

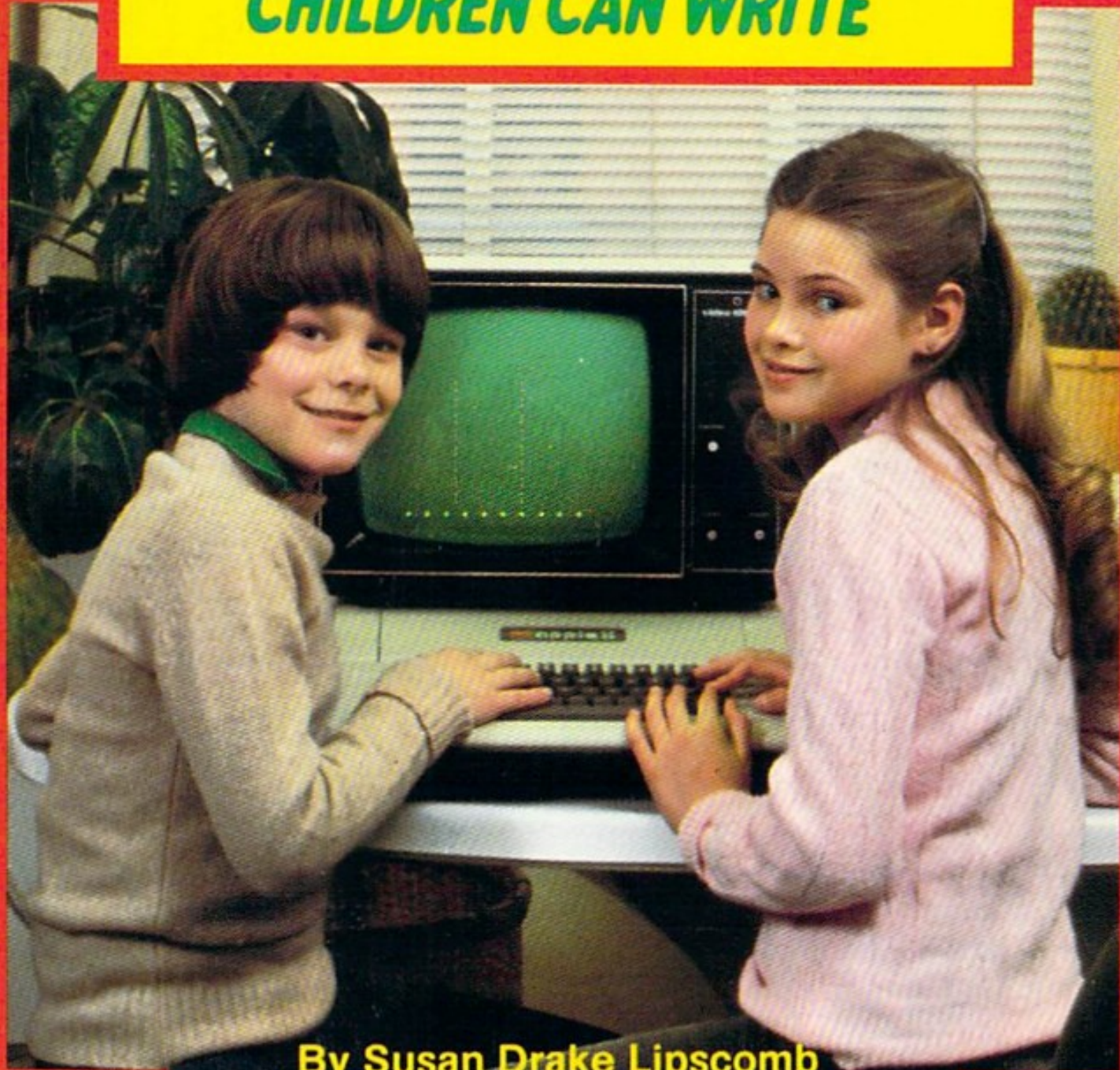
AVON **C**AMELOT

A Kids' Guide to
BASIC Programming

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BASIC FUN

**COMPUTER GAMES,
PUZZLES, AND PROBLEMS
CHILDREN CAN WRITE**



**By Susan Drake Lipscomb
and Margaret Ann Zuanich**

BASIC FUN

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SUZAN DRAKE LIPSCOMB and **MARGARET ANN ZUANICH** have a unique combination of skills that contributed to the creation of **BASIC FUN**. Margaret Zuanich's experience in the computer field has included everything from programming to management consulting. She earned her Master's Degree in Business and is now involved in computer systems training. Susan Lipscomb holds a Master's Degree in Education and has spent fourteen years in the area of language and learning disabilities. They both live in Palo Alto, California.

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BASIC FUN
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CHILDREN CAN WRITE

Susan Drake Lipscomb
and Margaret Ann Zuanich

AN AVON



CAMELOT BOOK

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INTRODUCTION

Are you getting bored with running packaged computer games? You can design your own once you learn how to communicate with the computer. BASIC Fun shows step-by-step how you can write computer programs—to solve your own problems, print your own pictures and invent your own games.

Special languages are used to communicate with a computer. For micro-computers, the language is called micro-BASIC. Each word in this language is called a programming statement. Computer programs are made up of programming statements which tell the computer what you want it to do.

BASIC Fun teaches you micro-BASIC by giving you simple programs showing how different programming statements work and where they belong in a program. First you should type and run the programs as they are printed in the book. Then see if you can make the few changes we've suggested, or use your own ideas to check your understanding of a programming statement. Finally, try to design your own programs or games just using ours as a guide.

Warning! You should use all the programs within each chapter—or at least read and understand those you don't use—before moving on to the next chapter. Following chapters build on and expand ideas learned in earlier ones—so work through the programs in the order they appear in the book.

Above all, we hope you have as much fun exploring your computer's possibilities and inventing programs as we did in writing this book.

The programs included in this text can be used on any computer that uses the programming language BASIC. They

were written in Applesoft BASIC using the Apple II Plus and tested on the Atari, Radio Shack TRS-80, Texas Instruments TI-99/4A, Hewlett-Packard HP-2000, IBM Personal Computer and the Osborn. We used a standard version of BASIC which is compatible with all of these computers. However, there are a few areas in which the computers differ. We have indicated in the Computer Notes following relevant programs any changes necessary to use the program on a particular computer. The Appendix contains a more detailed discussion of these differences. Before you begin using the programs, read the Appendix, and if necessary, refer to the Programmer's reference manual for your computer.

In order to make the programs as general as possible, we avoided using certain features included in one version of BASIC but left out in others. Once you become familiar with your own computer, you can add enhancements provided by your particular version of BASIC.

If you have trouble making a program work on your computer, we recommend the following steps:

1. Check your program line-by-line against the listing in the book.
2. Make sure you have made the changes for your computer given in the Computer Notes following each program.
3. Check the BASIC manual for your computer for any changes required for your version of BASIC.

If you still cannot make a program work on your computer, and think it is a genuine bug, send a description of the problem and a self-addressed, stamped envelope to the publisher. We will respond as quickly as we can to all such correspondence.

1 PRINT

How the Computer Speaks

This programming statement allows you to make the computer type out anything you want on the screen or paper.

PROBLEMS

1. Poem
2. Flag
3. Love
4. Face
5. Stellar
6. Space
7. KNOCK KNOCK
8. Riddles

POEM

You can turn your favorite poem into a computer program. Then, whenever you want to read your poem, just run your program.

Here is a poem we wrote. Put this in your computer by typing each line exactly as shown in the Program Listing.

Once you have our poem working on your computer, try writing one of your own.

SAMPLE RUN

```
ROSES ARE RED  
VIOLETS ARE BLUE  
YOU CAN LEARN TO WRITE PROGRAMS  
FOR MOST THINGS YOU DO
```

PROGRAM LISTING

```
100 PRINT "ROSES ARE RED"  
110 PRINT "VIOLETS ARE BLUE"  
120 PRINT "YOU CAN LEARN TO WRITE PROGRAMS"  
130 PRINT "FOR MOST THINGS YOU DO"  
140 END
```

Note: Lines 100-130: When this program is run, the computer prints out every letter between the two " marks on each line.

Line 140: The end statement tells the computer that it is the last line in the program. This statement is required for some computers and optional for others. We have included it in this text so the programs can be used on most computers.

FLAG

This program draws the American flag. Can you design a flag of your own and write a program that draws your flag?

SAMPLE RUN

```
◆◆◆◆◆◆◆◆◆◆XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
◆ ◆ ◆ ◆ ◆                                           X
◆ ◆ ◆ ◆ ◆ XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
◆ ◆ ◆ ◆ ◆                                           X
◆ ◆ ◆ ◆ ◆ XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                     X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                     X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                     X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

PROGRAM LISTING

```
100 PRINT "◆◆◆◆◆◆◆◆◆◆XXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
110 PRINT "◆ ◆ ◆ ◆ ◆                                           X"
120 PRINT "◆ ◆ ◆ ◆ ◆ XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
130 PRINT "◆ ◆ ◆ ◆ ◆                                           X"
140 PRINT "◆ ◆ ◆ ◆ ◆ XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
150 PRINT "X                                                     X"
160 PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
170 PRINT "X                                                     X"
180 PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
190 PRINT "X                                                     X"
200 PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
210 END
```

Note: Notice on the Program Listing that each line has a number. These tell the computer in what order the lines are to be run. You add a new line between two existing lines by giving the new line a number which falls between the existing line numbers.

LOVE

This program prints a very familiar word.

You can do the same thing with your own name or initials.

SAMPLE RUN

```
X      X      X  X  XXXX
X      X X     X  X  X
X      X  X    X  X  X
X      X  X    X  X  X
X      X  X    X  X  XXXX
X      X  X    X  X  X
X      X  X    X  X  X
X      X  X    X  X  X
XXXX      X      X      XXXX
```

PROGRAM LISTING

```
110 PRINT " X      X      X  X  XXXX"
120 PRINT " X      X X     X  X  X"
130 PRINT " X      X  X    X  X  X"
140 PRINT " X      X  X    X  X  X"
150 PRINT " X      X  X    X  X  XXXX"
160 PRINT " X      X  X    X  X  X"
170 PRINT " X      X  X    X  X  X"
180 PRINT " X      X  X    X  X  X"
190 PRINT " XXXX      X      X      XXXX"
200 END
```

FACE

This program draws a person's face.

See if you can change the expression, or add some hair.

What happens if you forget a " when you are typing a PRINT statement?

SAMPLE RUN



PROGRAM LISTING

```
130 PRINT "  
140 PRINT "  
150 PRINT "  
160 PRINT "  
170 PRINT "  
180 PRINT "  
190 END
```



STELLAR

This program draws a very familiar constellation of stars.
Try writing a program that draws a different constellation.

SAMPLE RUN

```
      *
    *
  *
*   *   *   *
      *

```

THIS IS A DRAWING OF THE BIG DIPPER

PROGRAM LISTING

```
100 PRINT "
110 PRINT
120 PRINT "  *"
130 PRINT "    *"
140 PRINT "*      *"
150 PRINT
151 PRINT
152 PRINT
160 PRINT "
165 PRINT
166 PRINT
170 PRINT "THIS IS A DRAWING OF THE BIG DIPPER"
180 END
```

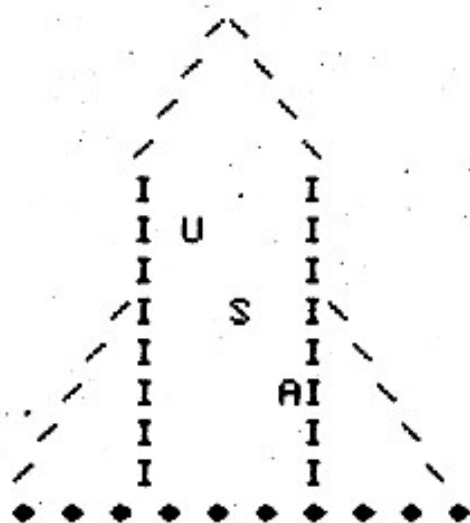
Note: Lines 165 and 166: The PRINT statement without any " " prints a blank line.

SPACE

This program draws a U.S. rocket ship which blasts off from your video terminal.

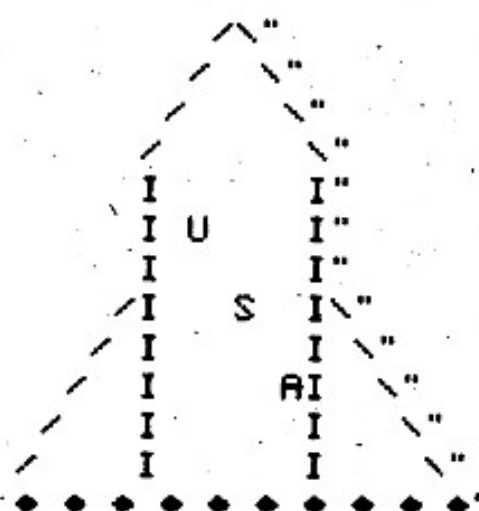
See if you can design your own model.

SAMPLE RUN



PROGRAM LISTING

```
100 PRINT "  
110 PRINT "  
120 PRINT "  
130 PRINT "  
140 PRINT "  
150 PRINT "  
160 PRINT "  
170 PRINT "  
180 PRINT "  
190 PRINT "  
200 PRINT "  
210 PRINT "  
220 PRINT "  
230 FOR I=1 TO 15  
240 FOR J=1 TO 100  
250 NEXT J  
260 PRINT  
270 NEXT I  
280 END
```



Note: This program shows you that you can put any number, letter or special character in a PRINT statement.

Lines 230-270: These statements make the rocket ship blast off your video terminal. They are explained further in Chapter 8.

Special credit to Chris Carlson

KNOCK KNOCK

The computer can tell KNOCK KNOCK jokes. Here is one that we like. Can you write a program that tells some of your favorite KNOCK KNOCK jokes?

SAMPLE RUN

KNOCK KNOCK

WHO'S THERE?

AMOS

AMOS WHO?

AMOS QUITO BIT ME!

PROGRAM LISTING

