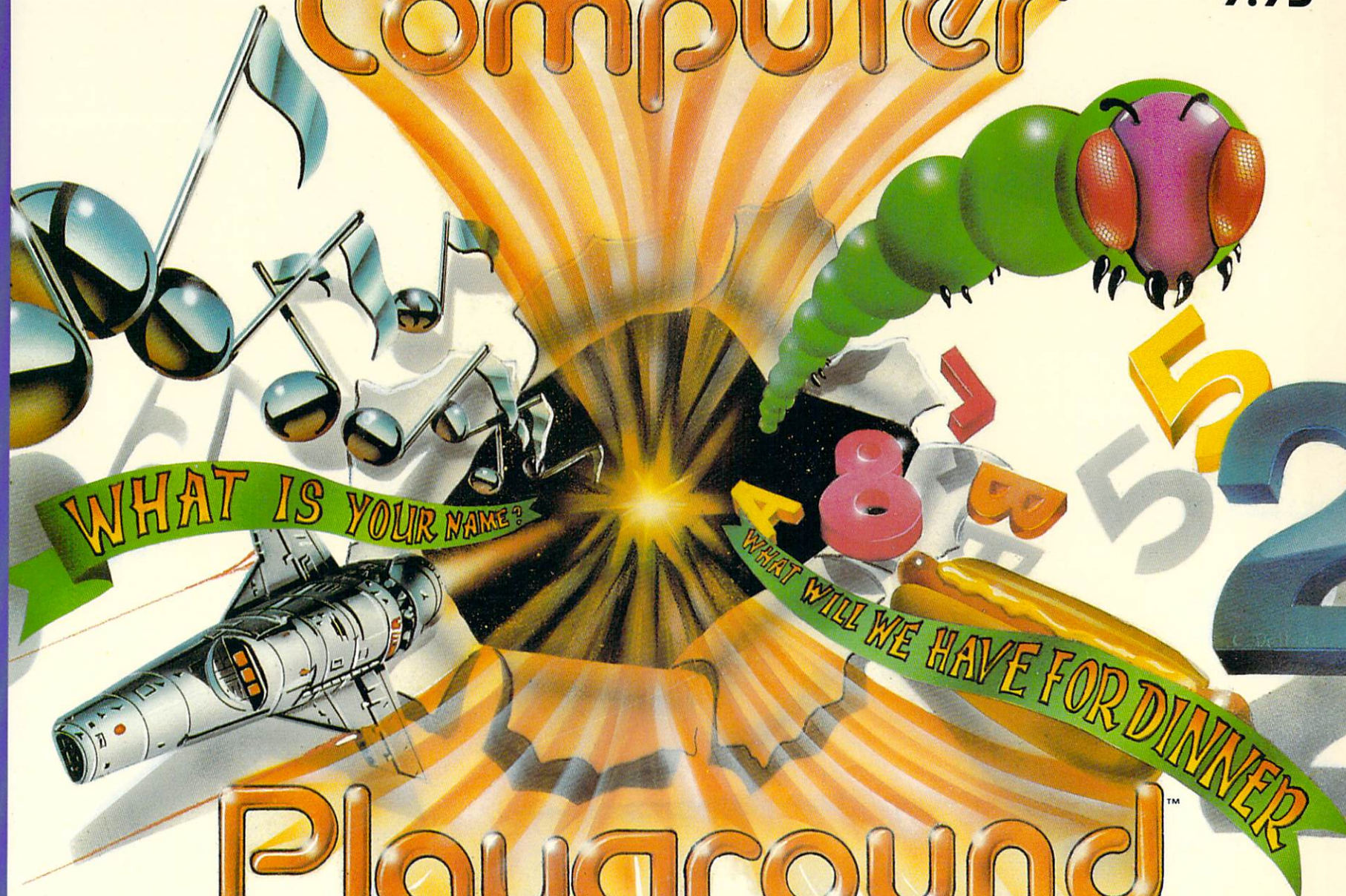


by
M. J.
Winter

\$9.95

Computer



WHAT IS YOUR NAME?

WHAT WILL WE HAVE FOR DINNER

Playground™

Commodore 64 / VIC-20



DATAMOST

Computer
Playground

Computer Playground

On the Commodore 64
and VIC 20

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My family, who not only live with three computers in the kitchen, but who liberally gave suggestions about the book.

THE PROBLEMS

1. Season's Greetings
2. Take a Number, Please
3. Mistakes
4. Initials
5. Where Now?
6. Wallpaper
7. Letter to Santa
8. Cursor Controls – color and movement
9. Invisible Writing
10. The Delay
11. Rockets
12. Counting and Repeating
13. Movers
14. The Worm Turns
15. More Counting
16. Testing with IF...THEN
17. Goldilocks
18. Animal Guess
19. Little Indians
20. Nursery Rhyme
21. Blinking Lizards
22. Screen Colors
23. PEEKaboo
24. Funny Bones and Sore Toes
25. Quiz Time
26. Pieces of Words
27. Black Magic
28. Rhyming Game
29. Compound Words
30. Word Puzzle
31. Doing Math
32. Math Quiz
33. Times Tables
34. Days and Nights
35. Think of a Number
36. Two Dice
37. Get Out of Jail
38. Harder Math Quiz
39. Number Guess
40. The Answer Machine
41. Dinner Darts
42. Crystal Ball

Introduction

This collection of BASIC computer activities is intended for the child whose family has a computer and for children in grades 2.5–6 who have access to a classroom computer. The activities have been tested with several groups of youngsters and have proved both popular and effective.

Each activity is presented as a “Problem” in a workbook. Children will find the problems both interesting and geared to their level of understanding. They will want to spend long periods of time repeating and varying a single activity.

As a child progresses through the workbook, she/he will learn how to use many of the features of the BASIC language. In doing so, the child will also build up a collection of programs which are both understood and entertaining

It is recommended that a knowledgeable adult supervise the child’s work in this book, to lend assistance when necessary.

Overview

Children can mimic before they can create. In some of the activities they are directed to run sample programs, then modify them. In others, the children complete partially written programs. The activities are all based on children's natural interest in words, games and graphics.

The BASIC content of each group of problems and a detailed description of each problem are indicated below.

problem of each group.

Group	Problems	Content
1	1-7	PRINT, GOTO, INPUT
2	8-15	Cursor Controls, FOR...NEXT
3	16-25	IF...THEN, POKE, PEEK
4	26-30	RIGHT\$, LEFT\$, etc.
5	31-34	Simple arithmetic applications
6	35-39	Random numbers
7	40-42	Lists of words (arrays)

Problems 1–7

BASIC Vocabulary

The first group of problems is based on the words PRINT and GOTO. INPUT is used in 6 and 7; END, TAB, and REM are touched on lightly.

Description of Problems

1. Greetings: The first problem is an introduction of PRINT and GOTO. PRINT used by itself leaves a blank line.
2. Number, Please: A program follows instructions according to the line numbers, not according to the order in which the lines are entered.
3. Mistakes: The message SYNTAX ERROR is likely to mean something is misspelled. An \emptyset appearing where a word is expected means the quotation marks were omitted.
4. Initials: A fun design. If the initial is slanted, (A, W, etc.) it will be easier to design the large initial on a grid.
5. Where Now?: A follow-the-program puzzle. END is necessary here or extra letters will be printed. The ; keeps the letters on the same row.

6. Wallpaper: INPUT P\$ means tell the computer the basic pattern. When INPUT is used, the computer must know whether to expect a number or a word. The \$ tells the computer that a word is coming.

7. Letter to Santa: This is mainly a debugging exercise — few children will type it correctly the first time. Screen editing (type over the mistake and press RETURN) should be demonstrated here. There is a quiz on matching the name of a variable with what it represents. 6–7 year olds will often not find this amusing.

Problems 8–15

BASIC Vocabulary

These problems introduce the use of cursor controls in PRINT statements. The FOR...NEXT statement is also introduced. Combined, the techniques can produce impressive graphics.

Description of Problems

8. Cursor Controls: To change cursor color or location in a PRINT statement, the cursor controls are typed in. Circled lower case abbreviations such as **(dn)** , **(clr)** , **(blk)** mean press down cursor, shifted clr/home, and ctrl black respectively.

9. Invisible Writing: Write with white ink on white paper.

10. The Delay: We make the computer pause while it counts to itself. Because the computer counts very rapidly, we make it count to a higher number.

11. Rockets: Using reversed graphics and appropriate pauses, we can make an endless series of handsome missiles soar through the atmosphere.

12. Counting and Repeating: Up to now, the computer has counted to itself. We watch it count; then make it print a word each time it counts. Finally, a reaction test shows how fast our reflexes are.

13. Movers: Movement is really an illusion. A star is printed, erased and printed again. It appears to leave tracks.

14. The Worm Turns: Same as #13, but this time a green worm with a purple head crawls across the screen.

15. More Counting: A review of the FOR...NEXT loop; this time the upper limit is an input.

Problems 16–25

BASIC Vocabulary

These problems introduce the IF...THEN test of whether or not two things are the same. POKE and PEEK are used in 21–23.

Descriptions of Problems

16. Testing with IF...THEN: = means "is the same as", < > means "is not the same as." IF statements can be complicated:

IF A\$="RED" OR A\$="BLUE" THEN...

17. Goldilocks: Complete the program by testing the temperature of the porridge.

18. Animal Guess: Uses IF...THEN with branching. Younger children will probably be content with changing line 100 every time. Others will want to make this a two-person game.

19. Little Indians: Combine FOR...NEXT with IF...THEN to print out the counting rhyme.

20. Nursery Rhyme: Same as #19.

21. Blinking Lizards: A graphics diversion; make the orphan blink her eyes.

22. Screen Colors: Change the screen and border colors using POKE. Keep a record of interesting color combinations. There are separate pages for the VIC and the 64.

23. PEEKaboo: The computer constantly checks the keyboard to see what key is being pressed. If it's the STOP key, the program will stop; otherwise it continues. Each key has a code number; in this problem we learn some of these codes.

24. **Funny Bones and Sore Toes:** The computer responds when certain keys are touched.

25. **Quiz Time:** What is the capital of Michigan? This is a three question quiz, with responses and second chances.

Problems 26–30

BASIC Vocabulary

The beginning and ending letter(s) of a word can be examined with the `LEFT$(A$,1)` and `RIGHT$(A$,1)` statements. Words can be glued together with the `+` sign.

Description of Problems

26. **Pieces of Words:** Use `LEFT$(A$,2)` to find the first two letters of `A$`, etc.

27. **Black Magic:** The computer plays 20 Questions with you. It apparently knows what it's doing. How can such a short program be so smart? The clue is in `RIGHT$`.

28. **Rhyming Game:** Now you guess at a word, and the computer gives hints.

29. **Compound Words:** Build up words using little words.

30. **Word Puzzle:** A pencil and paper puzzle. Form new words from old ones.

Problems 31–34

BASIC Vocabulary

Very simple arithmetic operations on variables are introduced. Experience has shown that manipulating variables generally requires a high level of mental development and the ability to handle abstractions. The operations in these problems are kept as concrete as possible.

Description of Problems

31. Doing Math: The operation is doubling. The information to be INPUT is a number, not a word; its name does not have a \$.

32. Math Quiz: How to add two numbers and compare the sum with the user's guess. Here = means "is the same as" and <> means "is not the same as."

33. Times Tables: Make the computer print multiplication tables. Operating on a FOR...NEXT variable may be difficult for some younger children to understand, but they will be delighted with the output.

34. Days and Nights: Use the computer to solve the problem of how much sleep we get in a year if we sleep eight hours a night. Several variables are used; the names are highly mnemonic.

Problems 35–39

BASIC Vocabulary

This group of problems is centered around making a program “think” of a number. This is done by including the line

```
10 DEF FNR(X) = INT(RND(1)*X +1)
```

and later referring to FNR(6) or FNR(8). Line 10 is intended as a magic formula; no explanation is given of why it works.

35. Think of a Number: How to use line 10 to generate numbers at random.

36. Two Dice: To “roll” two dice, it is necessary to refer to FNR(6) two times. Each reference is a roll.

37. Get Out Of Jail Free: The classical reason for rolling two dice. The program uses FOR...NEXT for the three rolls, IF...THEN for the test.

38. Harder Math Quiz: Use the number thinker to create the math problems. This usually results in a more difficult quiz.

39. Number Guess: In another classic game, the computer thinks of a number and the player guesses. Numbers are compared using < and >. The idea of a guess-counter is presented in an extension of the problem. Kids will enjoy printing colorful comments of TOO SMALL, etc.

Problems 40–42

BASIC Vocabulary

Although the concept of an array is abstract, the idea of a list of words is not. The computer must know how many words can be in the list; hence `DIM A$(10)` means at most ten words in the list. The first word is `A$(1)`, the second is `A$(2)`, etc.

In all three problems `FNR` is used to grab a word from the list. The magic line 10 is always used.

Description of Problems

40. **The Answer Machine:** The program shows how to set up a list and how to select an item from the list.

41. **Dinner Darts:** Throw the dart and see whether we eat hot dogs, steak, or granola.

42. **The Crystal Ball:** The computer turns fortune-teller by selecting words from three different lists. Each selection requires `FNR`.

NOTE

When the Commodore 64 is turned on, type

```
POKE 53281,1
```

and press RETURN. This creates a white screen with a blue border.

PROBLEM 1 SEASON'S GREETINGS

A. Enter this program and RUN it.

```
10 PRINT "HAPPY"  
20 PRINT "THANKSGIVING"
```

What happened? _____

B. Enter two more lines:

```
30 PRINT  
40 GOTO 10
```

Run the program again. What happened? _____

To stop this program, press the STOP key.

What did line 30 do? _____



C. Enter NEW. Now you write a program which prints the following message:

```
LITTLE BOPEEP  
LOST HER SHEEP
```

```
BOOHOO
```

Write your program here:

10 _____

20 _____

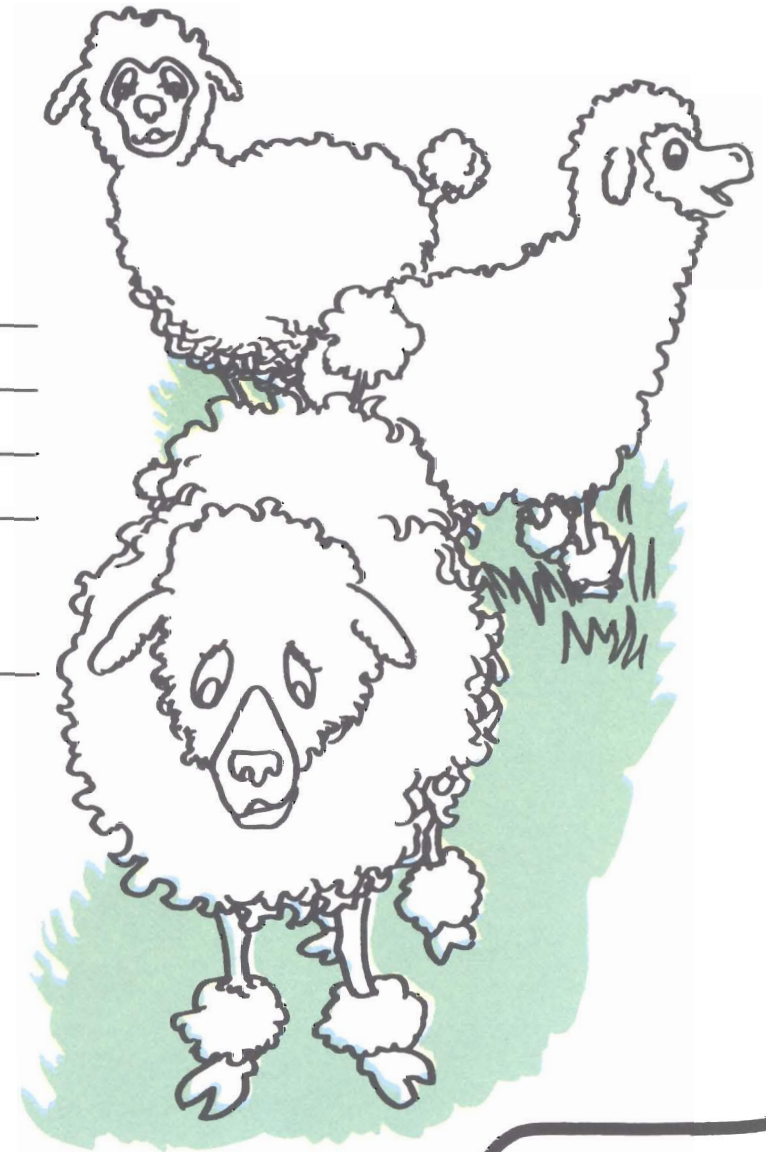
30 _____

40 _____

Run the program to check it.

Add line 50 so that BOOHOO keeps repeating.

50 _____



PROBLEM 2 TAKE A NUMBER, PLEASE

Enter and run each program. Record the computer's output.

A. NEW

```
38 PRINT "SUE HAS A"  
57 PRINT "BIKE"  
73 PRINT "LIGHT"
```

Output _____

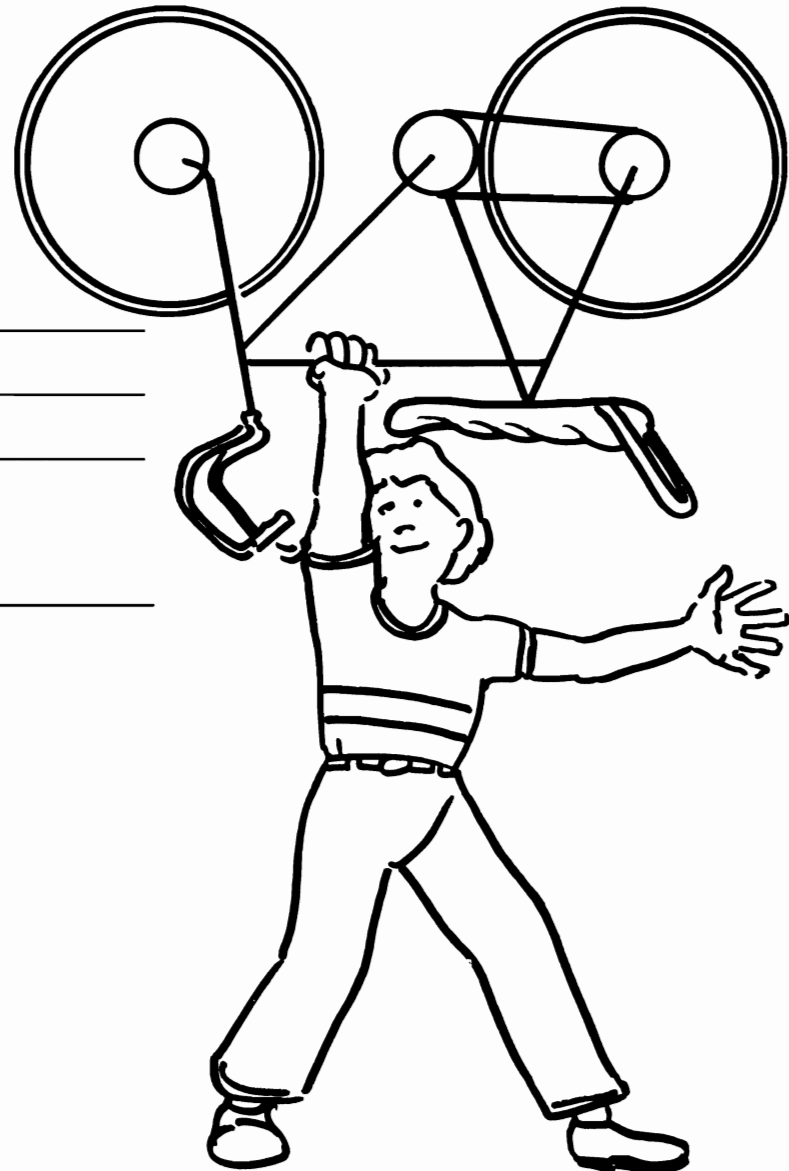


B. NEW

```
86 PRINT "SAM HAS A"  
93 PRINT "BIKE"  
88 PRINT "LIGHT"
```

Output _____

Why did the programs print something different?



PROBLEM 3 MISTAKES

Enter this program EXACTLY as it appears here.

```
10 PRINT "RED"  
20 PRINT "HOT"  
30 PRINT PEPPER
```

Run it.

What happens? _____

Fix line 20:

20 _____

Run the program now.

What happens? _____



Change line 30 so that the program prints

RED
HOT
PEPPER

30 _____

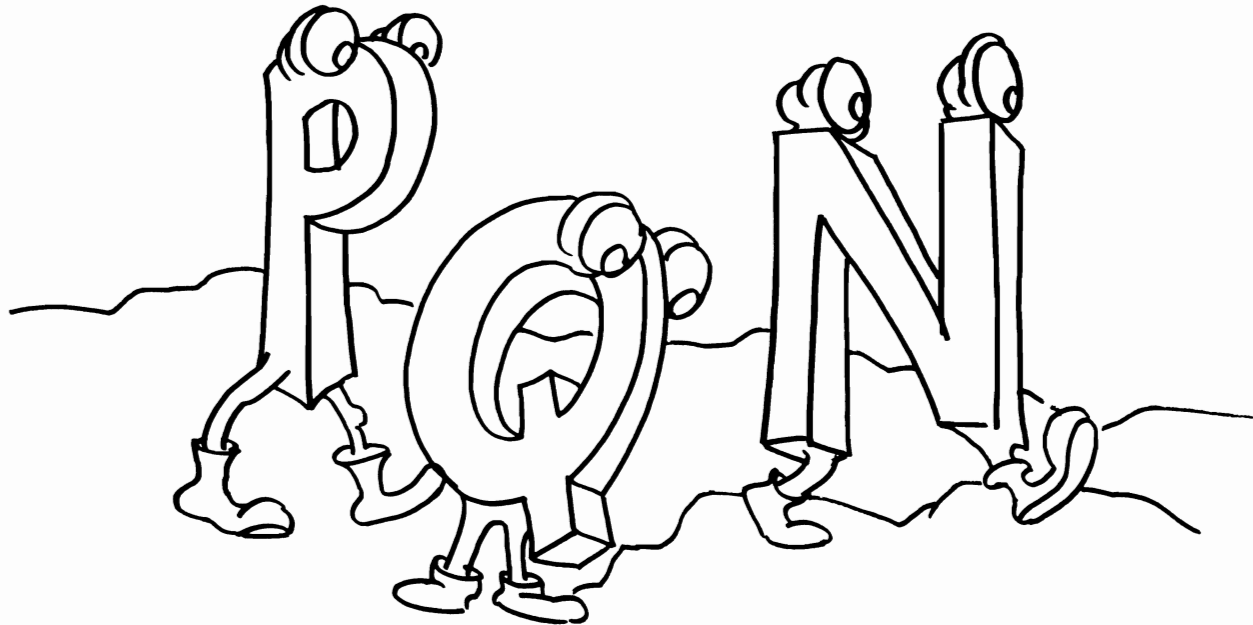


PROBLEM 4 INITIALS

Enter and run this program:

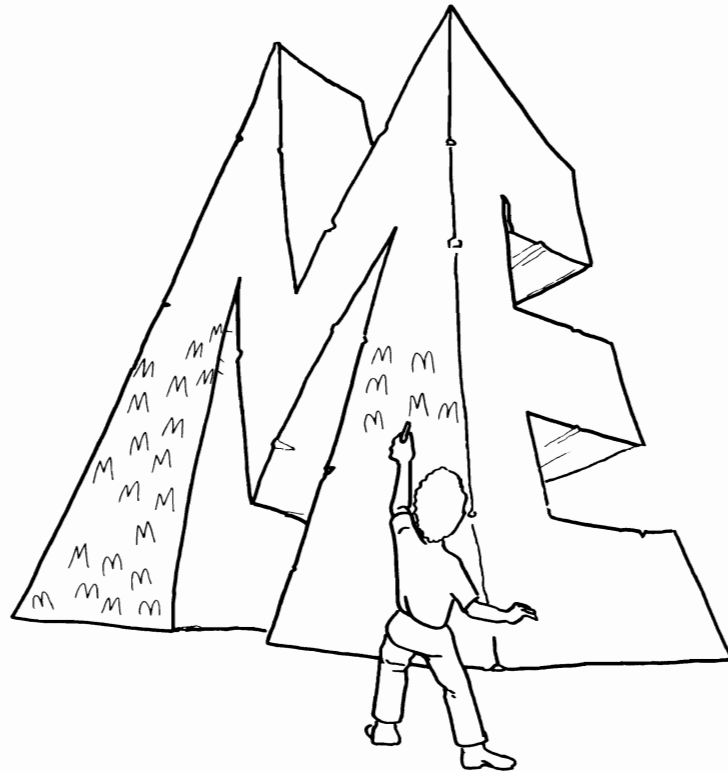
```
10 PRINT "PPPP"  
20 PRINT "P P"  
30 PRINT "PPPP"  
40 PRINT "P"  
50 PRINT "P"
```

Write a program like this which uses your initial to make a large initial.



Copy your program here: (You might not need all the lines.)

