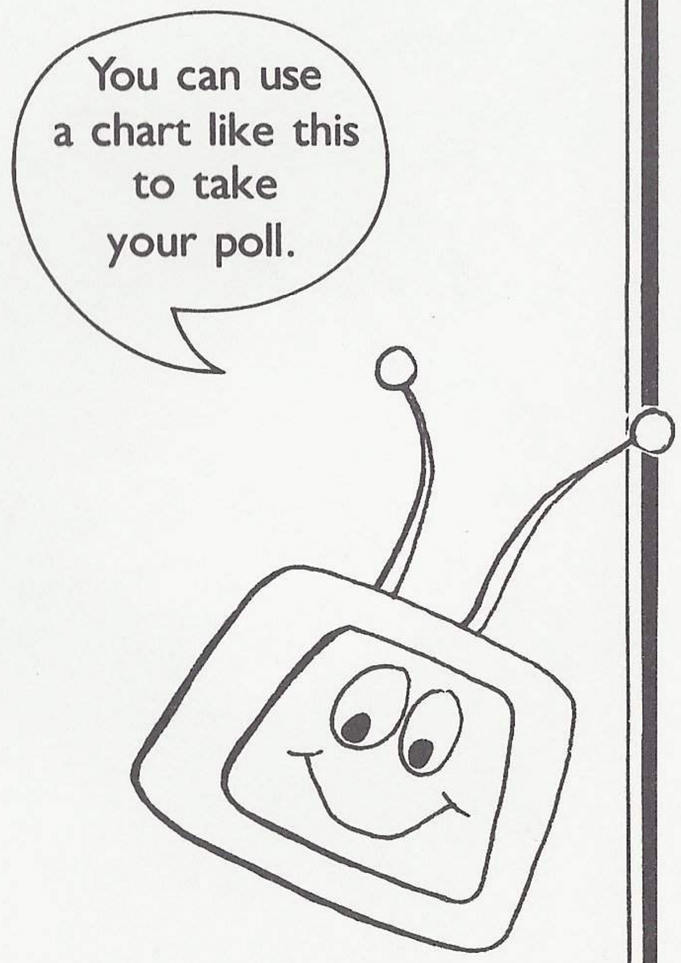
Many printers use ?TAB in slightly different ways. If the printout doesn't look quite "right," **edit** your TAB settings until your columns are lined up.

CHALLENGE



Take a poll of your friends' favorite kinds of pizza. Use ?TAB statements to make a chart that displays your results.

PIZZA FLAVOR:	BOYS:	GIRLS:
Cheese		
Mushroom		
Sausage		
Pepperoni		
Something Else		



Animation!

TYPE

```
NEW
100 POKE 53281,1
110 ? "[ ]"
120 ? "[ ]"
130 FOR X = 1 TO 35
140 ? TAB(X) "_♥"
160 NEXT X
RUN
```

TAB (X)
works like this:

TAB(1) → _♥

TAB(2) → _ _♥

TAB(3) → _ _ _♥

TAB(4) → _ _ _ _♥

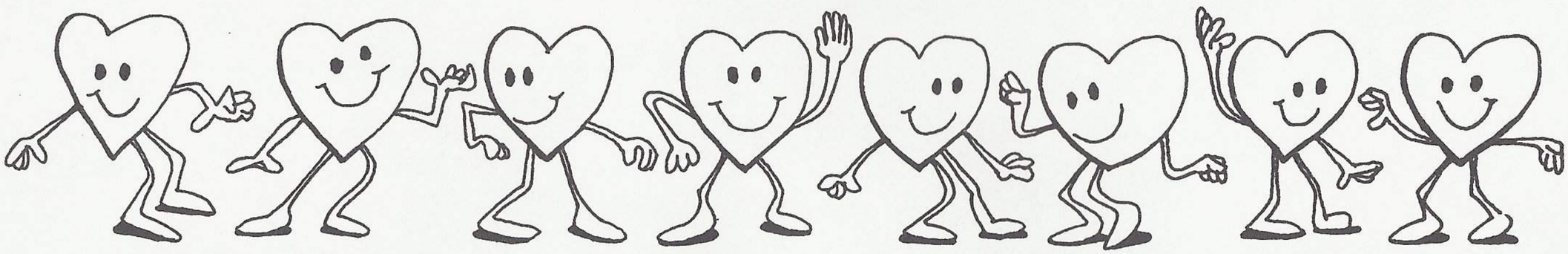
etc.
etc.
etc.

ADD

```
150 ? "[ ]"
RUN
```

Press the CLR HOME key (no SHIFT).

When we add [ ], the **64** jumps up to the TOP LINE each time around . . . before it prints another ♥.
The space (_) moves over and erases the ♥ from last time. The new ♥ keeps moving to the right. It's **ANIMATION!**



Moo!

NOW let's draw a *cow*:

TYPE

```
NEW
80 POKE 53281,5
100 ? "■"
135 ? "■"
170 ? TAB(W)
180 ? TAB(W)
190 ? TAB(W) "  _ _ _ _ _ _ ( ) "
200 ? TAB(W) "  _(■■■■■● ● "
210 ? TAB(W) "  _| ■■■■  ◡ "
220 ? TAB(W) "  _ _▌▌  ▌▌ "
RUN
```

CTRL and ! 1 BLK

NEXT make your cow *move* across the screen:

ADD

```
150 FOR W = 1 TO 28
230 ? "  ■ "
240 NEXT W
RUN
```

CLR HOME

KEEP GOING

ADD *a fence* in your cow's path:

```
110 FOR F = 1 TO 5
120 ? TAB(38) "■ X"
130 NEXT F
140 ? "■"
RUN
```

CTRL and " 2 WHT

CLR HOME

S . . . L . . . O . . .W your cow down:

```
160 FOR Q = 1 TO 40: NEXT Q
RUN
```

CLR HOME

ADD a comment:

```
250 ? "■"
260 ? TAB (28) "■ MOOOOO!"
270 GOTO 270
RUN
```

CTRL and # 3 RED



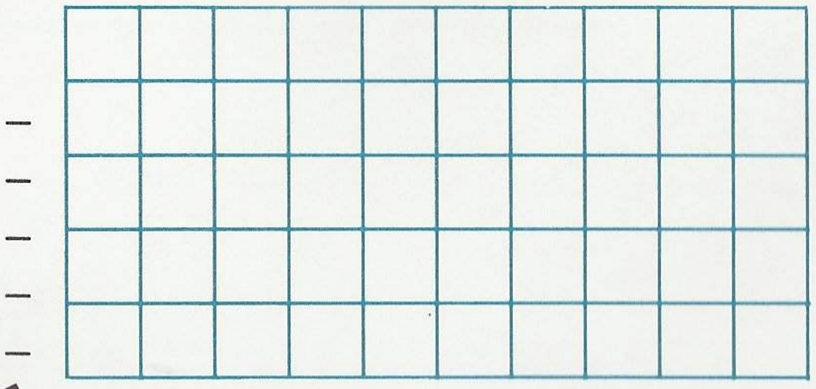
Truckin' Along

Now YOU drive a truck across the screen!

FIRST, draw your truck:

We didn't give **X** a value, so **X** will start out equal to **0**.

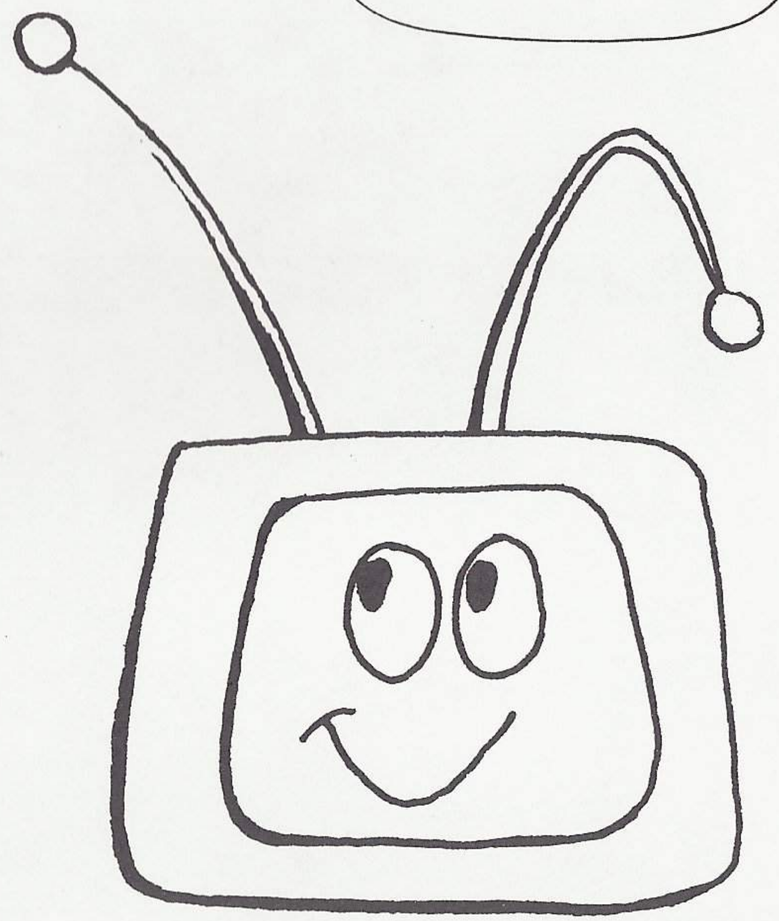
```
NEW
200 ? TAB(X) " _
210 ? TAB(X) " _
220 ? TAB(X) " _
230 ? TAB(X) " _
240 ? TAB(X) " _
RUN
```



Be sure you leave a space on each line.

Draw your truck here—line by line.

A "HANDY HINT":
Draw a SMALL truck!



KEEP GOING

Make your truck *MOVE* across the screen:

TYPE

```
100 ? "■"
110 FOR X = 1 TO 30
300 ? "■"
310 NEXT X
RUN
```

ADD a *title*:

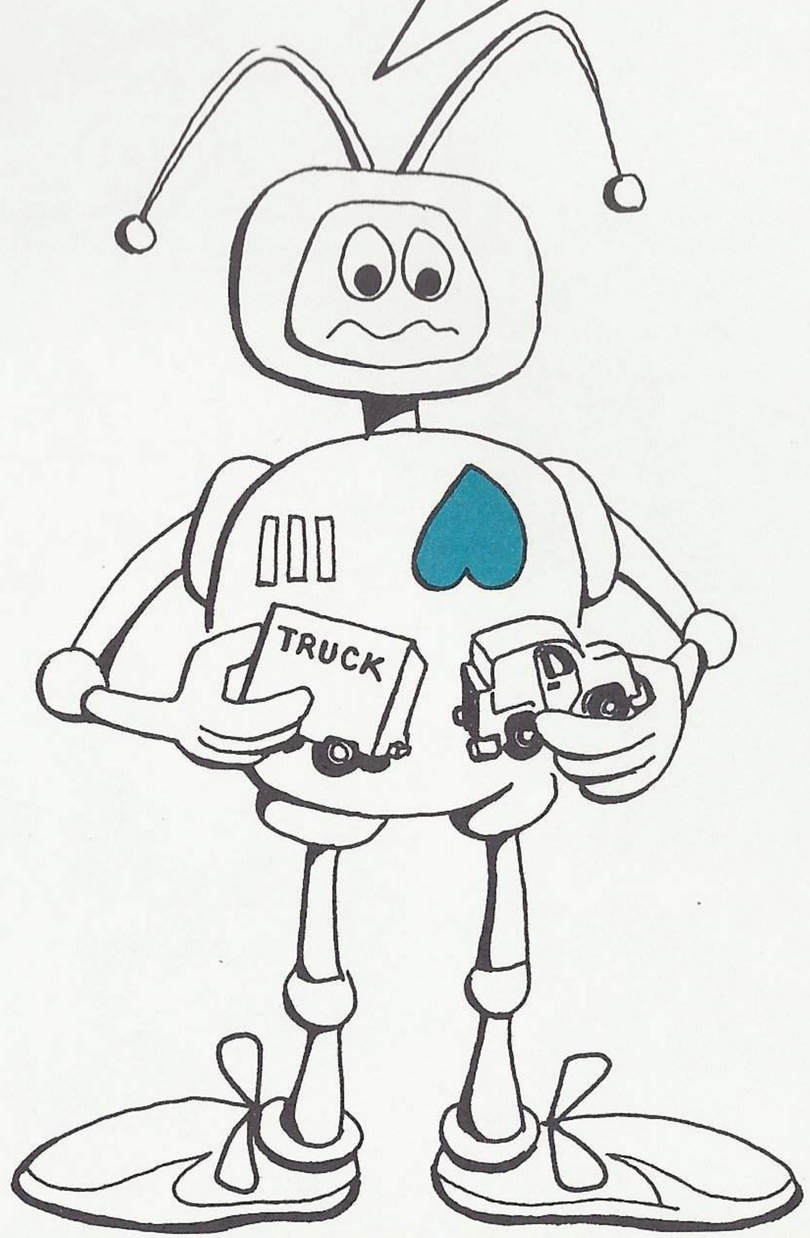
```
10 ? "■"
50 ? TAB(15) "MY TRUCK"
60 FOR Y = 1 TO 700: NEXT Y
RUN
```

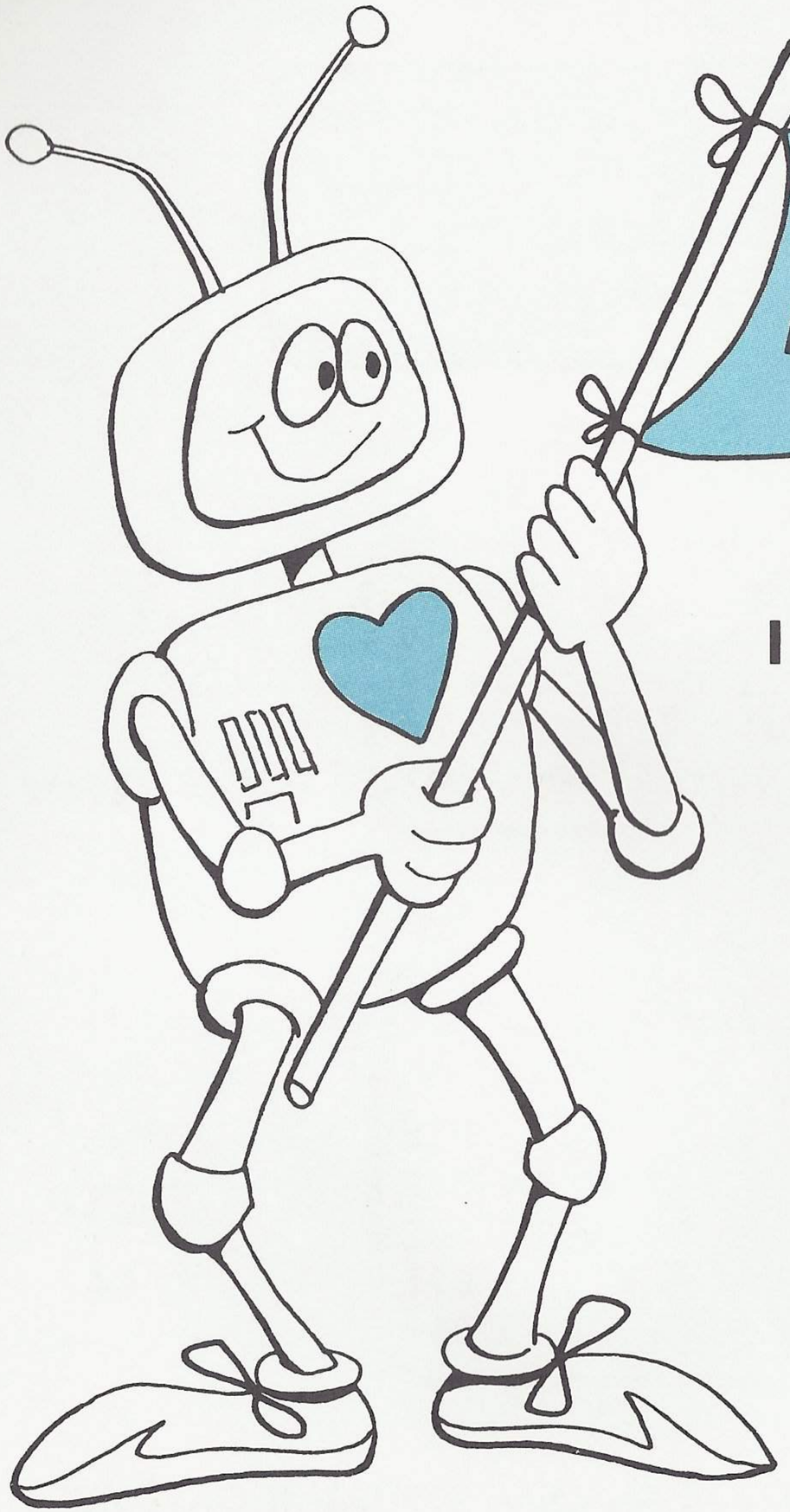
*****CHALLENGE*****

Add COLOR to your truck.
Change the background.
Make the truck and title different colors.