```
100 PRINT "KNOCK KNOCK"
110 PRINT
120 PRINT "WHO'S THERE?"
130 PRINT
140 PRINT "AMOS"
150 PRINT
160 PRINT "AMOS WHO?"
170 PRINT
180 PRINT "AMOS QUITO BIT ME!"
190 END
```

RIDDLES

You can put riddles into a computer program too. Here are 3 riddles. See if you can figure out the answers.

Write a riddle program of your own using your favorite riddles.

SAMPLE RUN

WHICH ANSWERS GO TO EACH OF THE FOLLWING RIDDLES?

1. WHY DID THE CHICKEN CROSS THE ROAD?
 2. WHY DID THE FARMER CALL HIS PIG INK?
 3. WHAT HAPPENS TO DUCKS WHEN THEY FLY UPSIDE DOWN?
-

ANSWERS

- A. BECAUSE HE NEVER STAYED IN HIS PEN
- B. THEY QUACK UP
- C. TO GET TO THE OTHER SIDE

PROGRAM LISTING

```
100 PRINT "WHICH ANSWERS GO TO EACH OF THE FOLLWING
    RIDDLES?"
110 PRINT
120 PRINT "1.  WHY DID THE CHICKEN CROSS THE ROAD?"
130 PRINT "2.  WHY DID THE FARMER CALL HIS PIG INK?"
140 PRINT "3.  WHAT HAPPENS TO DUCKS WHEN THEY FLY UPSIDE
    DOWN?"
150 PRINT "          ---"
160 PRINT
170 PRINT "ANSWERS"
180 PRINT
190 PRINT "A.  BECAUSE HE NEVER STAYED IN HIS PEN"
200 PRINT "B.  THEY QUACK UP"
210 PRINT "C.  TO GET TO THE OTHER SIDE"
220 END
```

Special credit to Paul Zuanich

2 LET

Adding 2 and 2

You use this programming statement when you want to tell the computer to do arithmetic.

PROBLEMS

1. Recycle
2. Baby Sister
3. Paper Route
4. Retirement
5. Moon
6. Pizza
7. Swim Team
8. Inheritance
9. Sleep-over

RECYCLE

You and two of your friends are collecting aluminum cans. If you collect 200 cans, and one friend collects 140 cans and the other 325, how many will you have altogether? This program gives you the answer.

How would you change the program if you collected 300 cans?

If another friend wanted to join your group, how would you change the program in order to add in the cans this friend collected?

You can use this same program to add other things, like test scores, money you have earned or the number of records you own.

SAMPLE RUN

200 + 140 + 325 = 665 TOTAL CANS COLLECTED

PROGRAM LISTING

```
100 LET A=200
110 LET B=140
120 LET C=325
130 LET D=A+B+C
140 PRINT A;" + ";B;" + ";C;" = ";D;" TOTAL CANS
    COLLECTED"
150 END
```

Note: Lines 100-130: A, B, C and D are numeric variables, and they can be set equal to any number or calculation.

Line 130: The symbol + tells the computer to add.

VARIABLE LIST

Tells you what the variables in a program are used for.

A—Number of cans you collected

B—Number of cans one friend collected

C—Number of cans the other friend collected

D—Sum of A, B, and C

COMPUTER NOTES

Radio Shack TRS-80 Color BASIC Does not use the word LET. Just leave this word out when entering lines 100-130. For example:

Instead of	LET A = 200
Use	A = 200

Remember to leave out the word LET in all the programs in the rest of the text too.

BABY SISTER

You are 10 years old now, and your baby sister is 2. How old will your sister be when you are 20? This program tells you.

How would you change the program if you were only 8 years old now?

What if your sister is older than you, can you still use this program?

SAMPLE RUN

IF YOU AND YOUR SISTER ARE 8 YEARS APART IN AGE
YOUR SISTER WILL BE 12 WHEN YOU ARE 20

PROGRAM LISTING

```
100 LET A=10
110 LET S=2
120 LET D=A-S
130 LET B=20-D
140 PRINT "IF YOU AND YOUR SISTER ARE ";D;" YEARS APART
    IN AGE"
150 PRINT "YOUR SISTER WILL BE ";B;" WHEN YOU ARE 20."
160 END
```

Note: Lines 120 and 130: The symbol - tells the computer to subtract.

VARIABLE LIST

A—Your age now
S—Your sister's age now
D—Years difference
B—Your sister's age when you are 20

PAPER ROUTE

You need to earn some money for Christmas presents. Your friend suggested that you deliver papers. If you expect to earn \$20 a week and there are $2\frac{1}{2}$ months until Christmas, how much money will you have for presents? Use this program to get the answer.

Try changing the number of months or the amount of money you will earn each week.

SAMPLE RUN

```
IF YOU EARN $ 20      EACH WEEK
YOU WILL HAVE $ 200   AFTER 2.5      MONTHS
```

PROGRAM LISTING

```
100 LET W=20
110 LET M=2.5
120 LET T=4*M*W
130 PRINT "IF YOU EARN $";W;" EACH WEEK"
140 PRINT "YOU WILL HAVE $ ";T;" AFTER ";M;" MONTHS"
150 END
```

Note: Line 120: The symbol * tells the computer to multiply.

Line 120: This program uses four weeks in a month to make the calculations easier.

VARIABLE LIST

W—Amount of money you earn each week

M—Number of months until Christmas

T—Total amount of money you will earn

RETIREMENT

If you want to earn \$900,000 before you retire and you can earn \$50,000 a year, how many years will you have to work before you can retire? This program gives you the answer.

Suppose you want to earn \$1,500,000. Can you change the program to give you the right answer?

SAMPLE RUN

IF YOU EARN \$ 50000. PER YEAR
YOU WILL HAVE TO WORK FOR 18 YEARS
IN ORDER TO EARN \$ 900000.

PROGRAM LISTING

```
100 LET A=900000.  
110 LET B=50000.  
120 LET C=A/B  
130 PRINT "IF YOU EARN $";B;" PER YEAR"  
140 PRINT "YOU WILL HAVE TO WORK FOR ";C;" YEARS"  
150 PRINT "IN ORDER TO EARN $ ";A  
160 END
```

Note: Line 120: The symbol / tells the computer to divide.

VARIABLE LIST

A—Total amount you want to earn
B—Amount you can earn each year
C—Number of years you must work

MOON

If you weigh 50 kilograms on Earth, how much would you weigh on the moon? This program can calculate the answer.

What if you weigh 45 kilograms? How would you change the program?

SAMPLE RUN

```
I CAN CONVERT YOUR EARTH WEIGHT TO YOUR MOON WEIGHT  
IF YOU WEIGHT 50    KILOGRAMS ON EARTH  
YOU WILL WEIGHT 8.33333    ON THE MOON
```

PROGRAM LISTING

```
100 PRINT "I CAN CONVERT YOUR EARTH WEIGHT TO YOUR  
    MOON WEIGHT"  
110 C=1/6  
120 W=50  
130 M=W*C  
140 PRINT "IF YOU WEIGH ";W;" KILOGRAMS ON EARTH"  
150 PRINT "YOU WILL WEIGH ";M;" ON THE MOON"  
160 END
```

Note: Lines 110-130: M, W and C are called numeric variables, and they can be set equal to any number.

VARIABLE LIST

C—Conversion factor—Earth to moon weight

W—Your weight on Earth

M—Your weight on the moon

PIZZA

Five of you are going out for pizza and cokes. You know that the pizza will cost \$10 and a coke will cost \$1. How much money should you take with you to pay for your share? Use this program for the answer.

Can you change the price of the pizza or the number of friends in this program?

What if you want 2 cokes? How would you change the program?

SAMPLE RUN

```
TO PAY YOUR SHARE OF THE $,10    PIZZA
AND BUY A $ 1      COKE, YOU WILL NEED $ 3
```

PROGRAM LISTING

```
100 LET P=10
110 LET C=1
120 LET F=5
130 LET M=P/F+C
140 PRINT "TO PAY YOUR SHARE OF THE $";P;" PIZZA"
150 PRINT "AND BUY A $";C;" COKE, YOU WILL NEED $";M
160 END
```

Note: Line 130: The computer divides first, then adds.

VARIABLE LIST

P—Price of pizza
C—Cost of coke
F—Number of friends

SWIM TEAM

In your workouts with the swim team, your coach has you swim 30 laps a day. If you swim 4 days a week, how many miles will you swim each week? This program gives you the answer for a pool 25 yards long.

Can you change the program so that you can find out how far you swim in a month?

What if your pool is only 20 yards long? How would you change the program?

SAMPLE RUN

```
IF YOU SWIM 30    LAPS A DAY FOR 4    DAYS
YOU WILL SWIM A TOTAL OF 1.70455    MILES
```

PROGRAM LISTING

```
100 LET L=30
110 LET D=4
120 LET N=L*D
130 LET Y=N*25
140 LET M=Y/1760
150 PRINT "IF YOU SWIM ";L;" LAPS A DAY FOR ";D;" DAYS"
160 PRINT "YOU WILL SWIM A TOTAL OF ";M;" MILES"
170 END
```

Note: Line 140: The computer multiplies first, then divides.

VARIABLE LIST

L—Number of laps per day
D—Number of days per week
N—Total number of laps per week
Y—Total number of yards per week
M—Number of miles per week

INHERITANCE

You have just received the news that you are to inherit some money from a distant uncle. You will receive \$200 a month until you are 18. If you are 10 now, how much money will you inherit altogether? Use this program to find out.

If you were to receive \$300 a month, how would you change this program? What if you are only 8 years old?

SAMPLE RUN

IF YOU RECEIVE \$ 200 FOR THE NEXT 96 MONTHS
YOU WILL RECEIVE \$ 19200 IN TOTAL

PROGRAM LISTING

```
100 LET A=200
110 LET Y=10
120 LET M=(18-Y)*12
130 LET T=M*A
140 PRINT "IF YOU RECEIVE $ ";A;" FOR THE NEXT
    ";M;" MONTHS"
150 PRINT "YOU WILL RECIEVE $";T;" IN TOTAL"
160 END
```

Note: Line 120: The () tell the computer to subtract first, then multiply.

VARIABLE LIST

A—Monthly payment

Y—Your current age

M—Number of months before you turn 18

T—Total amount you will receive

SLEEP-OVER

You are planning a sleep-over with 5 friends. Your mother told you to buy 2 hot dogs, 3 candy bars and something to read for yourself and each guest. You also need some soda, and you know that 1 liter of soda is enough for 3 of you. How much food will you buy at the store? Use this program to get the answer.

What if one of your friends cannot eat candy? How would you change the program?

SAMPLE RUN

```
FOR A SLEEP-OVER WITH 5    FRIENDS
YOU NEED 12    HOT DOGS, 18    CANDY BARS
2    LITERS OF SODA AND 6    COMIC BOOKS
```

PROGRAM LISTING

```
100 LET A=5
110 LET B=2
120 LET C=3
130 LET D=3
150 LET E=(A+1)*B
160 LET F=(A+1)*C
170 LET G=(A+1)/D
180 PRINT "FOR A SLEEP-OVER WITH ";A;" FRIENDS"
190 PRINT "YOU NEED ";E;" HOT DOGS, ";F;" CANDY BARS"
200 PRINT G;" LITERS OF SODA AND ";A+1;" COMIC BOOKS"
210 END
```

Note: Lines 150, 160 and 170: The () tell the computer to add first and then multiply or divide.

VARIABLE LIST

A—Number of guests

B—Number of hot dogs per person

- C—Number of candy bars per person
- D—Number of guests per 1 liter of soda
- E—Total number of hot dogs needed
- F—Total number of candy bars needed
- G—Total number of liters of soda needed

3

GOTO

Showing the Way

This programming statement allows you to tell the computer which line number to execute next.

This lets you repeat some lines in your program over and over.

PROBLEMS

1. Stars
2. Counting
3. Power
4. Hunt
5. Gambler
6. Family Tree

STARS

Write this program for your star-gazing friends. Hit the break key when you are tired of seeing stars.

Create your own universe or message by substituting your own lines.

SAMPLE RUN

SEEING STARS?

PROGRAM LISTING

```

100 REM♦♦THIS PROGRAM IS FOR STAR GAZERS♦♦
105 PRINT "
110 PRINT "♦♦
115 PRINT "
120 PRINT "♦
125 PRINT "
130 PRINT "
135 PRINT "
140 PRINT "
145 PRINT "
150 PRINT "
155 PRINT " ♦ SEEING STARS?"
160 GOTO 105
165 END

```

Note: Line 100: REM is a "remark" statement that appears in the listing but will not print when the program is run. It's the programmer's way of storing information for future reference.

Line 160: GOTO 105 tells the computer to return to line 105 and run through the program again.

Special credit to Felicia Lo.

COUNTING

This program counts by 2's. Hit your computer's break key to stop the program.

See if you can change it to count by 5's.

SAMPLE RUN

I CAN COUNT BY 2

2
4
6
8
10
12
14
16
18
20
22
24
26
28
30

PROGRAM LISTING

```
100 PRINT "I CAN COUNT BY 2"  
110 LET A=0  
115 LET A=A+2  
120 PRINT A  
125 GOTO 115  
130 END
```

Note: Line 110: Starts A at zero.

Line 115: Adds 2 more to A each time the computer returns to that line.

Line 125: Tells the computer to return to line 115 and run through the program again.

POWER

This program prints all the powers of 2. Use your computer's break key to stop the counting.

Can you change it to print all the powers of 3 or 4?

SAMPLE RUN

I CAN SHOW YOU ALL THE POWERS OF 2

2
4
8
16
32
64
128
256
512
1024
2048
4096

PROGRAM LISTING