10 _____
20 _____
30 _____
40 _____
50 _____
60 _____
70 _____
80 _____



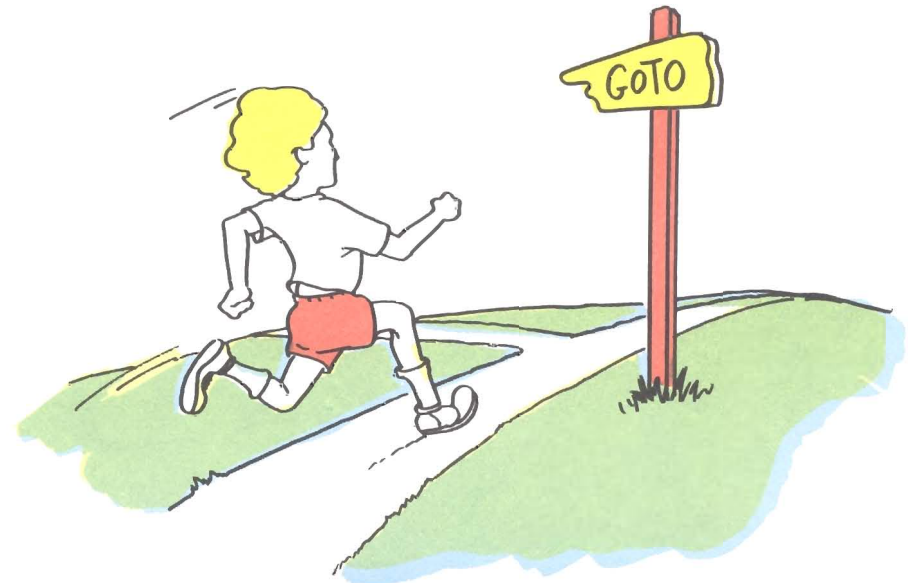
PROBLEM 5 WHERE NOW?

Unless you tell it to go somewhere else, a program which just finished one line will go to the next line number.

A. Look at this program. PREDICT what it will do. Then enter and run it to check.

```
10 GOTO 35
15 PRINT "T";
20 GOTO 45
25 PRINT "A";
30 GOTO 15
35 PRINT "R";
40 GOTO 25
45 END
```

Prediction: _____



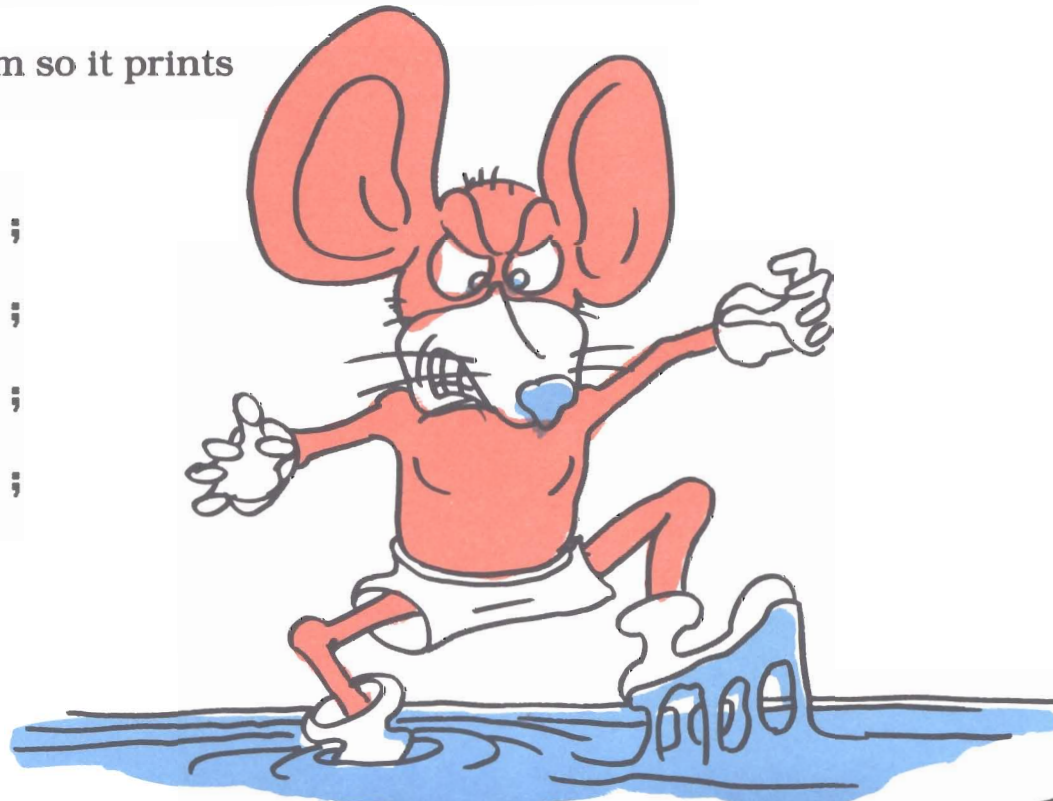
B. Fill in the GOTO statements to make the program print ART.

```
10 GOTO .....  
15 PRINT "T";  
20 GOTO .....  
25 PRINT "A";  
30 GOTO .....  
35 PRINT "R";  
40 GOTO .....  
45 END
```

What makes the letters print on the same line? _____

C. Complete this program so it prints MICE.

```
10 GOTO.....  
20 PRINT "E";  
30 GOTO.....  
40 PRINT "I";  
50 GOTO.....  
60 PRINT "M";  
70 GOTO.....  
80 PRINT "C";  
90 GOTO.....  
100 END
```



PROBLEM 6 WALLPAPER

Now we're going to design some wallpaper. Enter this program and run it several times.

```
10 PRINT "WHAT'S THE PATTERN?"  
20 INPUT P$  
30 PRINT P$;  
40 GOTO 30
```

Use the graphics characters for P\$. You can just type in the symbols, or put quotation marks around them.

Use quotation marks and color keys for colored wallpaper.

Try these — and others

• • • + / /
 \ X /
 ◡ • > ○ < • ◡
 ^ • • v

“ (red) ♥ (green) ♦♦ ”

(red) means: hold down the CTRL key, press the RED (the 3) key,
and release both keys.



PROBLEM 7 LETTER TO SANTA

Complete this program so it writes your letter to Santa. If you haven't been very good lately, skip this one.

```
10 PRINT "WHAT'S YOUR NAME?"
20 INPUT N$
30 PRINT "WHAT WOULD YOU LIKE?"
40 INPUT G$
50 PRINT
60 PRINT "WHO ELSE IS ON YOUR LIST?"
70 INPUT Q$
80 PRINT "WHAT DOES ";Q$;" WANT?"
90 INPUT QG$
100 REM THIS IS THE LETTER
110 PRINT
120 PRINT "DEAR _____"

130 PRINT "PLEASE BRING ME A ";_____
140 PRINT Q$;" WOULD LIKE A ";_____
150 PRINT "THANK YOU."
160 PRINT TAB(10)"LOVE"

170 PRINT TAB(10)_____
```


Draw a line from each label to what it stands for

N\$

gift you'd like

G\$

other person's name

Q\$

other person's gift

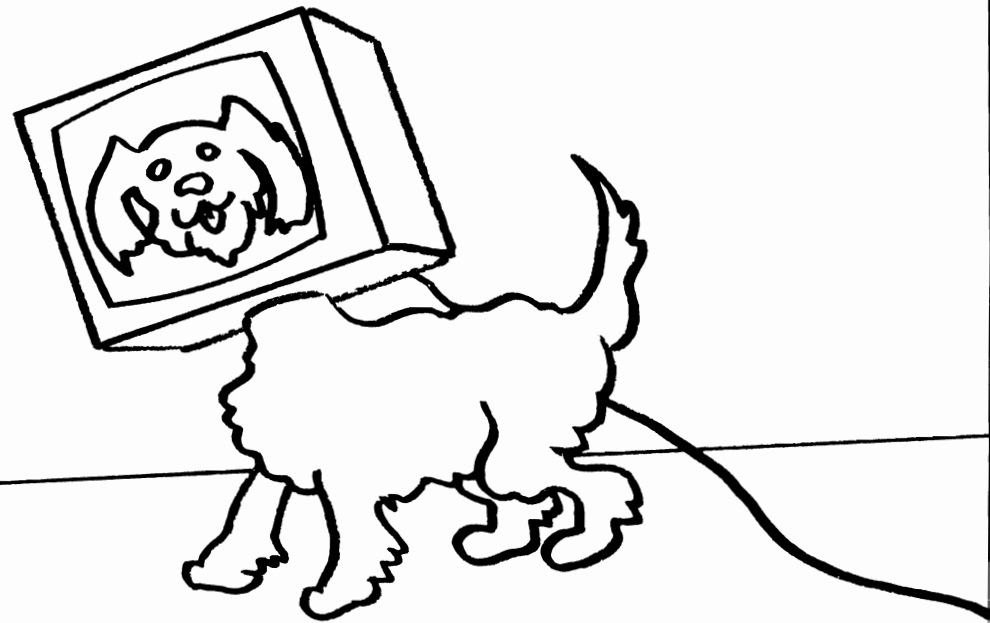
QG\$

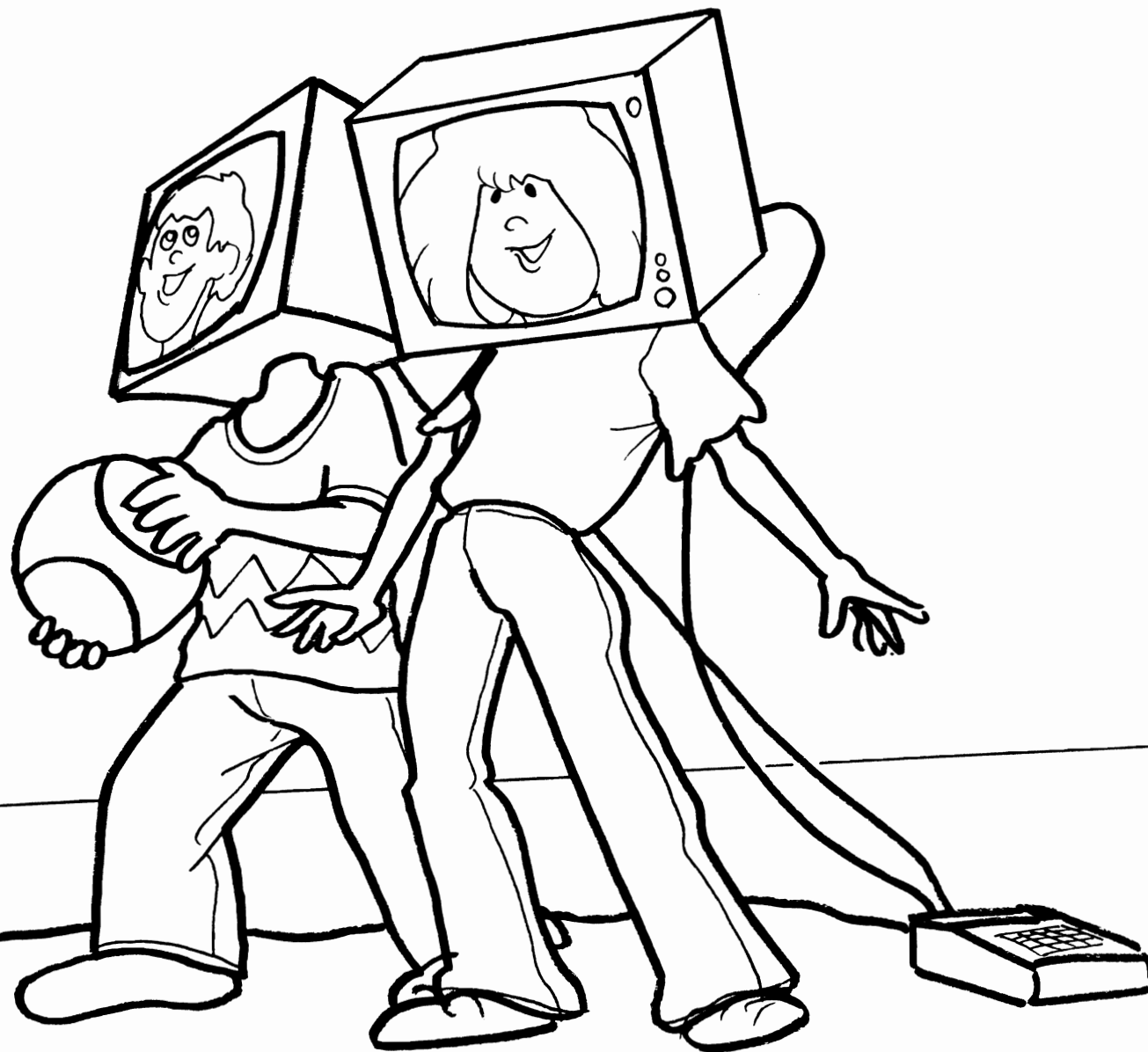
your name

What did TAB(10) do? _____








Color me!





PROBLEM 8 CURSOR CONTROLS

On the Commodore computers, you can move the cursor up and down by using the  key. You can move it right or left with the  key. You can clear the screen with the  key.

You can print “negatives” of the characters by using the RVS key. Hold down the  key and press the  key.

You can change the color of the cursor (and anything printed on the screen) by pressing a color key while holding down the CTRL key.

If you put the cursor command inside a PRINT statement, your program will make the cursor move, change color, etc.

When you see       in a program, you should press that cursor control key.

When you see **red** **blue** **wht** **rvs** in a listing, you should hold down the **CTRL** key and type the color key. **rvs** means the **RVS ON** key.

Enter and run this program.

```
10 PRINT " clr dn dn dn HELLO"  
20 PRINT " rd dn HOW ARE YOU?"  
30 PRINT " blue rvs TODAY?"  
40 PRINT "X dn X dn X dn X up X  
up X up X dn dn dn dn dn "  
"
```

What did line 40 draw? _____

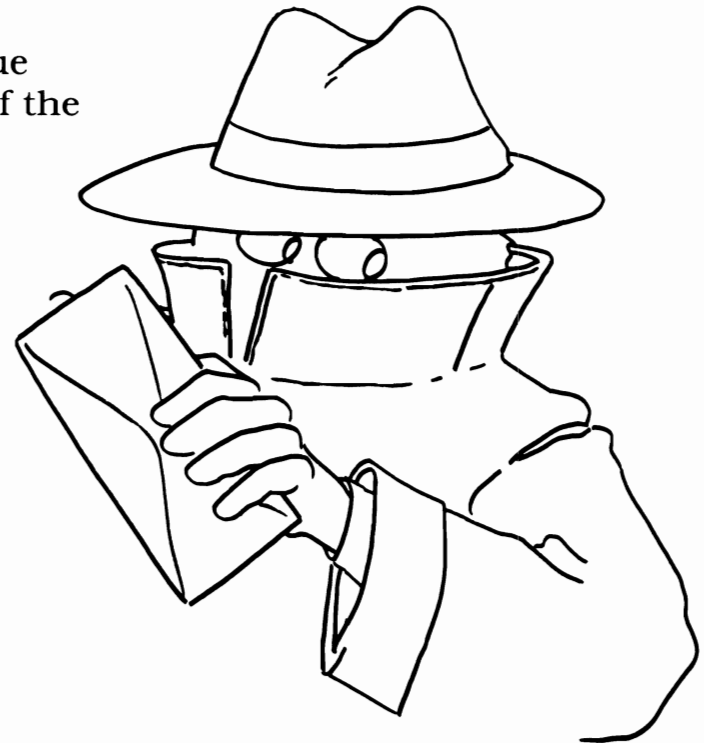


PROBLEM 9 INVISIBLE WRITING

White ink on white paper is hard to see without a filter. Try this program on your friends.

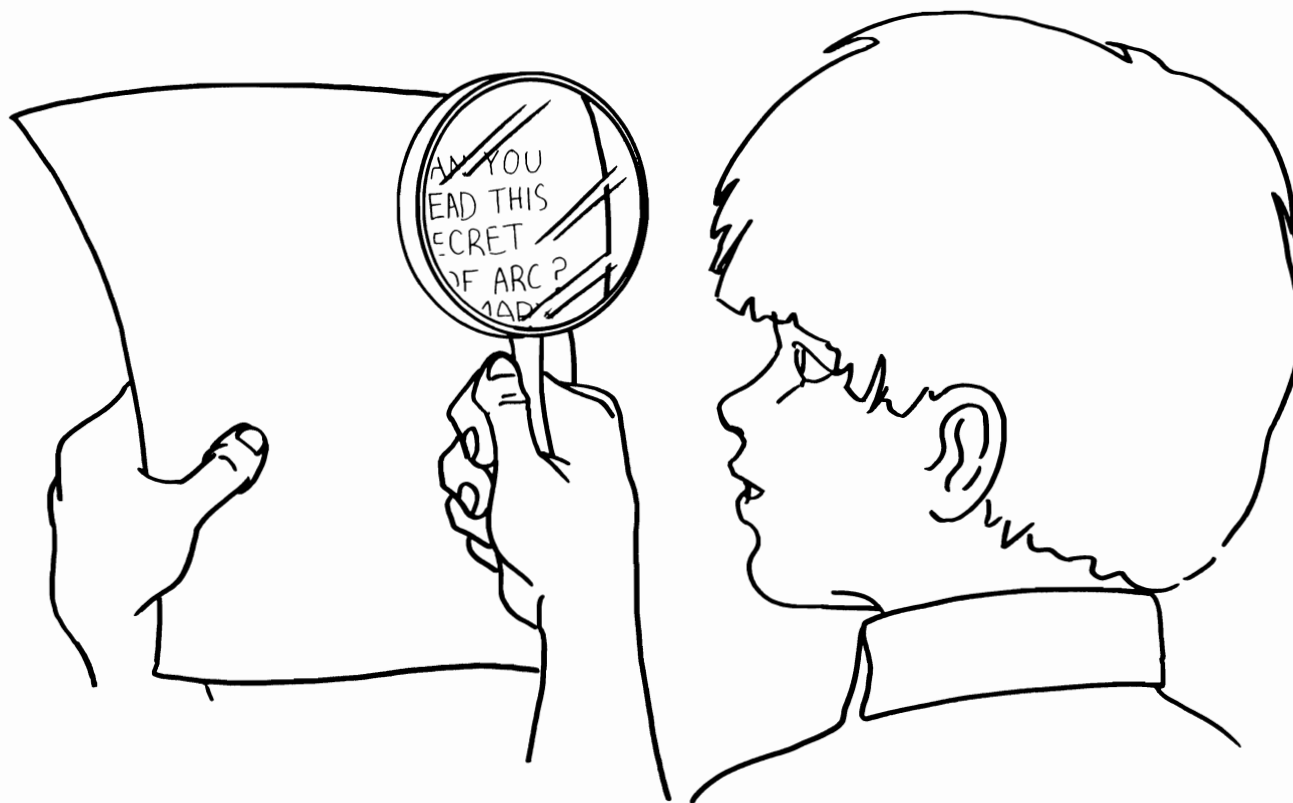
```
10 PRINT "TYPE YOUR MESSAGE."  
20 INPUT M$  
30 PRINT "clr READ THIS"  
40 PRINT "white "  
50 PRINT M$  
60 PRINT "blue "
```

To read the message, your friend will have to move the blue cursor across the invisible letters. They are near the top of the screen.



If someone tries this on you, you can see the message easily by changing the screen color. See Problem 22.

Warning: Unless you put the message in quotation marks, do not use a comma or a colon. The computer has been taught that those punctuation marks mean the end of a message, and it STOPS READING.



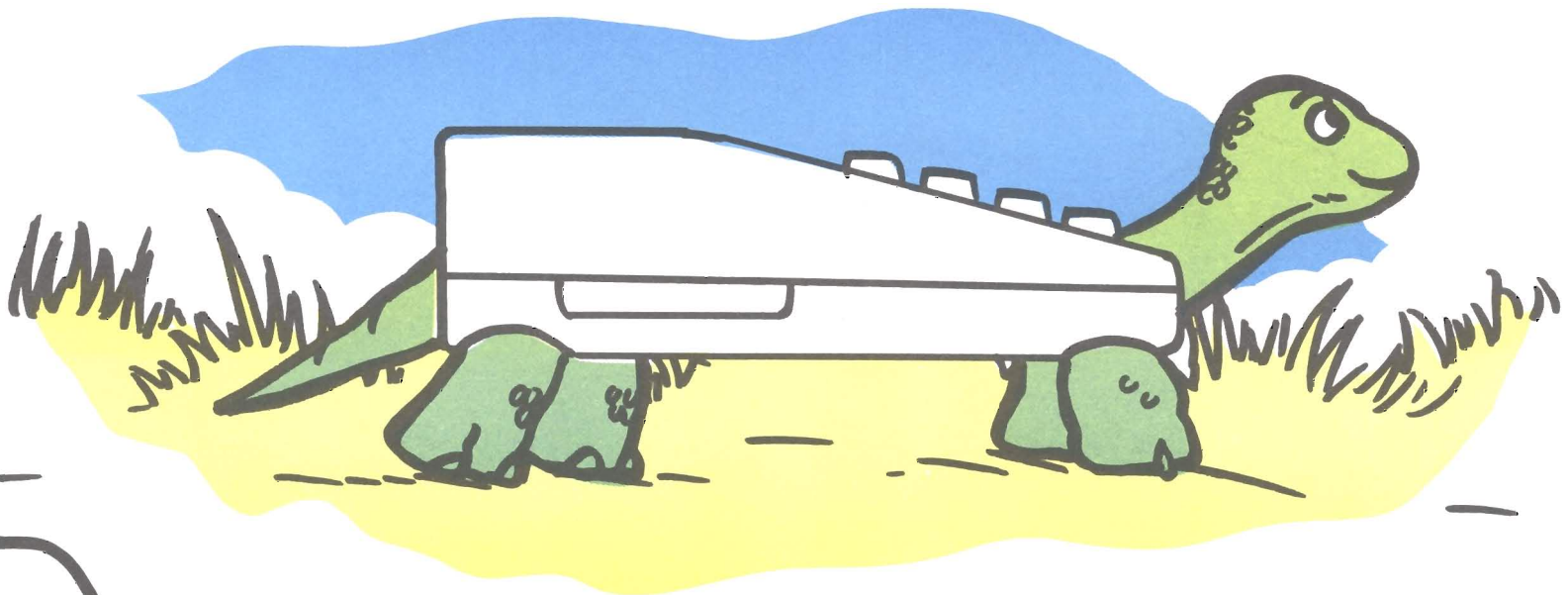
PROBLEM 10 THE DELAY

You'll need a watch or a clock for this one.

Enter and run the following program.

```
10 PRINT " (clr) ONE MINUTE, PLEASE"  
20 FOR T = 1 TO 500  
30 NEXT T  
40 PRINT " (dn) (dn) SORRY, WE'RE CLOSED"
```

In line 30, change the 500 to 1000, to 5000, to 10000, to 20000, to 40000. Run the program each time, and use a watch to time the length of each delay.



How long does each delay take?

1000 _____ sec

5000 _____ sec

10000 _____ sec

20000 _____ sec

40000 _____ sec



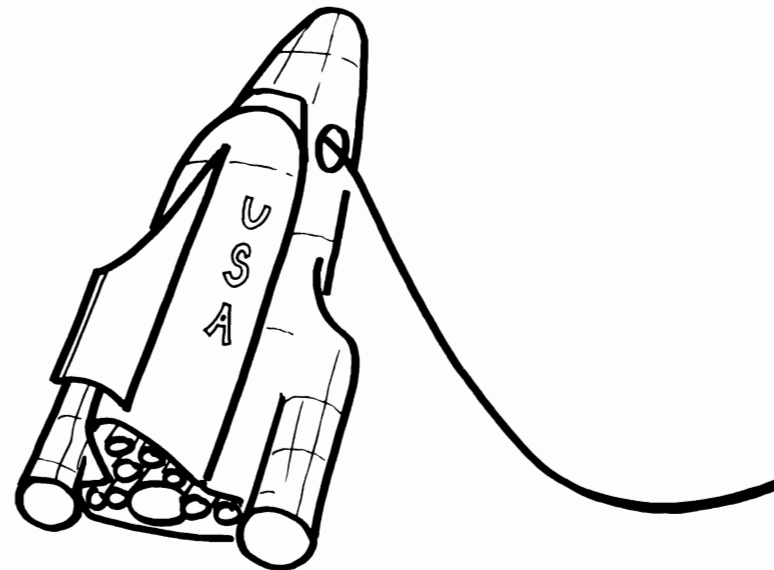
PROBLEM 11 ROCKETS

We're going to send rockets up into the wild blue yonder. We'll use reverse characters to draw the rockets.

In the program, (sp) means hit the space bar once.

On the VIC, we need line 10 to turn the screen blue. On the 64, start with line 20. (Press RUN and hit RESTORE to turn the screen blue.)

```
10 POKE 36879,110
20 PRINT "clr"
30 PRINT "dn dn dn dn dn dn
   dn dn dn dn dn dn dn dn
dn dn"
40 PRINT "blk sp rvs ▀ ▁"
50 PRINT "sp wht rvs sp U"
60 PRINT "sp wht rvs sp S"
70 PRINT "sp wht rvs sp A"
80 PRINT "sp wht rvs sp sp"
90 PRINT "red rvs ▀ sp sp ▁"
500 GOTO 30
```



RUN the program. You should see white rockets zooming up.

To make the rockets blast off, add a pause at line 100.