If your truck "CRACKS UP," either . . .

1. make your truck smaller, or
2. change line 110 so the ?TAB statements don't go so far to the right.





1 Use ?TAB statements to write a program that gives the following output:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
				C	O	M	P	U	T	E	R		M	A	T	H				
						B	Y		C	H	R	I	S		H	U	N	T	E	R

10 ? " ♥ "

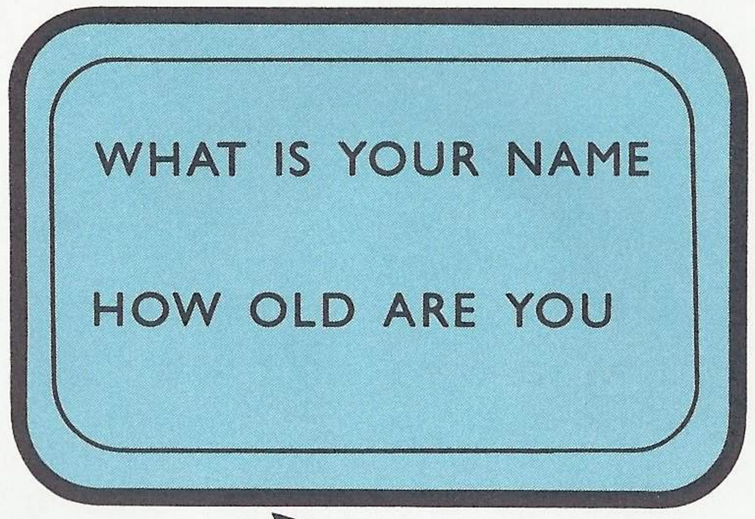
20 _____

30 _____

2

a

```
10 ? "WHAT IS YOUR NAME"
20 INPUT N$
30 ? "HOW OLD ARE YOU";
40 INPUT A
```



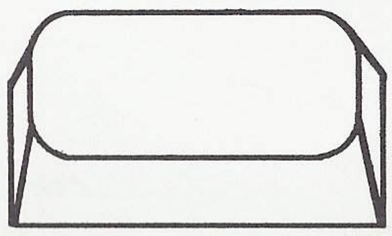
If this program is RUN on your computer, DRAW IN the question marks where they will appear on the screen.

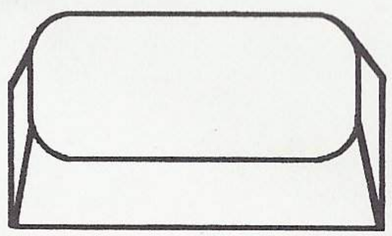
b Why is a **$** used with the variable in line 20, but not with the variable in line 40?

_____

_____

c What two keys must you press to interrupt this program?





3 READ this letter carefully:

D$

July 4

Dear Ace Hardware,

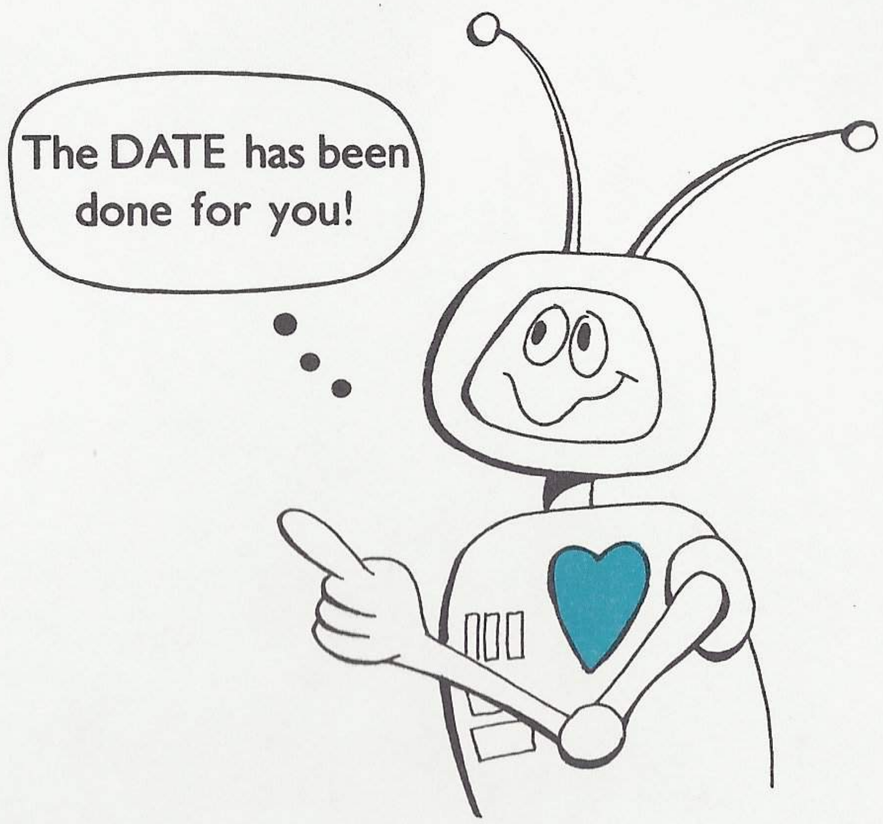
I would like to order the following items:

AMOUNT:	ITEM:	PRICE:
1	hammer	$5.68
2	boxes of nails	$4.50

Please send the hammer and boxes of nails to the address below.

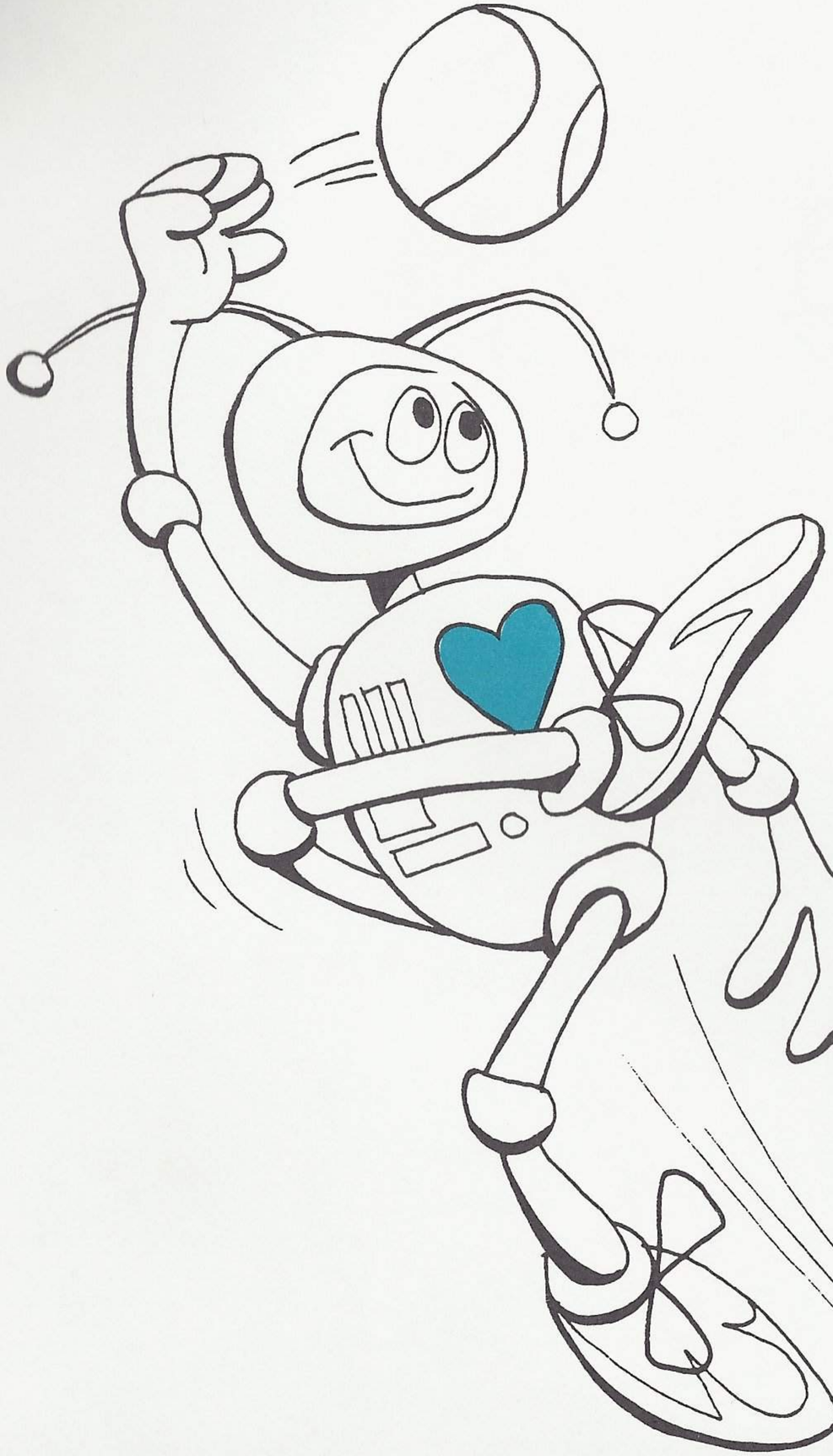
Sincerely,

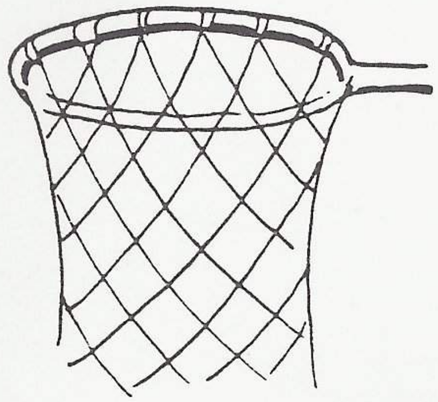
Sam Smith
123 North Street
New York, N.Y.



CIRCLE all the words or numbers that could be variables in this form letter.

LABEL each word or group of words with an appropriate variable name.





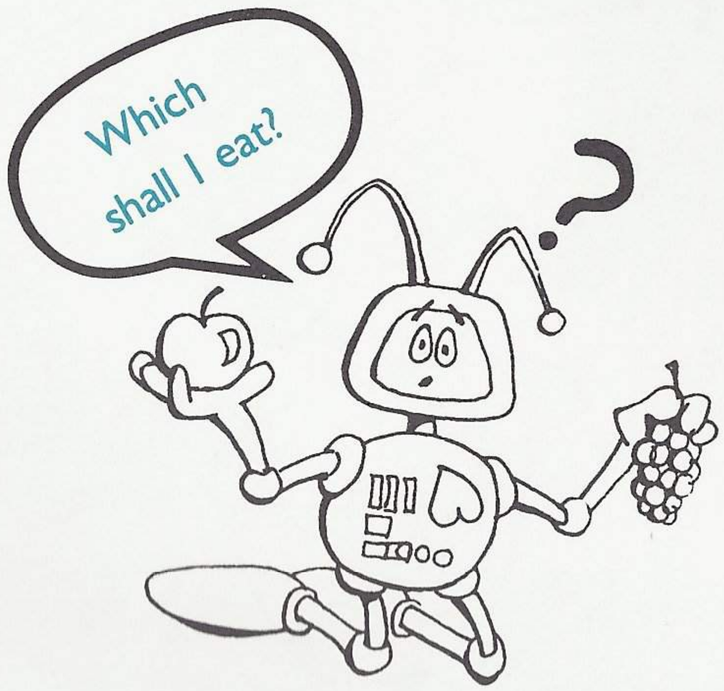
Part 8

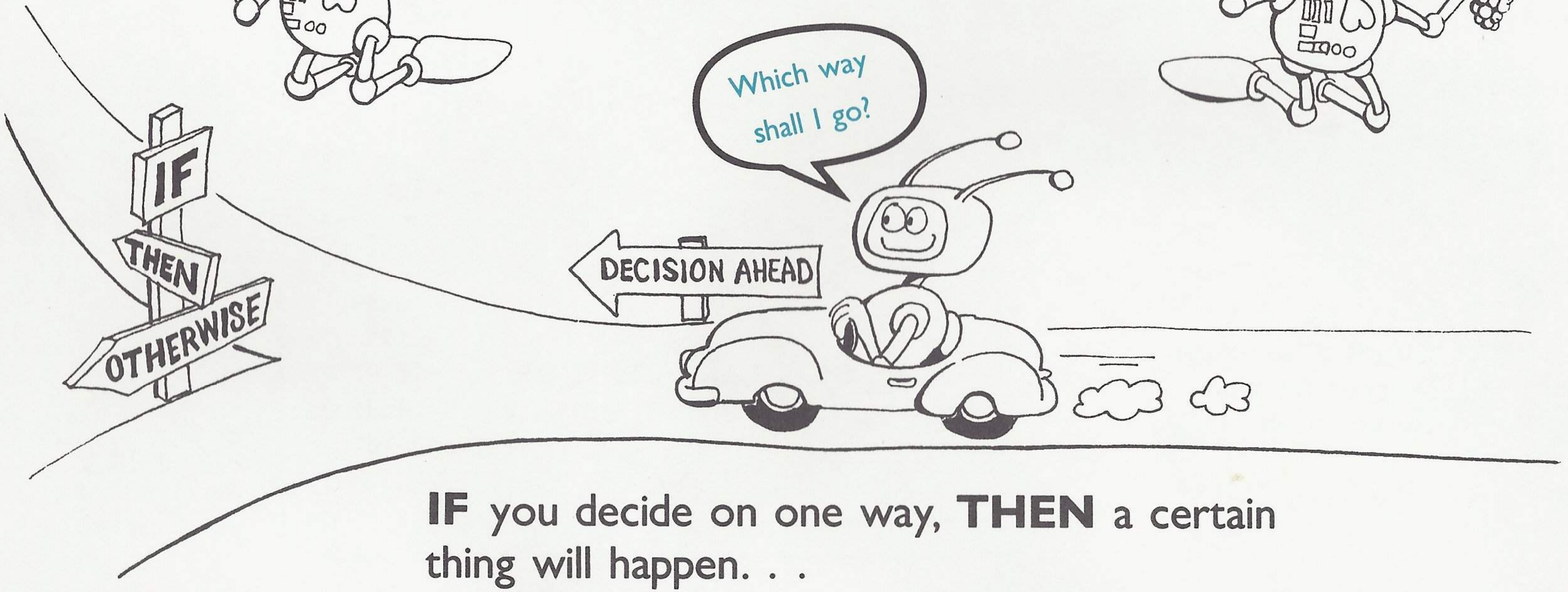
Creating Games

IF . . . THEN Statements

DECISIONS . . . DECISIONS!!
Often there are decisions to be made . . .