```
100 PRINT "I CAN SHOW YOU ALL THE POWERS OF 2"  
110 LET B=2  
115 LET A=B  
120 PRINT A  
125 LET A=B+A  
130 GOTO 120  
135 END
```

Note: Can you tell what the computer is doing in line 125? Notice that the variable A is on both sides of the = sign.

VARIABLE LIST

B—Number starting with
A—Result of calculation

HUNT

This program is a scrambled adventure. Thanks to the GOTO statement, the computer can unscramble and print out the adventure in a flash.

Can you beat the computer? Design a scrambled program of your own for your friends to try.

SAMPLE RUN

YOU ARE ON AN EXPEDITION SEARCHING FOR THE LOST ARK.
A FRIEND SHOWS YOU A LONG LOST MAP AND 'X' MARKS THE
SPOT

WHERE IT WAS BURIED.

YOU SEE THE 'X' ON THE MAP. IT IS BY THE TEMPLE OF THE
ANCIENT SUN GOD.

YOUR CREW STARTS DIGGING.

THEY UNCOVER A PIT FULL OF SNAKES, BUT THE ARK
IS THERE!!

YOU ENTER THE PIT WITH ROPES, AVOIDING THE SNAKES,
AND SECURE THE ROPES TO THE ARK. A HELICOPTER SAFELY
HOISTS IT OUT, BUT THERE ARE NO ROPES LEFT FOR YOU.
TOUGH LUCK!! THINK OF YOUR OWN SOLUTION.

PROGRAM LISTING

```
100 PRINT "YOU ARE ON AN EXPEDITION SEARCHING FOR THE  
    LOST ARK."  
110 GOTO 260  
120 PRINT "YOUR CREW STARTS DIGGING."  
130 GOTO 220  
140 PRINT "AND SECURE THE ROPES TO THE ARK. A HELICOPTER  
    SAFELY"  
150 GOTO 280  
160 PRINT "WHERE IT WAS BURIED."  
170 GOTO 240  
180 PRINT "TOUGH LUCK!! THINK OF YOUR OWN SOLUTION."  
190 GOTO 340  
200 PRINT "IS THERE!!"  
210 GOTO 300  
220 PRINT "THEY UNCOVER A PIT FULL OF SNAKES, BUT  
    THE ARK"  
230 GOTO 200
```

```
240 PRINT "YOU SEE THE 'X' ON THE MAP. IT IS BY THE  
    TEMPLE OF THE"  
250 GOTO 320  
260 PRINT "A FRIEND SHOWS YOU A LONG LOST MAP AND 'X'  
    MARKS THE SPOT"  
270 GOTO 160  
280 PRINT "HOISTS IT OUT, BUT THERE ARE NO ROPES LEFT  
    FOR YOU."  
290 GOTO 180  
300 PRINT "YOU ENTER THE PIT WITH ROPES, AVOIDING THE  
    SNAKES,"  
310 GOTO 140  
320 PRINT "ANCIENT SUN GOD."  
330 GOTO 120  
340 END
```

GAMBLER

If you bet \$2 at the blackjack tables at 2 to 1 odds and let your winnings ride, how quickly would your money grow? This program tells you. Use your computer's break key to stop the program.

How would you change the program if you wanted to start with a \$5 bet?

SAMPLE RUN

THIS PROGRAM SHOWS YOU HOW A \$2 BET AT THE BLACKJACK
TABLE
WILL GROW IF YOU KEEP WINNING AND LET YOUR WINNINGS
RIDE

ROUND	WINNINGS
1	\$ 5
2	\$ 12.5
3	\$ 31.25
4	\$ 78.13
5	\$ 195.31
6	\$ 488.28
7	\$ 1220.7
8	\$ 3051.76

PROGRAM LISTING

```
100 PRINT "THIS PROGRAM SHOWS YOU HOW A $2 BET
    AT THE BLACKJACK TABLE"
105 PRINT "WILL GROW IF YOU KEEP WINNING AND
    LET YOUR WINNINGS RIDE"
110 PRINT
115 LET A=2
120 LET B=0
125 PRINT "      ROUND                WINNINGS"
130 LET A=A+A+A/2
135 LET B=B+1
140 LET C=INT(A*100+.5)/100
145 PRINT "      ";B;"                $";C
150 GOTO 130
155 END
```

Note: Line 140: This formula rounds your winnings to the nearest cent.

Line 145: A ; or a ; is required in a PRINT STATEMENT between a numeric variable and the quotation marks. A ; uses fewer spaces than a , . However, the spacing varies among computers so you may have to experiment with yours.

FAMILY TREE

This program demonstrates how the number of people in your family can increase. Use your computer's break key to stop the program.

See what happens if you change the number of children each person has, or the time between generations.

Write a similar program to estimate the number of offspring your pet could have.

SAMPLE RUN

THIS PROGRAM SHOWS HOW THE NUMBER OF PEOPLE IN YOUR
FAMILY
CAN INCREASE

STARTING WITH 2 DESCENDENTS
IF EACH PERSON HAS 2 CHILDREN
WITH 20 YEARS BETWEEN GENERATIONS

YEARS	DESCENDENTS
20	4
40	8
60	16
80	32
100	64
120	128
140	256
160	512
180	1024
200	2048
220	4096
240	8192
260	16384

PROGRAM LISTING

```
100 PRINT "THIS PROGRAM SHOWS HOW THE NUMBER OF PEOPLE  
    IN YOUR FAMILY "  
105 PRINT "CAN INCREASE"  
115 PRINT  
120 T=20  
125 Y=0
```



```

130 A=2
135 C=2
140 D=A
145 PRINT "STARTING WITH ";A;" DESCENDENTS"
150 PRINT "IF EACH PERSON HAS ";C;" CHILDREN"
155 PRINT "WITH ";T;" YEARS BETWEEN GENERATIONS"
160 PRINT
165 PRINT "   YEARS           DESCENDENTS"
170 D=D+C
175 A=A+D
180 Y=Y+T
185 PRINT "   ";Y;"           ";D
190 GOTO 170
195 END

```

VARIABLE LIST

T—Years between generations
 A—Number of descendants in first generation
 C—Number of children per person

4

INPUT

Talking to the Computer

This programming statement allows you to enter different numbers into your program for the same problem each time it is run.

PROBLEMS

1. Conversion
2. Silicon Valley Game
3. The Great Magician
4. Batting Averages
5. Year 2000
6. Averages
7. Savings Account
8. Mileage
9. Recipe

CONVERSION

Do you know how many centimeters tall you are? Do you know how many centimeters tall your father is? You can use this program to convert inches to centimeters.

You could also use a very similar program to convert pounds to kilograms or gallons to liters.

To stop this program, hit the break key instead of entering a number.

SAMPLE RUN

CONVERT INCHES TO CENTIMETERS

INCHES?60

152.4 CENTIMETERS

INCHES?100

254 CENTIMETERS

PROGRAM LISTING

```
100 PRINT "CONVERT INCHES TO CENTIMETERS"
120 PRINT
130 PRINT "INCHES";
140 INPUT I
150 LET C=I*2.54
160 PRINT C;" CENTIMETERS"
170 GOTO 120
180 END
```

Note: Line 140: The INPUT statement allows you to type in different numeric values for I each time this statement is run.

VARIABLE LIST

I—Inches

C—Centimeters

SILICON VALLEY GAME

If you were a Silicon Valley executive and you had \$200,000 to spend, how many Mercedes could you buy? You can use this program to get the answer. To stop the program, hit the break key instead of entering a number.

What if you decided to economize and only spend \$100,000, how would you change this program?

SAMPLE RUN

YOU ARE A SILICON VALLEY EXECUTIVE AND
YOU HAVE 200,000 DOLLARS TO SPEND ON MERCEDES
HOW MANY CAN YOU BUY?

TYPE IN THE PRICE OF ONE MERCEDES?30000
YOU COULD BUY 6 MERCEDES
AND HAVE 20000 DOLLARS LEFT OVER.

PROGRAM LISTING

```
100 PRINT "YOU ARE A SILICON VALLEY EXECUTIVE AND"  
110 PRINT "YOU HAVE 200,000 DOLLARS TO SPEND ON  
    MERCEDES"  
120 PRINT "HOW MANY CAN YOU BUY?"  
140 PRINT  
150 PRINT "TYPE IN THE PRICE OF ONE MERCEDES";  
160 INPUT A  
170 LET B=200000./A  
180 LET B=INT(B)  
190 LET T=200000.-B*A  
200 PRINT "YOU COULD BUY ";B;" MERCEDES"  
210 PRINT "AND HAVE ";T;" DOLLARS LEFT OVER."  
220 GOTO 140  
230 END
```

Note: Line 150: The ; stops the computer from moving to the next line. This keeps the input on the same line as the print.

Line 180: This statement forces B to be a whole number.
Chapter 7 explains how the INT (Integer) function works.

VARIABLE LIST

A—Price of one Mercedes

B—Number of Mercedes you could buy

T—Money you have left over

THE GREAT MAGICIAN

Teach the computer a magic trick! Think of a number, follow the instructions and this program will guess your number. Don't be surprised if the computer is right every time.

Can you figure out how it does the trick? Can you write a magic trick of your own?

SAMPLE RUN

```
HI, I AM THE GREAT MAGICIAN.  
THINK OF A NUMBER, ANSWER MY QUESTION  
AND I WILL TRY TO GUESS YOUR NUMBER.  
OK, THINK OF A NUMBER- BUT DON'T TELL ME YET.  
  
NOW, TAKE YOUR NUMBER AND ADD 5.  
MULTIPLY THE RESULT BY 3 AND THEN SUBTRACT 8.  
MULTIPLY THIS RESULT BY 2 AND THEN ADD 4.  
WHAT DO YOU HAVE?  
YOUR NUMBER IS 10
```

PROGRAM LISTING

```
100 REM***NUMBER GUESSING GAME***  
110 PRINT "HI, I AM THE GREAT MAGICIAN."  
120 PRINT "THINK OF A NUMBER, ANSWER MY QUESTION"  
130 PRINT "AND I WILL TRY TO GUESS YOUR NUMBER."  
140 PRINT "OK, THINK OF A NUMBER- BUT DON'T TELL ME YET."  
150 PRINT  
160 PRINT "NOW TAKE YOUR NUMBER AND ADD 3. DIVIDE THE  
    RESULT BY 5."  
170 PRINT "NOW MULTIPLY BY 8, DIVIDE BY 5 AND ADD 5.  
    SUBTRACT 1."  
180 PRINT "WHAT DO YOU HAVE";  
190 INPUT B  
200 LET C=(B+1-5)*5/8*5-3  
210 PRINT "YOUR NUMBER IS ";C  
220 END
```

Note: Line 200: The computer does calculations with numeric variables. This is called a numeric expression.

VARIABLE LIST

B—Result of calculations

C—Number to guess

BATTING AVERAGES

This program calculates batting averages. You could use it to help your coach pick the players for your All Star team.

SAMPLE RUN

CALCULATE A PLAYER'S BATTING AVERAGE

NUMBER OF TIMES AT BAT?30
NUMBER OF HITS?6
NUMBER OF WALKS?12
YOUR BATTING AVERAGE IS .333333

NUMBER OF TIMES AT BAT?15
NUMBER OF HITS?5
NUMBER OF WALKS?0
YOUR BATTING AVERAGE IS .333333

PROGRAM LISTING

```
100 PRINT "CALCULATE A PLAYER'S BATTING AVERAGE"  
120 PRINT  
130 PRINT "NUMBER OF TIMES AT BAT";  
140 INPUT B  
150 PRINT "NUMBER OF HITS";  
160 INPUT H  
170 PRINT "NUMBER OF WALKS";  
180 INPUT W  
190 LET A=H/(B-W)  
200 PRINT "YOUR BATTING AVERAGE IS ";A  
210 PRINT  
220 GOTO 130  
230 END
```

Note: Notice that this program uses 3 different input statements.

VARIABLE LIST

B—Number of times at bat
H—Number of hits
W—Number of walks
A—Batting average

YEAR 2000

How old will you be in the year 2000? How old will your best friend be? You can use this program to find out.

How would you change this program if you wanted to know your age in the year 2025?

SAMPLE RUN

FIND OUT HOW OLD YOU WILL BE IN THE YEAR 2000

HOW OLD ARE YOU NOW?12

WHAT YEAR IS IT NOW?1982

IN THE YEAR 2000, YOU WILL BE 30

HOW OLD ARE YOU NOW?35

WHAT YEAR IS IT NOW?1982

IN THE YEAR 2000, YOU WILL BE 53

PROGRAM LISTING

```
100 PRINT "FIND OUT HOW OLD YOU WILL BE IN THE YEAR
    2000"
120 PRINT
130 PRINT "HOW OLD ARE YOU NOW";
140 INPUT A
150 PRINT "WHAT YEAR IS IT NOW";
160 INPUT Y
170 REM◆◆NOW CALCULATE THE NUMBER OF YEARS
180 LET T=2000-Y+A
190 PRINT "IN THE YEAR 2000, YOU WILL BE ";T
200 GOTO 120
210 END
```

VARIABLE LIST

A—Your age now

Y—Current year

T—Your age in the year 2000

AVERAGES

This program calculates the average of 5 numbers. You can use it to calculate test averages, the average age of 5 of your friends, or the average temperature over 5 days. Can you think of other uses for this program?

What if you need the average of 6 numbers? Can you change this program to calculate your answers?

SAMPLE RUN

CALCULATE THE AVERAGE OF FIVE NUMBERS
INPUT THE NUMBERS LIKE THIS 1,2,3,4,5

NUMBERS?10,20,30,40,50
AVERAGE IS 30

PROGRAM LISTING