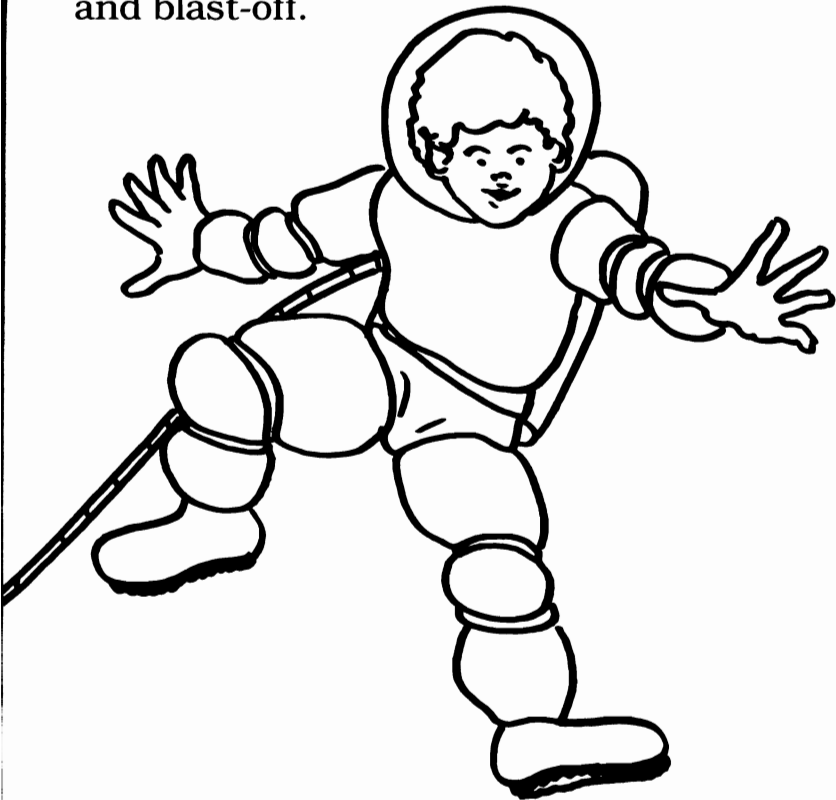
```
100 FOR T = 1 TO 500: NEXT T
```

Then add a row or two of yellow smoke.

```
210 PRINT "yellow XXXX"
```

```
220 PRINT "yellow YYYY"
```

Try making a fancier rocket. Put in a delay between ignition and blast-off.



PROBLEM 12 COUNTING AND REPEATING

A. To watch the computer count, enter this program and run it.

```
10 FOR K = 1 TO 10  
20 PRINT K  
30 NEXT K
```

Change line 10 so the numbers from 1 to 100 appear.

10 _____

Try to change line 20 so they are all on the screen at one time.
(Remember the wallpaper problem.)

20 _____

B. Complete this program to write your name 10 times.

```
10 FOR K = _____  
20 _____  
30 _____
```

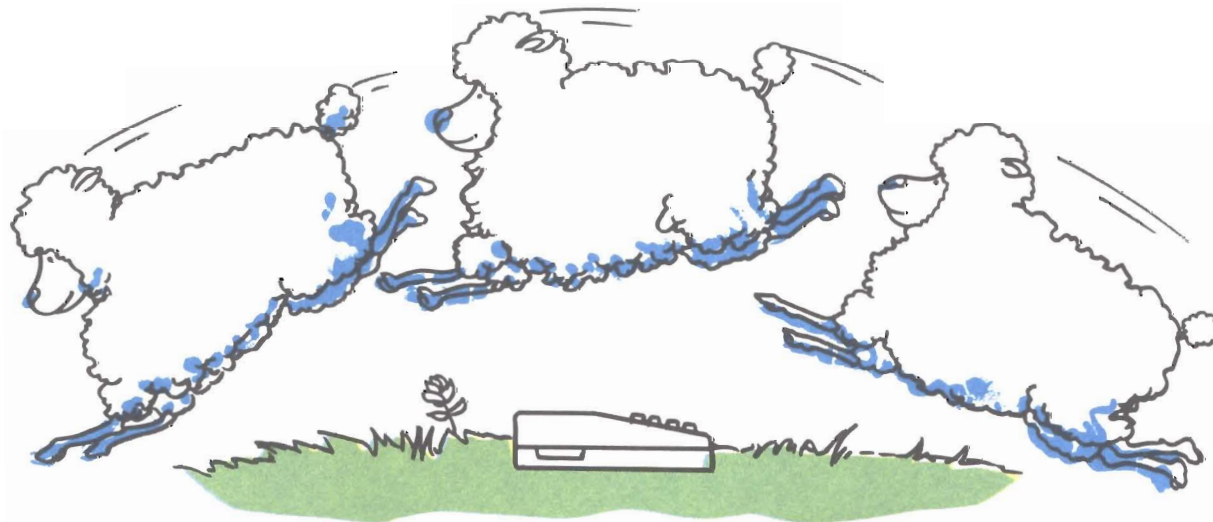
C. Test your reflexes. Run this program 3 times.

```
10 PRINT "WHEN THE NUMBERS APPEAR"  
20 PRINT "PRESS THE (TVS) STOP KEY"  
30 FOR T = 1 TO 1500: NEXT T  
40 FOR K = 1 TO 500  
50 PRINT K  
60 NEXT K
```

What were your reaction numbers? _____

How can you tell if someone pressed STOP before the numbers appeared?

What does line 30 do? _____



PROBLEM 13 MOVERS

Enter and run this program.

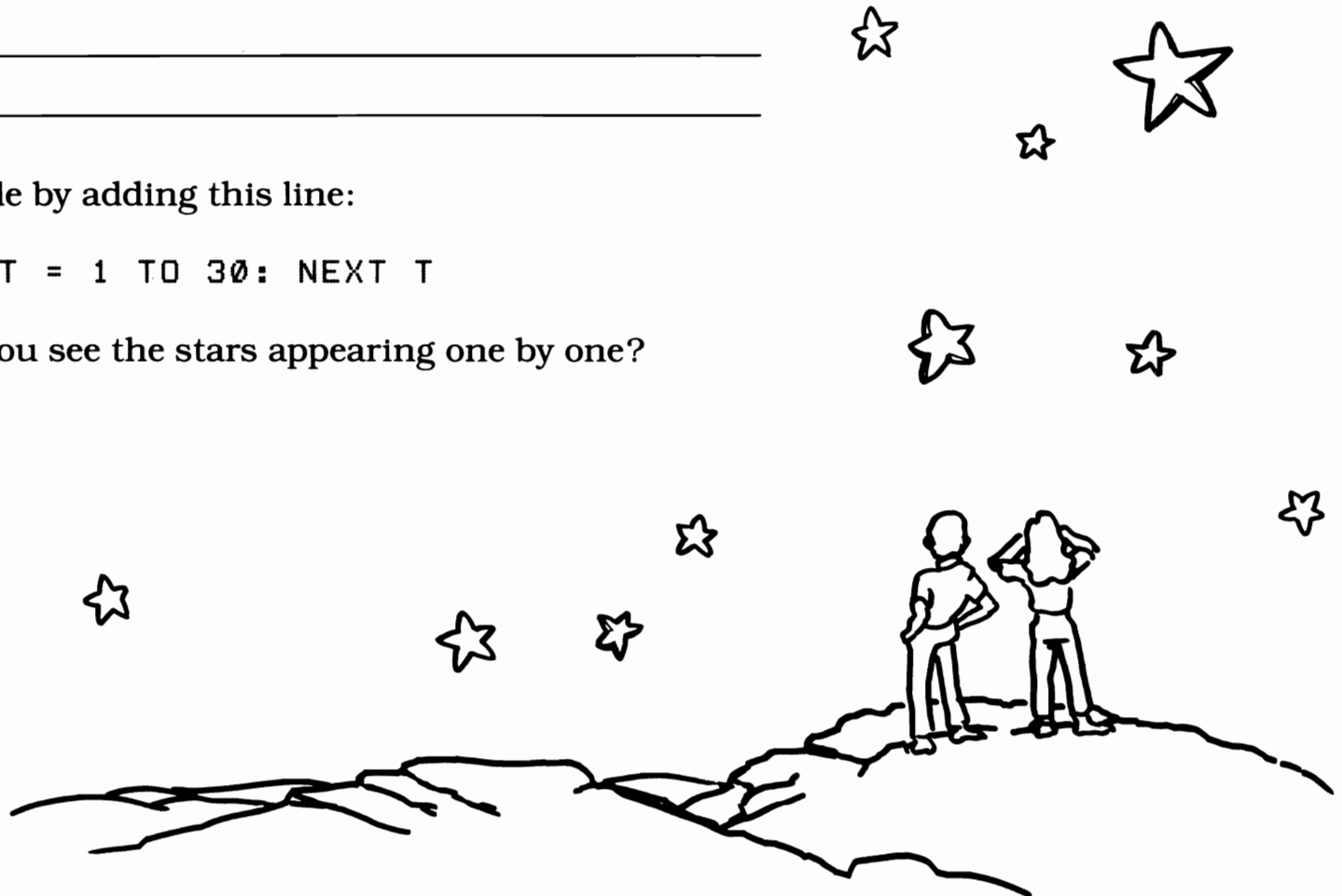
```
100 PRINT " clr *";  
110 FOR K = 1 TO 400  
120 PRINT "*";  
150 NEXT K
```

What happens? _____

Slow it down a little by adding this line:

```
130 FOR T = 1 TO 30: NEXT T
```

Run it now. Can you see the stars appearing one by one?



If we erase each star before we print the next one, it will look as if just one star is moving. Change line 120 so that it erases as it goes:

```
120 PRINT " 1f 5P *";
```

Run it now. Does the last star stay or disappear? _____

Finally, make the star leave a trail of dots:

```
120 PRINT " 1f ,*";
```



PROBLEM 14 THE WORM TURNS

This time we'll move a worm. The worm will have 5 green body segments and a purple head.

●●●●●*

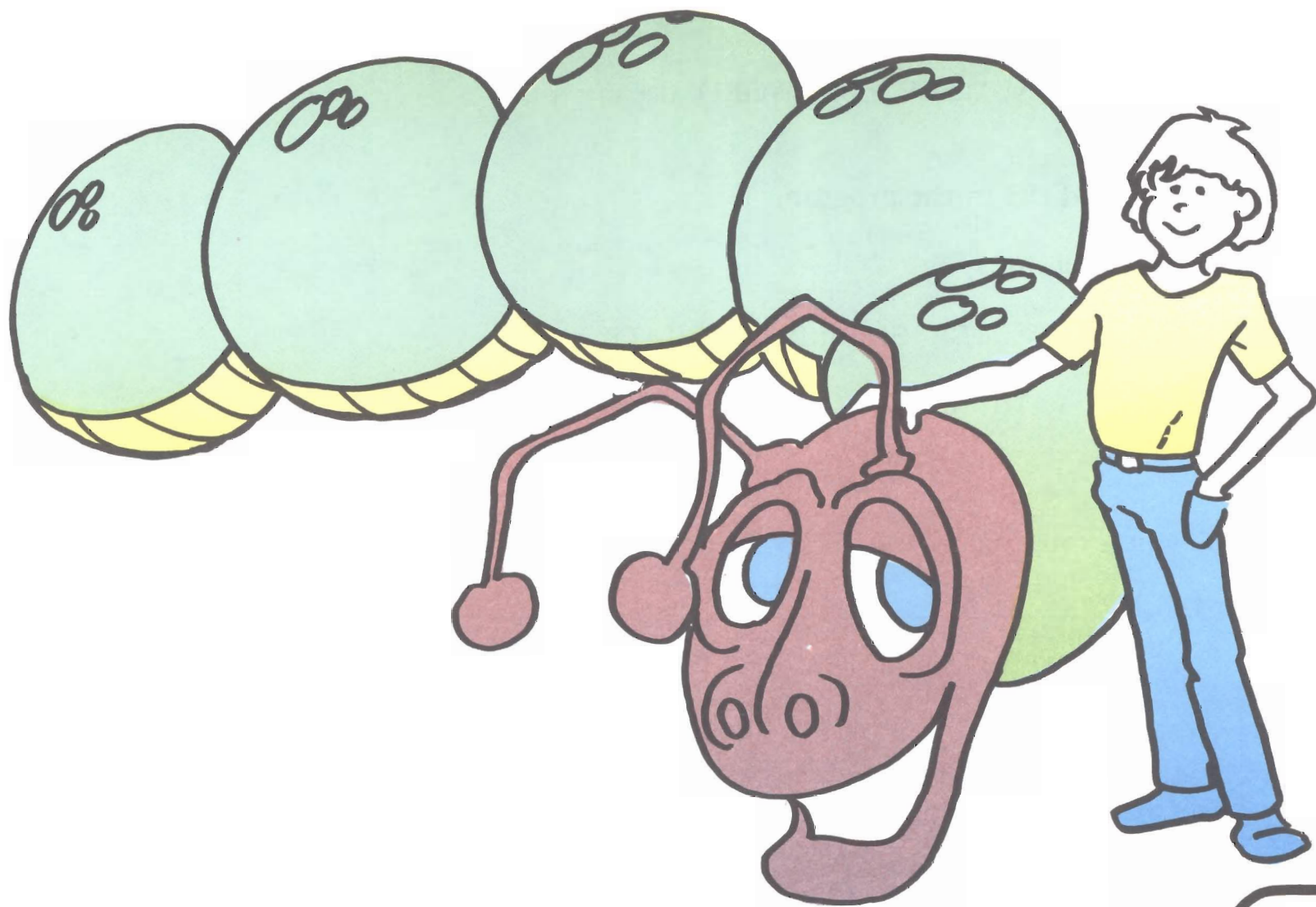
To reach the tip of the tail, we'll need to back up 6 times before erasing a segment.

Run this program (only line 100 and line 120 are different from the last problem).

```
100 PRINT " clr green ●●●●● Pur *";  
110 FOR K = 1 TO 400  
120 PRINT " lf lf lf lf lf lf  
   SP green ●●●●● Pur *";  
130 FOR T = 1 TO 30: NEXT T  
140 NEXT K
```

Adjust this by making the worm move slower, move faster, go all over the screen.

Then design something else which moves. You could try a train o-o o-o or a fish ><>.



PROBLEM 15 MORE COUNTING

This program uses an INPUT statement, so the user can tell the computer how high to count.

Because it's being told a NUMBER, not a WORD, the \$ is not used.

How High will be called HH in the program.

Enter and run this program:

```
10 PRINT "HOW HIGH SHOULD I COUNT?"
20 INPUT HH
30 FOR K = 1 TO HH
40 PRINT K
50 NEXT K
```

What happens when you answer the "HOW HIGH..." question with the word TEN? _____



(When the computer expects a NUMBER, you must enter a number.)

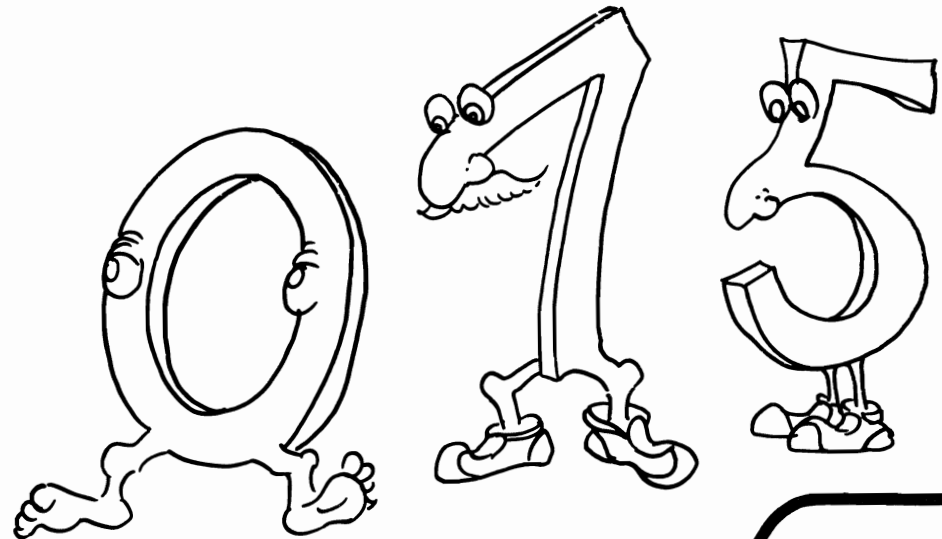
Add a line to make the program print

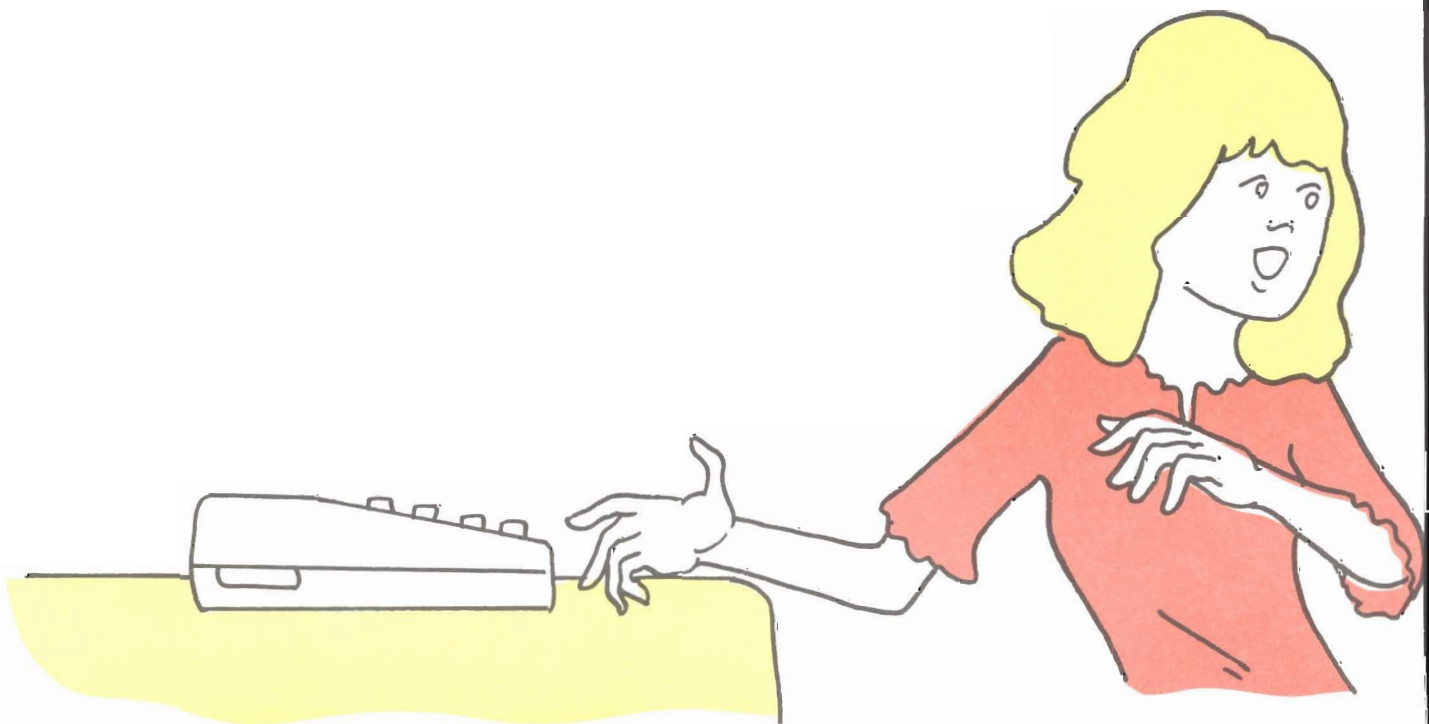
ALL DONE

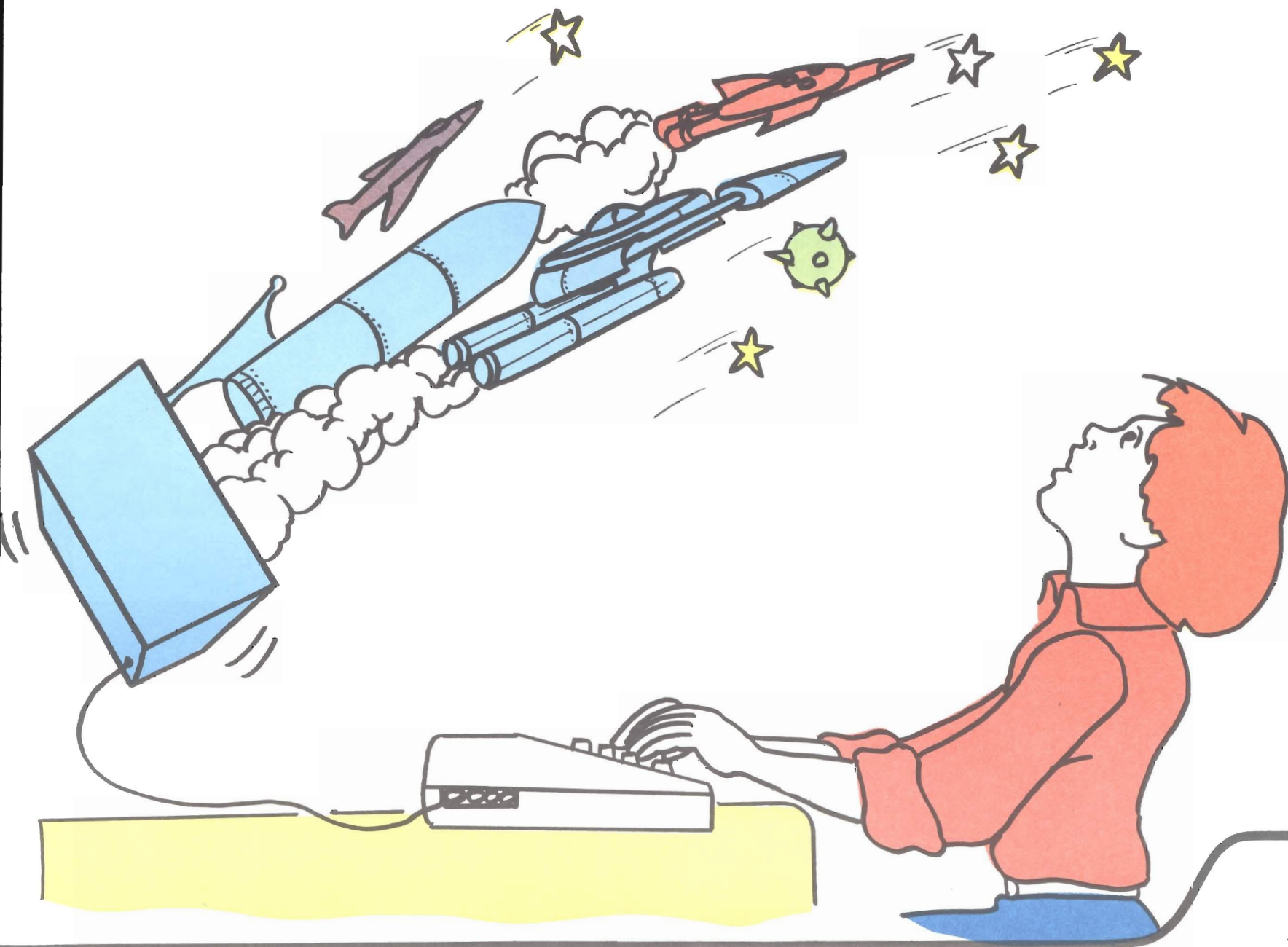
when it has finished counting. Write the line you added here:

What punctuation mark at the end of line 40 will make the computer print the counting numbers across the screen? _____

Test your answer. How high do the numbers get before they scroll off the top of the screen? _____







PROBLEM 16 TESTING WITH IF...THEN

In BASIC, "=" means "is the same as"
"<>" means "is not the same as"

We can compare numbers and we can compare words.

Enter and run this program:

```
10 PRINT "TELL ME A COLOR"  
20 INPUT C$  
30 IF C$ = "GREEN" THEN PRINT "GRASS IS  
GREEN"
```

What happens if you say RED? _____

Now you add line 40 so that the response to PINK is

VERY PREPPY.

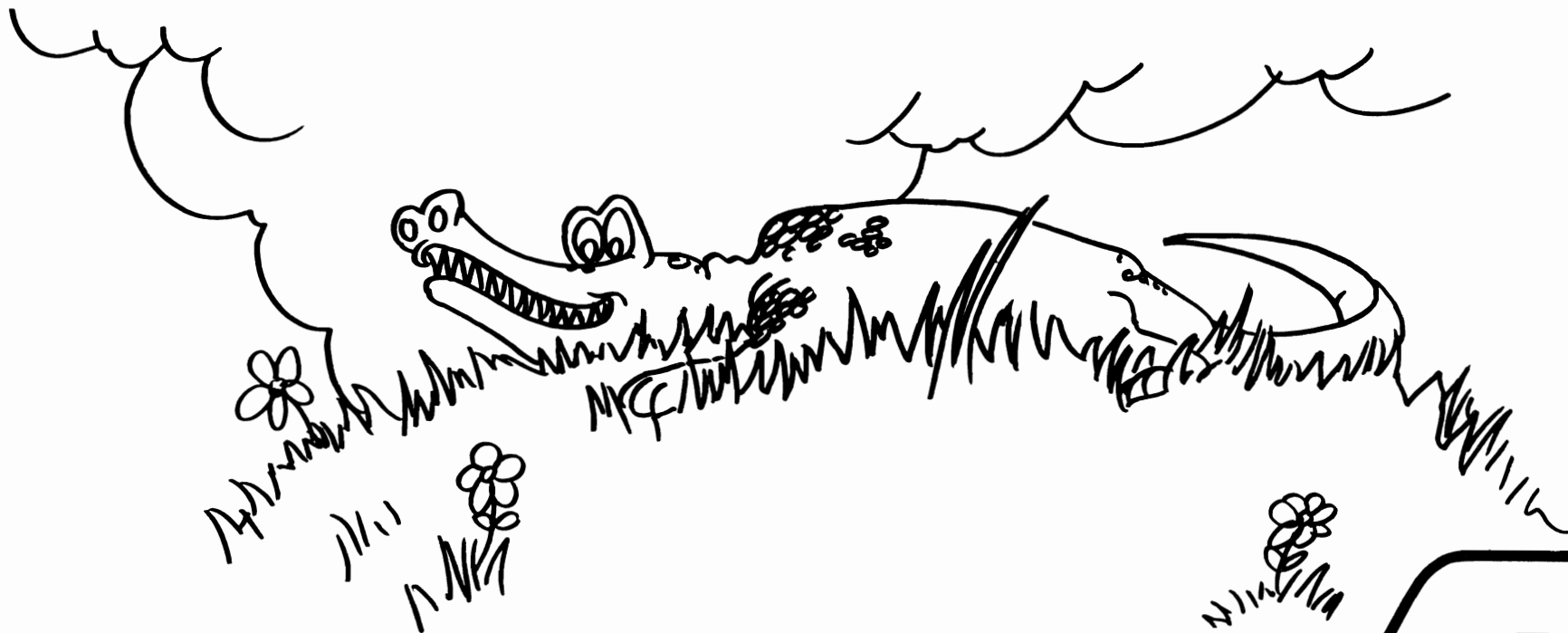
Write line 40 here:

40 _____

Finally, add line 50:

```
50 IF C$ = "RED" OR C$ = "BLUE" OR C$ =  
"YELLOW" THEN PRINT "PRIMARY COLOR"
```

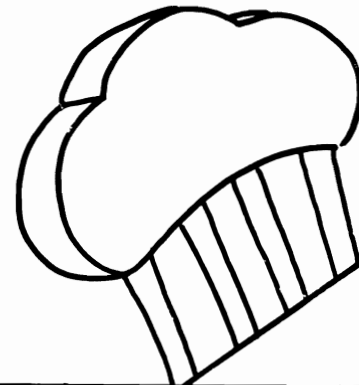
Run the program for all the colors you've used.