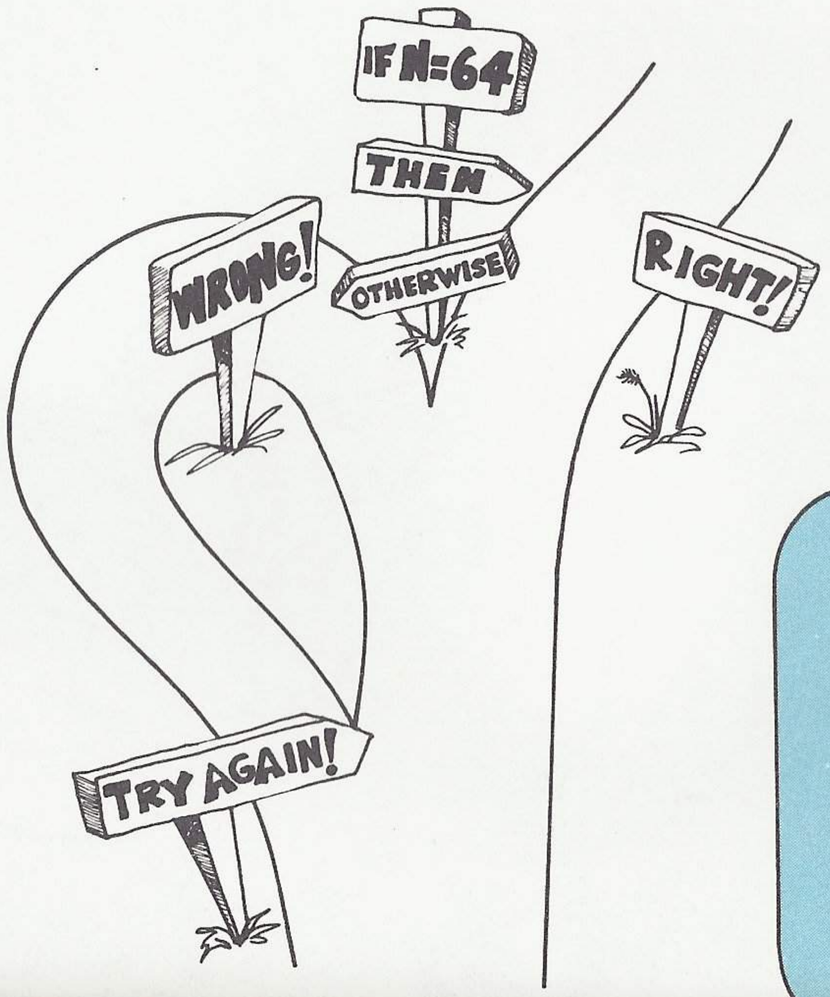
IF you decide on one way, **THEN** a certain thing will happen. . .
OTHERWISE, you automatically go the other way—and something different will occur.

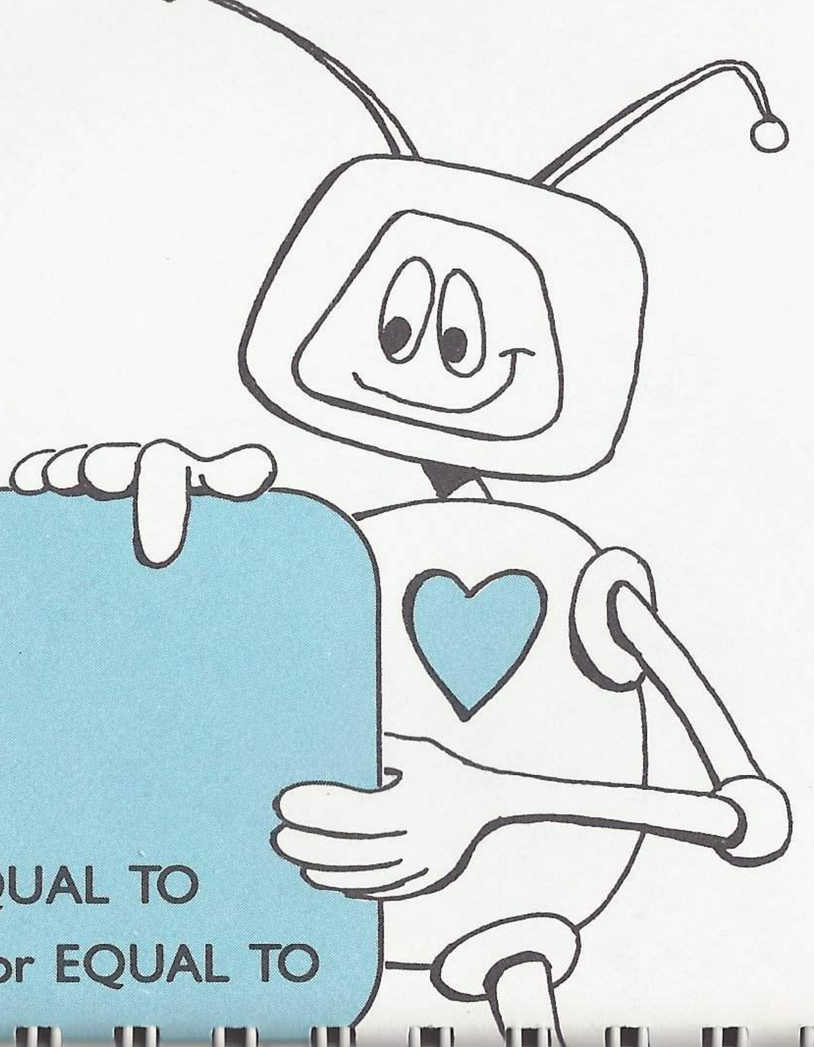
The 64 can make decisions too!

TYPE

```
NEW
10 ? "GUESS MY FAVORITE NUMBER"
20 INPUT N
30 IF N = 64 THEN ? "RIGHT!!":END
40 IF N <> 64 THEN ? "WRONG . . ."
50 GOTO 20
RUN
```

When the computer sees the END statement, it will not go on.





= EQUAL TO
< LESS THAN
> GREATER THAN
<> NOT EQUAL TO
<= LESS THAN or EQUAL TO
>= GREATER THAN or EQUAL TO

Count Off 1 . . . 2 . . . 3 . . .

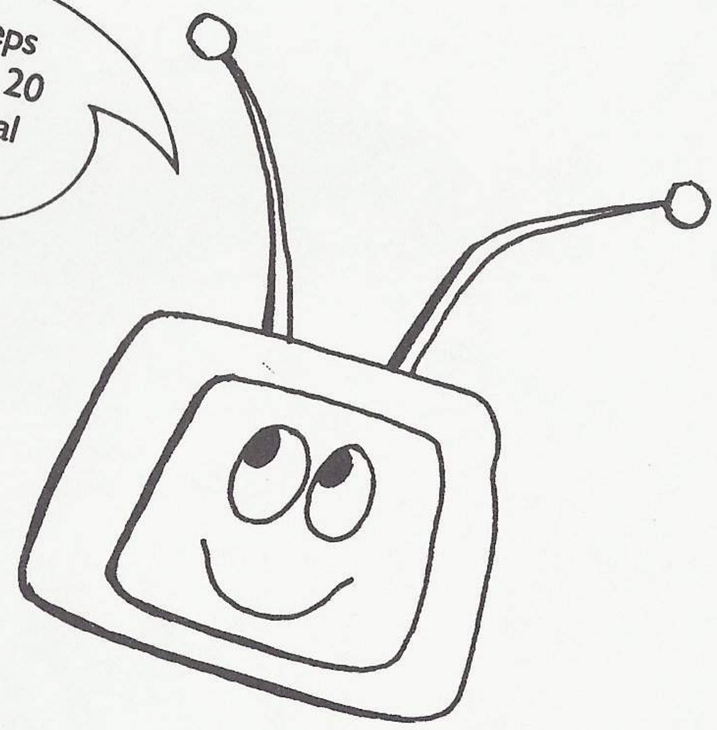
You have already made the computer **count** with a FOR . . . NEXT loop.
Like this . . .

```
NEW
10 FOR X = 1 TO 5
20 ? X
30 NEXT X
40 ? "ALL DONE"
RUN
1
2
3
4
5
ALL DONE
```

. . . NOW make it count with an IF . . . THEN statement.

```
NEW
10 X = 0
20 X = X + 1
30 ? X
40 IF X < 5 THEN GOTO 20
50 ? "ALL DONE"
RUN
```

The computer keeps looping back to line 20 until **X** is finally equal to 5.



CHALLENGE

Change the program so the computer . . .

counts to 50
counts to 50 by 2's
counts backwards from 50 to 10

Using IF . . . THEN

Let the computer tell you if your arithmetic is **right** or **wrong**!

TYPE

```
NEW
10 REM * * * MATH PROBLEMS * * *
20 INPUT "FIRST NUMBER"; A
30 INPUT "SECOND NUMBER"; B
40 ? A "+" B "=";
50 INPUT C
60 IF A + B <> C THEN ? "WRONG": GOTO 40
70 IF A + B = C THEN ? "RIGHT!"
RUN
```

SHORT CUT!!

BEFORE . . .

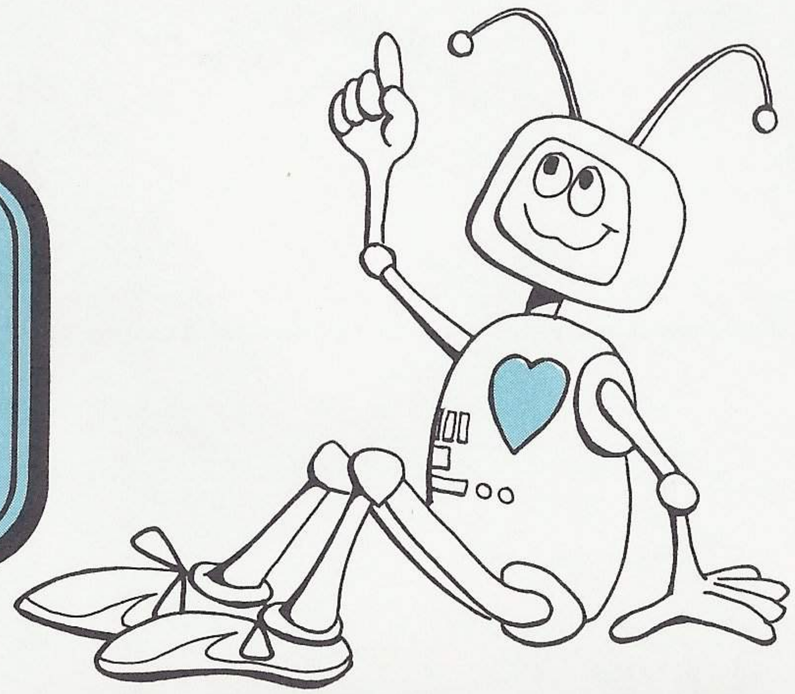
```
20 ? "FIRST NUMBER"
25 INPUT A
```

NOW . . .

```
20 INPUT "FIRST NUMBER": A
```

CHALLENGE

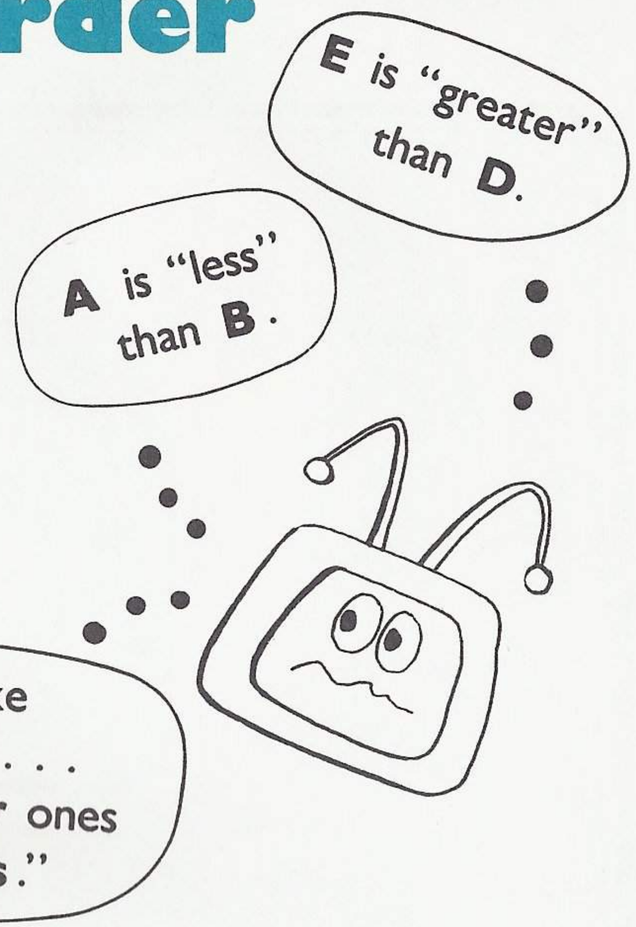
CHANGE your program so it will add THREE numbers. (HINT: You'll need to **add one** line and **change three** lines.)
"CLEAN-UP" your program: Clear the screen before starting. Add spaces between problems. Change the program so that it repeats.



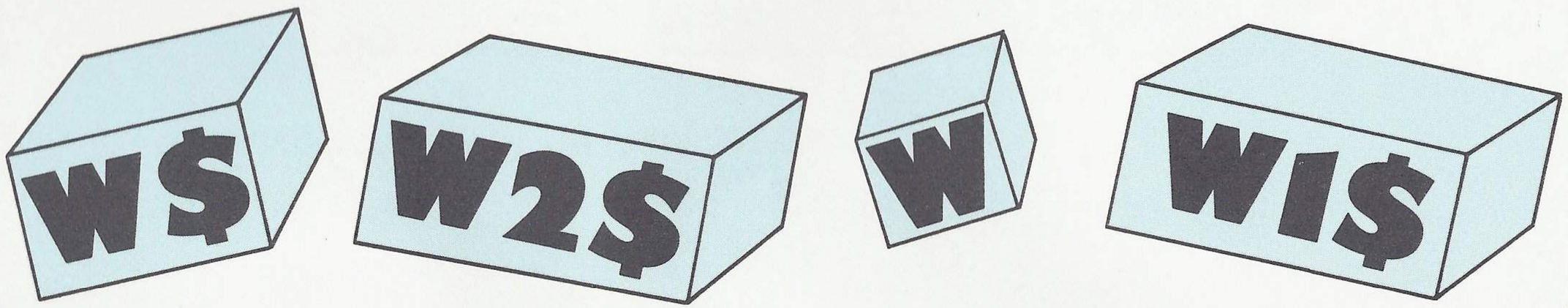
The 64 can put words into Alphabetical Order

TYPE

```
NEW
10 INPUT "FIRST WORD"; W1$
20 INPUT "SECOND WORD"; W2$
30 IF W1$ = W2$ THEN ? "SAME WORD"
40 IF W1$ < W2$ THEN ? W1$ "_ COMES FIRST"
50 IF W1$ > W2$ THEN ? W2$ "_ COMES FIRST"
RUN
```



All of these are "places" where the computer can store information . . .



CHALLENGE

Make up a quiz for a friend using IF . . . THEN statements.
The following may be part of your quiz.

```
WHO WAS THE FIRST PRESIDENT OF THE U.S.?
? LINCOLN
WRONG. TRY AGAIN.
? WASHINGTON
RIGHT!
```

```
HOW MUCH IS 25 + 10 + 14?
? 48
SORRY, THAT'S WRONG.
TRY AGAIN.
```

Be sure your questions are clear and easy to read.
Think about good spacing and correct spelling.

Random Numbers

Have you ever picked a number out of a hat?
The **64** is very good at picking out numbers for us to use in math problems, games, and in other ways.

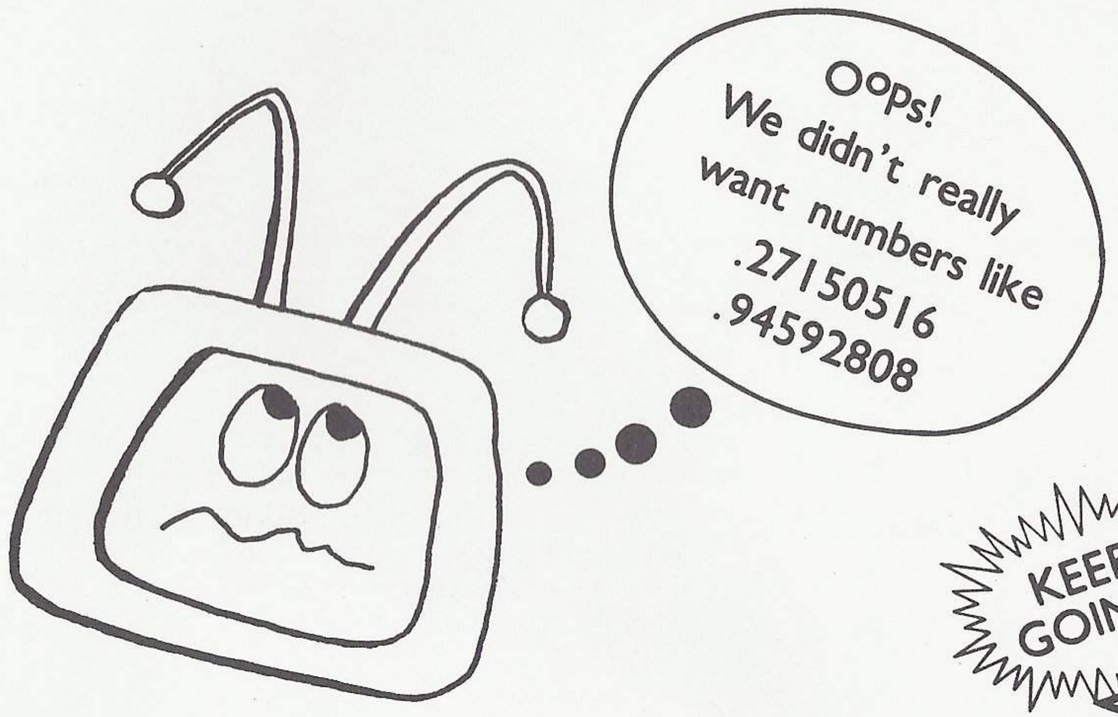


We call these "**random numbers**."