```
100 PRINT "CALCULATE THE AVERAGE OF FIVE NUMBERS"  
110 PRINT "INPUT THE NUMBERS LIKE THIS 1,2,3,4,5"  
120 PRINT  
130 PRINT "NUMBERS";  
140 INPUT A,B,C,D,E  
150 LET T=(A+B+C+D+E)/5  
160 PRINT "AVERAGE IS ";T  
170 PRINT  
180 END
```

Note: Line 150: The () tell the computer to add all 5 numbers together before dividing.

Line 140: Notice that you can put in more than 1 number in an INPUT statement.

VARIABLE LIST

T—Average of 5 numbers

SAVINGS ACCOUNT

Suppose your grandmother gives you some money to save for your college education. If you put it in the bank at the current interest rate, how much money will you have when you are ready to start college?

You can change the interest rate or the original amount, and see how much money you have.

SAMPLE RUN

FIND OUT HOW YOUR MONEY WILL GROW IN YOUR SAVINGS ACCOUNT

ORIGINAL AMOUNT?100
NUMBER OF YEARS?5
YEARLY INTEREST RATE (IN DECIMAL)? .055
AFTER 5 YEARS, YOU WILL HAVE 130.7 DOLLARS

ORIGINAL AMOUNT?200
NUMBER OF YEARS?10
YEARLY INTEREST RATE (IN DECIMAL)? .15
AFTER 10 YEARS, YOU WILL HAVE 809.11 DOLLARS

PROGRAM LISTING

```
100 PRINT "FIND OUT HOW YOUR MONEY WILL GROW IN YOUR
    SAVINGS ACCOUNT"
120 PRINT
130 PRINT "ORIGINAL AMOUNT";
140 INPUT A
150 PRINT "NUMBER OF YEARS";
160 INPUT N
170 PRINT "YEARLY INTEREST RATE (IN DECIMAL)";
180 INPUT I
190 LET T=A*(1+I) ** N
200 LET T=INT(T*100+.5)/100
210 PRINT "AFTER ";N;" YEARS, YOU WILL HAVE ";T;"
    DOLLARS"
220 PRINT
230 GOTO 120
240 END
```

Note: Line 190: The symbol ****** tells the computer to raise a number to a power, ie. **LETX = 2**4** tells the computer to raise 2 to the 4th power. Please note—your computer may use a different symbol. Refer to your BASIC manual under exponentiation to find out what your computer uses.

Line 200: This statement rounds the dollar amount to the nearest cent.

VARIABLE LIST

A—Original amount of money

N—Number of years to save

I—Yearly interest rate

T—Amount of money you have for college

MILEAGE

You are planning on taking a driving vacation with your parents. Your father wants to know how long it will take to get to your destination and how much money gas will cost. You can use this program to get the answers.

Can you add to the program to include food and lodging expenses for your trip?

What would you change if you wanted to use this program for a trip on a plane or train?

SAMPLE RUN

TAKING A VACATION ? USE THIS PROGRAM TO
CALCULATE YOUR DRIVING TIME AND
COST OF GASOLINE

MILES TO TRAVEL?500
MILES PER GALLON?15
PRICE PER GALLON?1.30
MILES PER HOUR?55
IT WILL TAKE 9.09091 HOURS AND COST 43.3333
DOLLARS.

PROGRAM LISTING

```
100 PRINT "TAKING A VACATION ? USE THIS PROGRAM TO"  
110 PRINT "CALCULATE YOUR DRIVING TIME AND"  
120 PRINT "COST OF GASOLINE"  
130 PRINT  
140 PRINT "MILES TO TRAVEL";  
150 INPUT M  
160 PRINT "MILES PER GALLON";  
170 INPUT A  
180 PRINT "PRICE PER GALLON";  
190 INPUT P  
200 PRINT "MILES PER HOUR";  
210 INPUT S  
220 LET T=M/S  
230 LET C=(M/A)*P  
240 PRINT "IT WILL TAKE ";T;" HOURS AND COST ";C;"  
DOLLARS."  
250 END
```


VARIABLE LIST

M—Miles to travel

A—Miles per gallon

P—Price per gallon

S—Miles per hour

T—Number of hours to reach destination

C—Total cost of gasoline

RECIPE

The computer can also help you out in the kitchen. Suppose you need to increase the size of your favorite recipe in order to feed a large crowd. This program converts the amount of ingredients you will need.

Use this program to make a recipe smaller also.

SAMPLE RUN

THIS PROGRAM ALTERS YOUR FAVORITE RECIPE.

NUMBER THE RECIPE ORIGINALLY SERVED?4

NUMBER NEW RECIPE TO SERVE?8

NOW INPUT THE ORIGINAL QUANTITY OF EACH
INGREDIENT(IN DECIMAL)?2

NEW QUANTITY 4

INGREDIENT(IN DECIMAL)?1.5

NEW QUANTITY 1

INGREDIENT(IN DECIMAL)?1.4

NEW QUANTITY 2.8

PROGRAM LISTING

```
100 PRINT "THIS PROGRAM ALTERS YOUR FAVORITE RECIPE."  
110 PRINT "NUMBER THE RECIPE ORIGINALLY SERVED";  
120 INPUT F  
130 PRINT "NUMBER NEW RECIPE TO SERVE";  
140 INPUT N  
150 PRINT "NOW INPUT THE ORIGINAL QUANTITY OF EACH"  
160 PRINT "INGREDIENT(IN DECIMAL)";  
170 INPUT I  
200 PRINT "NEW QUANTITY ";I*(N/F)  
210 PRINT  
220 GOTO 160  
230 END
```

Note: Line 200: A numeric expression can be used in a PRINT statement. The computer just prints the result of the calculation.

VARIABLE LIST

F—Number of people recipe originally served

N—Number of people the new recipe is to serve

I—Original quantity of an ingredient

5 STRINGS

Using Words with the Computer

A string variable contains letters or words instead of numbers. You can print strings, combine them to form words or sentences and input strings just as you can numbers.

PROBLEMS

1. Nonsense
2. A Man From Peru
3. A Young Lady Named Maude
4. Race
5. Rhyme
6. Names
7. Author

NONSENSE

This program prints out a message. Can you see where each word is stored in the program?

Can you write a scrambled message of your own? Which lines in the program must you change?

SAMPLE RUN

DID YOU THINK THIS WOULD PRINT NONSENSE?

PROGRAM LISTING

```
100 DIM A$(10),B$(10),C$(10),D$(10),E$(10),F$(10)
110 LET A$="SENSE?"
120 LET B$="DID YOU TH"
130 LET C$="INK THIS "
140 LET D$="INT NON"
150 LET E$="LD PR"
160 LET F$="WOU"
170 PRINT B$;C$;F$;E$;D$;A$
180 END
```

Note: Line 100: This is a dimension (DIM) statement. If you want a string variable to have more than one letter in it, you must use the DIM statement to save the spaces. In this case, A\$ can have 10 letters, B\$ can have 10 letters, etc.

Lines 110-160: A\$, B\$, etc., are used to store letters in the program. These variables are called string variables. The \$ tells the computer this is a string variable.

COMPUTER NOTES

TI-BASIC Do not use the DIM statement for string variables; the computer saves space automatically. Therefore, take out the string variables in the DIM statements in all the programs in this text. See Appendix A for a more detailed explanation.

A MAN FROM PERU

You can write a limerick like this one yourself. Just substitute your own words for A\$, B\$ and C\$.

If you have another limerick you like better, try putting it on the computer.

SAMPLE RUN

```
THERE WAS AN OLD MAN FROM PERU  
WHO DREAMED HE WAS EATING HIS SHOE  
HE WOKE UP IN THE NIGHT, WITH A TERRIBLE FRIGHT  
TO FIND OUT IT WAS PERFECTLY TRUE.
```

PROGRAM LISTING

```
100 DIM A$(10),B$(10),C$(10)  
110 LET A$="PERU"  
120 LET B$="SHOE"  
130 LET C$="TRUE"  
140 PRINT "THERE WAS AN OLD MAN FROM ";A$  
150 PRINT "WHO DREAMED HE WAS EATING HIS ";B$  
160 PRINT "HE WOKE UP IN THE NIGHT, WITH A TERRIBLE  
    FRIGHT"  
170 PRINT "TO FIND OUT IT WAS PERFECTLY ";C$;"."  
180 END
```

Note: Lines 140-170: You can use the string variables A\$, B\$ and C\$ in a PRINT statement just as you used the numeric variables.

A YOUNG LADY NAMED MAUDE

Here is another limerick. Input your own strings for your original version. It is easier to do it with this program, because the program asks you for each word.

SAMPLE RUN

```
THIS PROGRAM WRITES A LIMERICK
INPUT 3 WORDS THAT RHYME
FIRST WORD?MAUDE
SECOND WORD?BROAD
THIRD WORD?O LORD
```

```
THERE WAS A YOUNG LADY NAMED MAUDE
WHOSE FRAME WAS EXCEEDINGLY BROAD
TO EAT AT THE TABLE, SHE SCARCELY WAS ABLE
BUT OUT IN THE PANTRY, O LORD
```

PROGRAM LISTING

```
100 DIM A$(25),B$(25),C$(25)
110 PRINT "THIS PROGRAM WRITES A LIMERICK"
120 PRINT "INPUT 3 WORDS THAT RHYME"
130 PRINT "FIRST WORD";
140 INPUT A$
150 PRINT "SECOND WORD";
160 INPUT B$
170 PRINT "THIRD WORD";
180 INPUT C$
190 PRINT
200 PRINT
210 PRINT "THERE WAS A YOUNG LADY NAMED ";A$
220 PRINT "WHOSE FRAME WAS EXCEEDINGLY ";B$
230 PRINT "TO EAT AT THE TABLE, SHE SCARCELY WAS ABLE"
240 PRINT "BUT OUT IN THE PANTRY, ";C$
250 END
```

Note: Lines 140, 160, 180: The INPUT statement works for string variables as well as for numeric variables.

RACE

This program tells the story of a crazy race using names, a noun and an adjective that you choose.

Can you change the program to broadcast a game or tell a story?

SAMPLE RUN

WELCOME TO THE SCRAMBLED SWEEPSTAKES!

I NEED A PLURAL NOUN?HUNCHBACKS
I NEED A NAME?TIM CONWAY
I NEED A SECOND NAME?STEVE MARTIN
I NEED A THIRD NAME?ALAN ALDA
I NEED AN ADJECTIVE?FANTASTIC

ALL RIGHT, THE RACE IS ABOUT TO BEGIN!
THIS IS YOUR ANNOUNCER SPEAKING.
THE HUNCHBACKS ARE AT THE STARTING GATE...
AND THEY'RE OFF!

STEVE MARTIN IS IN THE LEAD. ALAN ALDA IS NEXT, TRAILED
BY TIM CONWAY.
THE HUNCHBACKS ARE COMING INTO THE STRETCH.
ALAN ALDA IS AHEAD AND STEVE MARTIN AND TIM CONWAY ARE
MOVING UP.
IT'S GOING TO BE CLOSE FOLKS... AND...
STEVE MARTIN CROSSES THE WIRE FIRST!!!

WHAT A FANTASTIC DAY AT THE TRACK!

PROGRAM LISTING

```
150 DIM A$(25),B$(25),C$(25),D$(25),E$(25)
160 PRINT
170 PRINT "WELCOME TO THE SCRAMBLED SWEEPSTAKES!"
180 PRINT
200 PRINT "I NEED A PLURAL NOUN";
205 INPUT A$
210 PRINT "I NEED A NAME";
220 INPUT B$
230 PRINT "I NEED A SECOND NAME";
240 INPUT C$
250 PRINT "I NEED A THIRD NAME";
```

```

260 INPUT D$
350 PRINT "I NEED AN ADJECTIVE";
360 INPUT E$
370 PRINT
380 PRINT "ALL RIGHT, THE RACE IS ABOUT TO BEGIN!"
390 PRINT "THIS IS YOUR ANNOUNCER SPEAKING."
400 PRINT "THE ";A$;" ARE AT THE STARTING GATE..."
410 PRINT "AND THEY'RE OFF!"
420 PRINT
430 PRINT C$;" IS IN THE LEAD. ";D$;" IS NEXT, TRAILED"
440 PRINT "BY ";B$;"."
450 PRINT "THE ";A$;" ARE COMING INTO THE STRETCH."
460 PRINT D$;" IS AHEAD AND ";C$;" AND ";B$;"
    ARE MOVING UP."
465 PRINT "IT'S GOING TO BE CLOSE FOLKS... AND..."
470 PRINT C$;" CROSSES THE WIRE FIRST!!!"
480 PRINT
490 PRINT "WHAT A ";E$;" DAY AT THE TRACK!"
500 END

```

VARIABLE LIST

A\$—Plural noun
 B\$—First name
 C\$—Second name
 D\$—Third name
 E\$—Adjective

RHYME

Your teacher told you to write a poem, and you are struggling with words to rhyme with your lines. Use this program to test out various possibilities.

Can you change it to handle words starting with digraphs(th,wh) or blends(st,tr)?

SAMPLE RUN

TEST RHYMING POSSIBILITIES WITH THIS PROGRAM

WHAT WORD ARE YOU RHYMING?

?CAT

NEW FIRST LETTER?H

HAT

NEW FIRST LETTER?B

BAT

NEW FIRST LETTER?S

SAT

PROGRAM LISTING

```
100 DIM Z$(10),X$(10),D$(1)
110 PRINT "TEST RHYMING POSSIBILITIES WITH THIS
    PROGRAM"
120 PRINT "WHAT WORD ARE YOU RHYMING?"
130 INPUT Z$
140 X$ = MID$(Z$,2)
145 PRINT "NEW FIRST LETTER";
150 INPUT D$
170 PRINT D$;X$
175 PRINT
180 GOTO 145
190 END
```

Note: Line 140: This statement puts Z\$ into X\$ starting with the second letter of Z\$.

The string function MID\$ allows you to take out part of a string. The format is MID\$(string,n,m) where:

string—the name of the string variable
n—the position of the first letter to use
m—number of letters to use, m is not required if you
want to use the entire string.

VARIABLE LIST

Z\$—Contains word trying to rhyme
D\$—Contains the letter input to make a new word
X\$—Contains the letters in Z\$ starting with the second letter

COMPUTER NOTES

HP-2000 BASIC	}	Replace line 140 with:
Atari BASIC		140 LET X\$ = Z\$(2)
TI-BASIC		Not suitable for the TI. See Appendix A.

NAMES

This program makes up a child's name by combining a first name and a last name. What names can you come up with?

Use a similar program to make up names for your soccer team or club.

Try changing the program so you can use it for compound words.

SAMPLE RUN

USE THIS PROGRAM TO EXPERIMENT WITH NAMES
IF PARENT'S WITH A LAST NAME OF ?WAHL

NAMED THEIR CHILD ?BRICK
THE CHILD'S FULL NAME WOULD BE BRICK WAHL

PROGRAM LISTING