PROBLEM 17 GOLDILOCKS

Complete and enter the Goldilocks program:

```
5 PRINT " (c l r) WHOSE PORRIDGE IS IT?"
10 PRINT " (d n) TASTE THE PORRIDGE"
15 PRINT " (d n) ENTER HOT, COLD, OR OK"
20 INPUT A$
30 IF A$ = "HOT" THEN PRINT "PAPA'S"
40 IF A$ = "COLD" THEN PRINT
   "_____ "
50 _____
60 END
```





PROBLEM 18 ANIMAL GUESS

Now we'll use IF...THEN to play a guessing game. First we'll set the animal to be a HORSE, then we'll add extra lines to make it a two-person game.

Look at the program. What happens after line 140 if the guess is HORSE?

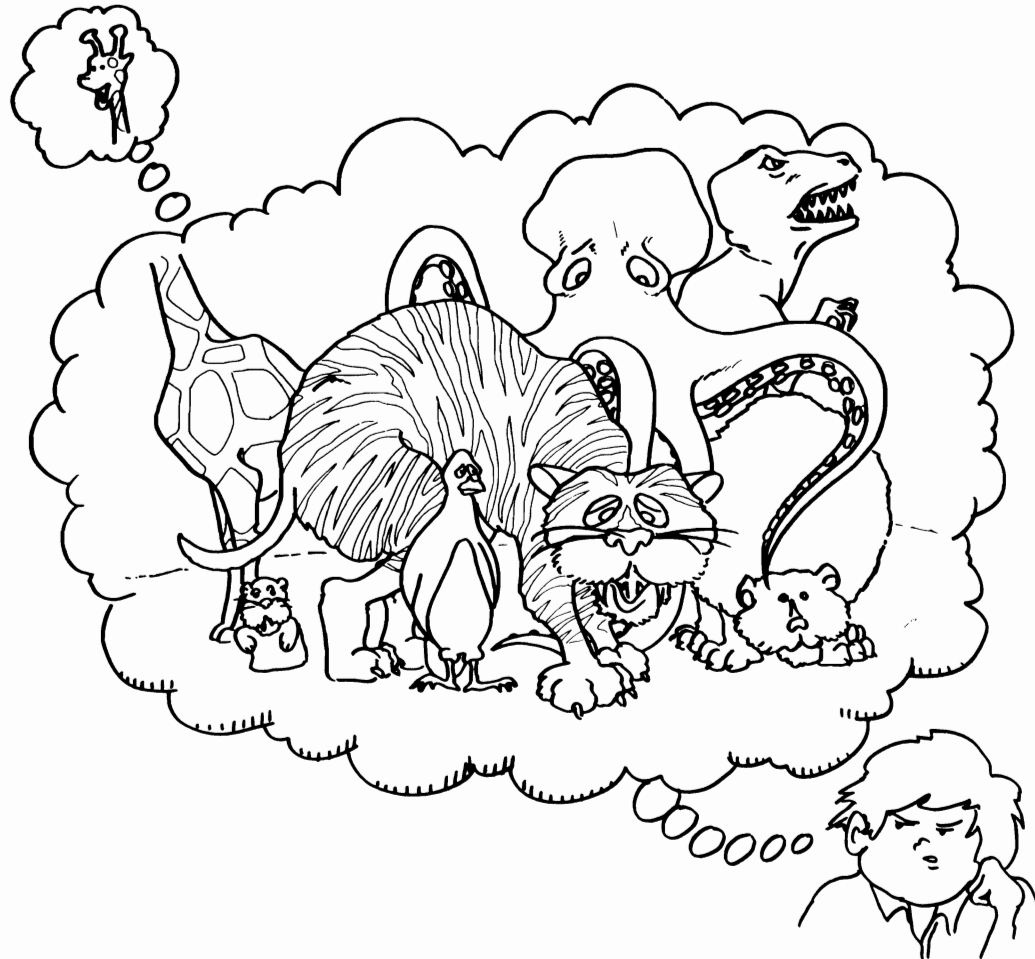
Complete line 170, then enter and run the program.

```
100 AN$ = "HORSE"  
110 PRINT " (clr) "  
120 PRINT "I'M THINKING OF AN ANIMAL"  
130 PRINT " (dn) GUESS"  
140 INPUT G$  
150 IF G$ <> AN$ THEN PRINT "NO"  
160 IF G$ <> AN$ THEN GOTO 130  
170 _____
```

Once the program is working, add these lines:

```
10 PRINT "THINKER"  
20 PRINT "TELL ME AN ANIMAL"  
100 INPUT AN$  
115 PRINT "GUESSER'S TURN"
```

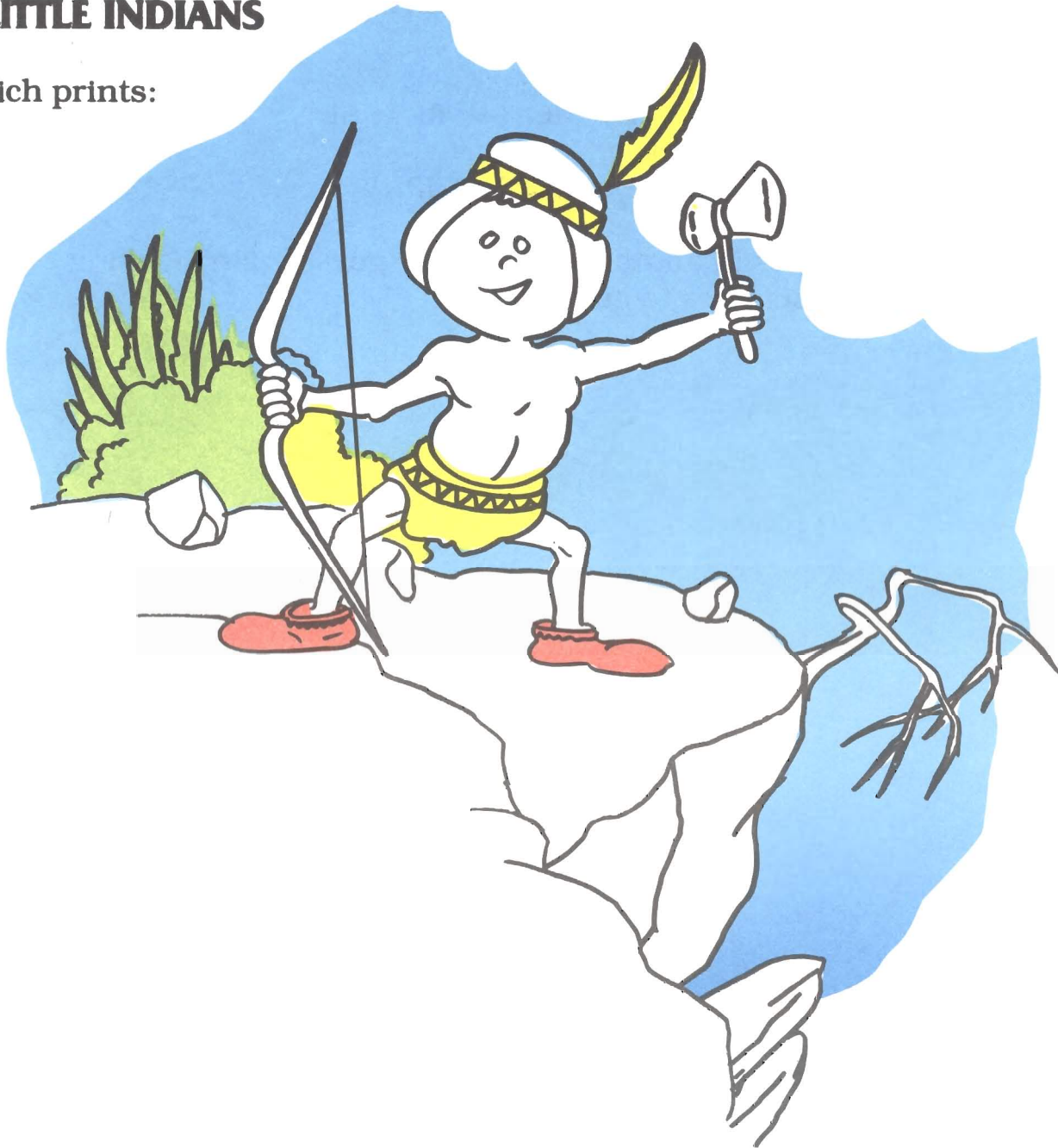
The thinker types in an animal while the guesser isn't looking.
Then the guesser tries to guess it.



PROBLEM 19 LITTLE INDIANS

We're going to write a program which prints:

```
1 LITTLE
2 LITTLE
3 LITTLE
INDIANS
4 LITTLE
5 LITTLE
6 LITTLE
INDIANS
7 LITTLE
8 LITTLE
9 LITTLE
INDIANS
10 LITTLE
INDIAN KIDS
```



Underneath which numbers is the word INDIANS? _____

Complete this program and run it.

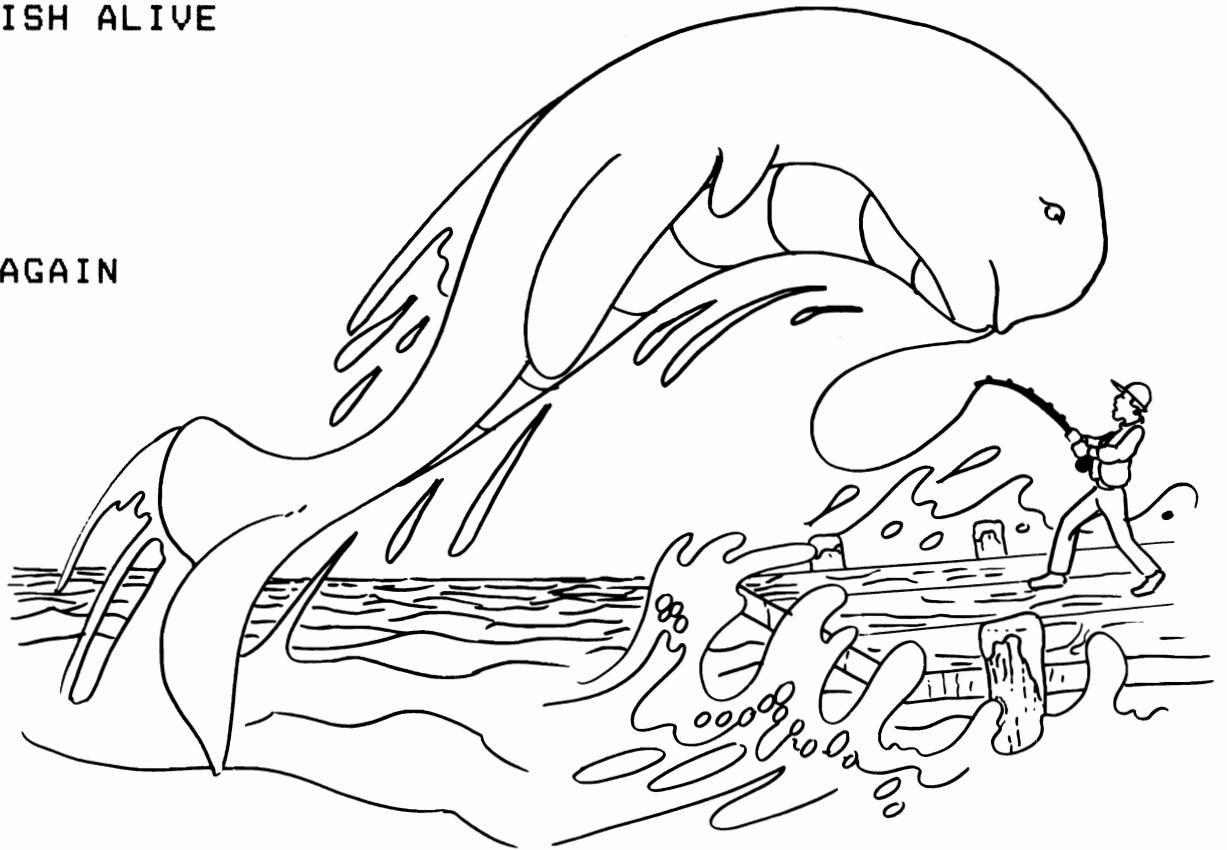
```
10 FOR K = 1 TO _____  
20 PRINT K "LITTLE"  
30 IF K = _____ OR K = _____ OR K = _____  
THEN _____  
40 NEXT K  
50 _____
```



PROBLEM 20 NURSERY RHYME

Now you write a counting rhyme program. Your program should print one of the rhymes below.

```
1  
2  
3  
4  
5  
ONCE I CAUGHT A FISH ALIVE  
6  
7  
8  
9  
10  
THEN I LET IT GO AGAIN
```



or this one

1

2

3

4

MARY AT THE COTTAGE DOOR

5

6

7

8

EATING CHERRIES OFF A PLATE

Use this space to record your program. You may not need all the lines.

10 FOR _____

20 PRINT _____

30 IF _____

40 IF _____

50 NEXT _____



PROBLEM 21 BLINKING LIZARDS

Type in and run this program to draw a famous face. Use the graphics ball on the W key for the eyes.

```
10 PRINT " clr red ";
20 PRINT "   @@@   "
30 PRINT "  @@@@@@  "
40 PRINT "  @   @   "
50 PRINT " @0  0@"
```

LIST the program. It will fit on the screen with the picture.

The eyes are in the 4th row of the screen. To make them blink, first put in a pause so we can see them open:

```
60 FOR T = 1 TO 700: NEXT T
```

Then, send the cursor home (that's the upperleft corner) and down to the 4th row:

```
70 PRINT " hm dn dn dn @- -@"
```

We used the `dn` key three times because we wanted to move down three rows from the top.

RUN the program now.

To keep the eyes blinking, add these lines:

```
80 FOR T = 1 TO 700: NEXT T
90 GOTO 10
```

Run it now. Why does the whole screen blink when the eyes are opened?

Fix this with a new line.

```
15 PRINT " (hm) ";
```

and change line 90 to

```
90 GOTO 15
```

Now...you change the eyes. Use the solid circle on the Q key. Maybe you can make them blink one at a time.



Write down any new lines you add.

You could try to add a mouth. Or draw another picture.





PROBLEM 22 SCREEN COLORS

Commodore 64

Changing the Screen Colors.

The 64 has 16 different colors it can use. Each color has a code number. Black is 0; orange is 8.

There is a special place in the 64's memory which keeps track of the screen color. That place is called "location 53281". If there's a 0 in 53281, the screen is black.

The border color is stored in location 53280. If there's a 0 in 53280, the border is black.

To change the number in a memory location, we use a special word called POKE.

Enter this program and run it:

```
10 PRINT "SCREEN COLOR"  
20 INPUT S  
30 PRINT "BORDER COLOR"  
40 INPUT B  
50 POKE 53281,S  
60 POKE 53280,B  
70 GOTO 10
```



Here are all the possible colors. Find the code number for each one.

red _____

light blue _____

light red _____

black _____

orange _____

dark gray _____

yellow _____

medium gray _____

green _____

light gray _____

light green _____

white _____

cyan _____

brown _____

blue _____

purple _____

PROBLEM 22

VIC

Changing the Screen Colors

On the VIC, each screen and border combination has a code number. A red screen with black border has code number 40.

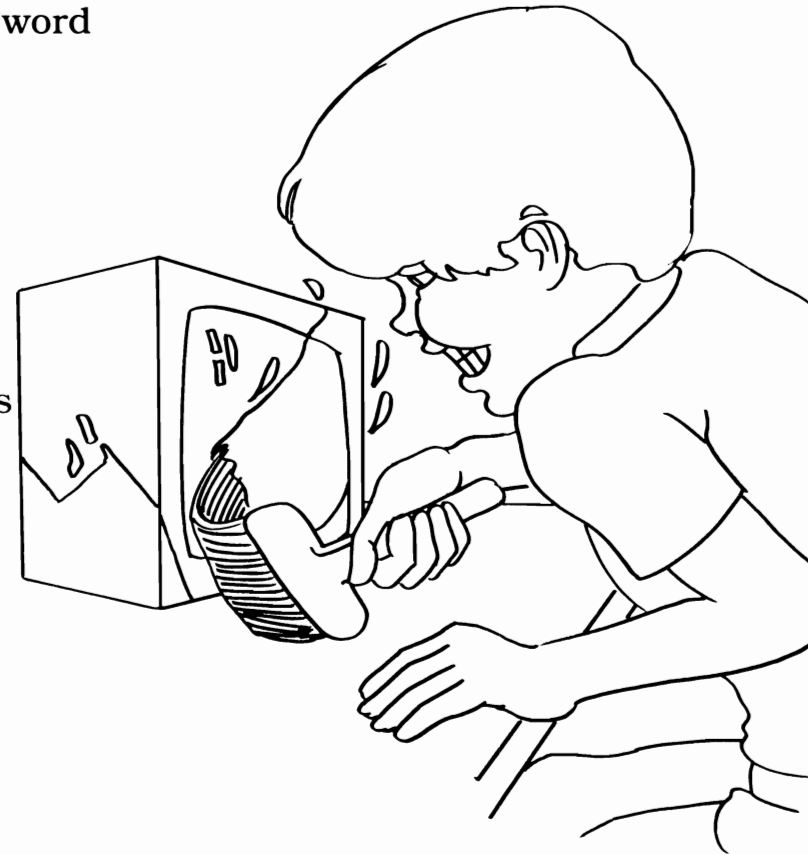
The code number for the colors is stored in a special place in the VIC's memory; the place is called "location 36879".

To change the number at location 36879, we use a special word called POKE.

Enter this program:

```
10 PRINT "SCREEN COLOR"  
20 INPUT N  
30 POKE 36879,N  
40 GOTO 10
```

When you run this program, you enter a number and press RETURN. Pick a number less than 255; 0 is OK.



Add the code numbers for these colors:

code #	screen	border
_____	red	blue
_____	yellow	red
_____	purple	blue

Record two other color combinations that you like:

_____	_____	_____
_____	_____	_____

To stop this program, hold down

RUN
STOP

 and press

RESTORE

.

PROBLEM 23 PEEKABOO — The Computer is Watching you

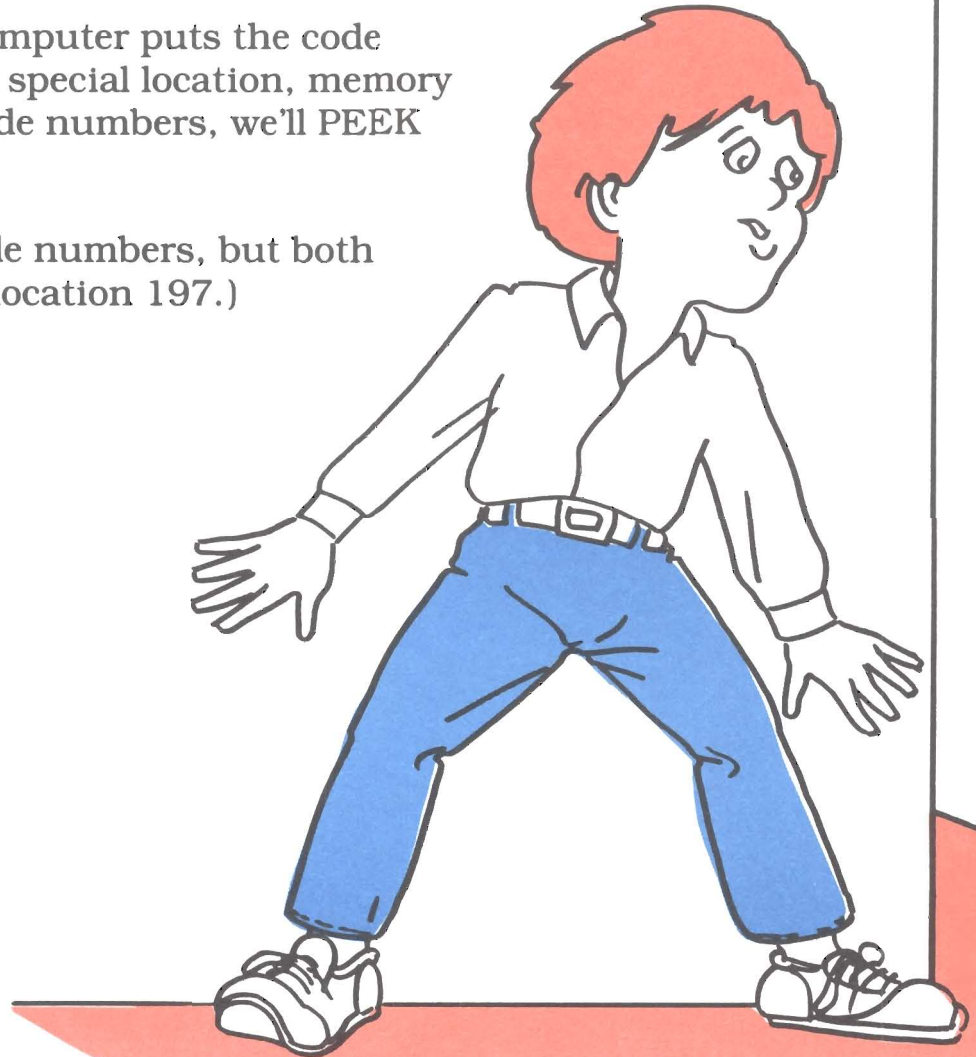
Even while it's running a program, the computer knows if you're touching a key, and it knows which key.

Every key has a code number. The computer puts the code number of the key being pressed in a special location, memory location 197. To learn some of the code numbers, we'll PEEK into location 197.

(The VIC and the 64 use different code numbers, but both computers keep the code number in location 197.)

Enter this program:

```
10 K = PEEK(197)
20 PRINT K
30 GOTO 10
```



Run the program. As you press different keys, the numbers will change. Find the code numbers which tell when the key being pressed is:

C _____ space bar _____

X _____ RETURN _____

S _____ no key being touched _____

f 1 _____ Z _____

What happens when you press

SHIFT _____

STOP _____

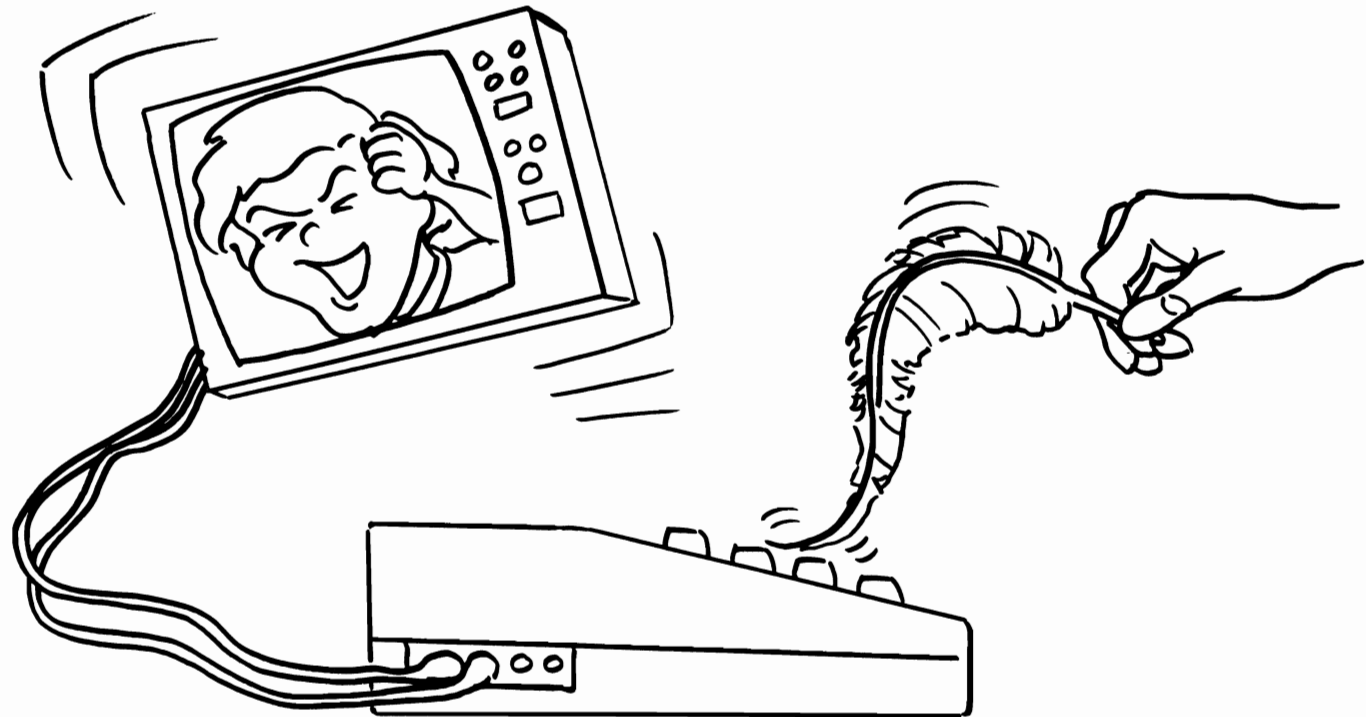


PROBLEM 24 FUNNY BONES AND SORE TOES

Try this one. In line 30 use the code number for C.

```
10 PRINT " (clr) IF YOU TOUCH (rvs) C"  
20 PRINT "I'LL SCREAM!"  
  
30 IF PEEK(197) = _____ THEN PRINT  
"EEEEEEK!"  
40 GOTO 10
```

Change the scream to a call for HELP.