TYPE

```
NEW
10 A = RND (1)
20 ? A
30 GOTO 10
RUN
```

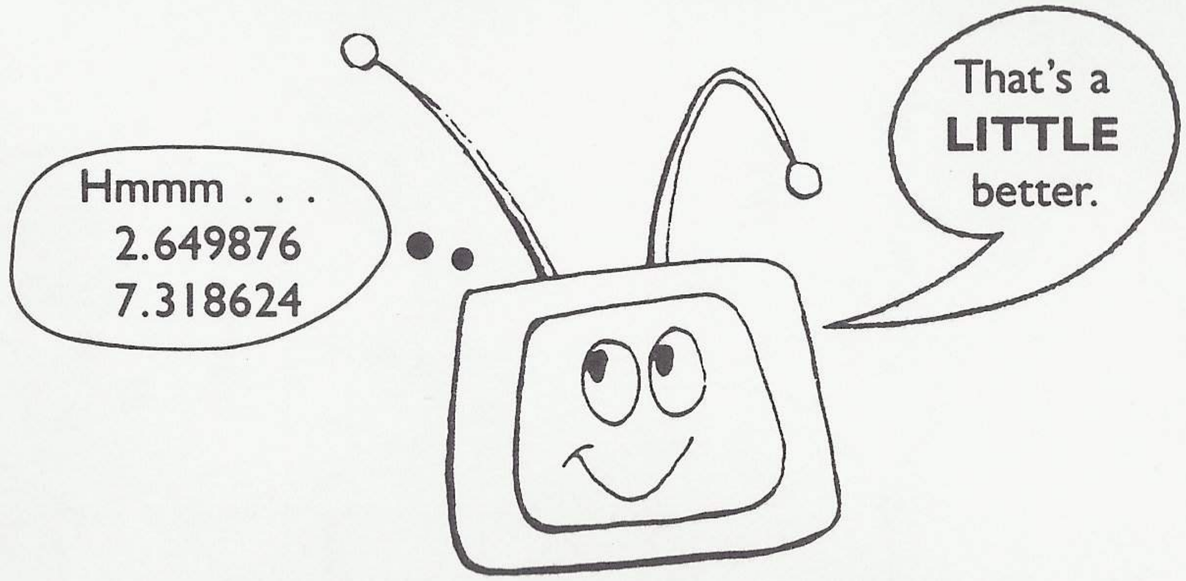
Press RUN STOP to stop the program.



Edit your program:

TYPE

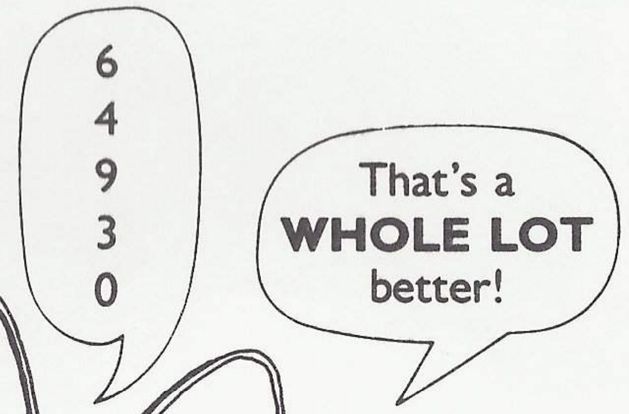
```
10 A = 10 * RND(1)
RUN
```

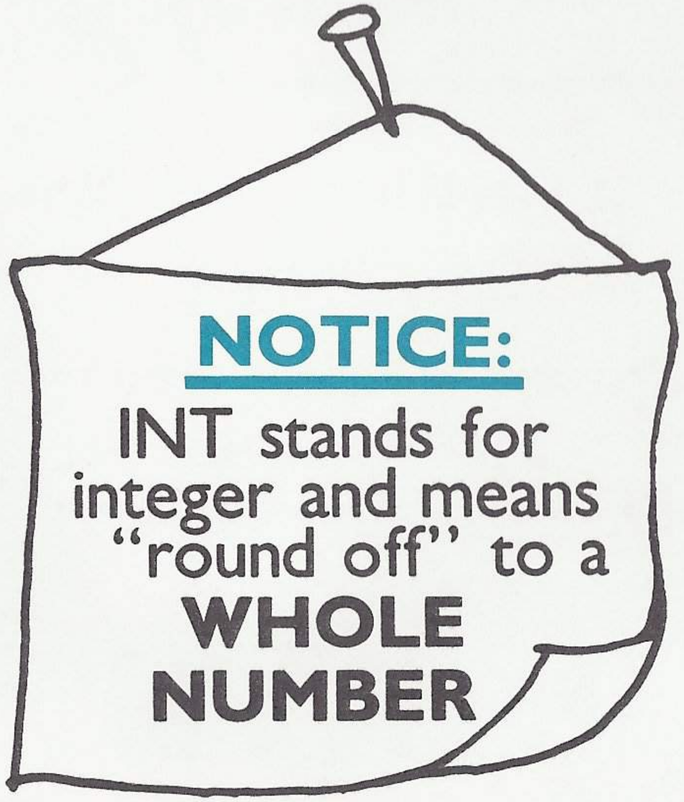


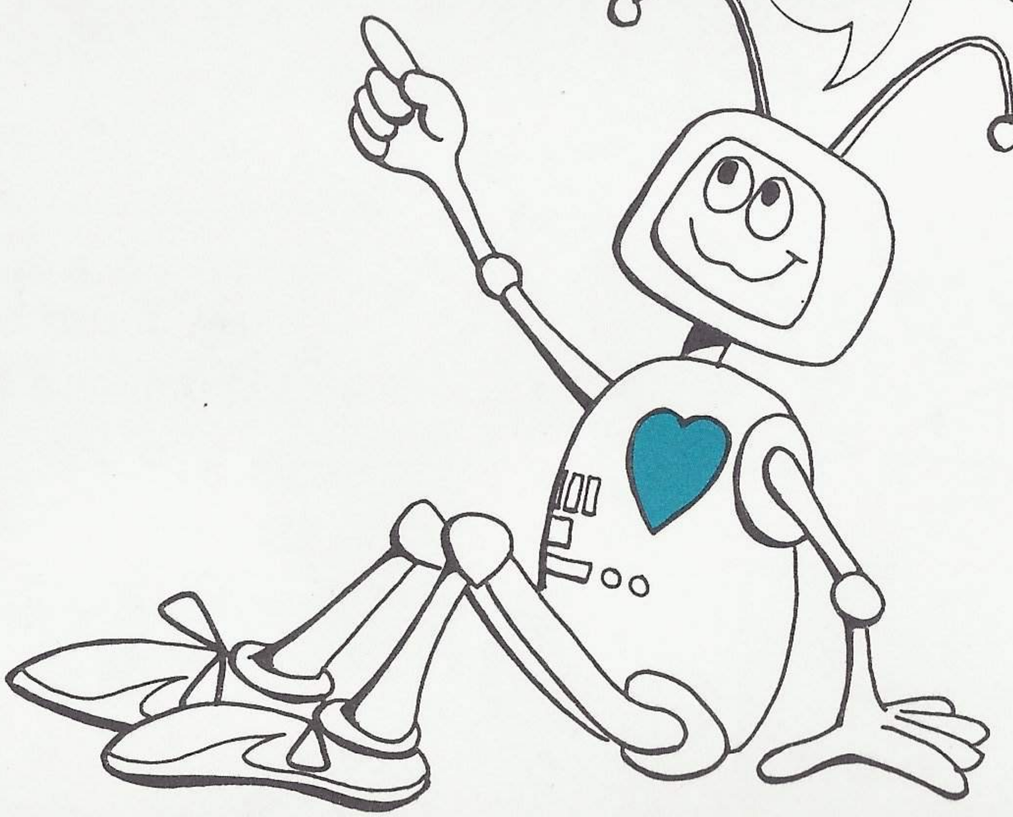
Now change it again:

TYPE

```
10 A = INT (10 * RND (1))
RUN
```







KEEP GOING

TYPE LIST.

```
LIST
10 A = INT (10 * RND (1))
20 PRINT A
30 GOTO 10
```

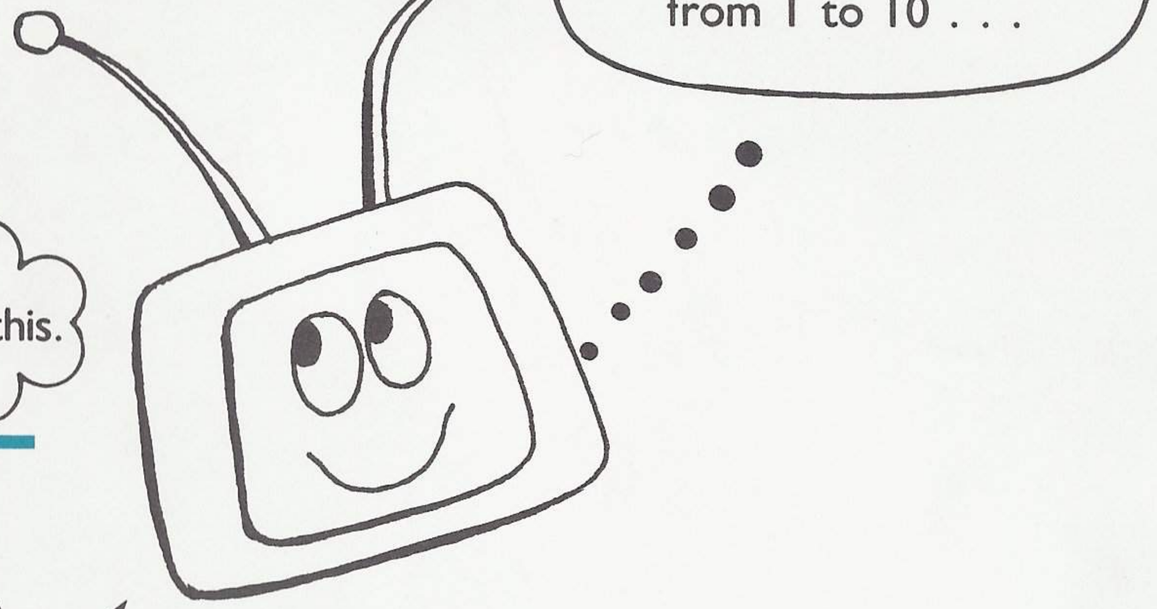
This program will choose numbers between 0 to 9. RUN it a while and see.

Add this.

Make a change.

```
10 A = INT (10 * RND(1)) +1
RUN
```

Hmmm . . .
Now the numbers go from 1 to 10 . . .



Change this.

Another change.

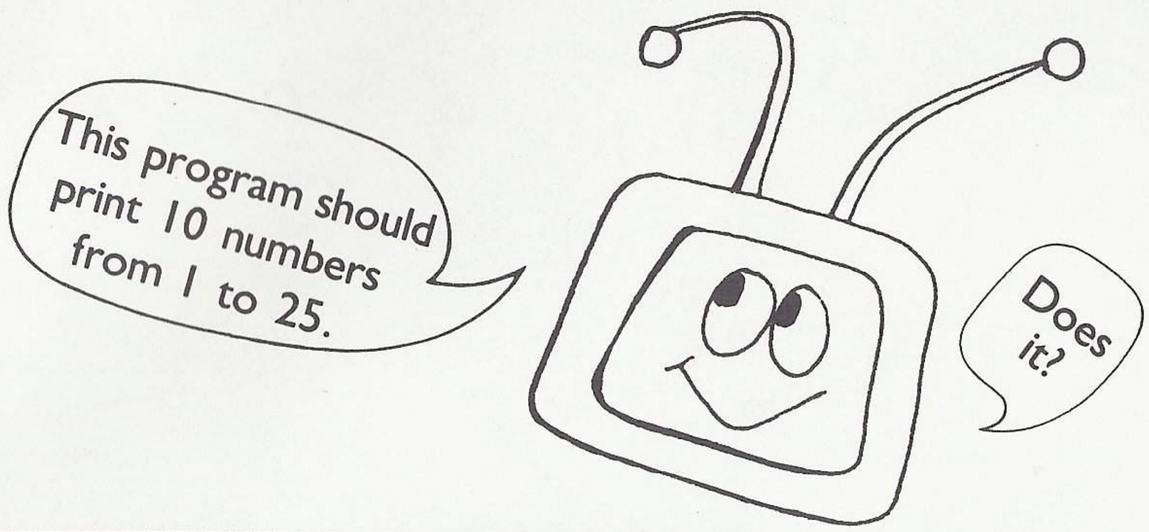
```
10 A = INT ( 20 * RND(1)) + 1
RUN
```

PREDICT

What will happen?
Were you right?

TYPE

```
NEW
10 REM * * PICK 10 NUMBERS OUT OF A HAT * *
20 FOR X = 1 TO 10
30 Z = INT (25 * RND(1)) + 1
40 ? Z
50 NEXT X
RUN
```



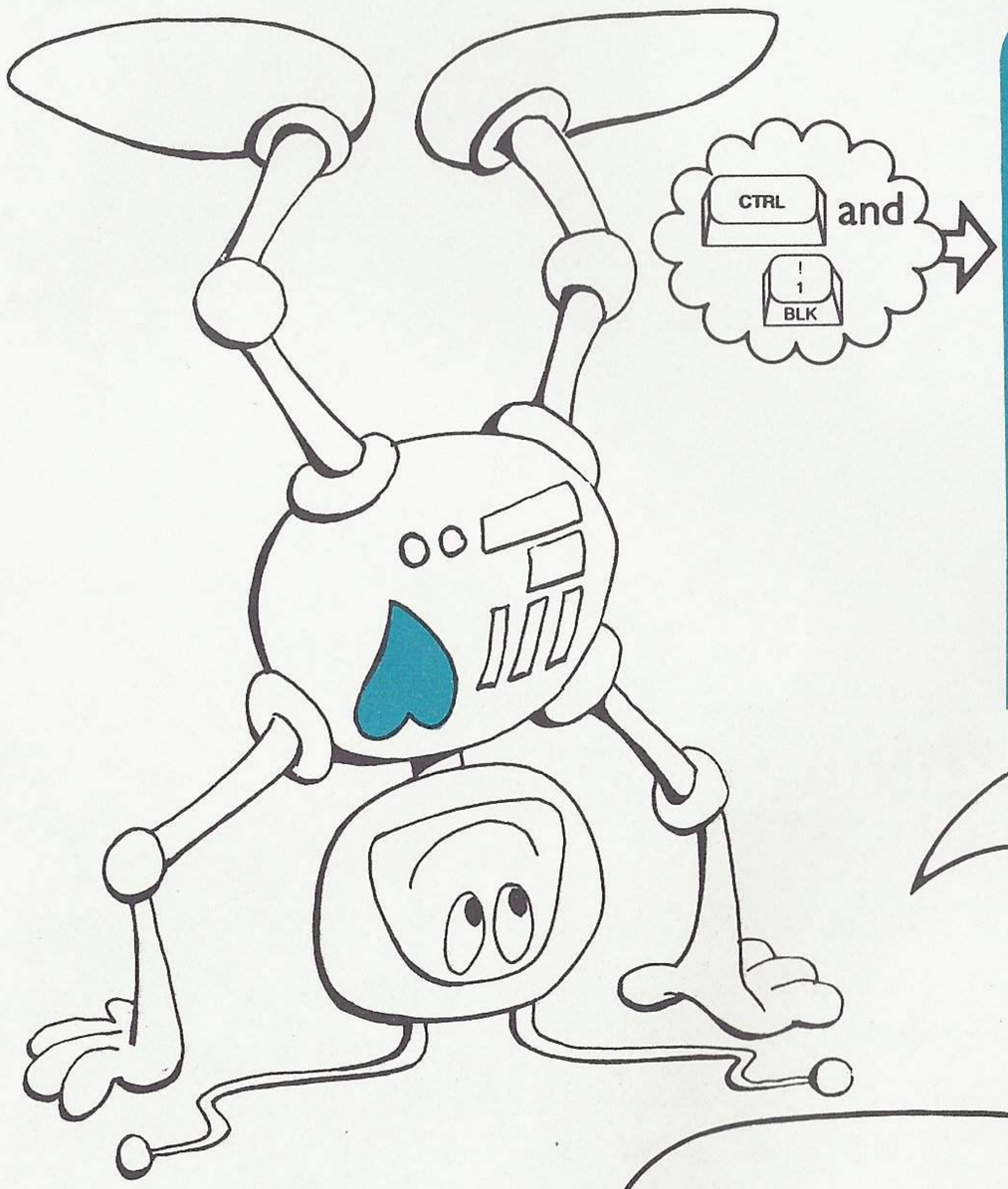
CHALLENGE

Now YOU change the program so it . . .

a prints 10 numbers from 1 to 100.
b prints 30 numbers from 0 to 99.
c prints 15 numbers from 1 to 25.