```
100 DIM A$(15),B$(15)
110 PRINT "USE THIS PROGRAM TO EXPERIMENT WITH NAMES"
120 PRINT "IF PARENTS WITH A LAST NAME OF ";
130 INPUT A$
140 PRINT
150 PRINT "NAMED THEIR CHILD ";
160 INPUT B$
170 PRINT "THE CHILD'S FULL NAME WOULD BE ";B$;" ";A$
180 GOTO 140
190 END
```

VARIABLE LIST

A\$—Parents' last name
B\$—Child's first name

AUTHOR

Change the words in a sentence to alter the message or improve your writing style. Change line 110 if you want to start with a different message.

You can only have 30 characters in variable A\$. What happens if you try to use more than 30? How would you change the program if you wanted more than 30?

SAMPLE RUN

```
SHERRI IS A PRETTY GIRL
WHAT WORD DO YOU WANT TO CHANGE?SHERRI
WITH WHAT?LYN
LYN IS A PRETTY GIRL
WHAT WORD DO YOU WANT TO CHANGE?PRETTY
WITH WHAT?SMART
LYN IS A SMART GIRL
WHAT WORD DO YOU WANT TO CHANGE?GIRL
WITH WHAT?PERSON
LYN IS A SMART PERSON
```

PROGRAM LISTING

```
100 DIM A$(30),B$(39),C$(10),D$(10)
110 LET A$ = " SHERRI IS A PRETTY GIRL"
120 PRINT A$
130 PRINT "WHAT WORD DO YOU WANT TO CHANGE";
140 INPUT C$
150 REM ** CREATE A NEW STRING
160 PRINT "WITH WHAT";
170 INPUT D$
180 REM **FIND FIRST POSITION IN A$ OF C$
182 LET F = LEN (C$)
185 LET A = LEN (A$)
190 FOR B = 1 TO A
200 IF MID$ (A$,B,F) = C$ THEN 240
210 NEXT B
220 PRINT C$" NOT IN",A$,"TRY AGAIN"
230 GOTO 130
240 LET B$ = A$
250 A$ = LEFT$ (B$,B - 1) + D$ + MID$ (B$,B + F)
260 GOTO 120
270 END
```


Note: Line 182: The LEN (length) statement determines the actual length of the string in A\$. In this case, A is set equal to the actual length of A\$.

Line 200: This statement determines the starting position of the word C\$ in the sentence A\$.

Line 250: This statement changes A\$ by replacing the old word C\$ with the new word D\$.

The string function LEFT\$ allows you to use only the first part of a string variable (the left-most letters). The format is LEFT\$(string, n) where:

string—name of the string variable

n—number of letters to use.

VARIABLE LIST

A\$—Expression starting with

B\$—Temporary variable used to hold expression in A\$ while changes are made

C\$—Word replacing

D\$—Word adding

A—Length of A\$

F—Length of C\$

B—Starting position of C\$ in A\$

COMPUTER NOTES

HP-2000 BASIC

Replace lines 190-210 with:

190 LET B=POS(A\$,C\$)

Replace line 250 with:

250 LET A\$(B,B+D) = D\$

255 LET A\$(B+D+1) = B\$ (B+F+1)

The POS (position) function determines the starting position of the word C\$ in the sentence A\$. The format is POS(string1,string2) where:

string1—name of string containing string2

Atari BASIC }
TI-BASIC }

Not suitable for use with
these versions of BASIC

6 IF. . . THEN

How the Computer Makes Decisions

This programming statement makes the computer decide which line number to execute next.

PROBLEMS

1. Tax
2. Foreign Currency
3. Mystery Code
4. Ten Speed
5. Time Differences
6. Interior Decorating
7. Driver's Test
8. Spelling
9. You Are a Detective

TAX

Sales tax is added to the price of most things you buy. In order to be sure you take enough money with you, use this program to find out exactly how much money you need to buy that rocket you've been looking at. Or, any other item you are thinking of buying. Your parents may find it useful too.

This program uses a tax of .065¢. If you live in a different state, the tax might be different. Can you change the program for a different tax rate?

SAMPLE RUN

I WILL FIGURE OUT HOW MUCH TAX WILL BE CHARGED ON AN ITEM
AND ADD IT TO YOUR PURCHASE. JUST INPUT THE PRICE.
INPUT '0' TO STOP.

PRICE OF ITEM?4.98
YOUR ITEM WILL COST \$ 5.3
PRICE OF ITEM?16.95
YOUR ITEM WILL COST \$ 18.05
PRICE OF ITEM?32.25
YOUR ITEM WILL COST \$ 34.35

PROGRAM LISTING

```
100 PRINT "I WILL FIGURE OUT HOW MUCH TAX WILL BE  
    CHARGED ON AN ITEM"  
110 PRINT "AND ADD IT TO YOUR PURCHASE. JUST INPUT  
    THE PRICE."  
120 PRINT "INPUT '0' TO STOP."  
130 PRINT  
140 PRINT "PRICE OF ITEM";  
150 INPUT P  
160 IF P=0 THEN 200  
170 LET P=P+.065*P  
180 PRINT "YOUR ITEM WILL COST $";INT(P*100+.5)/100  
190 GOTO 140  
200 END
```

Note: Line 160: This program uses another way to stop. If the input is equal to zero, then the program skips to line 200 and ends.

VARIABLE LIST

P—Price of an item

Special credit to Slaton Lipscomb

FOREIGN CURRENCY

Are you planning a vacation to a foreign country? You may have to change U.S. dollars into foreign currency. Do you know what the exchange rate will be? If you do, you can use this program to convert the U.S. dollar amount to foreign currency.

Can you write a program that converts foreign currency into U.S. dollars?

SAMPLE RUN

THIS PROGRAM CAN CONVERT OUR DOLLAR TO ANY FOREIGN CURRENCY

INPUT A 0 TO STOP PROGRAM

INPUT THE FOREIGN EQUIVALENT OF A DOLLAR?.9982

INPUT THE DOLLAR AMOUNT?100

100 U.S. DOLLARS EQUAL 99.82 IN FOREIGN CURRENCY

INPUT THE DOLLAR AMOUNT?2500

2500 U.S. DOLLARS EQUAL 2495.5 IN FOREIGN CURRENCY

INPUT THE DOLLAR AMOUNT?53

53 U.S. DOLLARS EQUAL 52.9 IN FOREIGN CURRENCY

PROGRAM LISTING

```
100 PRINT "THIS PROGRAM CAN CONVERT OUR DOLLAR TO ANY
    FOREIGN CURRENCY"
105 PRINT "INPUT A 0 TO STOP PROGRAM"
110 PRINT
115 PRINT "INPUT THE FOREIGN EQUIVALENT OF A DOLLAR";
120 INPUT F
125 PRINT "INPUT THE DOLLAR AMOUNT";
130 INPUT D
135 IF D=0 THEN 160
140 LET N=F*D
145 PRINT D;"U.S. DOLLARS EQUAL ";INT(N*100+.5)/100;"
    IN FOREIGN CURRENCY"
150 PRINT
155 GOTO 125
160 END
```

Note: Line 135: This is called an IF . . . THEN statement. If the condition is true, the program goes to the line given. Otherwise, the program goes to the next line.

VARIABLE LIST

F—Foreign equivalent of U.S. dollar
D—The dollar amount
N—Foreign currency

MYSTERY CODE

In order to finish this program, you have to decipher a secret message while the program is running.

Can you write a mystery code program like this one and let your friends try to solve it?

SAMPLE RUN

YOU ARE A BRITISH DIPLOMAT BEING HELD CAPTIVE BY A
TERRORIST GROUP.
SOMEONE JUST SLIPPED YOU A SECRET MESSAGE.
DECODE IT AND YOU CAN ESCAPE. HURRY THE TERRORISTS
ARE RETURNING!
HINT-CROSS OUT WORDS THAT RHYME
THE CODE IS.....

PSATRMATEFATSPATSCATLBATERATTYATTHATEZATRDATA
?A
KEY IS UNDER THE BOOK

PROGRAM LISTING

```
100 DIM A$(1)
110 PRINT "YOU ARE A BRITISH DIPLOMAT BEING HELD CAPTIVE
    BY A TERRORIST GROUP."
120 PRINT "SOMEONE JUST SLIPPED YOU A SECRET MESSAGE. "
130 PRINT "DECODE IT AND YOU CAN ESCAPE. HURRY THE
    TERRORISTS ARE RETURNING!"
140 PRINT "HINT-CROSS OUT WORDS THAT RHYME"
150 PRINT "THE CODE IS....."
160 PRINT
170 PRINT "PSATRMATEFATSPATSCATLBATERATTYATTHATEZATRDATA"
180 INPUT A$
190 IF A$="A" THEN 220
200 PRINT "♦♦♦BANG BANG THEY SHOT YOU♦♦♦"
210 GOTO 230
220 PRINT "KEY IS UNDER THE BOOK"
230 END
```

Note: Line 190: Notice that a string variable can be used in an IF
... THEN statement too.

TEN SPEED

The computer can help you save toward a goal. This program calculates the time it will take you to save for a ten speed bicycle.

If you change values for the interest rate, the total amount needed, and the monthly amount, you can use the program to calculate how long it will take to save for a vacation, for college, or anything else you want.

SAMPLE RUN

YOU HAVE DECIDED TO SAVE FOR A NEW TEN SPEED
IF THE BANK PAYS 5 1/2 % INTEREST COMPOUNDED MONTHLY
HOW LONG WILL IT TAKE TO SAVE FOR YOUR TEN SPEED?
THIS PROGRAM WILL GIVE YOU THE ANSWER

HOW MUCH WILL YOUR BIKE COST?183.95
HOW MUCH CAN YOU SAVE A MONTH?15

FOR YOUR \$ 183.95 TEN SPEED, SAVING \$ 15
A MONTH,
YOU CAN HAVE \$ 185.45 IN 12 MONTHS.

PROGRAM LISTING

```
100 PRINT "YOU HAVE DECIDED TO SAVE FOR A NEW TEN SPEED"  
105 PRINT "IF THE BANK PAYS 5 1/2 % INTEREST COMPOUNDED  
MONTHLY"  
110 PRINT "HOW LONG WILL IT TAKE TO SAVE FOR YOUR TEN  
SPEED?"  
115 PRINT "THIS PROGRAM WILL GIVE YOU THE ANSWER"  
120 PRINT  
125 PRINT "HOW MUCH WILL YOUR BIKE COST";  
130 INPUT A  
135 LET R=.055  
140 PRINT "HOW MUCH CAN YOU SAVE A MONTH";  
145 INPUT M  
150 LET T=0  
155 LET N=0  
160 LET N=N+1  
165 LET T=T+M  
170 LET T=T*(1+R/12)  
175 IF T>A THEN 185
```



```

180 GOTO 160
185 PRINT
190 PRINT "FOR YOUR $ ";A;" TEN SPEED, SAVING $ ";M;"
    A MONTH,"
195 PRINT "YOU CAN HAVE $ ";INT(T*100+.5)/100;" IN
    ";N;" MONTHS."
200 END

```

Note: Line 175: The symbol $>$ means greater than. This IF . . . THEN statement stops the program as soon as T, the total saved, is greater than A, the amount needed.

VARIABLE LIST

A—Amount needed for purchase
 R—Current interest rate
 M—Monthly savings
 T—Total earnings
 N—Number of months

TIME DIFFERENCES

If you live on the West Coast and you want to call your cousin in Boston, you might want to know what time it is in Boston. This program lets you convert from your time to the time anywhere else in the world.

How would you change the program if you lived in New York and wanted to call a friend in Seattle?

SAMPLE RUN

I CAN TELL YOU WHAT TIME IT IS ANYWHERE IN THE WORLD
JUST INPUT THIS INFORMATION
HIT '0' TO STOP.

YOUR TIME IN HOURS?8
THE TIME DIFFERENCE IN HOURS?3
THEIR TIME IS 11 0'CLOCK

YOUR TIME IN HOURS?8
THE TIME DIFFERENCE IN HOURS?-3
THEIR TIME IS 5 0'CLOCK

PROGRAM LISTING

```
100 PRINT "I CAN TELL YOU WHAT TIME IT IS  
    ANYWHERE IN THE WORLD"  
105 PRINT "JUST INPUT THIS INFORMATION"  
110 PRINT "HIT '0' TO STOP."  
115 PRINT  
120 PRINT "YOUR TIME IN HOURS";  
130 INPUT T  
132 IF T=0 THEN 175  
135 PRINT "THE TIME DIFFERENCE IN HOURS";  
140 INPUT D  
145 LET N=T+D  
150 IF N <= 12 THEN 160  
155 N=N-12  
160 PRINT "THEIR TIME IS ";N;" 0'CLOCK"  
165 PRINT  
170 GOTO 120  
175 END
```

Note: Line 150: The symbols \leq mean less than or equal to. The program will skip to line 160 if N is equal to 12 or any number less than 12.

VARIABLE LIST

T—Your time

D—Time difference in hours

N—Their time

INTERIOR DECORATING

You want to paint your bedroom walls, and you have some paint already. Now, you are not sure you have enough paint. Use this program to find out if you need to buy any more.

Can you change the program to estimate your needs for more than one room?

SAMPLE RUN

YOU ARE PAINTING YOUR ROOM AND NEED
TO FIND OUT IF YOU HAVE ENOUGH
PAINT. INPUT THE FOLLOWING

LENGTH AND WIDTH OF ROOM?12,20
SQ FT PER GALLON OF PAINT?100
GALLONS OF PAINT YOU HAVE NOW?2

BUY MORE PAINT, YOU NEED 3.12 GALLONS MORE

PROGRAM LISTING