Give the computer a "funny key"; make it giggle when its funny key is touched. You select the key and use its code number in line 30. Write your funny key program here:

```
10 PRINT " _____ "  
20 PRINT _____  
30 IF PEEK(197) = _____  
40 _____
```

Give your computer a sore key, too. Make it say OUCH when the sore key is touched. Use line 35 for the sore key test.

```
35 _____
```

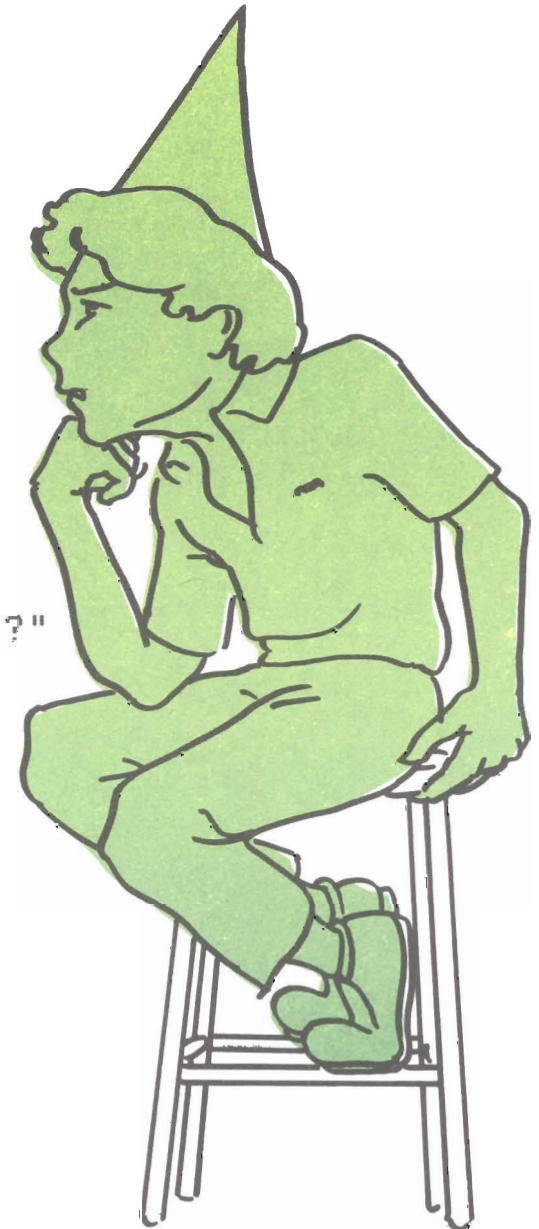
PROBLEM 25 QUIZ TIME

Read the program. How many questions are on the quiz? _____

Complete line 90 so that the color question is asked again if the answer is not GREEN.

Then add another question to the quiz. Use lines 100 – 130.

```
10 PRINT " clr QUIZ TIME"  
20 PRINT "WHAT IS THE CAPITAL OF MICHIGAN?"  
30 INPUT A$  
40 IF A$ = "LANSING" THEN PRINT "RIGHT!"  
50 IF A$ <> "LANSING" THEN PRINT "NO"  
55 PRINT  
60 PRINT "WHAT COLOR DO BLUE AND YELLOW MAKE?"
```



```
70 INPUT C$  
80 IF C$ = "GREEN" THEN PRINT "GOOD"  
90 IF C$ <> "GREEN" THEN PRINT "TRY AGAIN":
```

```
GOTO _____
```

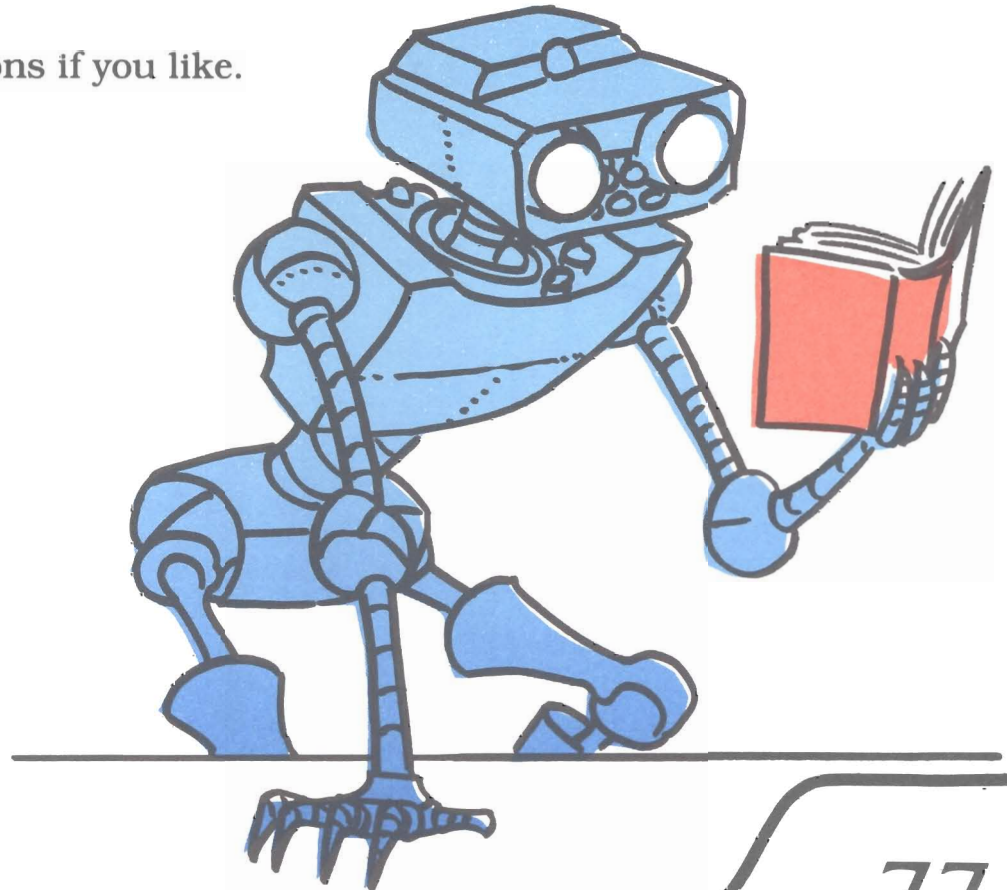
```
100 PRINT _____
```

```
110 INPUT D$ _____
```

```
120 IF D$ _____
```

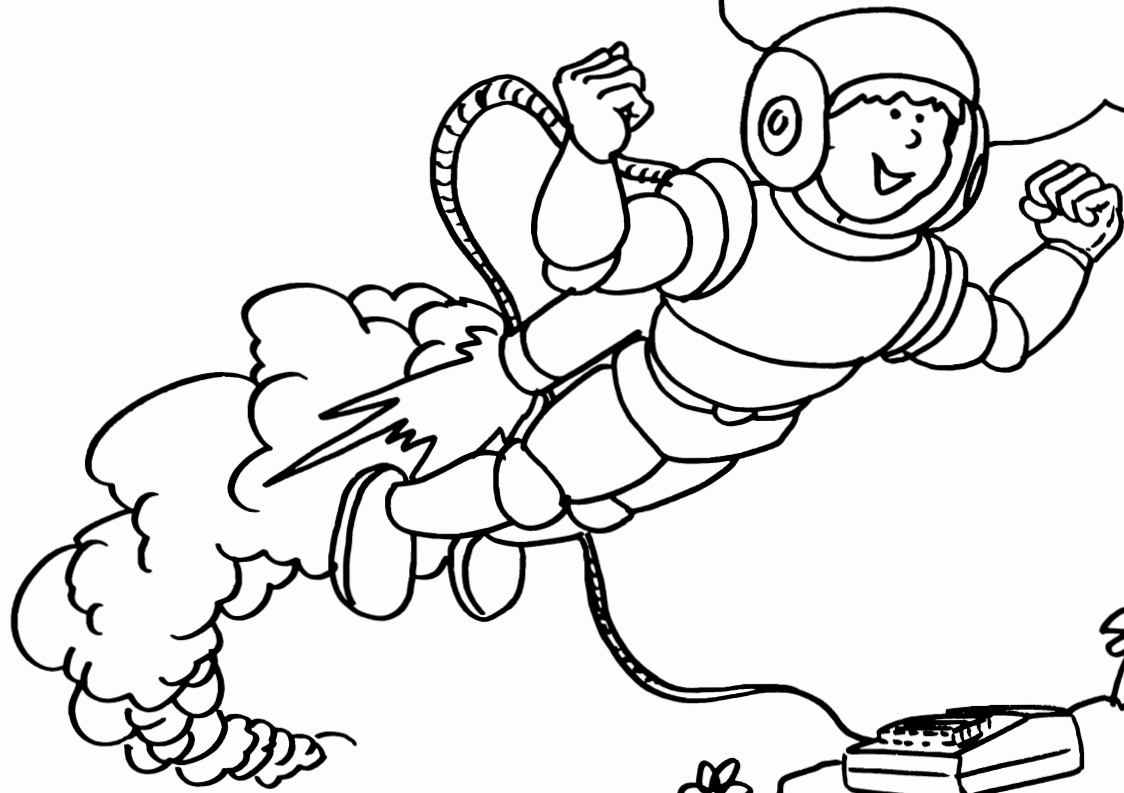
```
130 IF D$ <> _____
```

Have a friend try your quiz. Add more questions if you like.



Color Me!





PROBLEM 26 PIECES OF WORDS

Run this program. Copy the output, then try to answer the questions.

```
10 A$ = "BICYCLE"  
20 PRINT LEFT$(A$,1)  
30 PRINT LEFT$(A$,2)  
40 PRINT LEFT$(A$,3)  
50 PRINT  
60 PRINT RIGHT$(A$,1)  
70 PRINT RIGHT$(A$,2)  
80 PRINT  
90 PRINT LEN(A$)
```

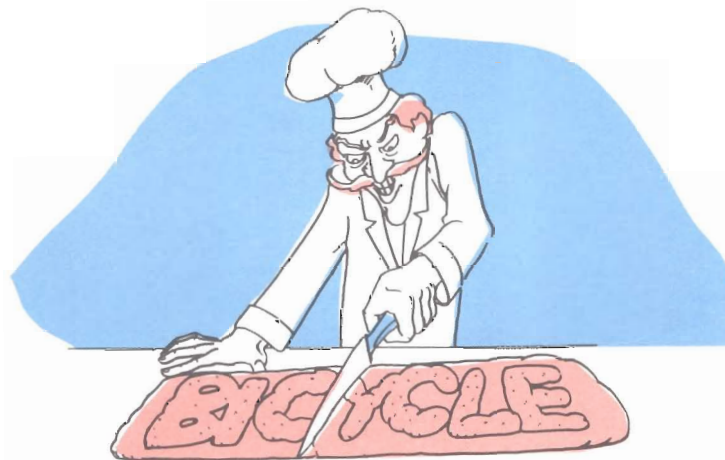
Output

Now suppose line 10 were changed to

```
10 A$ = "MISSISSIPPI"
```

Predict here what the output will be.

Now change line 10 and check your prediction.



PROBLEM 27 BLACK MAGIC

Enter and run this game of 20 QUESTIONS. Baffle your family and friends with how smart your computer is.

Ask questions such as:

```
IS IT ALIVE            IS IT GREEN
DOES IT SWIM          IS IT A REPTILE

10 PRINT " (clr) I'M THINKING OF
SOMETHING ANIMAL"
20 PRINT "ASK ME QUESTIONS - DON'T USE A
QUESTION MARK"
30 FOR Q = 1 TO 20
40 INPUT Q$
50 IF RIGHT$(Q$,1) = "E" THEN R$ = "YES"
60 IF RIGHT$(Q$,1) <> "E" THEN R$ = "NO"
70 PRINT R$
80 NEXT Q
90 PRINT "GAME OVER"
```

What's the secret? What makes the computer answer

YES? _____

Add this line:

```
75 IF RIGHT$(Q$,2) = "TE" THEN GOTO 90
```

What does this do when you play the game? _____



PROBLEM 28 RHYMING GAME

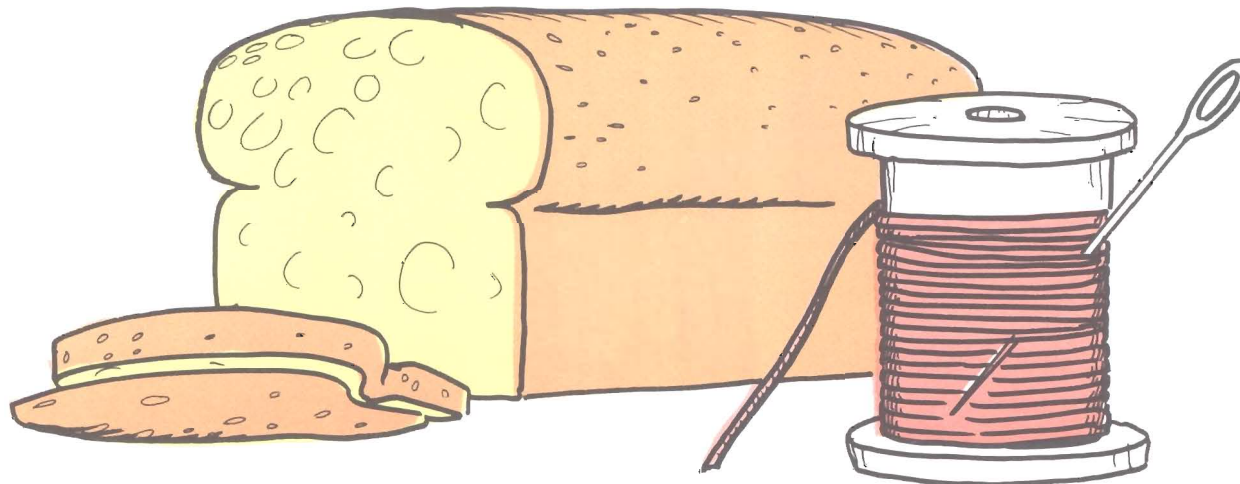
This program is a guess-the-rhyme game. The player gets three guesses. Each time the guess is wrong, a hint is given.

Complete the missing lines. The second hint should be the length of the secret word.

```
50 A$ = "BREAD"  
60 B$ = "THREAD"  
  
100 PRINT "I'M THINKING OF A WORD"  
110 PRINT "IT RHYMES WITH "; A$  
  
120 PRINT " (dn) GUESS"  
130 INPUT G$  
140 IF G$ = B$ THEN 500  
150 PRINT "NO"  
160 PRINT "IT STARTS WITH "; LEFT$(B$,1)
```

```
220 PRINT " dn GUESS"  
230 _____  
  
240 IF G$ = B$ THEN _____  
250 PRINT "NO"  
  
260 _____  
  
320 PRINT " dn LAST GUESS"  
330 _____  
  
340 _____  
350 PRINT "NO, IT WAS ";B$  
360 END  
500 PRINT _____
```

When this program is working, change A\$ and B\$ and let a friend try your game.



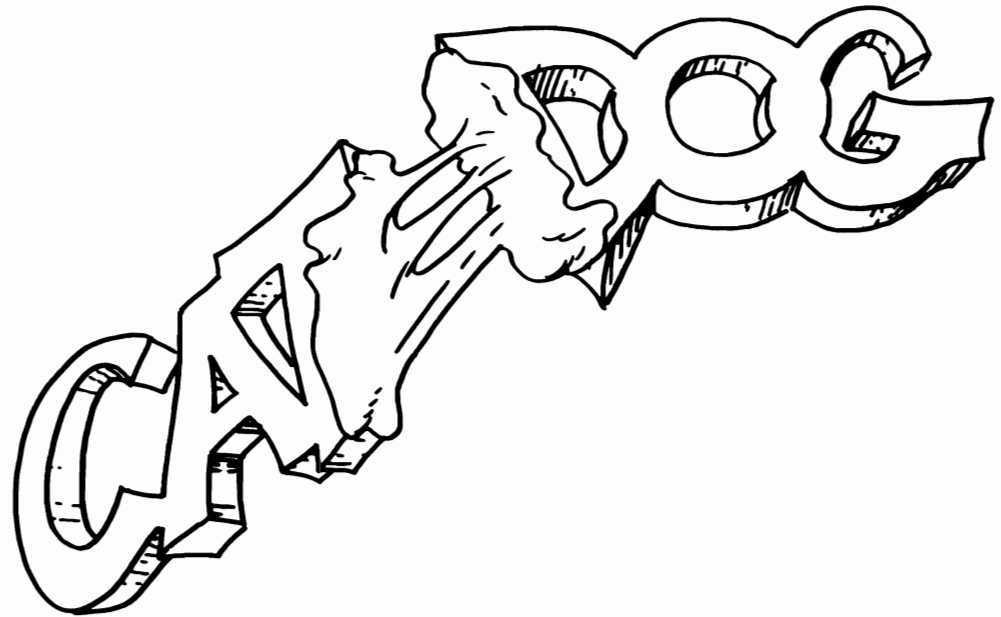
PROBLEM 29 COMPOUND WORDS

The computer will make compound words.

Enter this program:

```
10 PRINT "TELL ME 2 WORDS"  
20 PRINT "AND I'LL GLUE THEM TOGETHER"  
30 INPUT A$, B$  
40 C$ = A$ + B$  
50 PRINT  
60 PRINT C$
```

Run the program for these pairs of words and copy the output.
Press RETURN after entering each word.



Words

Output

BOOK
END

UP
SHOT

UP
CATCH

Now change line 40 to

40 C\$ = B\$ + A\$

and run for the same sets of words. What happens?

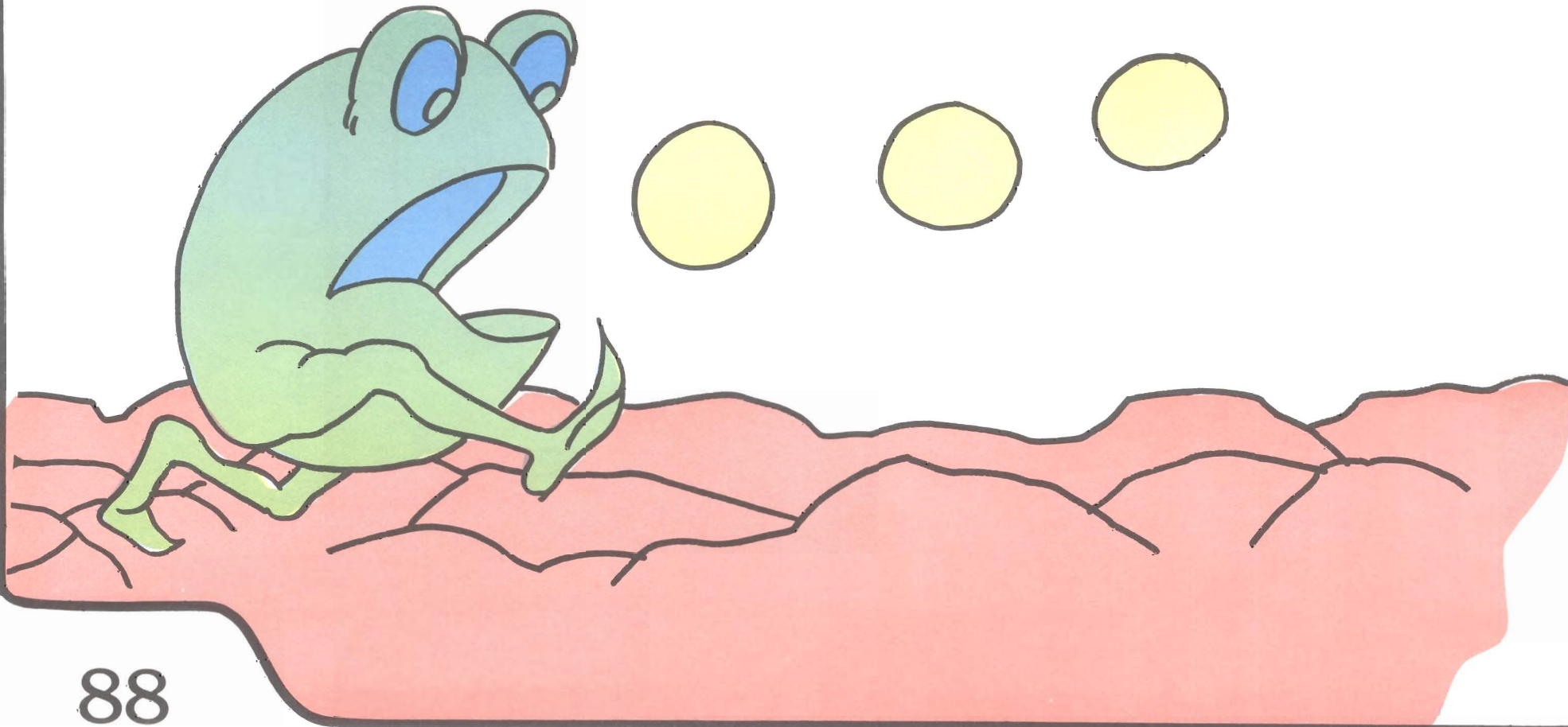


PROBLEM 30 WORD PUZZLE

Look at this program. PREDICT the output. Check it by running the program, if you're not sure.

```
100 A$ = "PACMAN"  
110 B$ = LEFT$(A$,2) + RIGHT$(A$,1)  
120 PRINT B$
```

Output _____



Now you write a program which takes the words SHORTCAKE
and makes SHOES.

```
10 A$ = "SHORTCAKE"
```

```
20 _____
```