Number Games

TYPE



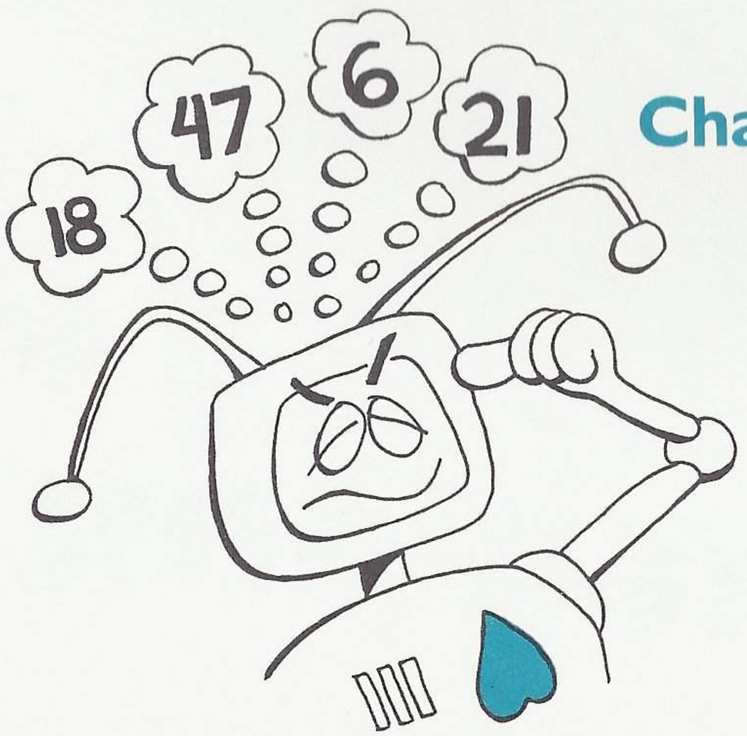

```
NEW
5 REM * * MATH MACHINE * *
10 POKE 53281,13: POKE 53280,6
15 ? "■ "
20 X = INT (10 * RND(1))+1
30 Y = INT (10 * RND(1))+1
40 ? X "+" Y "=";
50 INPUT Z
60 IF Z = X + Y THEN ? "SUPER!": GOTO 20
70 ? "SORRY . . . TRY AGAIN": GOTO 40
RUN
```

Hold down RUN STOP and press RESTORE to stop the program.

Change your program so it does *MULTIPLICATION!* TRY IT!

Try Another

```
NEW
10 REM * * GUESS MY NUMBER * *
20 N = INT (50 * RND(1)) + 1
30 ? "I'M THINKING OF A NUMBER"
40 ? "BETWEEN 1 AND 50."
50 ? "CAN YOU GUESS IT?"
60 INPUT "TAKE A GUESS"; G
70 IF G < N THEN ? "GUESS A BIGGER NUMBER": GOTO 60
80 IF G > N THEN ? "GUESS A SMALLER NUMBER ": GOTO 60
90 IF G = N THEN ? "WOW! YOU GUESSED IT!"
RUN
```



Change your program to guess numbers from 1 to 100.

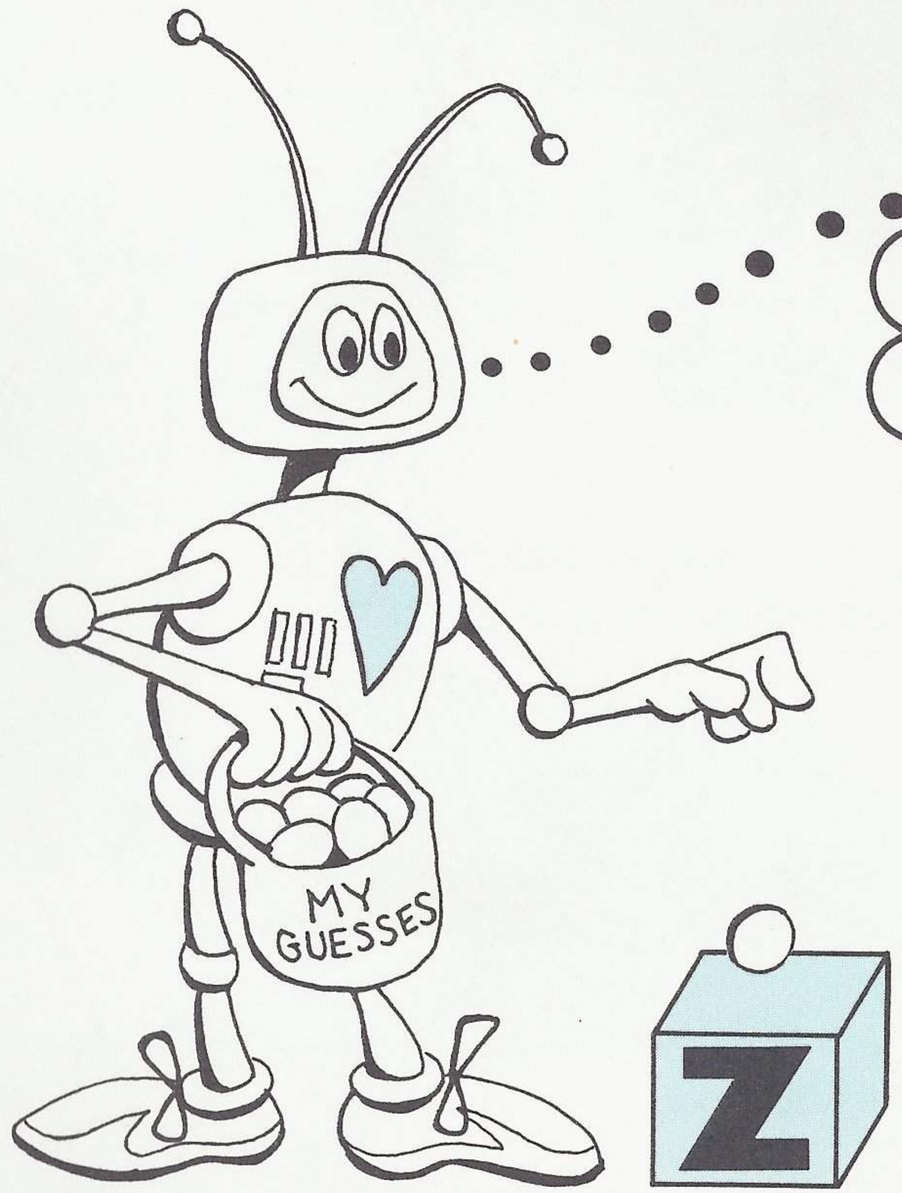
KEEP GOING

Change your program so it will KEEP SCORE:

ADD

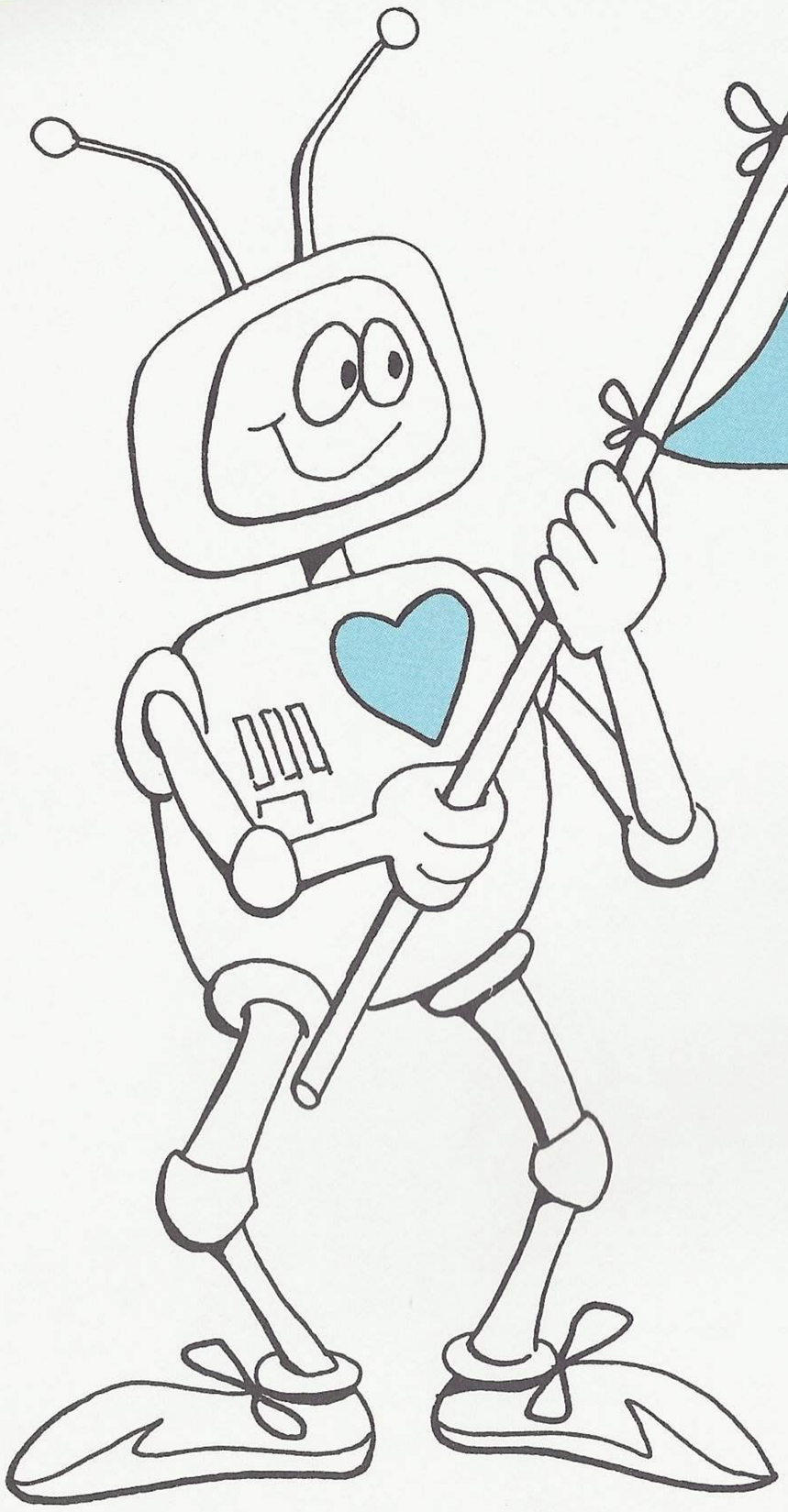
```
65 Z = Z + 1
90 ? "YOU GUESSED MY NUMBER IN" Z "GUESSES."
RUN
```

Z = 0
until you make your first guess.



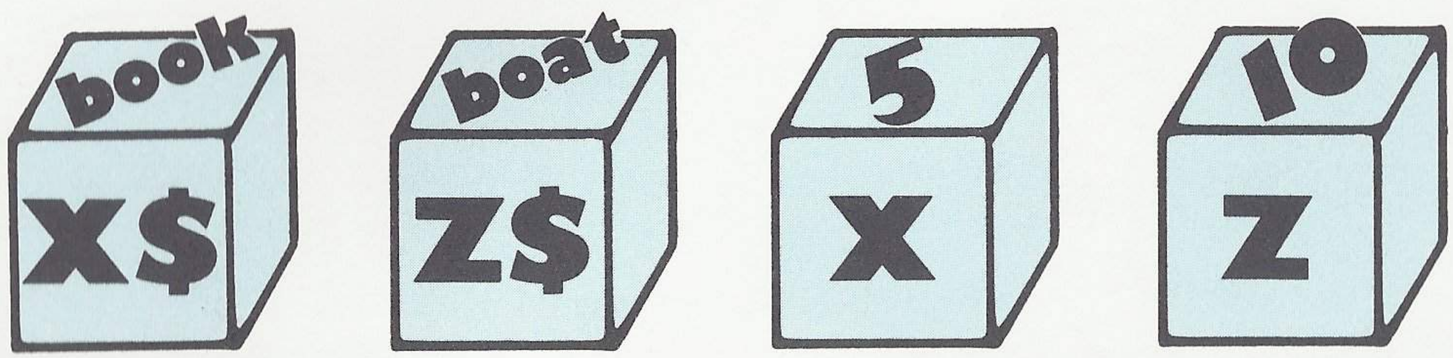
Every time the program loops back for another guess, line 65 adds 1 to the value of Z.

KEEP GOING



Review

1 Pretend that the computer has been programmed to have these values in its "memory boxes":



Answer *true* or *false*.

a ___ X = Z
b ___ X < Z
c ___ X$ > Z$
d ___ X$ = X
e ___ X + Z = X$
f ___ 2 * X = Z

2 LOOK at the sample program. CIRCLE the word that makes each sentence true.

```
10 X = 100
20 X = X - 2
30 ? X
40 IF X > 50 THEN GOTO 20
```

a This program counts forward backward.

b It will stop at 48 50 52.

c To make the computer count by threes, you should change line
10 20 30 40.

d To make the computer start counting at 70, you should change line
10 20 30 40 70.

3 Now LOOK at another program. Fill in the words or numbers to make each sentence true.

```
10 FOR Q = 1 TO 15
20 N = INT (20 * RND (1))
30 ? N
40 NEXT Q
```

a This program will print _____ numbers.

b The numbers could be as small as _____ and as large as_____ .

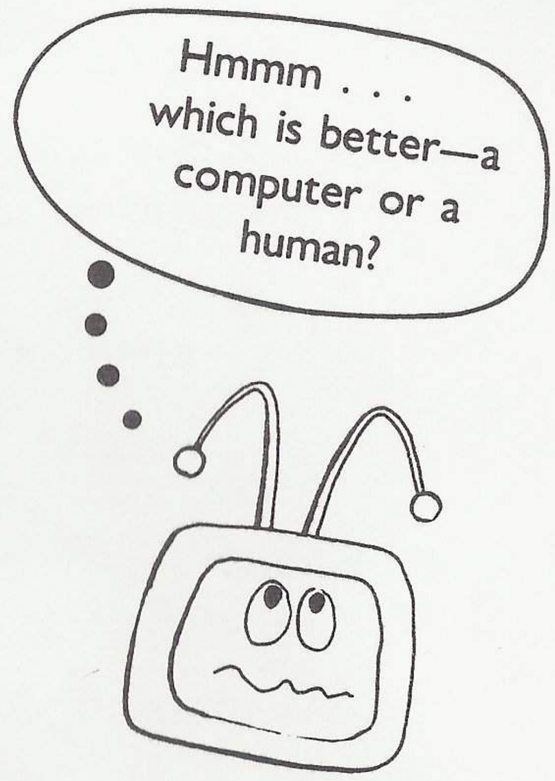
c We use INT so that all the numbers will be printed as _____ .

d If we want the computer to print out a longer list of numbers, we should change line _____ .