```
100 PRINT "YOU ARE PAINTING YOUR ROOM AND NEED"  
105 PRINT "TO FIND OUT IF YOU HAVE ENOUGH"  
110 PRINT "PAINT. INPUT THE FOLLOWING"  
115 PRINT  
120 PRINT "LENGTH AND WIDTH OF ROOM";  
125 INPUT L,W  
130 PRINT "SQ FT PER GALLON OF PAINT";  
135 INPUT S  
140 PRINT "GALLONS OF PAINT YOU HAVE NOW";  
145 INPUT B  
147 LET H=8  
150 PRINT  
155 LET A=2*L*H+2*W*H  
160 LET G=A/S  
165 IF B <= G THEN 180  
170 PRINT "YOU ARE O.K., YOU ONLY NEED ";G;" GALLONS."  
175 GOTO 185  
180 PRINT "BUY MORE PAINT. YOU NEED ";G-B;" GALLONS  
MORE."  
185 END
```

Note: Line 155: Calculates the square feet in your room.

Line 160: Calculates the gallons of paint needed.

VARIABLE LIST

L—Length

W—Width

S—Square feet per gallon

B—Gallons of paint you have now

A—Area of your room

G—Gallons needed

H—Height of room—set to 8 in this problem

DRIVER'S TEST

When you take the test for your driver's license, you have to estimate the braking distance required to stop a moving car. To practice, try taking our driving test. Remember, it takes a lot farther to stop a moving car than you might think!

SAMPLE RUN

THIS PROGRAM HELPS YOU DECIDE
WHEN TO PUT ON THE BRAKES

MI/HR CAR IS TRAVELING?25
YOUR ESTIMATE OF FEET REQUIRED TO STOP?35
YOU WOULD HAVE STOPPED TOO SOON
IT TAKES 20.8765 FEET TO STOP
AGAIN?Y

MI/HR CAR IS TRAVELING?60
YOUR ESTIMATE OF FEET REQUIRED TO STOP?100
YOU WOULD HAVE CRASHED!
IT TAKES 120.248 FEET TO STOP
AGAIN?N

PROGRAM LISTING

```
100 DIM A$(1)
105 PRINT "THIS PROGRAM HELPS YOU DECIDE"
110 PRINT "WHEN TO PUT ON THE BRAKES"
115 PRINT
120 PRINT "MI/HR CAR IS TRAVELING";
125 INPUT S
130 LET S=S*5280/3600
135 D=S ♦♦ 2/64.4
140 PRINT "YOUR ESTIMATE OF FEET REQUIRED TO STOP";
145 INPUT F
150 IF F<D-2 THEN 170
155 IF F>D+2 THEN 180
160 PRINT "YOU WERE CLOSE ENOUGH - GOOD DRIVING!"
165 GOTO 190
170 PRINT "YOU WOULD HAVE CRASHED!"
175 GOTO 190
180 PRINT "YOU WOULD HAVE STOPPED TOO SOON"
185 GOTO 190
```

```

190 PRINT "IT TAKES ";D;" FEET TO STOP"
195 PRINT "AGAIN";
200 INPUT A$
205 PRINT
210 IF A$="Y" THEN 120
215 END

```

Note: Line 150: Notice that an IF . . . THEN statement can use a numeric expression. The program computes the result of the numeric expression and then applies the IF . . . THEN test.

Lines 150-155: These statements are used together in order to determine if the feet estimated are within 4 feet of the actual feet required to stop.

Lines 195-210: These statements are a clever way of finding out if the person running the program wants to continue. Compare this with the method used in Chapter 4.

VARIABLE LIST

S—Miles/Hour converted to Feet/Sec

D—Feet required to stop

F—Input estimate of feet required to stop

SPELLING

The computer can help you and your friends solve spelling puzzles. In this game, you have to supply the missing letters needed to complete the word.

Try writing your own program using a different word. You could also add other words to this program.

SAMPLE RUN

TRY TO FIGURE OUT THE MISSING LETTERS IN THIS WORD

```
C_ROM_?  
THE FIRST LETTER IS?T  
WRONG, TRY AGAIN  
THE FIRST LETTER IS?H  
RIGHT - THE SECOND LETTER IS?R  
WRONG - TRY AGAIN  
THE SECOND LETTER IS?E  
RIGHT, YOU SPELLED CHROME
```

PROGRAM LISTING

```
100 DIM A$(11),B$(11)  
110 PRINT "TRY TO FIGURE OUT THE MISSING LETTERS IN  
THIS WORD"  
120 PRINT  
130 PRINT "C_ROM_?"  
140 PRINT "THE FIRST LETTER IS";  
150 INPUT A$  
160 IF A$="H" THEN 180  
170 GOTO 240  
180 PRINT "RIGHT - ";  
190 PRINT "THE SECOND LETTER IS";  
200 INPUT B$  
210 IF B$="E" THEN 260  
220 PRINT "WRONG - TRY AGAIN"  
230 GOTO 190  
240 PRINT "WRONG, TRY AGAIN"  
250 GOTO 140  
260 PRINT "RIGHT, YOU SPELLED CHROME"  
270 END
```

Note: Line 160: *If* you input "H" *then* the computer goes to line 180; otherwise it drops down to line 170.

YOU ARE A DETECTIVE

Each time you run through this program, you can have a different adventure. Watch out though, only one path is correct.

You can write your own mystery programs too. Just think of a story and use the IF . . . THEN statements to send your detective on different adventures.

SAMPLE RUN

YOU ARE A DETECTIVE. YOU RECEIVE A CALL FROM MR. DREW. HE ASKS YOU TO COME OVER. HE BELIEVES HIS LIFE IS IN DANGER. IF YOU DECIDE TO GO TO HIS HOUSE TYPE YES. IF YOU DECLINE TYPE NO.

?YES

MR. DREW MEETS YOU AT HIS HOUSE. HE TELLS YOU HE SUSPECTS HIS WIFE IS TRYING TO KILL HIM. HE ASKS YOU TO STAY FOR DINNER SO YOU CAN MEET HER AS WELL AS HIS NIECE LUCY AND A FRIEND DR. QUIMBY. IF YOU ACCEPT HIS INVITATION TYPE MDREW IF YOU DECIDE TO GO HOME TO WATCH YOUR FAVORITE TV SHOW SAYING YOU'LL CALL MR. DREW IN THE MORNING TYPE CALL

?MDREW

MRS. DREW, A RATHER PLUMP PLEASANT WOMAN IS VERY GRACIOUS AT DINNER. AFTER DINNER MR. DREW OFFERS HIS GUESTS A GLASS OF BRANDY. SINCE YOU DECLINE YOU DECIDE TO STROLL AROUND THE GARDEN. SUDDENLY YOU HEAR A CRASH FOLLOWED BY A SCREAM! YOU RUSH IN TO FIND MR. DREW HAS BEEN POISONED! THE POLICE ARE CALLED. BEFORE THEY ARRIVE - YOU DECIDE TO INTERVIEW THE WITNESSES. IF YOU CHOOSE TO SPEAK TO THEM AS A GROUP, TYPE GROUP.

IF YOU INTERVIEW THEM INDIVIDUALLY TYPE ONE.

?ONE

DURING YOUR INTERROGATION OF MR. DREW'S NIECE, SHE MAKES A FATAL SLIP. YOU DISCOVER SHE HAD THE OPPORTUNITY TO PUT ARSENIC IN MR. DREW'S BRANDY BECAUSE SHE WANTED HER INHERITANCE MONEY NOW! WITH

THE POLICE COOPERATION SHE IS
ARRESTED AND CHARGED WITH HIS
MURDER. GREAT GOING! MRS. DREW
REWARDS YOU HANDSOMLY!

PROGRAM LISTING

```
60  DIM X$(10),Y$(10),Z$(10)
100 PRINT "YOU ARE A DETECTIVE.  YOU RECEIVE A CALL"
110 PRINT "FROM MR. DREW.  HE ASKS YOU TO COME"
120 PRINT "OVER.  HE BELIEVES HIS LIFE IS IN DANGER."
130 PRINT "IF YOU DECIDE TO GO TO HIS HOUSE TYPE YES."
150 PRINT "IF YOU DECLINE TYPE NO."
160 INPUT X$
165 IF X$="YES" THEN 200
170 IF X$="NO" THEN 300
180 PRINT "I NEED A YES OR NO ANSWER.  TRY AGAIN."
190 GOTO 160
195 REM♦♦ DECIDE TO MEET MR DREW.
200 PRINT "MR. DREW MEETS YOU AT HIS HOUSE.  HE TELLS"
210 PRINT "YOU HE SUSPECTS HIS WIFE IS TRYING TO"
220 PRINT "KILL HIM.  HE ASKS YOU TO STAY FOR"
230 PRINT "DINNER SO YOU CAN MEET HER AS WELL"
240 PRINT "AS HIS NIECE LUCY AND A FRIEND DR. QUIMBY."
260 PRINT "IF YOU ACCEPT HIS INVITATION TYPE MDREW"
270 PRINT "IF YOU DECIDE TO GO HOME TO WATCH YOUR"
280 PRINT "FAVORITE TV SHOW SAYING YOU'LL CALL"
290 PRINT "MR. DREW IN THE MORNING TYPE CALL"
292 INPUT Y$
294 IF Y$="MDREW" THEN 400
296 IF Y$="CALL" THEN 500
297 PRINT "I NEED A MDREW OR CALL - TRY AGAIN."
298 GOTO 292
300 PRINT "YOU OBVIOUSLY AREN'T VERY INTERESTED"
310 PRINT "IN KEEPING UP YOUR BUSINESS.  SOON"
320 PRINT "YOU ARE FORCED TO FIND ANOTHER JOB."
330 PRINT "BETTER LUCK NEXT TIME!"
340 GOTO 999
400 REM♦♦DECIDE TO STAY FOR DINNER
410 PRINT "MRS. DREW, A RATHER PLUMP PLEASANT WOMAN"
420 PRINT "IS VERY GRACIOUS AT DINNER.  AFTER DINNER"
430 PRINT "MR. DREW OFFERS HIS GUESTS A GLASS OF"
440 PRINT "BRANDY.  SINCE YOU DECLINE YOU DECIDE"
450 PRINT "TO STROLL AROUND THE GARDEN.  SUDDENLY"
460 PRINT "YOU HEAR A CRASH FOLLOWED BY A SCREAM!"
465 PRINT "YOU RUSH IN TO FIND MR. DREW HAS BEEN "
470 PRINT "POISONED!  THE POLICE ARE CALLED.  BEFORE"
475 PRINT "THEY ARRIVE - YOU DECIDE TO INTERVIEW THE
    WITNESSES."
```

```

476 PRINT "IF YOU CHOOSE TO SPEAK TO"
480 PRINT "THEM AS A GROUP, TYPE GROUP."
490 PRINT "IF YOU INTERVIEW THEM INDIVIDUALLY TYPE
    ONE."
491 INPUT Z$
492 IF Z$="GROUP" THEN 600
493 IF Z$="ONE" THEN 700
494 PRINT "I NEED A GROUP OR ONE - TRY AGAIN."
495 GOTO 491
499 REM♦♦DIDN'T STAY FOR DINNER
500 PRINT "YOU CALL THE DREW'S HOUSE IN THE MORNING."
510 PRINT "THE POLICE ANSWER THE PHONE. MR. DREW"
520 PRINT "WAS MURDERED LAST NIGHT. HE WAS POISONED"
530 PRINT "AT DINNER. YOU ARE WANTED AS A WITNESS"
540 PRINT "BUT YOUR DETECTIVE SERVICES ARE NOT
    REQUIRED."
550 PRINT "TOO BAD!"
560 GOTO 999
600 REM♦♦INTERVIEW THE GROUP
605 PRINT "WHEN YOU INTERVIEW THE GROUP, YOU FIND"
610 PRINT "OUT NOTHING USEFUL. YOU ARE FORCED"
620 PRINT "TO TURN THE CASE OVER TO THE POLICE"
630 PRINT "WHEN THEY ARRIVE. OUT OF LUCK!"
640 GOTO 999
699 REM♦♦INTERVIEW INDIVIDUALLY
700 PRINT "DURING YOUR INTERROGATION OF MR. DREW'S"
710 PRINT "NIECE, SHE MAKES A FATAL SLIP."
720 PRINT "YOU DISCOVER SHE HAD THE OPPORTUNITY"
730 PRINT "TO PUT ARSENIC IN MR.DREW'S "
740 PRINT "BRANDY BECAUSE SHE WANTED"
750 PRINT "HER INHERITANCE MONEY NOW! WITH"
760 PRINT "THE POLICE COOPERATION SHE IS"
770 PRINT "ARRESTED AND CHARGED WITH HIS"
780 PRINT "MURDER. GREAT GOING! MRS. DREW"
790 PRINT "REWARDS YOU HANDSOMLY!"
999 END

```

Note: Line 165: Notice that you can use words in your IF . . . THEN statements too.

7 FUNCTIONS (INT, RND, ABS)

Doing Complex Things the Easy Way

Functions are programs built-in to the computer that you can use to make it easy for you to do complicated operations in your own programs.

The functions you need for games are:

INT Integer function—Changes any decimal number to a whole number.

$\text{INT}(6.15) = 6$

RND Random function—Generates random numbers from 0 to 1.

ABS Absolute value function—Eliminates the minus sign in a negative number.

$\text{ABS}(-10) = 10$

PROBLEMS

1. Soccer
2. Shell Game
3. Dice Game
4. Number Guessing Game
5. Number Sequences
6. How Warm Is Your Heart?
7. War

SOCCER

One of the rules of AYSO (American Youth Soccer Organization) soccer is that everyone on the team must play at least 2 quarters. If all 15 players show up for a game, it is difficult to have everyone play an equal amount of time. This program can help you out. It calculates the number of quarters everyone can play, depending on how many show up for the game.

How can you change the program for your basketball team?

Alter the program to tell you how many innings everyone can play on your Little League team.

SAMPLE RUN