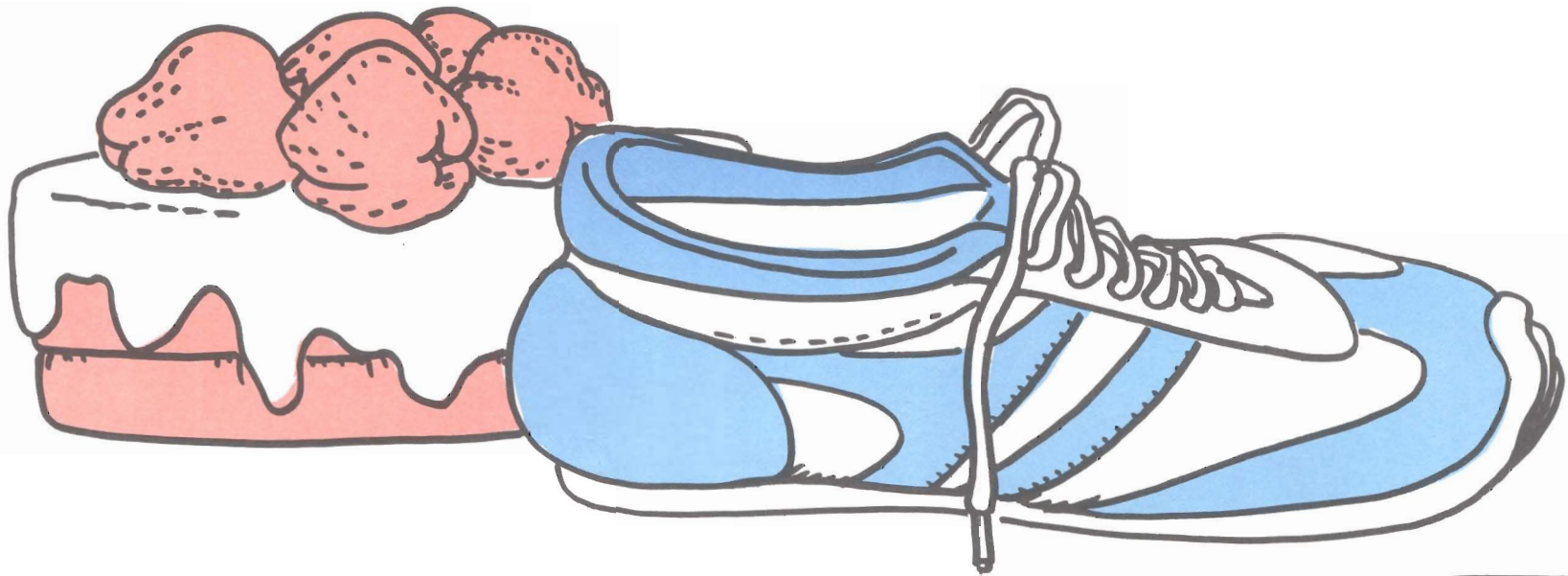
```
30 _____
```

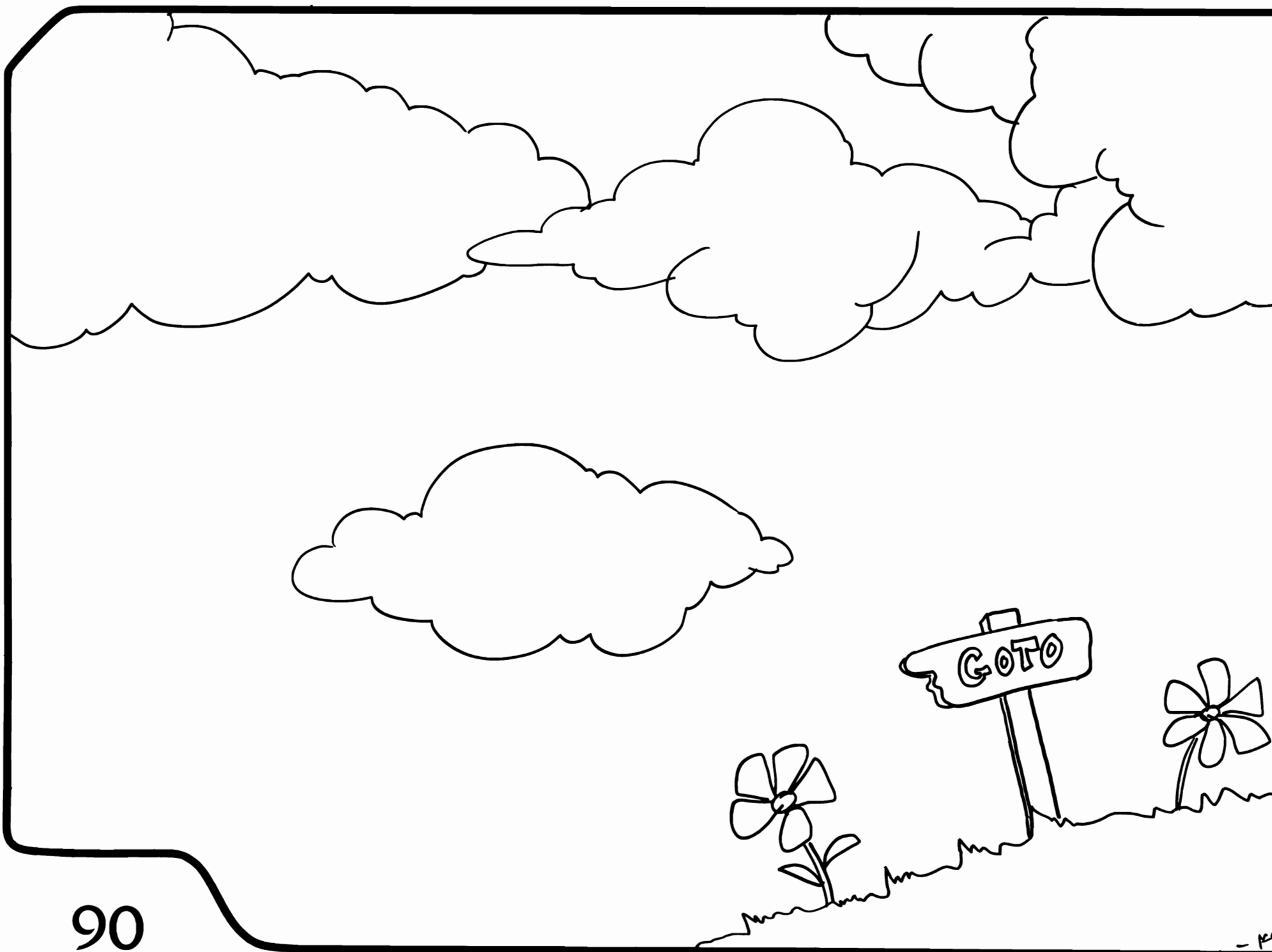
Extra challenge:

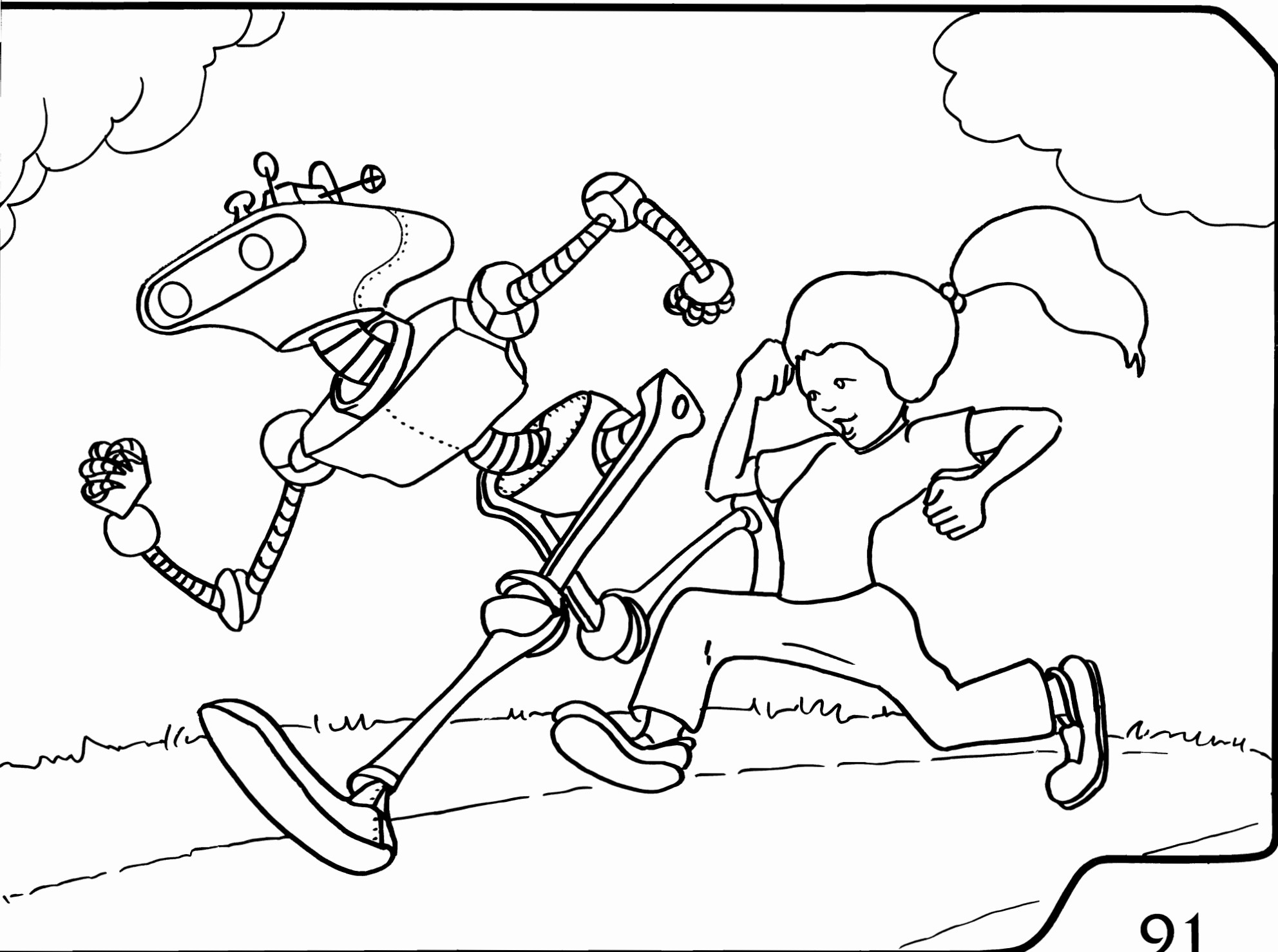
Add a line (or two) which gets CAKE from A\$

```
_____
```

```
_____
```







PROBLEM 31 DOING MATH

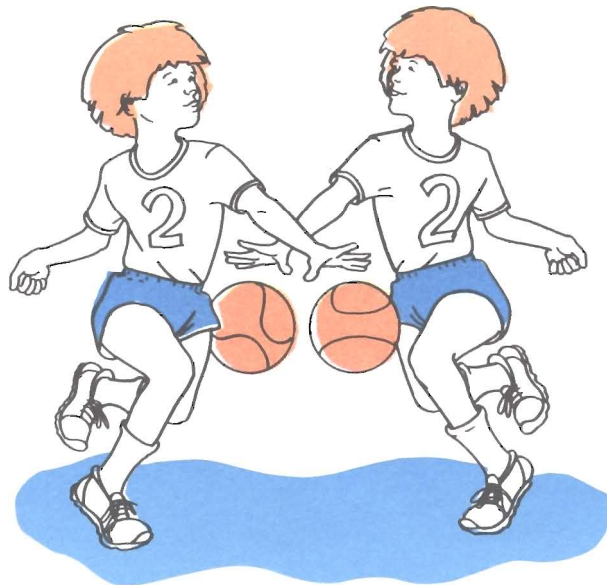
Enter and run this program.

```
10 PRINT " (clr) GIVE ME A NUMBER"  
20 PRINT "AND I'LL DOUBLE IT"  
30 INPUT N  
40 PRINT 2*N
```

Add these lines:

```
100 PRINT "PLAY AGAIN?"  
110 INPUT A$  
120 IF A$ = "YES" THEN 10
```

Run the program. What happens when you answer the question with:



YES _____

NO _____

Y _____

P _____

YEP _____

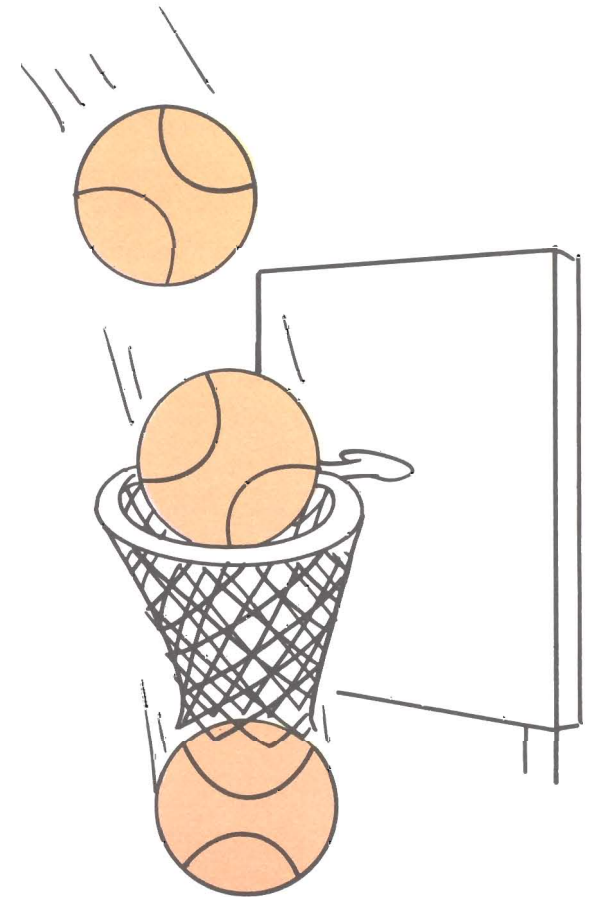
YOU BET _____

Change line 120 to

```
120 IF LEFT$(A$,1) = "Y" THEN GOTO 10
```

Then try the answers above. What happens?

Make the computer triple the number.



PROBLEM 32 MATH QUIZ

Math quiz time. Run this addition quiz.

```
10 PRINT "MATH TEST"  
20 PRINT " dn GIVE ME TWO NUMBERS"  
30 INPUT A  
40 INPUT B  
50 PRINT " dn dn WHAT IS ";A; "+";B  
60 INPUT C  
70 IF C = A + B THEN PRINT "RIGHT"  
80 IF C <> A + B THEN PRINT "WRONG"
```

Change this to a multiplication test. What lines need changing?

1

6

90

54

17

2

3

8



PROBLEM 33 TIMES TABLES

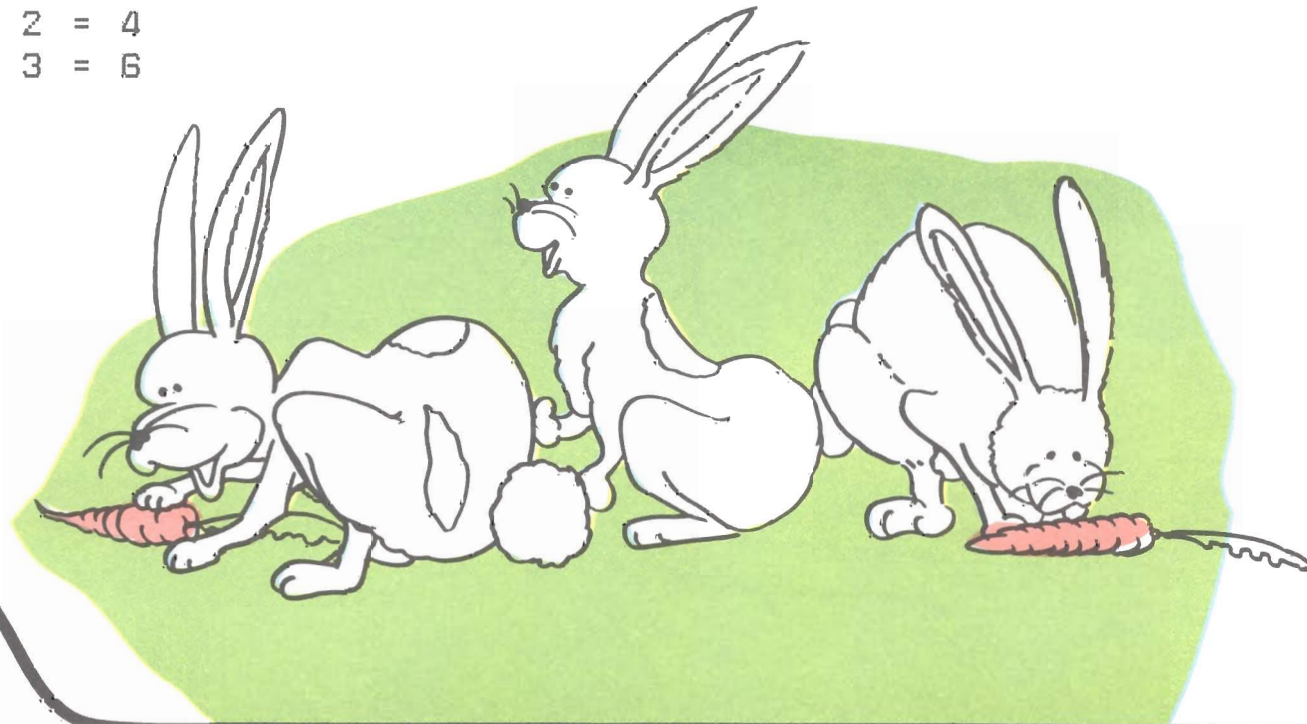
This time we'll make the computer multiply the first ten numbers by 2.

Enter and run this program:

```
10 PRINT " clr TIMES TABLES"  
20 FOR N = 1 TO 10  
30 PRINT N, 2*N  
40 NEXT N
```

We can make the output look like a math book:

```
2 x 1 = 2  
2 x 2 = 4  
2 x 3 = 6
```



by changing line 30. We want "2 ×" and "=" to be printed each time. Change line 30 to

```
30 PRINT "2 X"; N; "="; 2*N
```

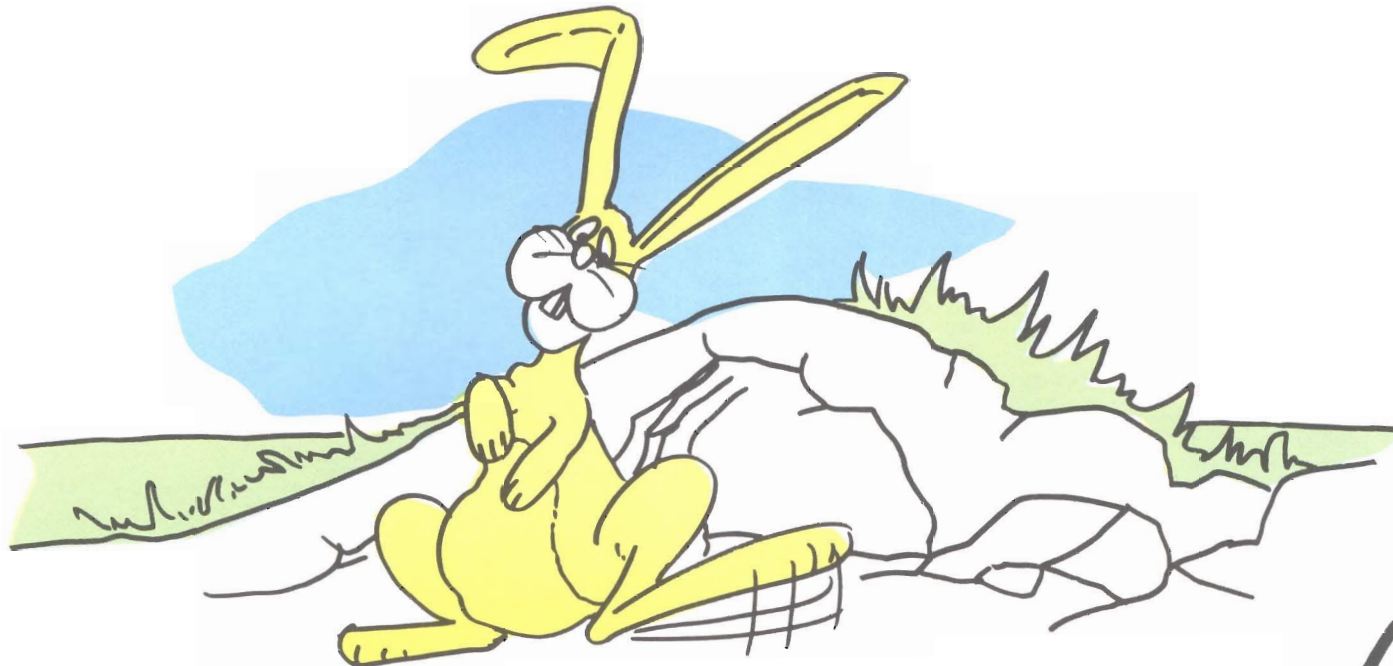
and run the program.

Now change line 30 so the computer does the SEVEN's table:

```
30 _____
```

Make another change to do the TWELVE's table. How much is

12 × 9? _____



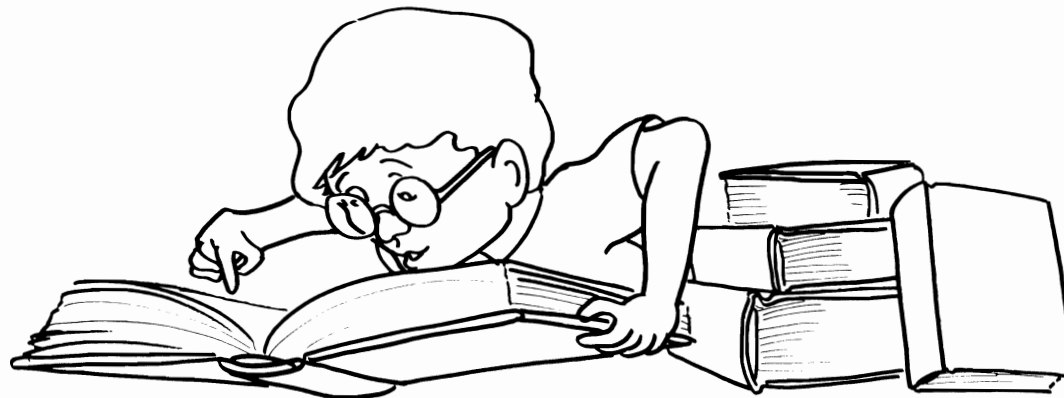
PROBLEM 34 DAYS AND NIGHTS

If you spend two hours a day watching television, how many 24-hour days is that equal to?

If you sleep eight hours a night, how much sleep is that each year? The computer can be taught to solve problems like these.

Read this program.

```
100 PRINT " clr "  
110 PRINT " WHAT'S THE ACTIVITY?"  
120 INPUT A$  
130 PRINT " dn TELL ME HOW MANY HOURS  
YOU SPEND EACH DAY"  
140 PRINT A$  
150 INPUT H  
160 HY = H*365  
170 PRINT "TOTAL HOURS " HY  
180 CD = HY/24  
190 PRINT "COMPLETE DAYS" CD
```

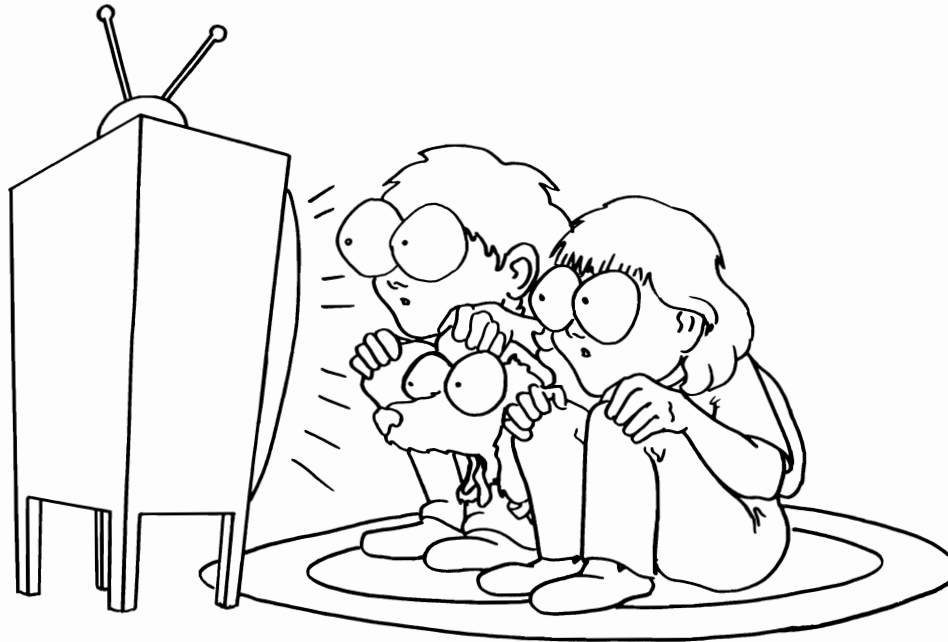


There are four variables in this program. Match their names with what they stand for:

A\$	hours each day
CD	hours each year
HY	the activity
H	total days and nights

Run the program for activities you do such as:

Playing the piano
Watching television
Sleeping
Reading
Looking for your socks



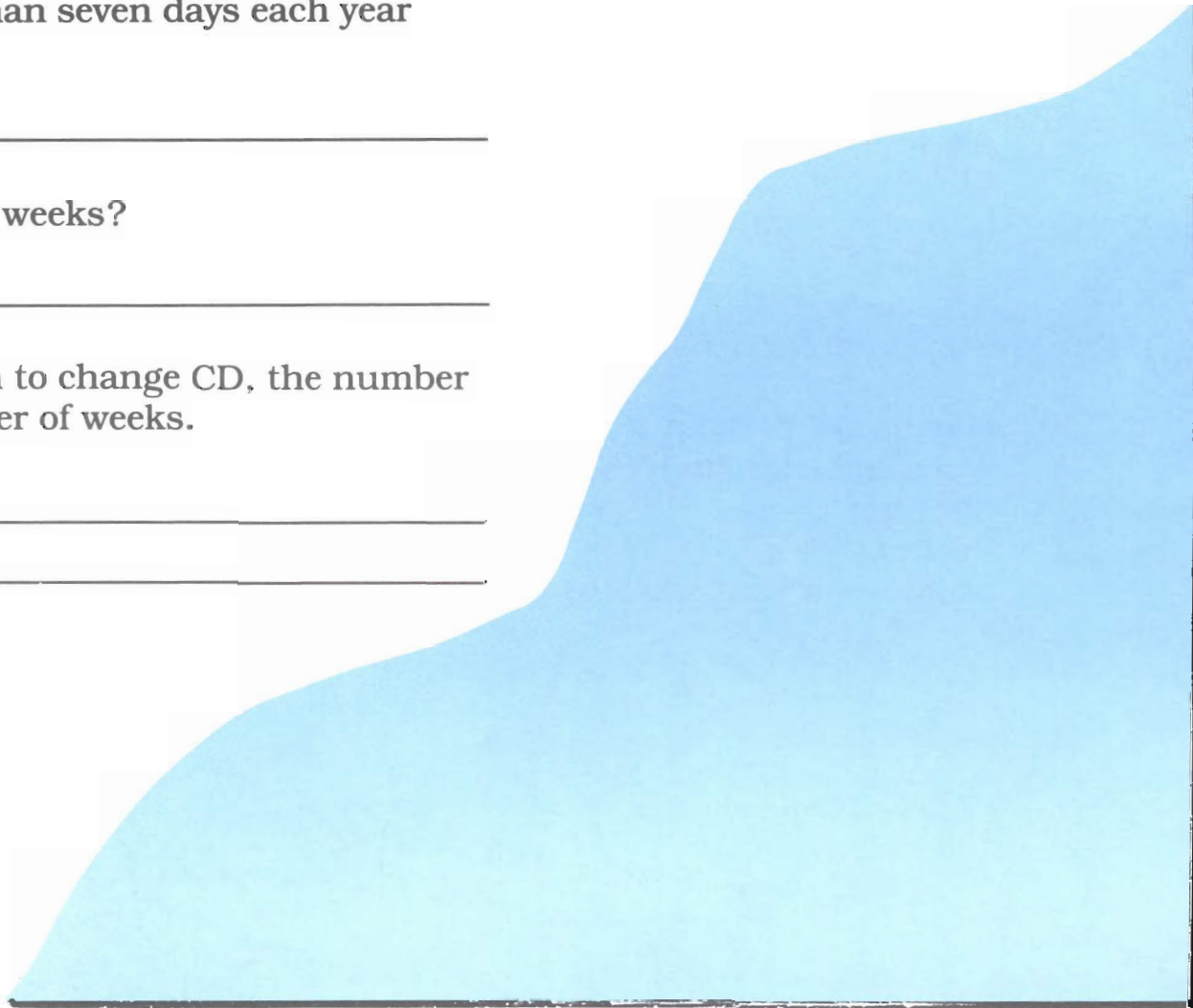
What things do YOU spend more than seven days each year doing?