4 → Put a **C** next to jobs that a computer might be programmed to do.

→ Put an **H** next to jobs that a human might be "programmed" to do.

→ Put a **B** if **both** a computer and a human might be programmed to do the job.



__ Get ice cream out of a freezer and fix an ice cream cone.

__ Calculate your income tax.

__ Add up a thousand numbers in a few seconds.

__ Taste several kinds of cookies and decide which flavor is best.

__ Look at your Address Book and find all the people in it who live in San Francisco.

__ Keep track of time to a fraction of a second.

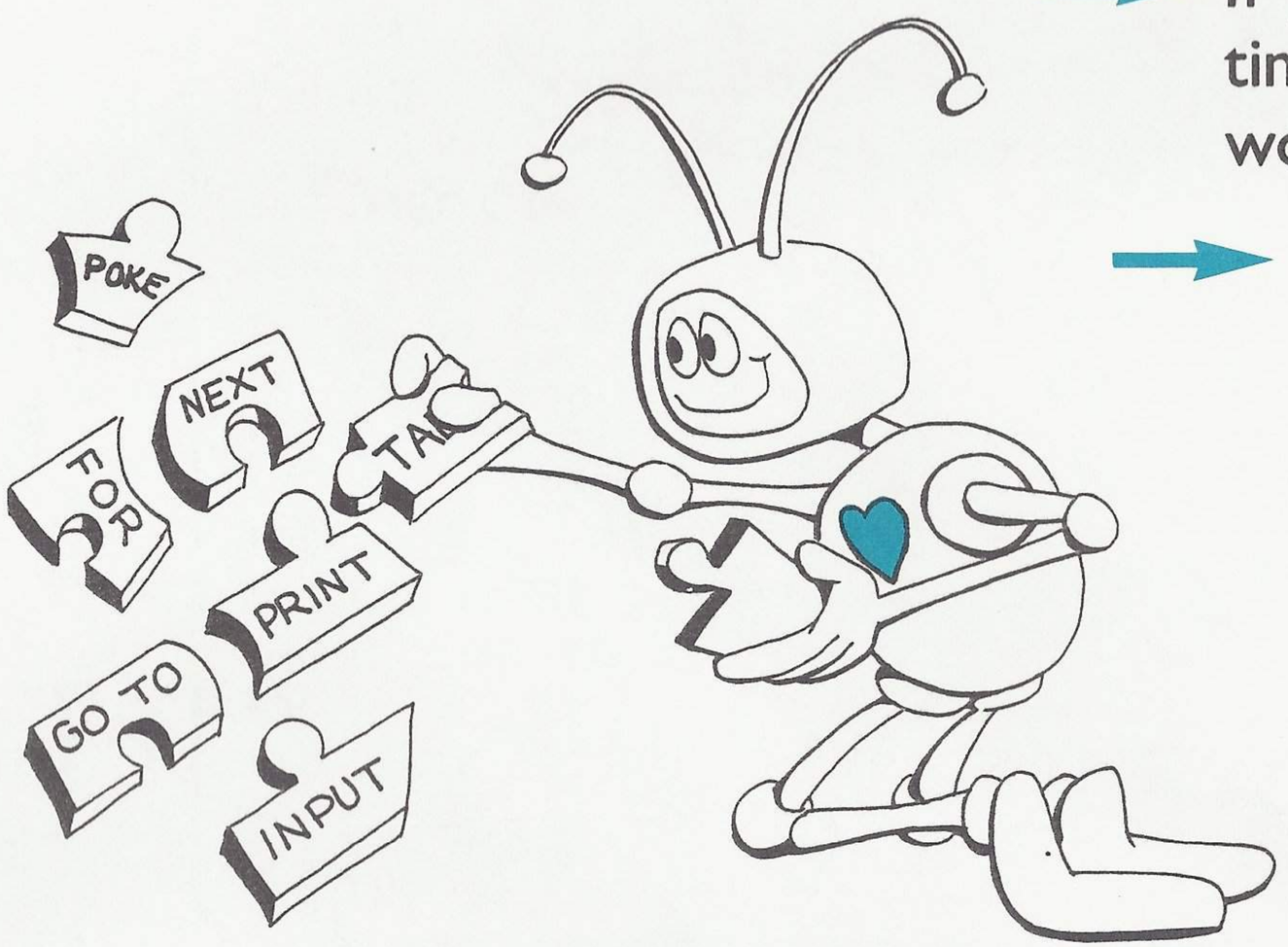
Put It All Together!

→ Let's write a FUN story using almost everything you have learned so far.

→ **Carefully** type in the program on the following pages.

→ If you can't finish it all at one time, be sure to SAVE your work on a tape or disk.

→ You can continue later and then SAVE it again!



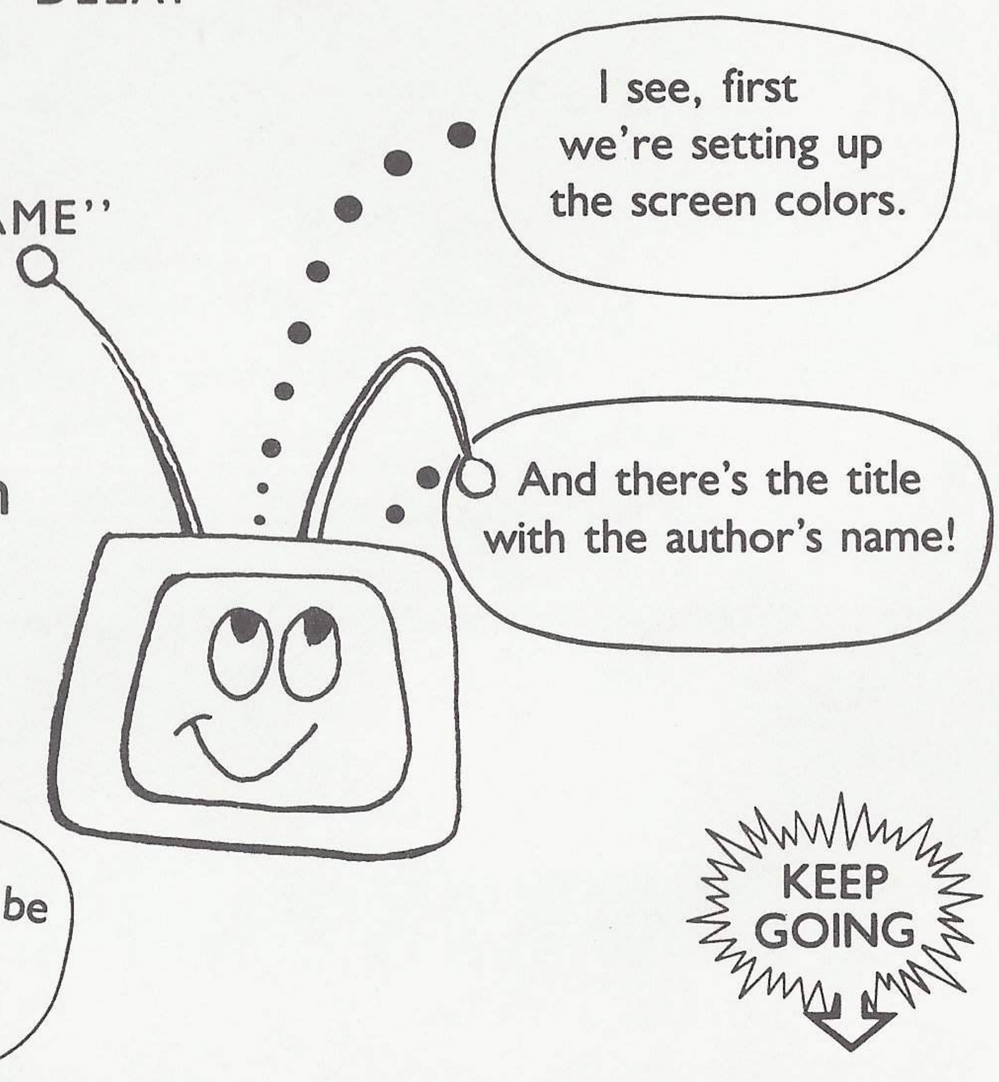


TYPE

```
NEW
100 ? "■"
110 POKE 53281,14: POKE 53280,6
120 ? "■"
130 ? "TELL ME YOUR NAME"
140 INPUT G$
150 ? "■"
160 ? "↓↓↓↓↓↓↓→→→→→→→→→→→→→→→→ AN ADVENTURE"
170 ? "↓→→→→→→→→→→→→→→→→→→→→ BY _ " G$
180 FOR DELAY = 1 TO 1500: NEXT DELAY
190 ? "■ ↓↓↓↓↓↓"
200 ? "TELL ME A FRIEND'S NAME"
210 INPUT N1$
220 ? "AND ANOTHER FRIEND'S NAME"
230 INPUT N2$
```

CTRL and 1 BLK

Cursor down and to the right



* Try RUNning just this much of the program to see that it works properly.

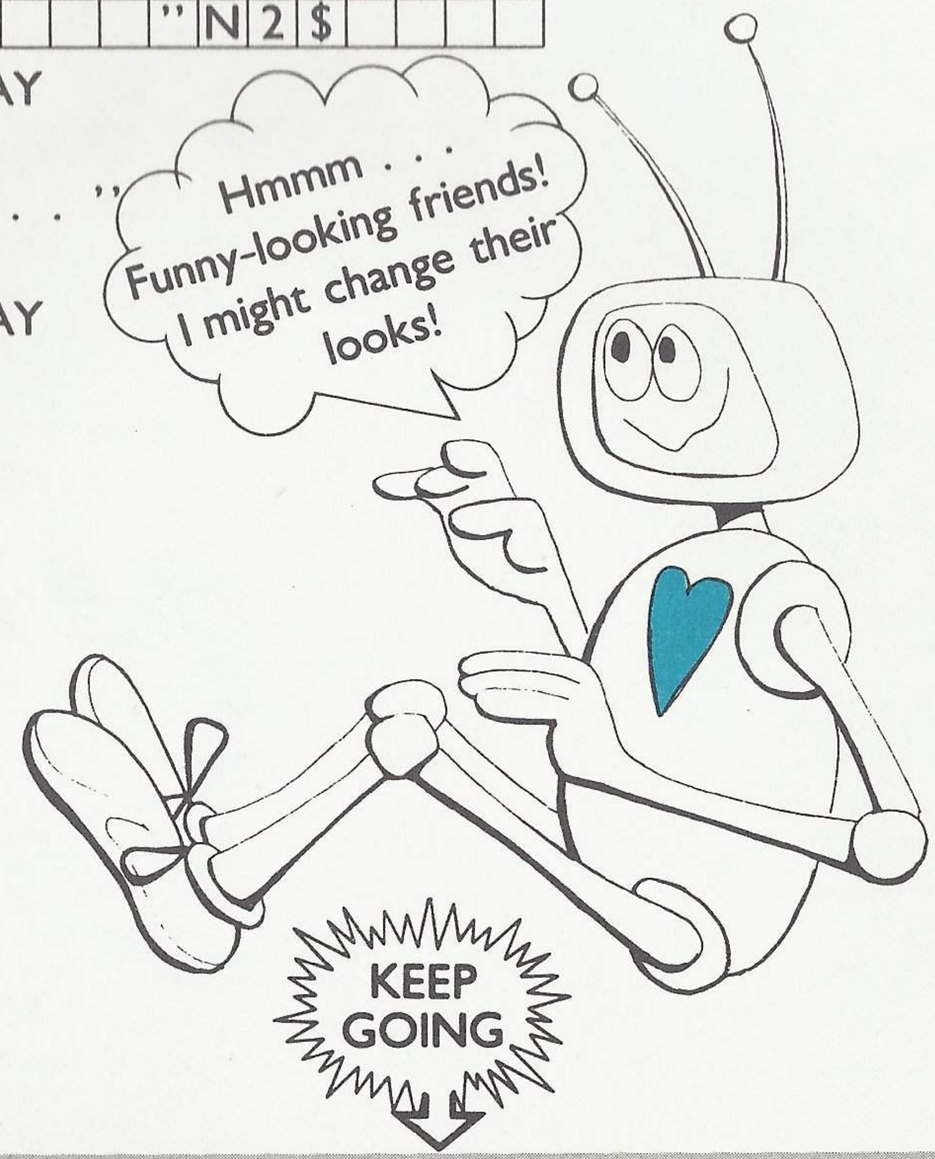
* Now LIST and continue.

KEEP GOING

```
240 ? " ♥ "
250 ? "ONCE UPON A TIME THERE WERE TWO"
260 ? "FRIENDS NAMED_" N1$ "_AND_" N2$ "."
270 ? : ? : ?
280 ? "                @@@@@@
290 ? "             @┌─┬─┬─┬─┐@
300 ? "             @│ * │ * │@
310 ? "             @│   V   │@
320 ? "              │ \____/ │
330 ? "              └─┴─┴─┴─┘
340 ? : ?                                  /┌─┬─┬─┬─┬─┐\
350 ? "              " N1$ "                /│ ●   ● │\"
360 FOR DELAY = 1 TO 3000: NEXT DELAY      \│   ○   │/
370 ? " ♥ "                                 \_____/
380 ? "THEY DECIDED TO LEAVE HOME . . . "
390 ? "AND GO ON A TRIP."
400 FOR DELAY = 1 TO 3000: NEXT DELAY
```

TYPE

? : ? : ? means three blank lines will be printed.



* RUN your program now and correct any "BUGS" that may appear.

* LIST your program and keep going . . .

TYPE

```
410  REM  **BY  BRANDON  **
420  POKE  53281,1
430 ?"■"
440 ?"■                  **"
450 ?"■                 ****"
460 ?"■               *******"
470 ?"■               *******"
480 ?"■                ****"
490 ?"■                 **"
500 ?"■                 **"
510 ?"■                 **"
520 ?"
530 ?;?"■"
540  FOR  C=1  TO  18
550 ?TAB(C)"
560 ?TAB(C)"
570 ?TAB(C)"
580 ?TAB(C)"
590 ?TAB(C)"
600 ?"■↓↓↓↓↓↓↓↓↓↓↓↓"
610  NEXT  C
```

■ = Clear Screen — SHIFT and CLR HOME

■ = Green — CTRL and & 6 GRN

■ = Black — CTRL and ! 1 BLK

■ = Top line — C= and T

■ = Blue — CTRL and ' 7 BLU

■ = Bottom line — C= and O

■ = Corner — SHIFT and L

■ = Side line — C= and H

■ = Reverse field — CTRL and / 9 RVS ON

■ = Red — CTRL and # 3 RED

■ = "Box" — C= and +

■ = "Window" — SHIFT and W

KEEP GOING

RUN your program to see if this works!

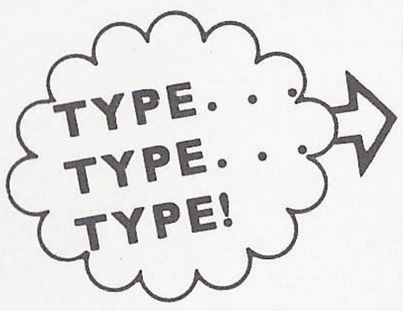
More to **TYPE**

```
620 FOR DELAY = 1 TO 1000: NEXT DELAY
630 ? "♥"
640 ? : ?
650 ? "WHAT FUN IT WOULD BE TO GO ON A ROCKET!"
660 ? : ?
670 ? "SHOULD THEY GO TO:"
680 ? TAB (5) "THE MOON"
690 ? TAB (5) "MARS"
700 ? TAB (5) "PLUTO"
710 ? TAB (5) "VENUS"
720 ? "↓ YOU CHOOSE ONE FOR THEM."
730 INPUT "TYPE IN ONE PLACE"; P$
740 FOR DELAY = 1 TO 500: NEXT DELAY
```



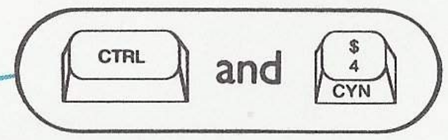
* RUN your program . . .
  Make it **all** work correctly!