```
I WILL FIND OUT HOW MANY QUARTERS
EACH MEMBER OF THE TEAM CAN PLAY
NUMBER OF PLAYERS FOR THIS GAME?15
EVERYONE PLAYS 2    QUARTERS
WHILE 14    PLAYERS WILL PLAY 3    QUARTERS
```

PROGRAM LISTING

```
100 PRINT "I WILL FIND OUT HOW MANY QUARTERS"
105 PRINT "EACH MEMBER OF THE TEAM CAN PLAY"
110 PRINT "NUMBER OF PLAYERS FOR THIS GAME";
115 INPUT N
120 LET P=11*4
125 LET A=P/N
127 IF A >= 4 THEN 155
128 LET A=INT(A)
135 LET Q=P-A*N
140 PRINT "EVERYONE PLAYS ";A;" QUARTERS"
145 PRINT "WHILE ";Q;" PLAYERS WILL PLAY ";A+1;"
    QUARTERS"
150 GOTO 160
155 PRINT "EVERYONE NEEDS TO PLAY 4 QUARTERS"
160 END
```


Note: Line 125: The INT function forces the result of P/N to be a whole number, or integer. It cuts off any fractions without rounding.

ex. $\text{INT}(3.25) = 3$

$\text{INT}(3.95) = 3$

VARIABLE LIST

N—Number of players at this game

P—Total number of quarters available for the game

A—Number of quarters needed for everyone to play

Q—Extra quarters some players can play

SHELL GAME

In this game, you play the original carnival shell game with the computer. Needless to say, this computer's "hand" is definitely quicker than your eye!

Design your own slight of hand game or have your friends guess a prize behind door number 1, 2, or 3.

SAMPLE RUN

```
READY TO PLAY THE SHELL GAME?
SEE IF YOU CAN GUESS WHICH CUP HAS THE BEAN
OK PLACE YOUR BET?25
WHICH CUP HAS THE BEAN 1 2 OR 3?
?3
YOU ARE RIGHT!
YOU WON $ 50
YOUR TOTAL WINNINGS ARE $ 50
WANT TO TRY AGAIN?Y
OK PLACE YOUR BET?25
WHICH CUP HAS THE BEAN 1 2 OR 3?
?2
YOU ARE RIGHT!
YOU WON $ 50
YOUR TOTAL WINNINGS ARE $ 100
WANT TO TRY AGAIN?Y
OK PLACE YOUR BET?25
WHICH CUP HAS THE BEAN 1 2 OR 3?
?1
I FOOLED YOU THE BEAN WAS IN CUP 2
SORRY . . . YOU LOST $ 25
YOUR TOTAL WINNINGS ARE $ 75
WANT TO TRY AGAIN?N
```

PROGRAM LISTING

```
100 DIM A$(1)
105 PRINT "READY TO PLAY THE SHELL GAME?"
110 PRINT "SEE IF YOU CAN GUESS WHICH CUP HAS THE BEAN"
115 LET T=0
120 PRINT "OK PLACE YOUR BET":
125 INPUT B
130 LET R=INT(RND(1)*3+1)
135 PRINT "WHICH CUP HAS THE BEAN 1 2 OR 3?"
```

```

140 INPUT A
145 IF A=R THEN 155
150 GOTO 185
155 PRINT "YOU ARE RIGHT!"
160 LET B=B+2
165 LET T=T+B
170 PRINT "YOU WON $ ";B
175 PRINT "YOUR TOTAL WINNINGS ARE $ ";T
180 GOTO 205
185 PRINT "I FOOLED YOU. THE BEAN WAS IN CUP ";R
190 T=T-B
195 PRINT "SORRY...YOU LOST $ ";B
200 PRINT "YOUR TOTAL WINNINGS ARE $ ";T
205 PRINT "WANT TO TRY AGAIN";
210 INPUT AS
215 IF AS="Y" THEN 120
220 END

```

Note: Line 130: This statement gets a random number from 1 to 3. The RND(0) function gives a number from 0 to .9999. Try calculating this expression yourself using different random numbers. This is called playing computer. If you want a number from 1 to 6, just change the 3 to a 6.

VARIABLE LIST

T—Total winnings
 B—Bet
 R—Cup with the bean
 A—Your guess of the cup

COMPUTER NOTES

The format for the RND function varies with each computer. See Appendix A for the proper format for your computer.

DICE GAME

This program pretends that the computer can throw dice. The person playing the game starts with some money, then wins or loses depending on the throw of the dice as follows:

Dice throw	Original amount of money is:
6 or 12	Tripled
8 or 9	Doubled
7 or 11	Lost
All others	No change

Try changing the betting odds for the game.

SAMPLE RUN

READY TO PLAY THE DICE GAME?

WHAT IS YOUR BET?10
DICE THROW IS 5
NO CHANGE
YOUR TOTAL WINNINGS ARE 0
AGAIN?Y

WHAT IS YOUR BET?25
DICE THROW IS 7
YOU LOST!
YOUR TOTAL WINNINGS ARE-25
AGAIN?Y

WHAT IS YOUR BET?25
DICE THROW IS 7
YOU LOST!
YOUR TOTAL WINNINGS ARE-50
AGAIN?Y

WHAT IS YOUR BET?50
DICE THROW IS 8
YOU WIN! YOU DOUBLED YOUR BET!
YOUR TOTAL WINNINGS ARE 50
AGAIN?Y

WHAT IS YOUR BET?10
DICE THROW IS 5
NO CHANGE
YOUR TOTAL WINNINGS ARE 50
AGAIN?N

PROGRAM LISTING

```
100 DIM A$(1)
105 LET T=0
110 PRINT "READY TO PLAY THE DICE GAME?"
115 PRINT
120 PRINT "WHAT IS YOUR BET?";
125 INPUT M
130 LET A=INT(RND(1)*6+1)
135 LET B=INT(RND(1)*6+1)
140 LET C=A+B
145 PRINT "DICE THROW IS ";C
150 IF C=6 THEN 195
155 IF C=12 THEN 195
160 IF C=8 THEN 210
165 IF C=9 THEN 210
170 IF C=7 THEN 225
175 IF C=11 THEN 225
180 PRINT "NO CHANGE"
185 LET M=0
190 GOTO 240
195 PRINT "YOU WIN! YOU TRIPLED YOUR BET!"
200 LET M=M*3
205 GOTO 240
210 LET M=M*2
215 PRINT "YOU WIN! YOU DOUBLED YOUR BET!"
220 GOTO 240
225 PRINT "YOU LOST!"
230 LET T=T-M
235 GOTO 245
240 LET T=T+M
245 PRINT "YOUR TOTAL WINNINGS ARE ";T
250 PRINT "AGAIN?";
255 INPUT A$
260 IF A$="Y" THEN 115
265 END
```

Note: Lines 130, 135: These statements work as if the computer was rolling the dice. They set the numeric variables A and B to a random number between 1 and 6.

VARIABLE LIST

M—Your bet
A—Die throw #1
B—Die throw #2
C—Total of both dice
T—Total winnings

NUMBER GUESSING GAME

In this game the computer picks a number from 1 to 100, then 2 players try to guess the number. The player closest to the number wins 10 points.

What if the number was from 1 to 200? What would you change?

SAMPLE RUN

WELCOME TO THE NUMBER GUESSING GAME
THIS IS A GAME FOR TWO PLAYERS
THE COMPUTER PICKS A NUMBER FROM 1 TO 100
EACH PLAYER GUESSES A NUMBER
THE PLAYER CLOSEST TO THE CORRECT NUMBER GETS 10 POINTS
A PLAYER GETS 50 POINTS IF THE PLAYER GUESSES THE NUMBER

OK INPUT YOUR GUESS

PLAYER 1?30

PLAYER 2?70

PLAYER 2 WINS

THE COMPUTER'S NUMBER WAS 64

THE SCORE IS - PLAYER 1 0

PLAYER 2 10

AGAIN?Y

OK INPUT YOUR GUESS

PLAYER 1?750

PLAYER 2?100

PLAYER 1 WINS

THE COMPUTER'S NUMBER WAS 51

THE SCORE IS - PLAYER 1 10

PLAYER 2 10

AGAIN?Y

OK INPUT YOUR GUESS

PLAYER 1?20

PLAYER 2?80

PLAYER 1 WINS

THE COMPUTER'S NUMBER WAS 42

THE SCORE IS - PLAYER 1 20

PLAYER 2 10

AGAIN?N

PROGRAM LISTING

```
100 DIM A$(1)
105 PRINT "WELCOME TO THE NUMBER GUESSING GAME"
110 PRINT "THIS IS A GAME FOR TWO PLAYERS"
115 PRINT "THE COMPUTER PICKS A NUMBER FROM 1 TO 100"
120 PRINT "EACH PLAYER GUESSES A NUMBER"
125 LET S=0
130 LET T=0
135 PRINT "THE PLAYER CLOSEST TO THE CORRECT NUMBER
    GETS 10 POINTS"
140 PRINT "A PLAYER GETS 50 POINTS IF THE PLAYER
    GUESSES THE NUMBER"
145 PRINT
150 PRINT "OK INPUT YOUR GUESS"
155 PRINT "PLAYER 1";
160 INPUT P
165 PRINT "PLAYER 2";
170 INPUT N
175 A=INT(RND(1)*100+1)
180 LET B=ABS(P-A)
185 LET C=ABS(N-A)
190 IF B>C THEN 235
195 IF B<C THEN 220
200 PRINT "YOU BOTH WIN"
205 LET S=S+10
210 LET T=T+10
215 GOTO 245
220 PRINT "PLAYER 1 WINS"
225 LET S=S+10
230 GOTO 245
235 PRINT "PLAYER 2 WINS"
240 LET T=T+10
245 PRINT "THE COMPUTER'S NUMBER WAS ";A
250 PRINT "THE SCORE IS - PLAYER 1 ";S
255 PRINT "                - PLAYER 2 ";T
260 PRINT "AGAIN";
265 INPUT A$
270 IF A$="Y" THEN 150
275 END
```

Note: Line 175: The computer gets a random number from 1 to 100.

Lines 180, 185: The ABS function eliminates the minus sign. For example, if $P=5$ and $A=10$ then $P-A=-5$, but the ABS function would change -5 to 5 .

Lines 190, 195: The computer calculates which guess is closest to the computer's number.

VARIABLE LIST

P—Player #1's guess

N—Player #2's guess

A—The computer's number

B—The difference between Player #1 and the computer

C—The difference between Player #2 and the computer

S—Player #1's winnings

T—Player #2's winnings

NUMBER SEQUENCES

This program prints a sequence of numbers. See if you can figure out what the next number should be.

Can you fix the program so it keeps track of the number of correct answers?

SAMPLE RUN

THIS PROGRAM PRINTS A SEQUENCE OF NUMBERS
SEE IF YOU CAN FIGURE OUT WHAT THE NEXT NUMBER SHOULD BE

3 5 7 9 11 ?13

YOU WERE RIGHT, CONGRATULATIONS!

3 9 27 81 243 ?729

YOU WERE RIGHT, CONGRATULATIONS!

5 10 20 40 80 ?160

YOU WERE RIGHT, CONGRATULATIONS!

3 7 11 15 19 ?12

SORRY, THE NEXT NUMBER IS 23

1 3 9 27 81 ?243

YOU WERE RIGHT, CONGRATULATIONS!

3 10 17 24 31 ?38

YOU WERE RIGHT, CONGRATULATIONS!

PROGRAM LISTING

```
100 PRINT "THIS PROGRAM PRINTS A SEQUENCE OF NUMBERS"
105 PRINT "SEE IF YOU CAN FIGURE OUT WHAT THE NEXT
      NUMBER SHOULD BE"
110 S=INT(RND(1)*2+1)
115 A=INT(RND(1)*5+1)
120 B=INT(RND(1)*10+1)
125 C=INT(RND(1)*3+1)
130 IF C=1 THEN 125
135 I=0
140 IF S=1 THEN 165
145 REM** THIS IS A GEOMETRIC SEQUENCE
150 N=A*C ** I
155 GOTO 170
160 REM** THIS IS AN ARITHMETRIC SEQUENCE
165 N=A+I*B
170 I=I+1
175 IF I>5 THEN 190
```

```

177 LET N=INT(N)
180 PRINT N;
185 GOTO 140
190 INPUT M
195 IF M=N THEN 210
200 PRINT "SORRY, THE NEXT NUMBER IS ";N
205 GOTO 110
210 PRINT "YOU WERE RIGHT, CONGRATULATIONS!"
215 GOTO 110
220 END

```

Note: Line 150: The computer calculates a geometric sequence.
 Line 165: The computer calculates an arithmetic sequence.

VARIABLE LIST

S—Determines the type of sequence
 S = 1 arithmetic sequence
 S = 2 geometric sequence
 A—For arithmetic sequence—first number
 For geometric sequence—multiplier
 B—For arithmetic sequence—common difference
 C—For geometric sequence—common ratio
 M—Next number in sequence

HOW WARM IS YOUR HEART?

How warm is your heart? Use this program to find out. You type in a number from 1 to 5 and the computer decides how warm you really are. Don't be surprised if the computer changes its mind. After all, computers don't know everything.

You can add responses of your own to this program.

Try writing a program of your own that evaluates someone's personality or athletic ability.

SAMPLE RUN

```
TO SEE HOW WARM YOUR HEART IS
TYPE A NUMBER FROM 1 TO 5
?1
YOUR HEART IS ON FIRE!!
TYPE A NUMBER FROM 1 TO 5
?5
YOUR HEART IS IN THE NORTH POLE!
TYPE A NUMBER FROM 1 TO 5
?3
YOUR HEART IS IN THE NORTH POLE!
```

PROGRAM LISTING

```
100 PRINT "TO SEE HOW WARM YOUR HEART IS"
105 PRINT "TYPE A NUMBER FROM 1 TO 5"
110 INPUT N
115 IF N>5 THEN 105
120 S=INT(RND(1)*2)*(-2)+1
125 R=INT(RND(1)*5+1)
130 T=N+S*R
135 IF T>1 THEN 150
140 PRINT "YOUR HEART IS IN THE NORTH POLE!"
145 GOTO 105
150 IF T>2 THEN 165
155 PRINT "YOUR HEART IS IN A DEEP FREEZE!"
160 GOTO 105
165 IF T>3 THEN 180
170 PRINT "YOUR HEART IS THAWING OUT!"
175 GOTO 105
180 IF T>4 THEN 195
185 PRINT "YOUR HEART IS STARTING TO GLOW!"
```