How do you convert 14 days to two weeks?

Try to add two lines to the program to change CD, the number of complete days, to CW, the number of weeks.

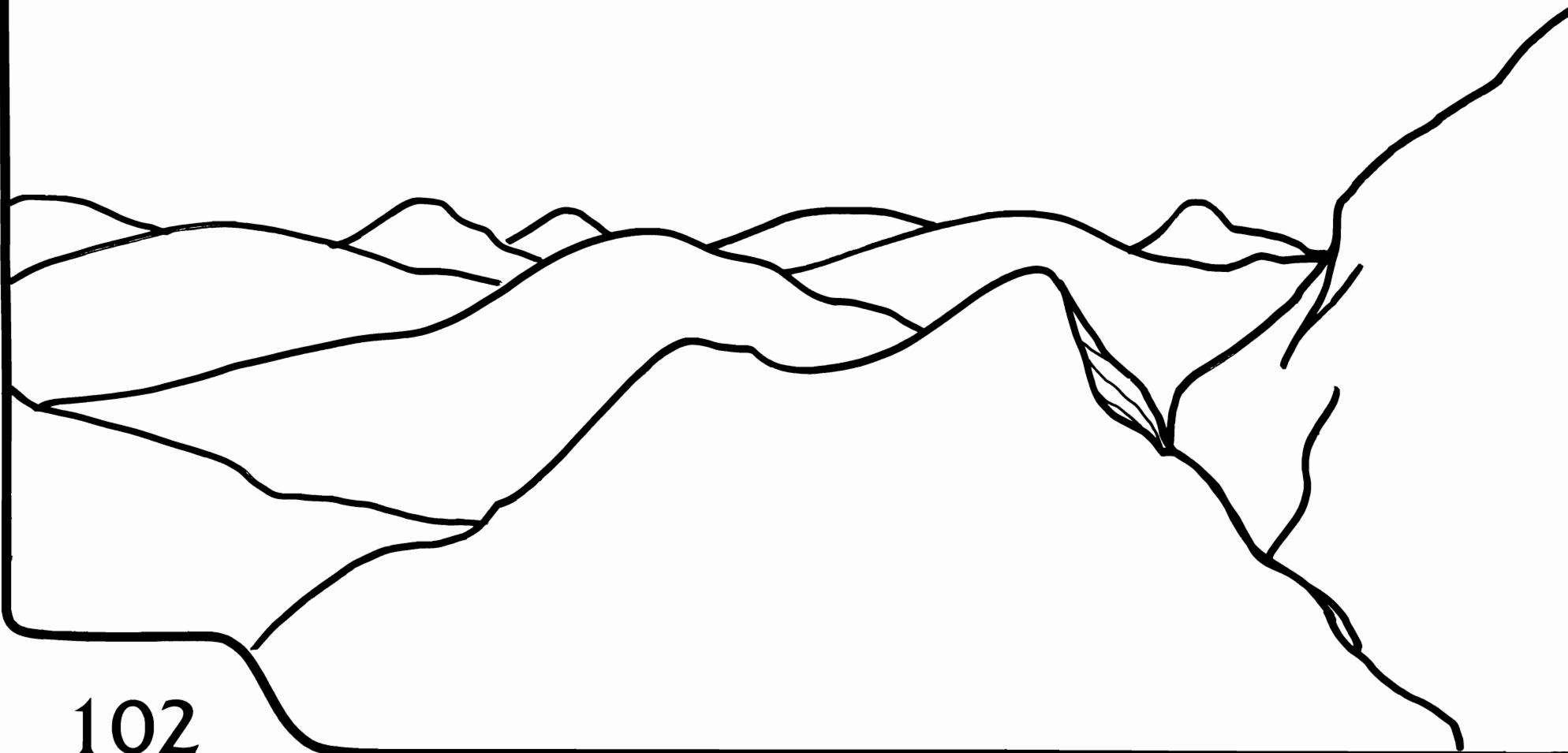
200 _____

210 _____





Color Me!



102



PROBLEM 35 THINK OF A NUMBER

To make the computer “think” of a number, first put this line at the beginning of your program.

```
+++++  
+                                     +  
+ 10 DEF FNR(X) = INT(RND(1)*X + 1) +  
+                                     +  
+++++
```

To roll a die, you want the computer to “think” of a number from 1 to 6. Here’s how to do it:

Add these lines:

```
20 D = FNR(6)  
30 PRINT "YOU ROLLED A " D
```


Either run this program six times, or add lines 15 and 35 to make it repeat the roll six times.

```
15 FOR R = _____
```

```
35 NEXT R
```

Record your rolls here:



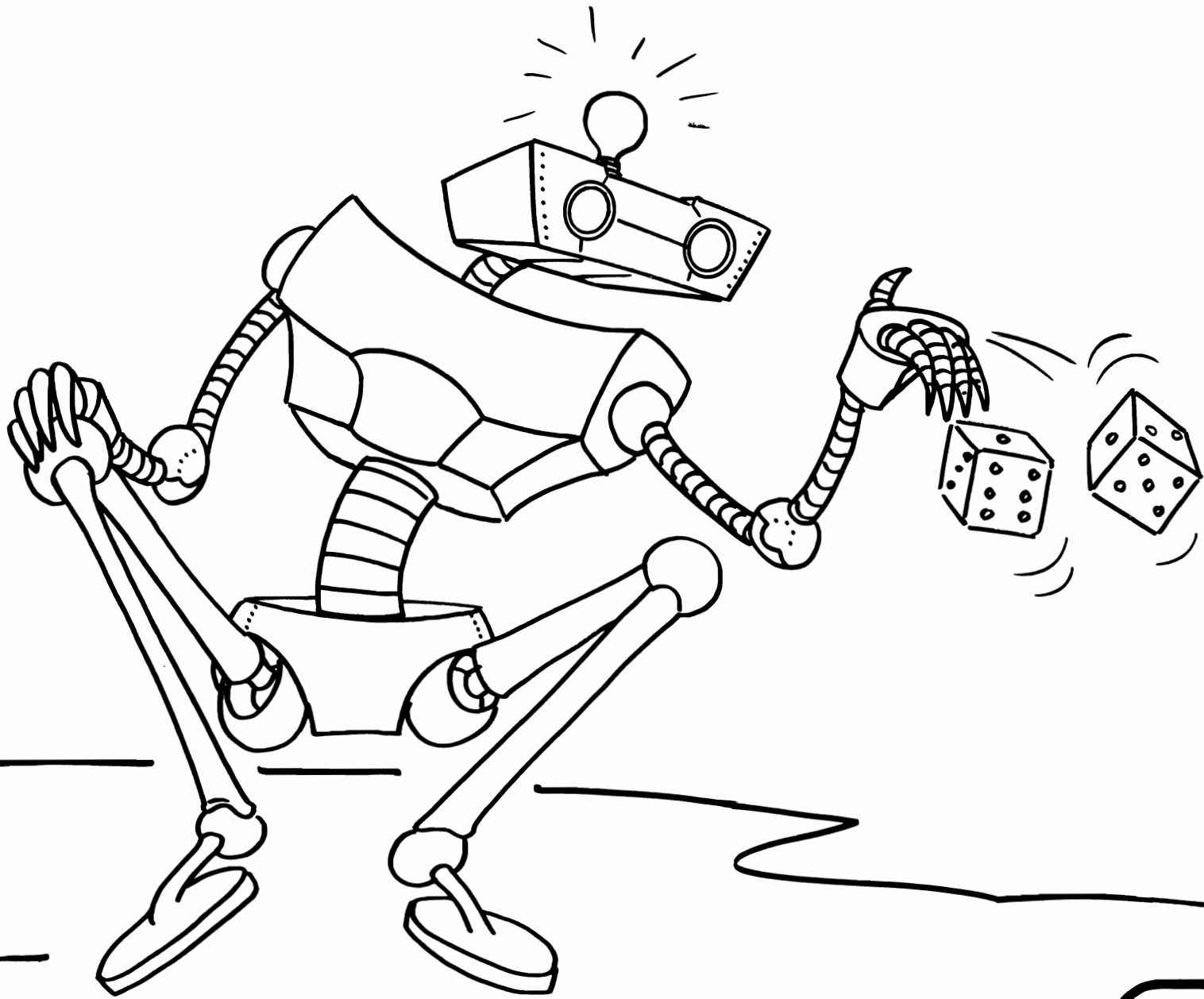
PROBLEM 36 TWO DICE

This time we want to roll TWO dice. Each time we roll a die, we must use FNR(6).

Enter this program. Either run it six times or put in a FOR...NEXT loop.

```
10 DEF FNR(X) = INT(RND(1)*X + 1)
20 D = FNR(6)
30 E = FNR(6)
40 PRINT D,E
```

Roll the dice six times and copy your results.



PROBLEM 37 GET OUT OF JAIL FREE

Finish this get-out-of-jail-free program and enter. You may use lines 10 - 30 of the last problem. You get three tries.

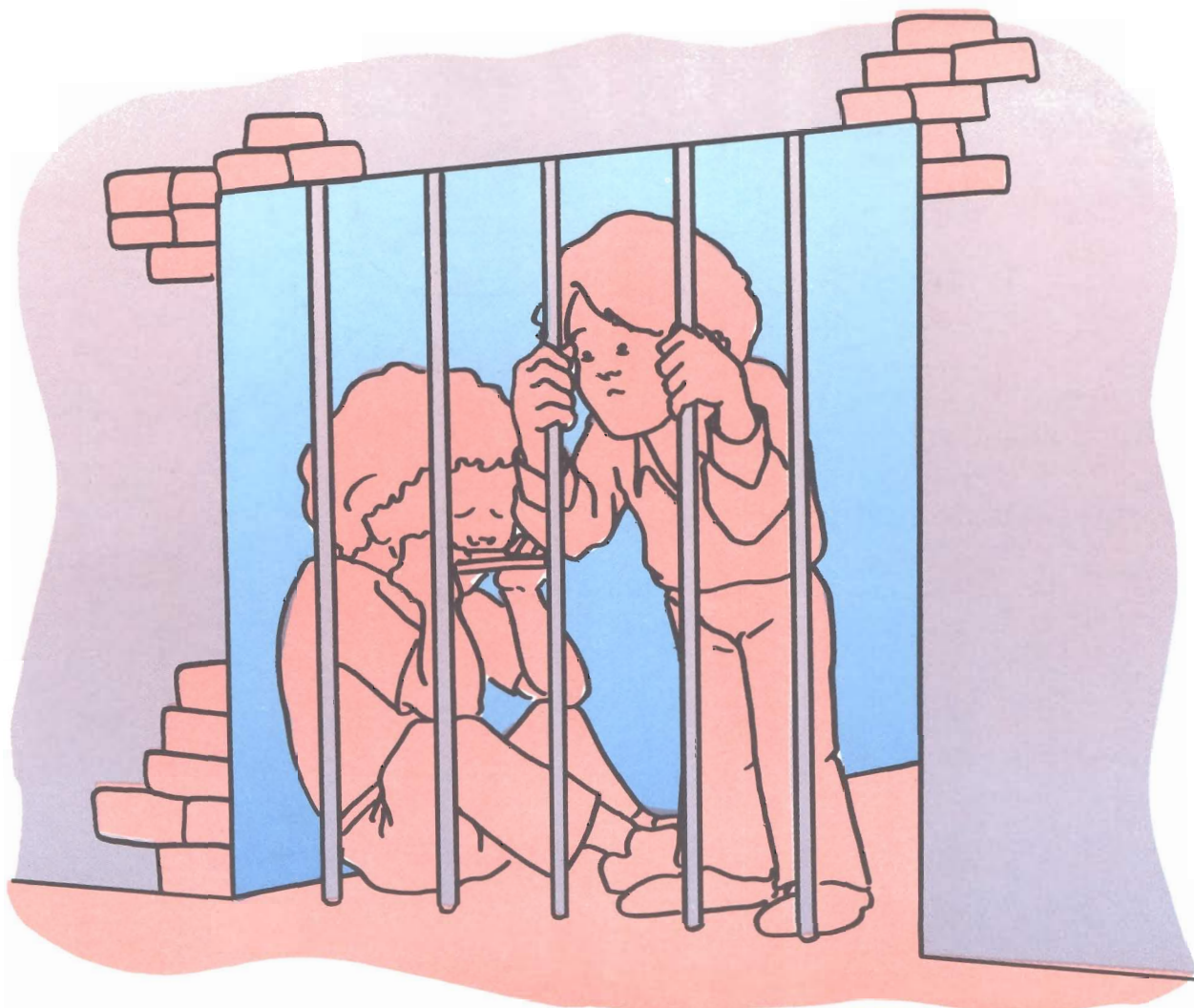
```
10 DEF FNR(X) = INT(RND(1)*X + 1)

15 FOR R = _____
20 D = FNR(6)
30 E = FNR(6)
40 PRINT D,E

50 IF _____
60 NEXT R
70 PRINT "SORRY, PAY $50."
80 END
100 PRINT "GET OUT OF JAIL FREE!"
```

Run this program six times. How many times did you get out of jail free? _____

How many times did you pay \$50? _____



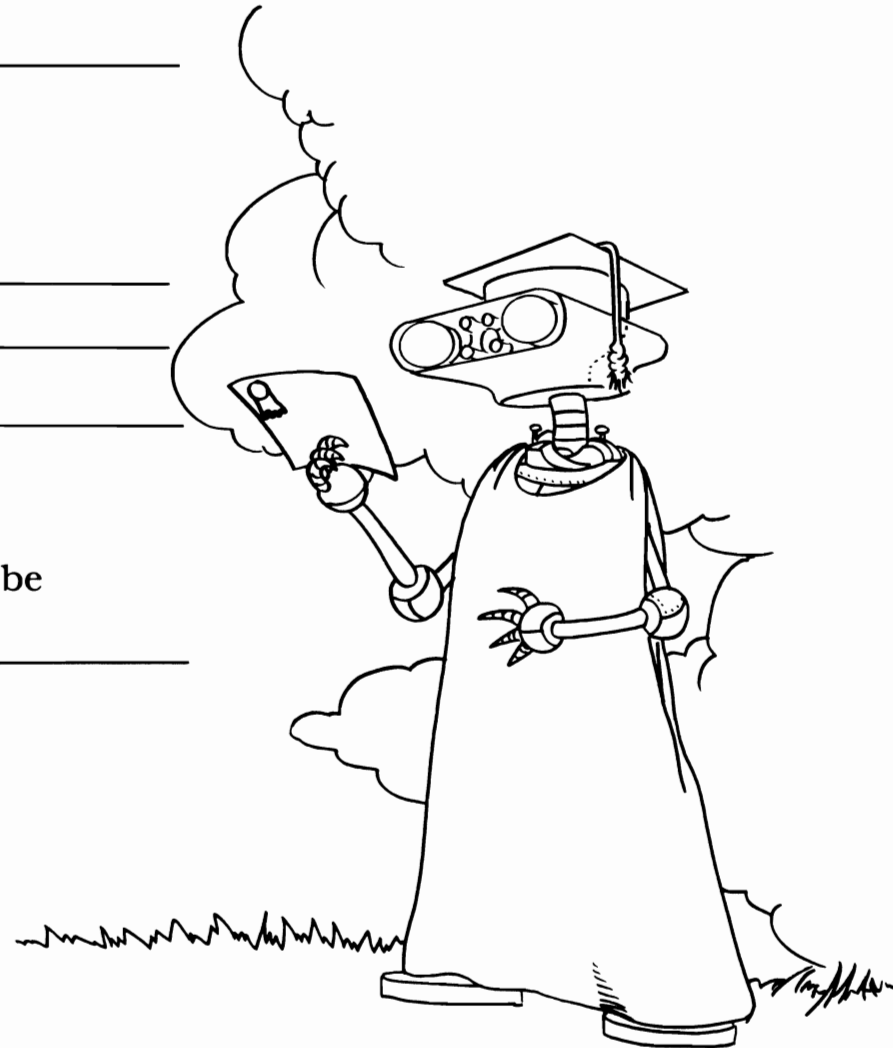
PROBLEM 38 HARDER MATH QUIZ

Complete this quiz so that it presents five problems. Use lines 15 and 80 to make a FOR...NEXT loop.

```
10 DEF FNR(X) = INT(RND(1)*X + 1)
15 _____
20 A = FNR(10)
30 B = FNR(10)
40 PRINT A; "+"; B; "=";
50 INPUT C
60 IF C = A + B THEN PRINT _____
70 IF C <> A + B THEN _____
80 _____
```

Do one (or both) of the following:

- A. Change this to a multiplication quiz. What has to be changed? _____



B. Leave it as an addition quiz but make it ask the sum of three numbers.

Generate a third number D in line 35.

Change line 40 to print the sum of three numbers.

Change lines 60 and 70.

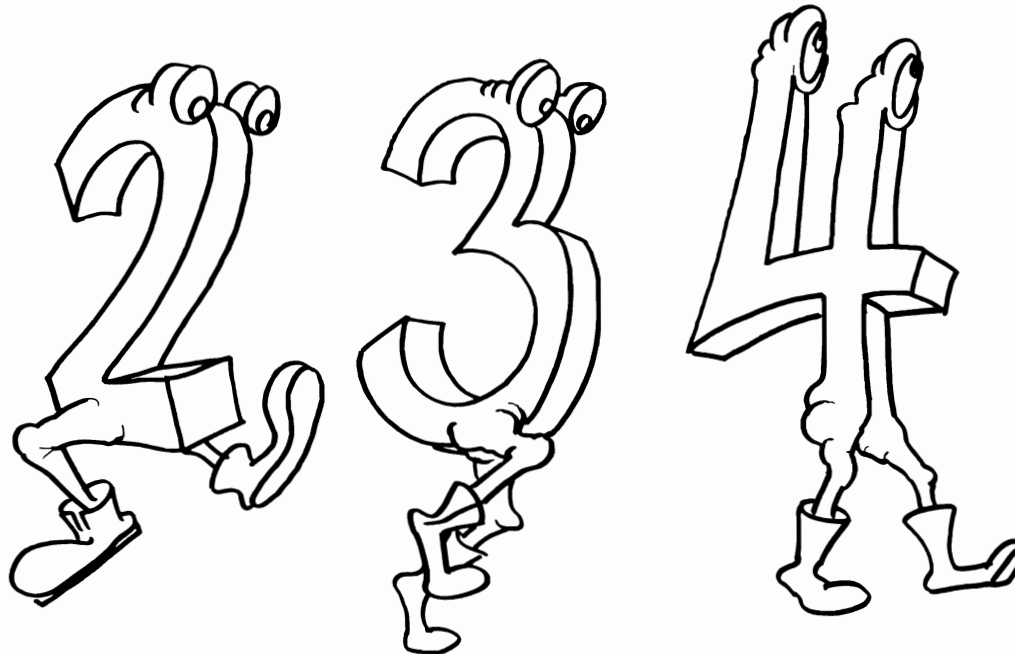
Write your new lines here.

35 D = _____

40 PRINT _____

60 IF _____

70 IF _____



PROBLEM 39 NUMBER GUESS

In this program, the computer "thinks" of a number and you try to guess it. If you guess wrong, it tells you TOO BIG or TOO SMALL. Complete the program and run it to check it out.

```
10 DEF FNR(X) = INT(RND(1)*X + 1)
20 N = FNR(100)
30 PRINT "I'M THINKING OF A NUMBER"
40 PRINT "GUESS"
50 INPUT G

70 IF G = N THEN 500
80 IF G < N THEN PRINT _____
90 IF _____
100 GOTO _____

500 PRINT _____
```

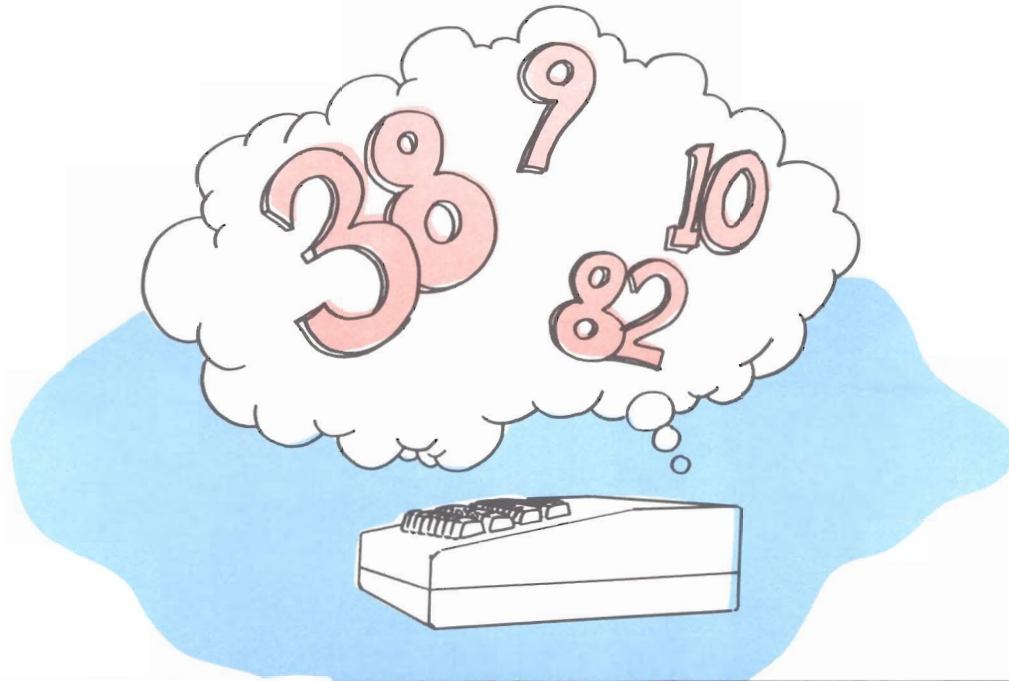

What numbers did the computer think of? _____

What's the biggest number it's allowed to think of? _____

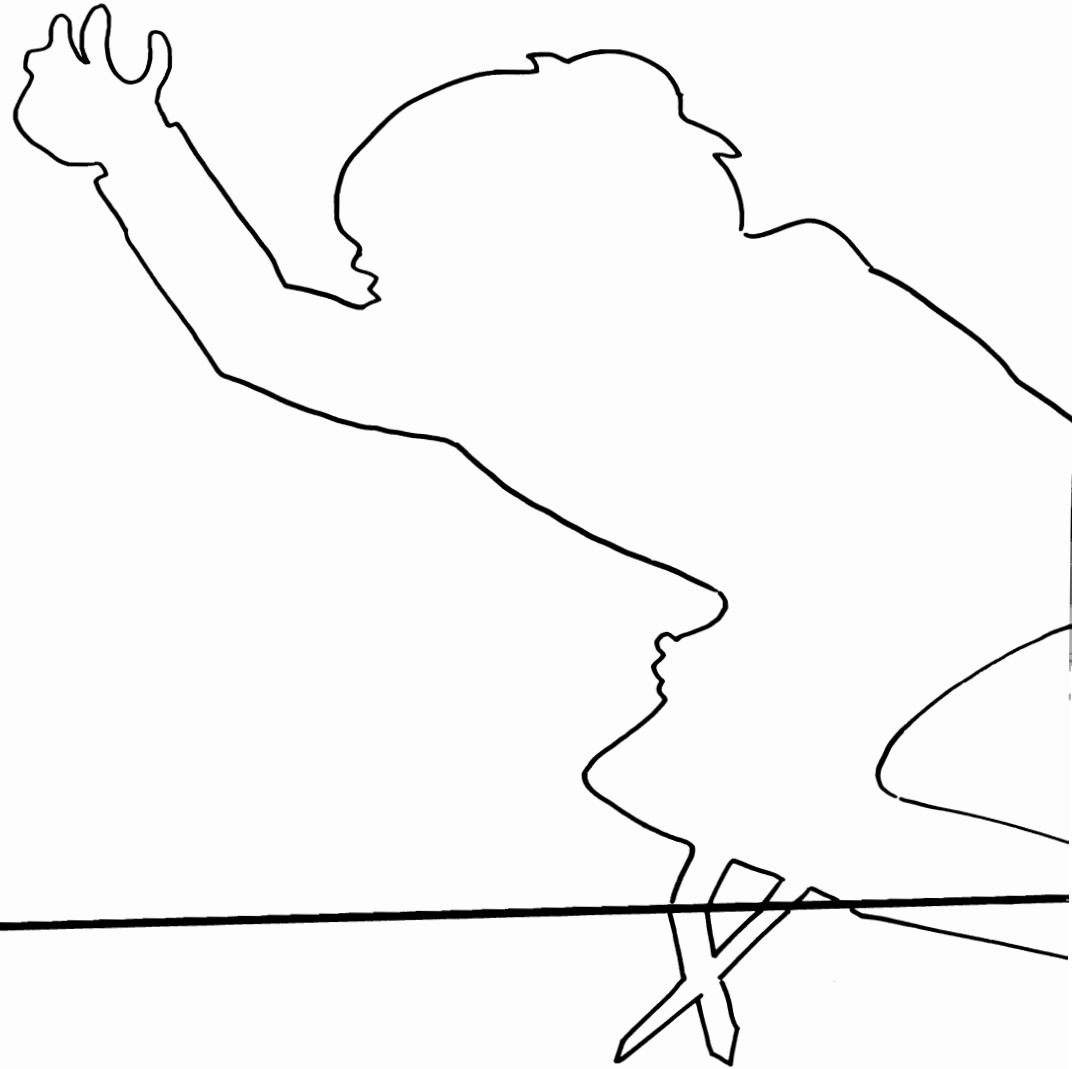
To count the guesses, add these lines to click a guess counter:

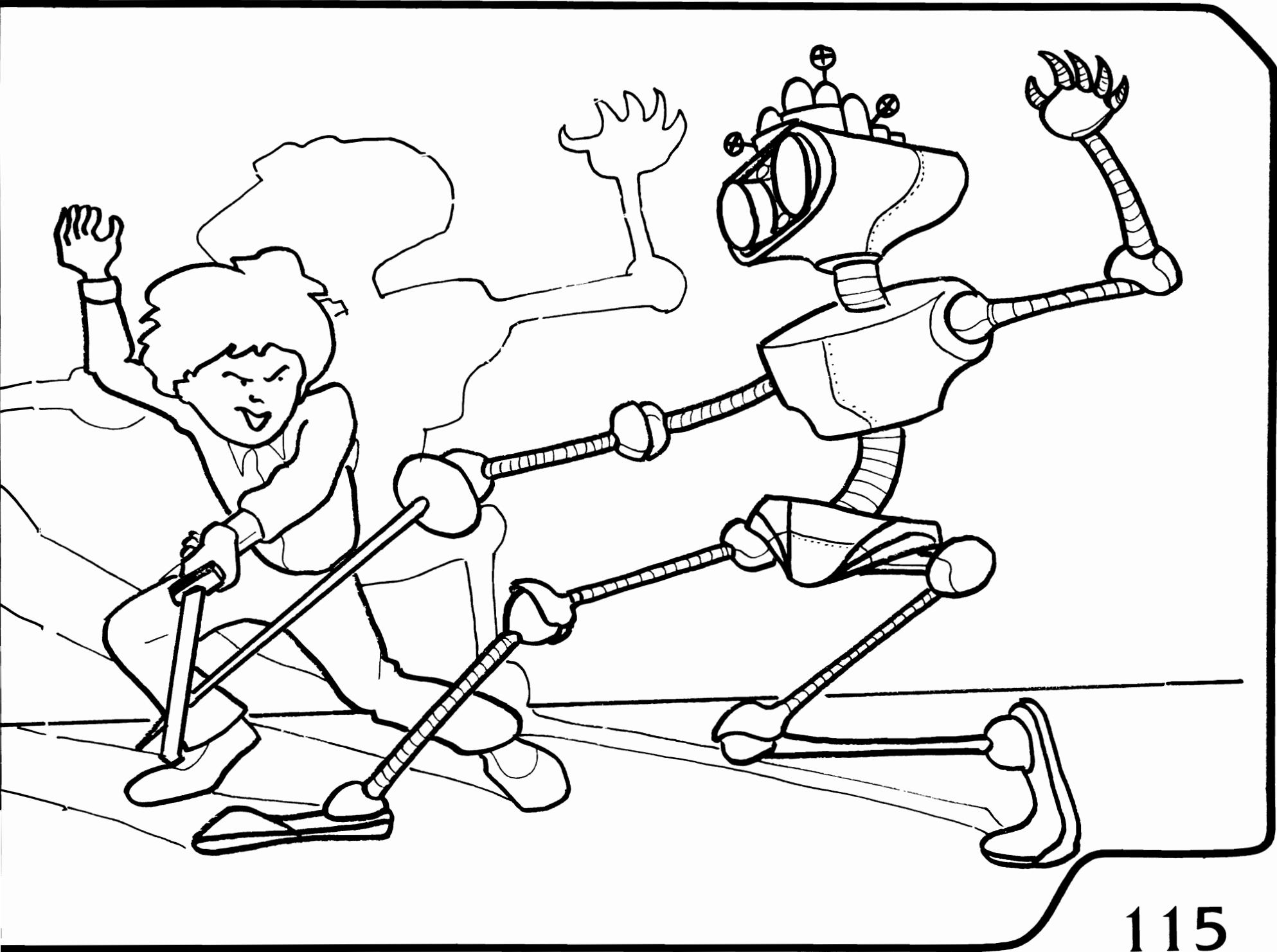
```
5 C = 0
60 C = C + 1
510 PRINT "IT TOOK YOU"
520 PRINT C "GUESSES"
```

Run the program several times and keep track of how many guesses it took you.



Color me!





PROBLEM 40 THE ANSWER MACHINE – Using a List

Is it going to rain tomorrow? Will I find my watch under the bed? Will my loose tooth come out today?

We'll make up a list of ten answers and let the computer pick one every time a question is asked.

The computer needs a number for every item on a list. The answers in the program will all be called A\$.

The first answer has name A\$(1).
The second answer has name A\$(2).
The third answer has name A\$(3).
and so on.

Whenever a list is used in a program, the computer must be warned how long the list is allowed to get. Line 20 says our list won't have more than ten things on it.



Finish the program on the next page; enter and run it to see how a list works.

```
10 DEF FNR(X)=INT(RND(1)*X+1)
20 DIM A$(10)
21 A$(1)="YES"
22 A$(2)="NO"
23 A$(3)="PERHAPS"
24 A$(4)="DEFINITELY NOT"
25 A$(5)= _____
26 A$(6)= _____
27 A$(7)= _____
28 A$(8)= _____
29 A$(9)= _____
30 A$(10)= _____

50 PRINT " (clr) "
60 PRINT " (dn) (dn) (dn) NEXT QUESTION,
PLEASE"
70 INPUT Q$
80 N = FNR(10)
90 PRINT A$(N)
100 GOTO 60
```

PROBLEM 41 DINNER DARTS

This program will "throw a dart" at a list of dinner menus. When you have a list, you must use the DIM statement to tell the computer how long the list is allowed to get.

Enter and run this one.

```
10 DEF FNR(X) = INT(RND(1)*X+1)
20 DIM M$(10)
30 M$(1)="SPAGHETTI"
40 M$(2)="MEATLOAF"
50 M$(3)="FRIED CHICKEN"
60 M$(4)="STEAK"

200 PRINT " clr DINNER DECIDER"
210 PRINT "TONIGHT WE'LL HAVE"
220 FOR T = 1 TO 1000: NEXT T
230 D = FNR(4)
240 PRINT M$(D)
```



Add four more dishes to the list:

70 M\$(5) = _____

80 M\$(6) = _____

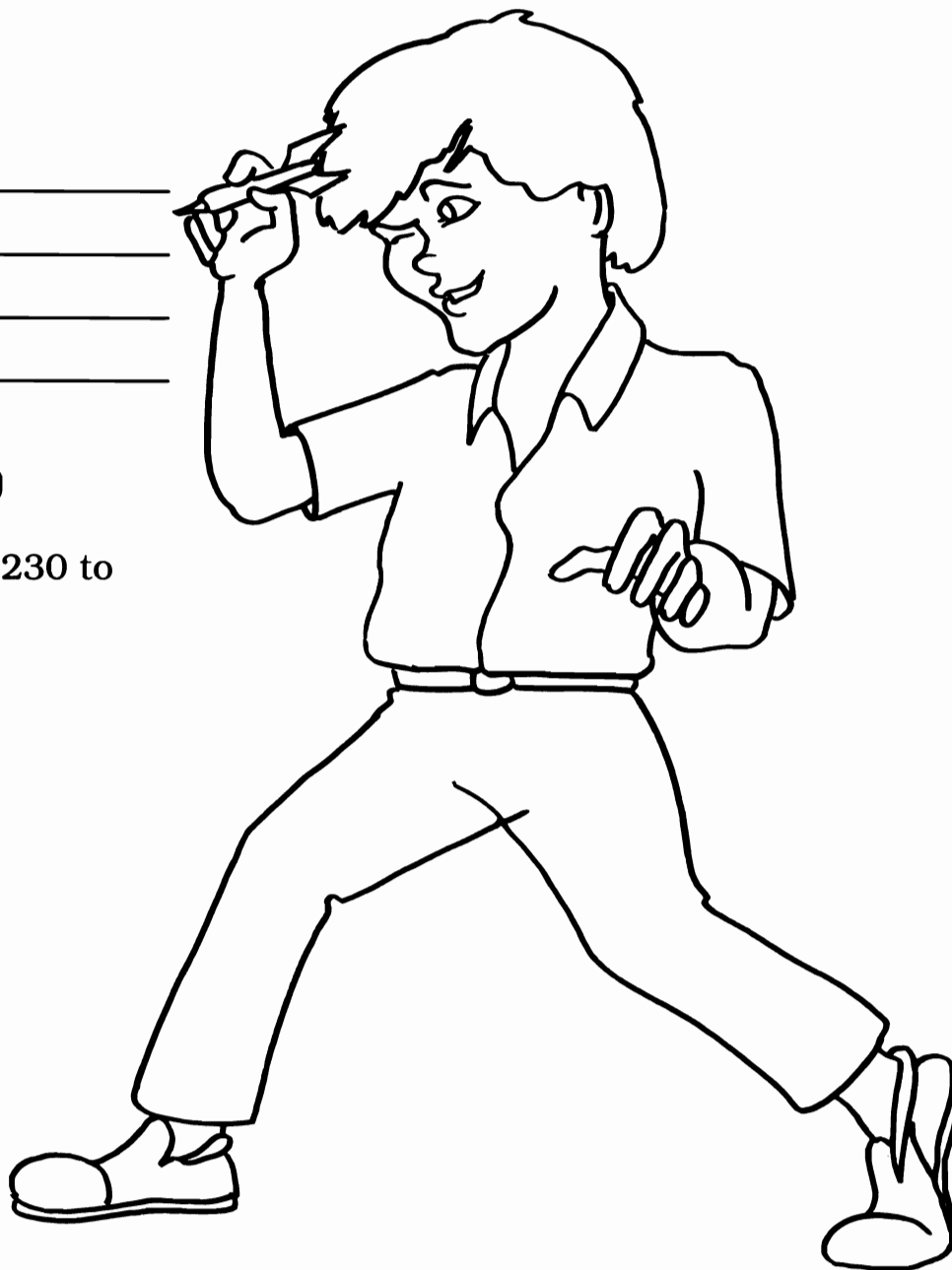
90 M\$(7) = _____

100 M\$(8) = _____

(Don't forget the QUOTATION MARKS.)

To use your expanded list, change line 230 to

230 D = FNR(8)



PROBLEM 42 THE CRYSTAL BALL

The last problem is to write a program which tells fortunes.
Here's how to start it:

```
10 DEF FNR(X) = INT(X*RND(1)+1)
20 DIM D$(10), E$(10), P$(10)

31 D$(1) = "LUCKY"
32 D$(2) = "SAD"
33 D$(3) = "COLD"

61 E$(1) = "SPAGHETTI"
62 E$(2) = "ICE CREAM"
63 E$(3) = "GRANOLA"

81 P$(1) = "GIN RUMMY"
82 P$(2) = "THE PIANO"
83 P$(3) = "SOCCER"

100 PRINT " (clr) WHAT'S YOUR NAME?"
110 INPUT N$
200 PRINT " (dn) TODAY YOU WILL BE"
210 D = FNR(3)
220 PRINT D$(D)
```



```
230 PRINT " dn ESPECIALLY IF YOU EAT"  
240 E = FNR(3)  
250 PRINT E$(E)  
260 PRINT " dn AND PLAY"  
270 P = FNR(3)  
280 PRINT P$(P)
```

Now add some more possibilities:

```
34 D$(4) = _____  
35 D$(5) = _____  
36 D$(6) = _____  
64 E$(4) = _____  
65 E$(5) = _____  
84 P$(4) = _____
```

To make sure the crystal ball can see all the possibilities, what changes must you make in lines:

```
210 D = _____  
240 E = _____  
270 P = _____
```

Try making the messages appear in different colors, too.



OPERATIONAL GLOSSARY

PRINT "HI" — puts HI on the screen.

GOTO 50 — do line 50 next.

INPUT N\$ — the program needs a word before it can go on. Everything stops until the user types a word and presses return.

END — stop the program here.

PRINT TAB(10)"HI" — move over 10 spaces, then print HI.

REM — short for remark. Doesn't do anything.

FOR...NEXT — used to make the computer stop and count, or repeat something.

IF...THEN — tests whether things are the same or different.

OR — used with IF...THEN.

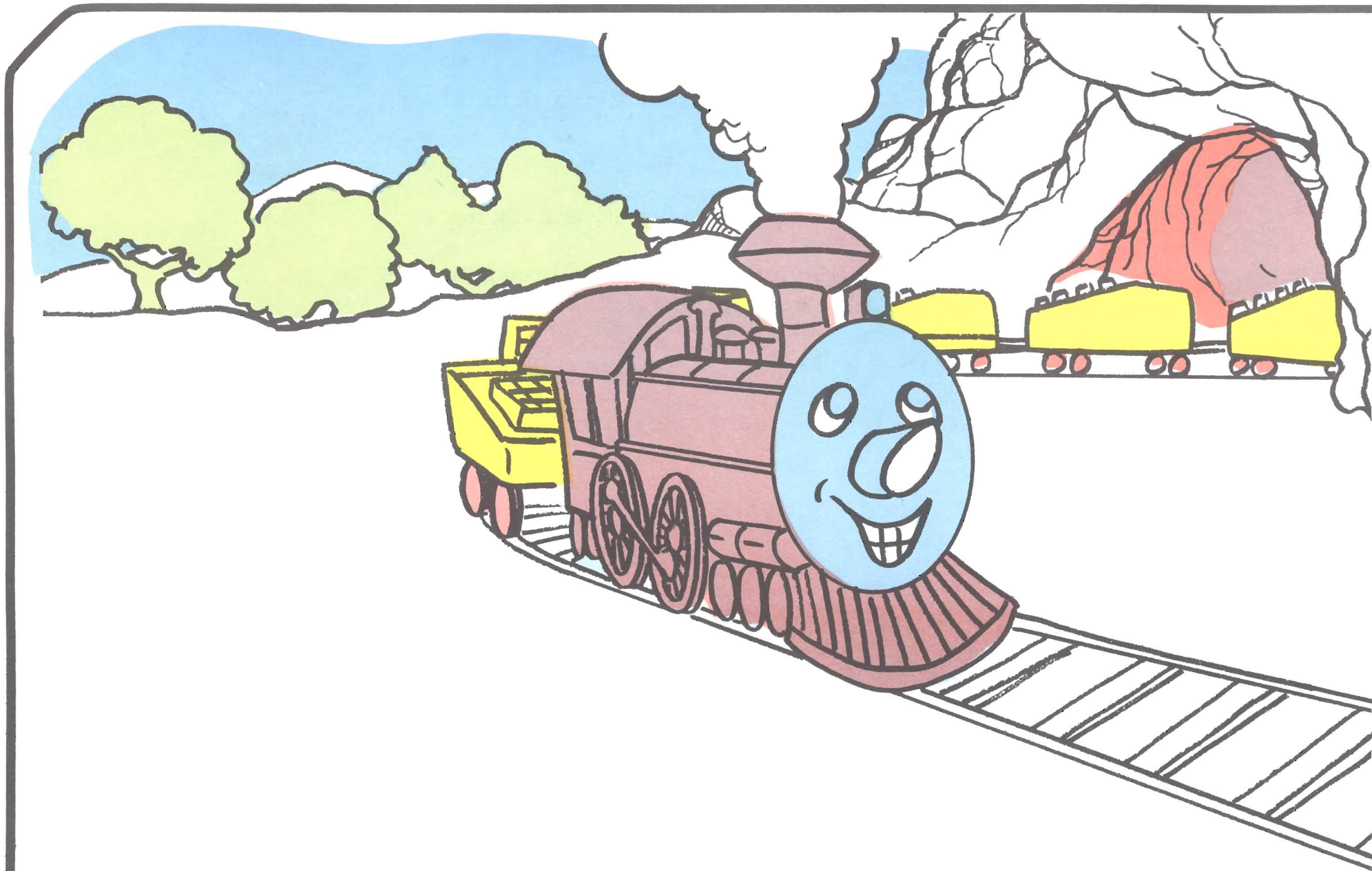
POKE — get into the computer's memory and change it.

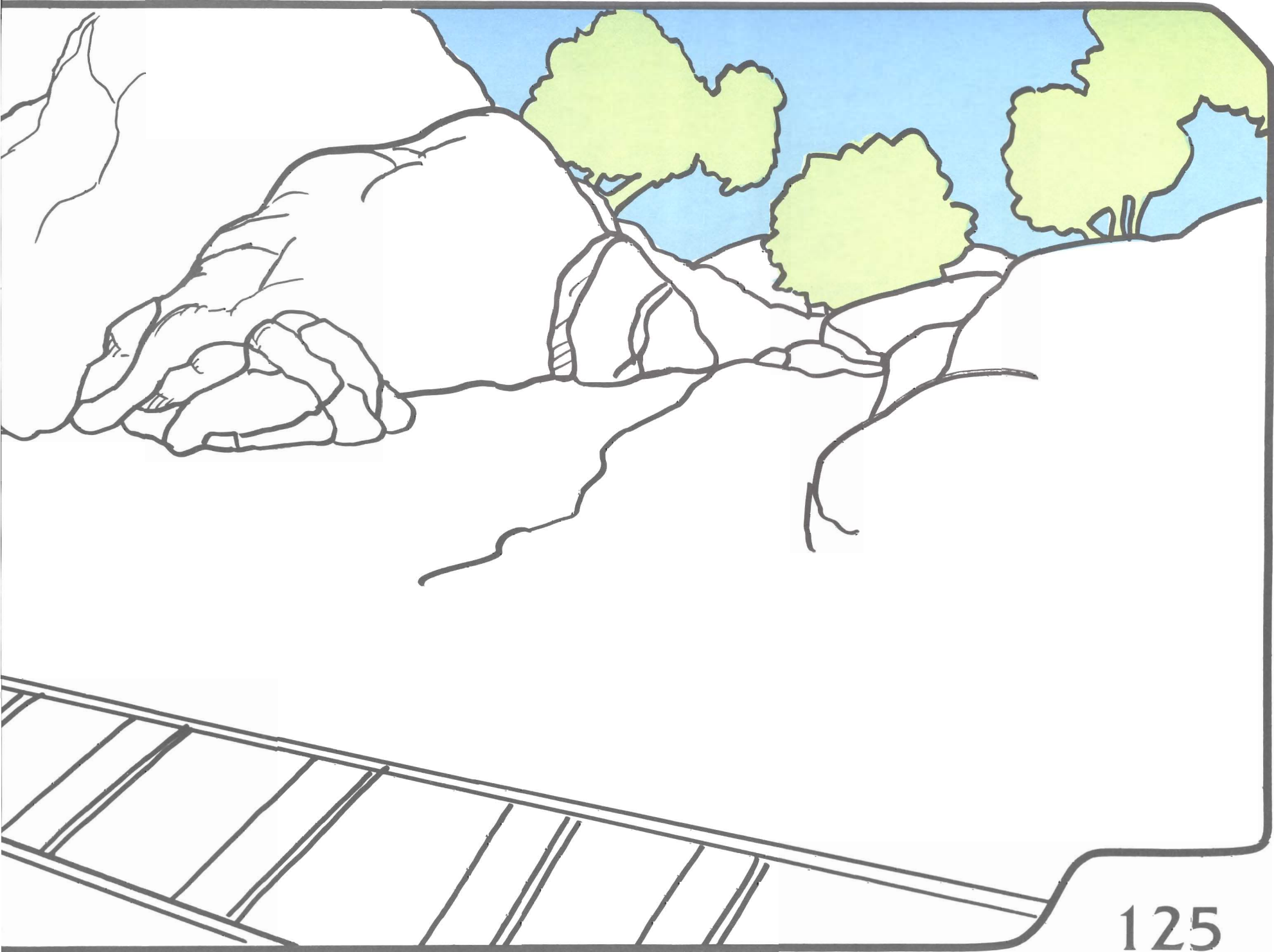
PEEK — look at the computer's memory and report to the program. Used to tell if keyboard is touched.

RIGHT\$, LEFT\$ — looking at ends and beginnings of words.

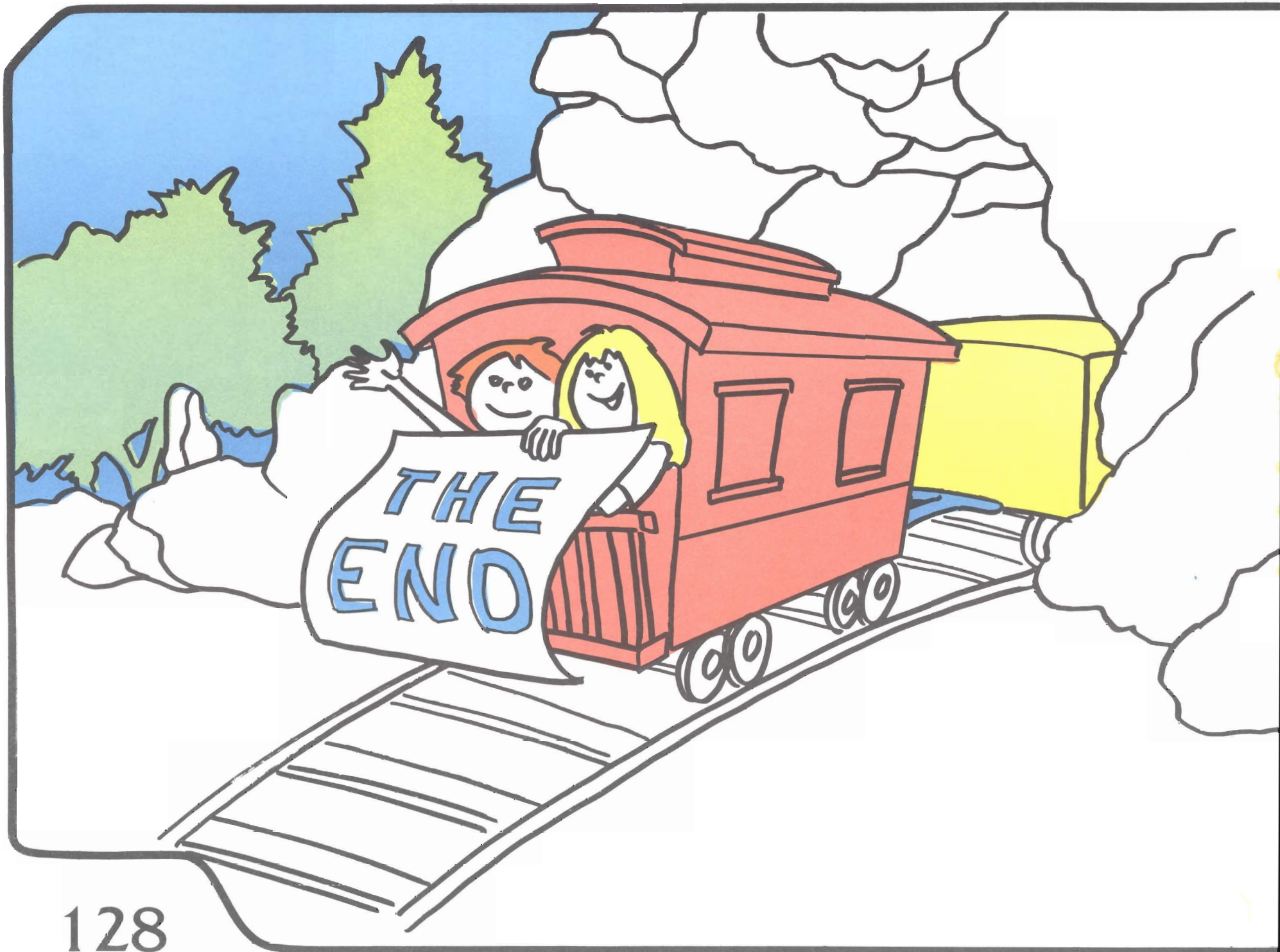
$D = \text{INT}(\text{RND}(1)*6 + 1)$ — makes the computer think of a number from 1 to 6.

DIM A\$(10) — there's a list of at most 10 items. The first item is A\$(1), the second is A\$(2),...





*Mary Jean Winter is a professor of Mathematics at Michigan State University. She has been actively involved in mathematics education (K-12) for the last 8 years. She was formerly a numerical analyst in industry and academia. She is the author of Chivalry, Great Adventure, Wordspot and Witchnumber, published by Comm*Data; numerous articles on using calculators and computers in the classroom, as well as calculator activities for Scott Foresman's elementary series math text book. The author also teaches computing at MSU Summer Computer Camps for children ages 10-16. She has a Ph.D. in mathematics from Carnegie Mellon University and an A.B. in mathematics and history from Vassar College. She is presently working on Atari and Apple versions of Computer Playground.*



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