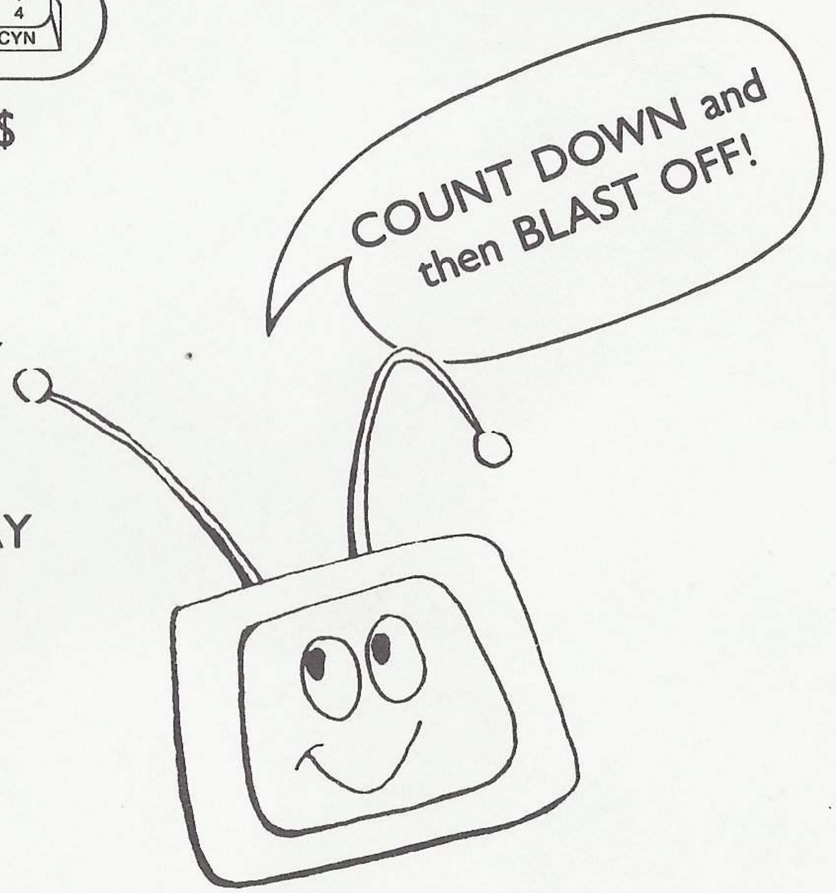
* LIST the program and keep on going . . .




```
750 ? "■"
760 ? "AS THEY HEAD FOR THE LAUNCH PAD,"
770 ? "THEY ARE THINKING HOW MUCH FUN"
780 ? "IT WOULD BE TO GO TO _" P$ "."
790 ? : ?
800 IF P$ = "THE MOON" THEN ? "CRATERS . . . HOW EXCITING!"
810 IF P$ = "PLUTO" THEN ? "WHAT A LONG WAY TO PLUTO!"
820 IF P$ = "MARS" THEN ? "I WONDER IF THERE IS LIFE ON MARS . . ."
830 IF P$ = "VENUS" THEN ? "BUT THERE ARE LOTS OF CLOUDS THERE!"
840 FOR DELAY = 1 TO 5000: NEXT DELAY
850 ? "■"
860 POKE 53281,0
870 ? "■"
880 ? "TIME FOR _ " N1$ "_ AND _ " N2$
890 ? " TO BLAST OFF!"
900 FOR B = 10 TO 1 STEP -1
910 ? B
920 FOR DELAY = 1 TO 300: NEXT DELAY
930 NEXT B
940 ? "BLAST OFF!!"
950 FOR DELAY = 1 TO 1500: NEXT DELAY
```

IF . . . THEN





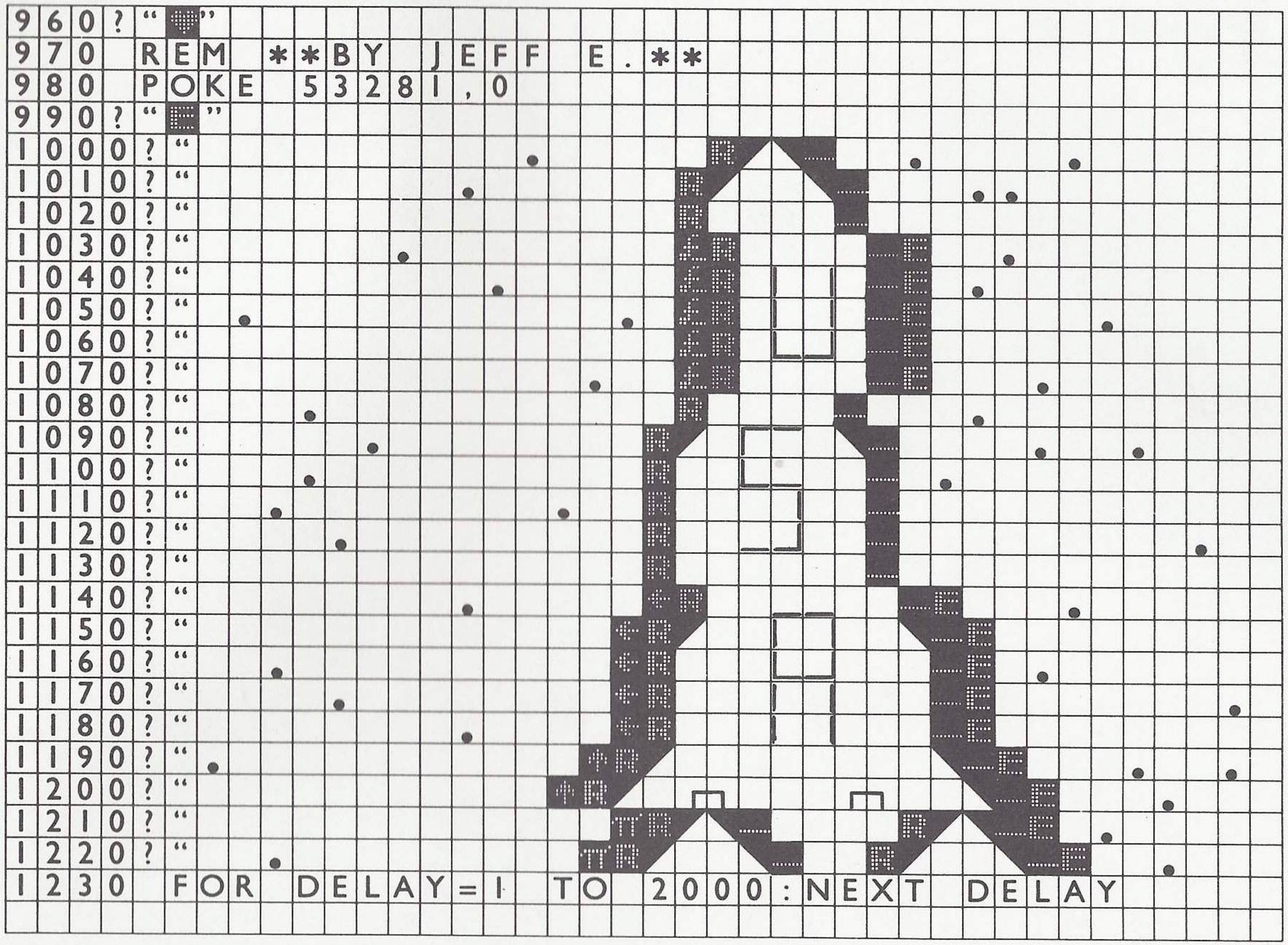
* RUN your program and get rid of all BUGS!

  Then LIST it and continue . . .



Rocket Among the Stars!

```
960 ? " ■ "
970   REM  **BY  JEFF  E.**
980   POKE  53281,0
990 ? " E "
1000 ? "
1010 ? "
1020 ? "
1030 ? "
1040 ? "
1050 ? "
1060 ? "
1070 ? "
1080 ? "
1090 ? "
1100 ? "
1110 ? "
1120 ? "
1130 ? "
1140 ? "
1150 ? "
1160 ? "
1170 ? "
1180 ? "
1190 ? "
1200 ? "
1210 ? "
1220 ? "
1230   FOR DELAY=1 TO 2000:NEXT DELAY
```



■ = Reverse Video
CTRL and 9 RVS ON

■ = Reverse Off
CTRL and 0 RVS OFF

■ = Red
CTRL and 3 RED

■ = White
CTRL and 2 WHT

■ = Blue
CTRL and 7 BLU

■ = Green
CTRL and 6 GRN

■ = Yellow
CTRL and 8 YEL

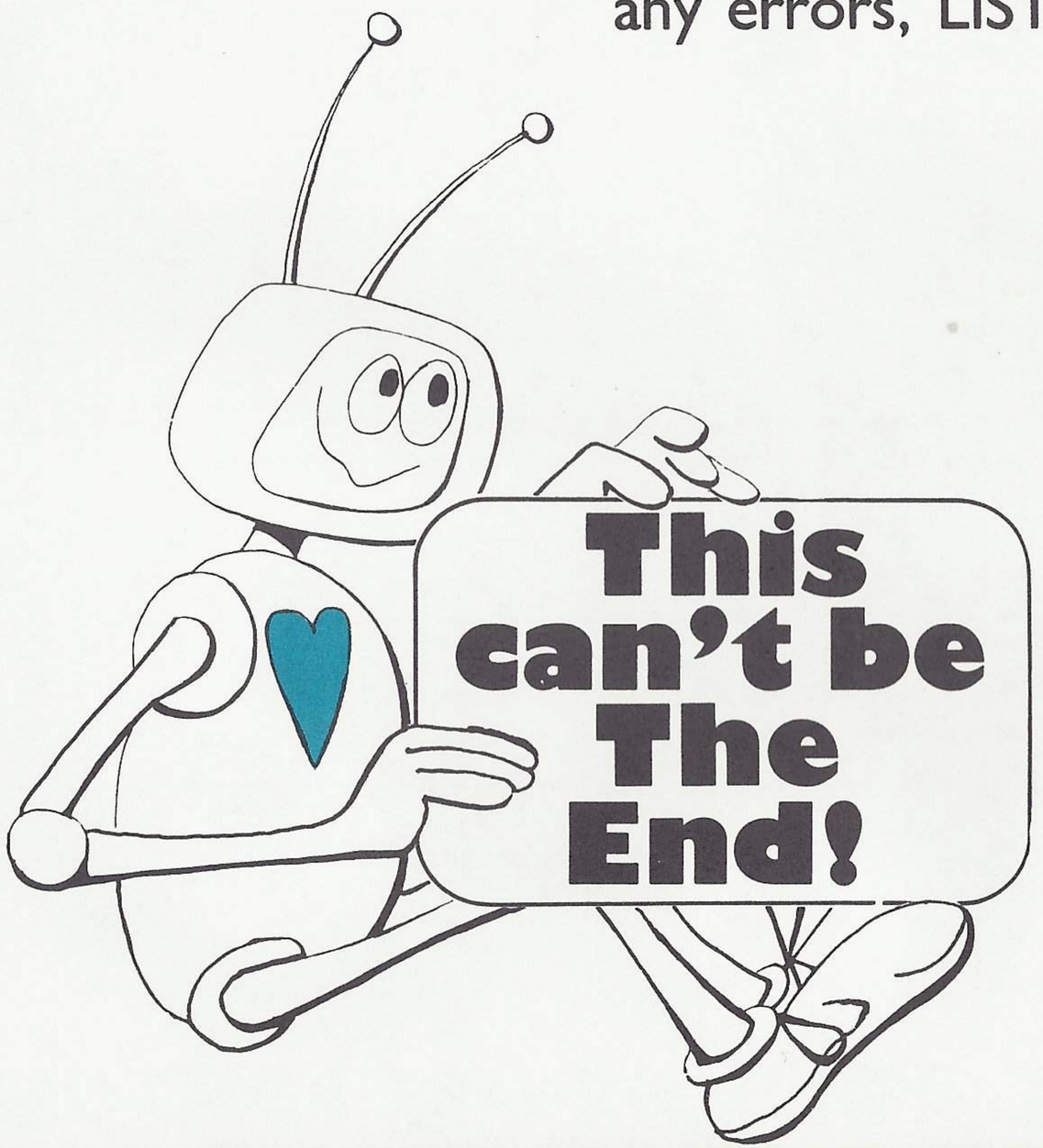
ONE MORE !

TYPE

```
1240 ? "↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓"
1250 ? "→ → → → → → BYE BYE _" N1$ "_ AND _" N2$ "!!"
```

25 cursor downs

RUN your entire program now!! If you have any errors, LIST your program and "debug" it.



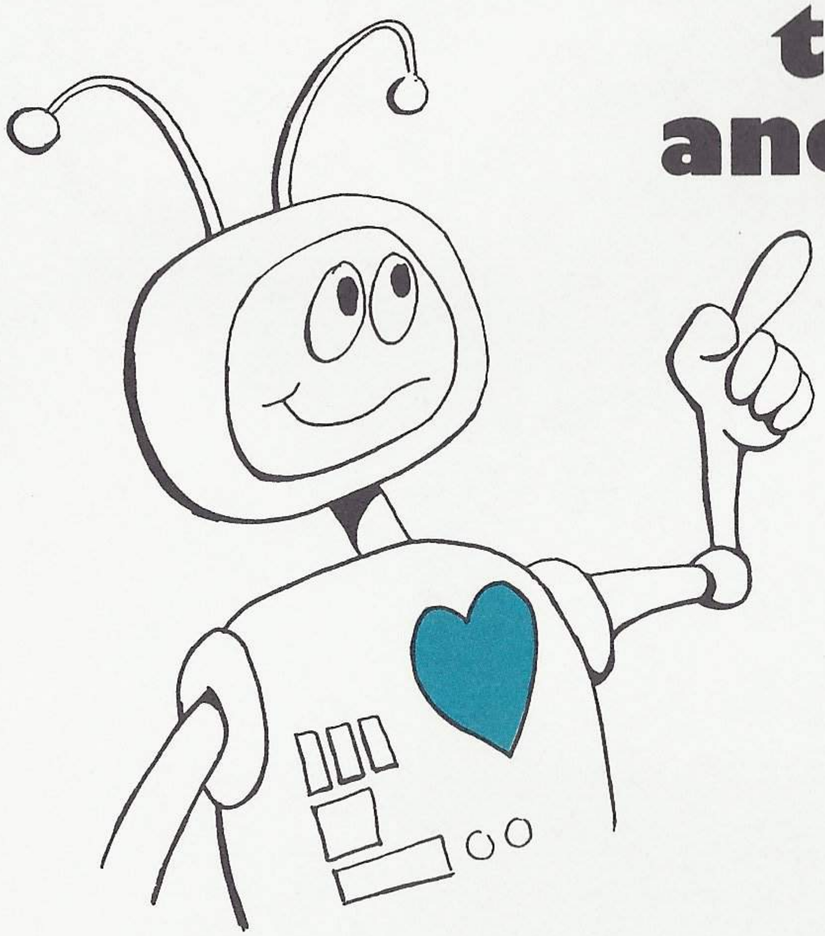
DON'T STOP HERE

Add to your program . . .
Be sure to save it on disk or tape.
Share it with your friends!

Explore!!
Enjoy!!

Answers

to Review Questions and Selected Challenges



ANSWERS TO REVIEW QUESTIONS

REVIEW 1 *(22–24)*

1 **b** pictures and symbols

2 The writing on the screen changes from uppercase to lowercase or to graphics "code."

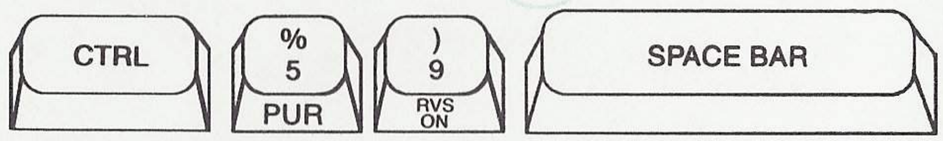
3 16 colors

4 c, e, a, f, b, d

5 **a** ♥ **b** × **c** ⊥ **d** ▚

6 **a** MY KCAT CHASES RATS
b MY DOG HAS FLEAS

7



REVIEW 2 *(40–41)*

1 **a** ?2+3 **b** ? "HELLO"
c PIRNT "COMPUTERS"

2 BASIC

3 ?

4 **a** 5 **b** POKE 53281
c orange border **d** 0

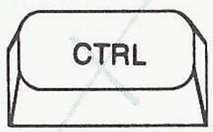
5 Check your answers on the computer.

REVIEW 3 *(63–65)*

1 **a**



b



2 **a**

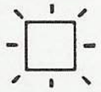
```
RUN
I
♥ ♥ ♥
MY
COMPUTER
READY
```

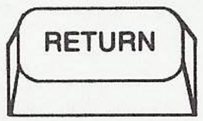
b

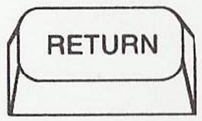
```
LIST
10  PRINT "I"
20  PRINT "♥ ♥ ♥"
30  PRINT "MY"
40  PRINT "COMPUTER"
READY
```

ANSWERS TO REVIEW QUESTIONS

c NEW
READY



3 a 10 ? "BOB" 

b 20 

4

	ACROSS		DOWN
1.	RUN	1.	REM
4.	LINE NUMBER	2.	DELETE
6.	SAVE	3.	PRINT
7.	RUN STOP	4.	LIST
8.	VERIFY	5.	GOTO

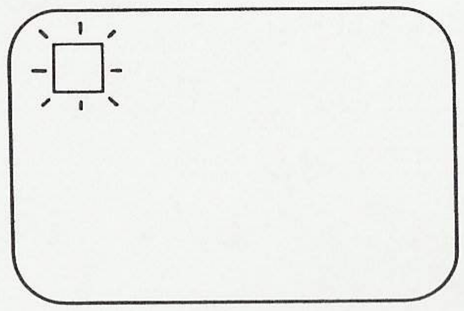
REVIEW 4 *(85–87)*

1 Print an empty line.

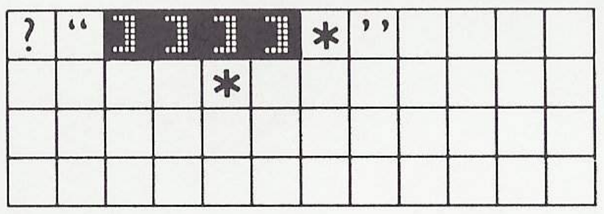
2 a. 

b. 

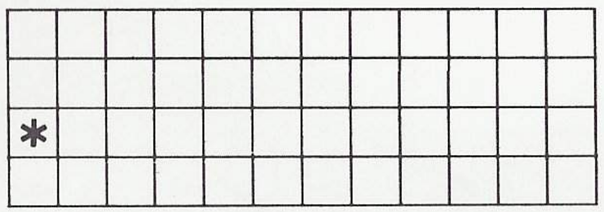
c. ●●●■■■●●●

3  (upper left corner)

4 a.



b.

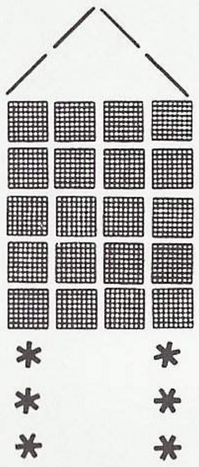


5 (d) turns off reverse video, (f) prints a ♥, (g) turns on reverse video, (e) makes cursor go to HOME position, (b) changes printing to black, (h) changes printing to green, (a) clears the screen, (c) tells cursor to go down.

ANSWERS TO REVIEW QUESTIONS

REVIEW 5 *(107–109)*

1



2
```
10 ? FOR X = 1—10
20 ? SMILE"
30 FOR DELAY = 1 TO 500;
    NEXT D
40 NEXT Y
```

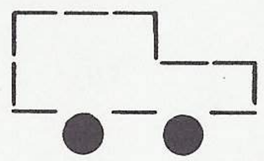
3 **a.**
```
10 FOR X = 1 TO 100
20 PRINT X
30 NEXT X
```

b.
```
10 FOR N = 100 TO 50 STEP –5
20 PRINT N
30 NEXT N
```

4 A, D, C, B

REVIEW 6 *(128–130)*

1



2
```
HAPPY BIRTHDAY TO YOU
HAPPY BIRTHDAY TO YOU
HAPPY BIRTHDAY DEAR FRIEND
HAPPY HAPPY BIRTHDAY TO YOU
```

3 **a** N = 6
b X = 5 Z = 3 M = 0
c T = 7

4 **a**
```
10 X = 0
20 ? X
30 X = X + 5
40 GOTO 20
```

b
```
10 X = 1
20 ? X
30 X = 2*X
40 GOTO 20
```

REVIEW 7 *(152–154)*

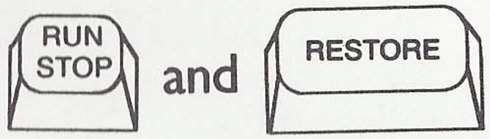
1
```
20 ? TAB (5) "COMPUTER MATH"
30 ? TAB (7) "BY CHRIS HUNTER"
```

ANSWERS TO REVIEW QUESTIONS

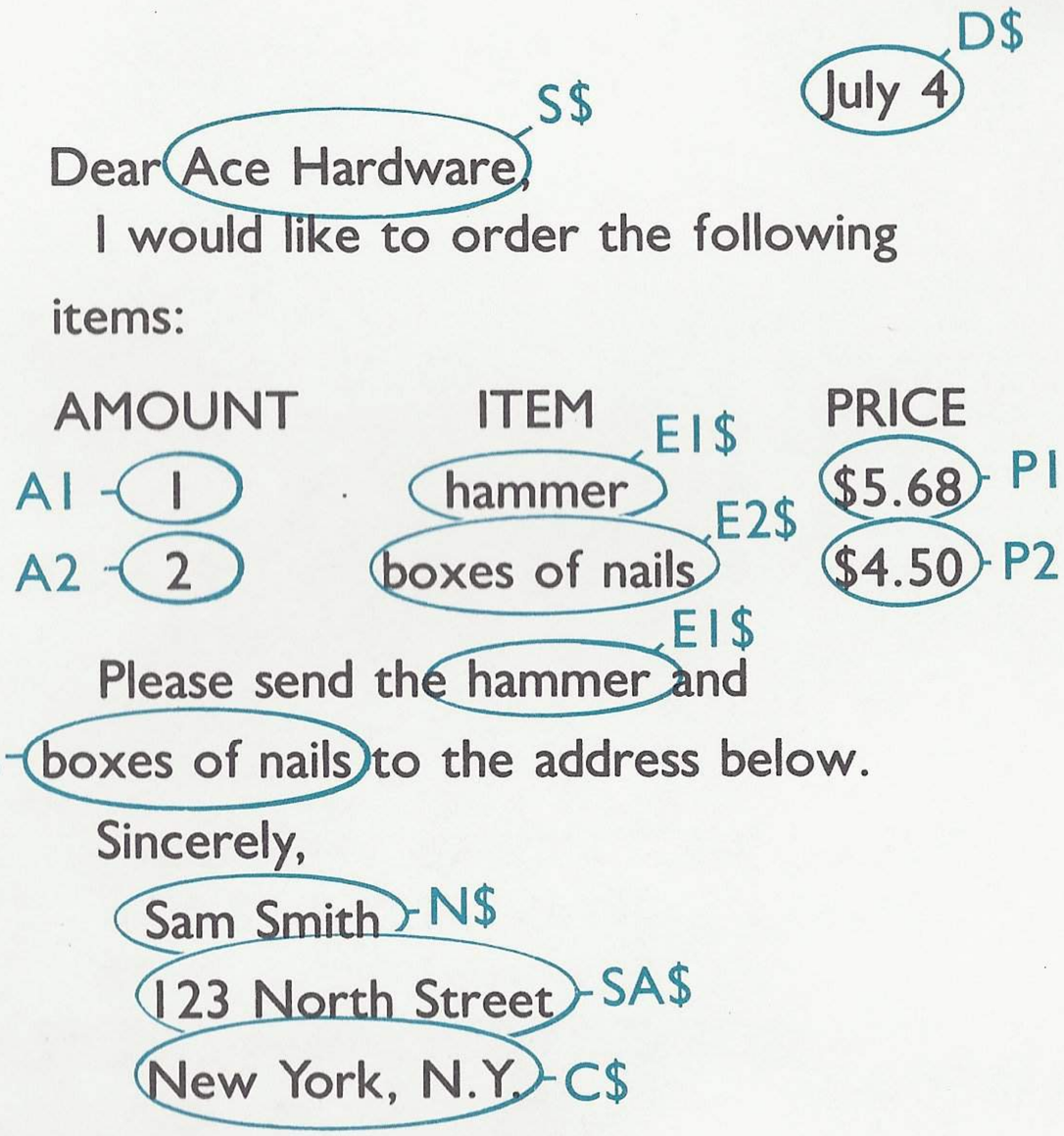
2 a

```
WHAT IS YOUR NAME
?
HOW OLD ARE YOU  ?
```

b Line 20 uses a string variable and contains letters, while line 40 uses a numeric variable, which doesn't require a **$**.

c 

3



(Variable "names" may vary.)

REVIEW 8 *(170–172)*

1 **a** F **b** T **c** T **d** F **e** F **f** T

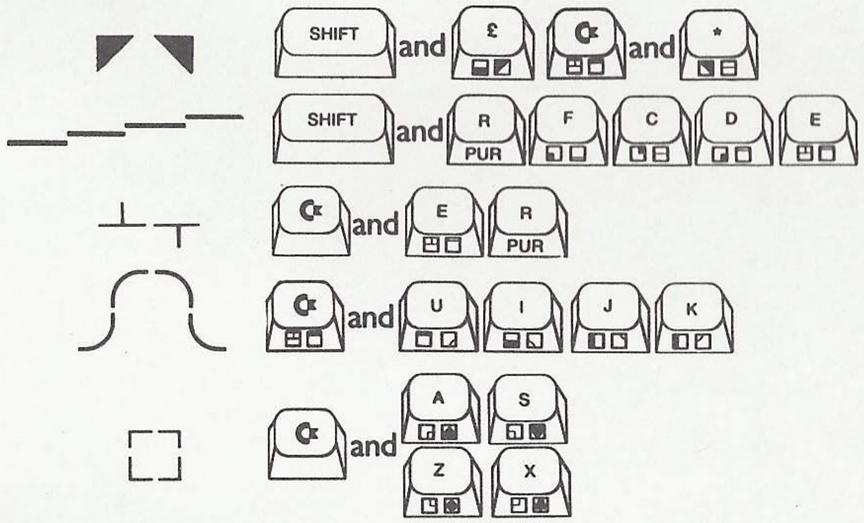
2 **a** backwards **b** 50 **c** 20 **d** 10

3 **a** 15 **b** 0 and 19 **c** whole numbers **d** 10

4 H, B, C, H, B, C

ANSWERS TO SELECTED CHALLENGES

LESSON 3 *(14)*



LESSON 7 *(34)*

POKE 53281,7 makes the screen yellow.

POKE 53280,6 makes the border blue.



makes the writing blue.

POKE 53281,6 makes the screen blue.

LESSON 8 *(39)* (Answers may vary slightly.)

1 ? "THERE ARE " 29 * 10 "TOES IN MY CLASSROOM." (29 students, with 10 toes each.)

2 ? "THERE ARE " 4 * 2 "EARS IN MY FAMILY." (4 family members, with 2 ears each.)

3 ? " THERE ARE " 60 * 60 "SECONDS IN ONE HOUR." (60 minutes, with 60 seconds each.)

? "THERE ARE " 10 * 60 "SECONDS IN ONE RECESS." (10 minutes of recess, with 60 seconds each.)

4 ? "THERE ARE " 60 * 60 * 6 "SECONDS IN ONE SCHOOL DAY." (6 hours, with 60 minutes each, and 60 seconds in each minute.)

ANSWERS TO SELECTED CHALLENGES

LESSON 9 *(48)*

Type RUN and LIST

LESSON 11 *(54)*

(Answers may vary slightly.)

```
20 ? 0 + 1, 1 + 1
30 ? 2 + 1, 2 + 2
50 ? 3 + 4, 4 + 4
60 ? 4 + 5, 5 + 5
```

LESSON 18 *(102)*

a

100 =	4 seconds
1000 =	46 seconds
10,000 =	7 minutes, 39 seconds
100,000 =	1 hour, 16 minutes, 27 seconds

b

100 =	less than a second
1000 =	2 seconds
10,000 =	18 seconds
100,000 =	2 minutes, 54 seconds
One million =	28 minutes, 33 seconds

LESSON 22 *(123)*

```
10 J$ = "JINGLE"
20 B$ = "BELLS"
30 S$ = "***"
40 ? S$ J$ B$ S$
50 ? S$ J$ B$ S$
60 ? J$ "ALL THE WAY!"
```

COLORS:

(Suggestions—choices may vary.)

```
POKE 53281,5
POKE 53280,2
```



ANSWERS TO SELECTED CHALLENGES

LESSON 24 *(137)*

```
100 PRINT "HOW MANY SCOOPS OF ICE CREAM CAN YOU"
110 PRINT "EAT IN ONE HOUR";
120 INPUT S
130 PRINT "HOW MANY HOURS A DAY DO YOU EAT"
140 PRINT "ICE CREAM";
150 INPUT H
160 PRINT "YOU EAT" S * H "SCOOPS OF ICE CREAM A DAY!"
170 PRINT "ONE SCOOP HAS 200 CALORIES."
180 PRINT "THAT MEANS YOU EAT" 200 * S * H "CALORIES"
190 PRINT "WORTH OF ICE CREAM IN ONE DAY."
```

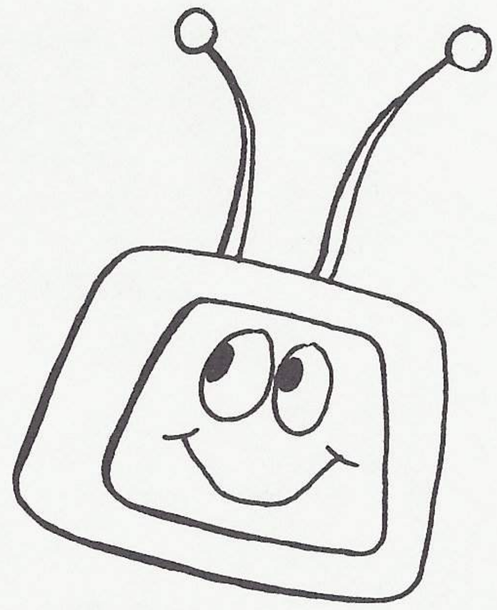
LESSON 28 *(159)*

a 40 IF X < 50 THEN GOTO 20

b 20 X = X + 2

c 10 X = 50
20 X = X – 1
40 IF X > 10 THEN GOTO 20

ANSWERS TO SELECTED CHALLENGES



LESSON 29 *(160)*

a
```
35 INPUT "THIRD NUMBER"; X
40 ? A " +" B " +" X " =";
60 IF A + B + X <> C THEN ?
      "WRONG": GOTO 40
70 IF A + B + X = C THEN ? "RIGHT!"
```

b
```
5 ? "♥"
80 ? : ?
90 GOTO 20
```

LESSON 30 *(166)*

a
```
30 Z = INT (100* RND (1)) + 1
```

b
```
20 FOR X = 1 TO 30
30 Z = INT (100* RND (1))
```

c
```
20 FOR X = 1 TO 15
30 Z = INT (25 * RND (1)) + 1
```

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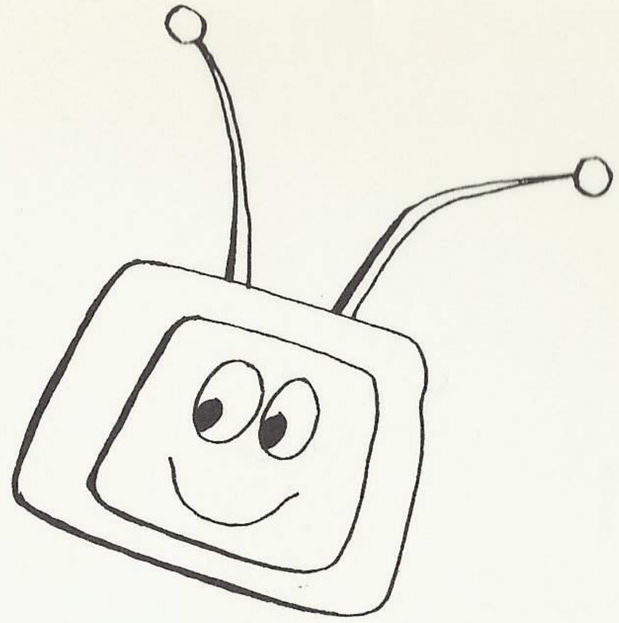
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