```
190 GOTO 105
195 PRINT "YOUR HEART IS ON FIRE!!"
200 GOTO 105
205 END
```

Note: Line 120: Pretend that you are the computer, and try to calculate what value S can have when this statement is run.

VARIABLE LIST

N—Number input

R—Random number 1 to 5

S—Determines if random number is added to or subtracted from the number input

T—Determines which response is printed

WAR

Play the card game WAR with the computer. You and the computer each start with 26 cards. When it is your turn, input a number from 1 to 5. If you match with the computer, you have a BATTLE. Input a 1 or 2 to decide the outcome. If you pick the same number as the computer, you win. If it is different, the computer wins. The winner of the BATTLE gets all of the opponent's cards since the last BATTLE. The WAR is won when one of you gets more than 42 cards. Good Luck!

Can you write a program that plays one of your favorite card games?

SAMPLE RUN

WELCOME TO THE GAME WAR
WE EACH START WITH 26 CARDS
NUMBERED 1-5
WHEN IT IS YOUR TURN - INPUT A NUMBER 1 - 5

YOUR CARD?1
COMPUTERS CARD 1
THIS IS WAR. PICK A 1 OR 2?1
TOSS WAS A 1
YOU WIN 1 CARDS

YOUR CARD?2
COMPUTERS CARD 4
YOUR CARD?3
COMPUTERS CARD 4
YOUR CARD?2
COMPUTERS CARD 4
YOUR CARD?4
COMPUTERS CARD 1
YOUR CARD?1
COMPUTERS CARD 4
YOUR CARD?4
COMPUTERS CARD 2
YOUR CARD?3
COMPUTERS CARD 4
YOUR CARD?2
COMPUTERS CARD 2
THIS IS WAR. PICK A 1 OR 2?1
TOSS WAS A 1
YOU WIN 8 CARDS

PROGRAM LISTING

```
100 DIM AS(1)
105 PRINT "WELCOME TO THE GAME WAR"
110 PRINT "WE EACH START WITH 26 CARDS"
115 PRINT "NUMBERED 1-5"
120 PRINT "WHEN IT IS YOUR TURN - INPUT A NUMBER 1 - 5"
125 REM♦♦COMPUTERS CARDS
130 LET T=26
135 REM♦♦YOUR CARDS
140 LET S=26
145 LET U=0
150 LET V=0
155 PRINT
160 PRINT "YOUR CARD";
165 INPUT N
170 LET V=V+1
175 C=INT(RND(1)*5+1)
180 PRINT "COMPUTER'S CARD ";C
185 LET U=U+1
190 IF C=N THEN 230
195 IF U<T THEN 210
200 REM♦♦ USED ALL CARDS IN PILE - TURN PILE OVER
205 LET U=0
210 IF V<S THEN 160
215 LET V=0
220 GOTO 160
225 REM♦♦HAD A MATCH♦♦
230 PRINT "THIS IS WAR. PICK A 1 OR 2";
235 INPUT P
240 R=INT(RND(1)*2+1)
245 PRINT "TOSS WAS A ";R
250 IF R=P THEN 280
255 PRINT "I WIN ";V;" CARDS"
260 LET S=S-V
265 LET T=T+V
270 IF T>42 THEN 325
275 GOTO 145
280 PRINT "YOU WIN ";U;" CARDS"
285 LET S=S+U
290 LET T=T-U
295 IF S>42 THEN 310
300 GOTO 145
305 REM♦♦PLAYER WINS GAME♦♦
310 PRINT "YOU WIN GAME"
315 GOTO 330
320 REM♦♦COMPUTER WINS♦♦
325 PRINT "I WIN GAME"
330 PRINT "I HAVE ";T;" CARDS"
335 PRINT "YOU HAVE ";S;" CARDS"
```

```

340 PRINT
345 PRINT "TRY AGAIN(Y/N)";
350 INPUT A$
355 IF A$="Y" THEN 105
360 PRINT
365 PRINT "BETTER LUCK NEXT TIME!"
370 END

```

Note: Line 175: This statement randomly assigns a number from 1 to 5 to the numeric variable C. This is how a programmer makes the computer play games.

Lines 125, 135: Notice how the REM statement is used to identify variables. This makes it easier to change or fix a program later.

VARIABLE LIST

T—Number of cards the computer has
 S—Number of cards the player has
 U—Number of cards computer has turned up
 V—Number of cards the player has turned up
 C—Computer's number (1-5)
 N—Player's number (1-5)
 P—Player's guess during a battle (1-2)
 R—Random number determining winner of a battle

8 FOR . . . NEXT

The Computer Repeats Itself

The FOR . . . NEXT statements allow you to tell the computer to repeat some lines in your program as many times as you want. In every FOR . . . NEXT loop, the FOR statement is the beginning point of the loop and the NEXT statement is always the last statement in the loop.

PROBLEMS

1. Fancy Counting
2. Blast Off
3. Pinball
4. Paper, Rock, Scissors
5. Ring the Bell

FANCY COUNTING

This program counts by fives. It is very similar to one in Chapter 3, but this one uses a new programming technique. Which program do you like better?

Can you change this program to count by 2's or by 10's?

SAMPLE RUN

THIS PROGRAM COUNTS BY FIVES - WATCH

5

10

15

20

25

30

35

40

45

50

HOW DID YOU LIKE THAT?

PROGRAM LISTING

```
100 PRINT "THIS PROGRAM COUNTS BY FIVES - WATCH"
110 FOR I=5 TO 50 STEP 5
120 PRINT I
130 NEXT I
140 PRINT "HOW DID YOU LIKE THAT?"
150 END
```

Note: Lines 110-130: This is called a FOR . . . NEXT loop. The computer executes lines 110, 120, and 130 and then goes back to 110 and starts over. Each time line 110 is executed, the variable I is increased by 5. When I is greater than 50 the computer skips around the loop and goes to line 140.

BLAST OFF

This program counts backward from 10 to 1 and then Blasts Off!
You can change the count-down sequence by changing line 30.

SAMPLE RUN

HELLO, I AM READY TO BLAST OFF
HERE IS THE COUNT DOWN

10
9
8
7
6
5
4
3
2
1
BLAST OFF

PROGRAM LISTING

```
10 PRINT "HELLO, I AM READY TO BLAST OFF"  
20 PRINT "HERE IS THE COUNT DOWN"  
30 FOR I=10 TO 1 STEP -1  
40 PRINT I  
50 NEXT I  
60 PRINT "BLAST OFF"  
70 END
```

Note: Line 30: The FOR . . . NEXT statement can also use a minus step like this one. Then the computer stops the loop when $I = 1$.

PINBALL

The computer can play Pinball too. The highest possible score in this game is 50; see how well you do. This game makes some noise if your terminal has a bell.

Try changing the characters (the letters or numbers) displayed during the game. You might use names or nouns instead of numbers.

Try changing the program so the player has to pay a quarter to play, and then keep track of the total amount of money the player spends.

SAMPLE RUN

TYPE A NUMBER TO START YOUR BALL OFF?4

♦♦TWO♦♦

♦♦FIVE♦♦

♦♦SIX♦♦

♦♦TWO♦♦

♦♦FIVE♦♦

♦♦THREE♦♦

♦♦SIX♦♦

♦♦FOUR♦♦

♦♦SIX♦♦

♦♦TWO♦♦

YOUR SCORE IS 41

YOUR TOTAL SCORE IS 41

PROGRAM LISTING

```
100 DIM A$(1)
105 T=0
110 PRINT "TYPE A NUMBER TO START YOUR BALL OFF";
115 INPUT A
120 S=0
125 FOR I=1 TO 10
130 R=INT(RND(1)*6+1)
135 S=S+R
140 IF R>1 THEN 155
145 PRINT TAB(R*10),CHR$(7),"♦♦ONE♦♦"
150 GOTO 220
155 IF R>2 THEN 170
160 PRINT TAB(R*10),CHR$(7),"♦♦TWO♦♦"
```

```

165 GOTO 220
170 IF R>3 THEN 185
175 PRINT TAB(R*10),CHR$(7),"◆◆THREE◆◆"
180 GOTO 220
185 IF R>4 THEN 200
190 PRINT TAB(R*10),CHR$(7),"◆◆FOUR◆◆"
195 GOTO 220
200 IF R>5 THEN 215
205 PRINT TAB(R*10),CHR$(7),"◆◆FIVE◆◆"
210 GOTO 220
215 PRINT TAB(R*10),CHR$(7),"◆◆SIX◆◆"
220 NEXT I
225 PRINT "YOUR SCORE IS",S
230 T=T+S
235 PRINT "YOUR TOTAL SCORE IS",T
240 PRINT "AGAIN";
245 INPUT A$
250 IF A$="Y" THEN 110
255 END

```

Note: Line 145: CHR\$(7) rings a bell on your terminal.

Line 150: You can use a GOTO statement to jump to the end of the loop.

Line 125, 220: Notice how many lines of code are included in this FOR . . . NEXT loop.

VARIABLE LIST

T—Total score

S—Game score

R—Points for each round

PAPER, ROCK, SCISSORS

You can play this game with your computer. Remember . . . rock breaks scissors, scissors cut paper and paper covers rock.

Try changing the program so the computer keeps score.

SAMPLE RUN

PLAY THE GAME - PAPER, ROCK, SCISSORS - WITH THE COMPUTER
MAKE YOUR CHOICE AND THEN TYPE IN
R FOR ROCK, S FOR SCISSORS, P FOR PAPER
TYPE X TO STOP

?R

YOU WIN ** COMPUTER HAD S

?S

COMPUTER WON ** COMPUTER HAD R

?S

WE MATCHED

?R

YOU WIN ** COMPUTER HAD S

?S

YOU WIN ** COMPUTER HAD P

?P

YOU WIN ** COMPUTER HAD R

?X

PROGRAM LISTING

```
100 DIM B$(4),A$(1)
105 LET B$ = "PSRX"
110 PRINT "PLAY THE GAME - PAPER, ROCK, SCISSORS - WITH
    THE COMPUTER"
115 PRINT "MAKE YOUR CHOICE AND THEN TYPE IN"
120 PRINT "R FOR ROCK, S FOR SCISSORS, P FOR PAPER"
125 PRINT "TYPE X TO STOP"
130 LET C = INT ( RND (1) * 3 + 1)
135 INPUT A$
140 REM **FIND OUT WHAT LETTER WAS TYPED IN
145 FOR I = 1 TO 4
150 IF A$ = MID$ (B$,I,1) THEN 170
155 NEXT I
160 PRINT "I NEED A R,S,P,X PLEASE"
165 GOTO 135
170 IF I = 4 THEN 250
```

```

175 REM **GOT A MATCH
180 IF C = I THEN 240
185 REM **GOT P,R OR R,P
190 IF C + I = 4 THEN 225
195 IF C > I THEN 210
200 PRINT "YOU WIN ** COMPUTER HAD "; MID$ (B$,C,1)
205 GOTO 130
210 PRINT "COMPUTER WON ** COMPUTER HAD "; MID$ (B$,C,1)
215 GOTO 130
220 REM **PLAY WON
225 IF C > I THEN 200
230 REM **COMPUTER WON
235 GOTO 210
240 PRINT "WE MATCHED"
245 GOTO 130
250 END

```

Note: Lines 145-155: These statements translate the input character into a number which the program can use.

Lines 160-165: This "error routine" is needed in case the input character is wrong.

VARIABLE LIST

C—Computer's choice

I—Player's choice in numeric

A\$—Character input by player

COMPUTER NOTES

HP-2000 BASIC

Replace line 150 with:

150 IF A\$=B\$(I,I) THEN 170

Replace line 200 with:

200 PRINT "YOU WIN ** COMPUTER
HAD "; B\$(C,C)

Replace line 210 with:

210 PRINT "COMPUTER WON ** COM-
PUTER HAD "; B\$(C,C)

Atari-BASIC

Replace line 150 with:

150 IF A\$ = B\$(I,I) THEN 170

Replace line 200 with:

200 PRINT "YOU WIN ** COMPUTER
HAD ", B\$(C,C)

Replace line 210 with:

210 PRINT "COMPUTER WON ** COM-
PUTER HAD "; B\$(C,C)

TI-BASIC

Replace line 150 with:

150 IF A\$ = SEG\$(B\$,I,1) THEN 170

Replace line 200 with:

200 PRINT "YOU WIN ** COMPUTER
HAD "; SEG\$(B\$,C,1)

Replace line 210 with:

210 PRINT "COMPUTER WON ** COM-
PUTER HAD "; SEG\$(B\$,C,1)

RING THE BELL

Now is your chance to see how strong you are. In this game you are trying to ring the bell by hitting the platform with a sledgehammer—all pretend of course! The computer tells you how well you do.

Try changing the game by adding carnival prizes after a certain number of points.

SAMPLE RUN

```
YOU ARE TRYING TO WIN THE STRONG MAN CONTEST AT THE
LOCAL CARNIVAL
YOU ARE GOING TO SWING THE SLEDGE HAMMER AND TRY TO
RING THE BELL
TO SWING, TYPE A LETTER FROM A-Z
THIS WILL COST YOU .25 - PUT YOUR QUARTER ON THE TERMINAL

NOW MAKE YOUR SWING?E
YOU CAN HARDLY PICK UP THE HAMMER, YOU SCORED 2
YOUR TOTAL SCORE IS                2
YOU HAVE SPENT $.25
THIS WILL COST YOU .25 - PUT YOUR QUARTER ON THE TERMINAL

NOW MAKE YOUR SWING?A
YOUR 90 YEAR OLD AUNT COULD HAVE SCORED 3
YOUR TOTAL SCORE IS                5
YOU HAVE SPENT $.5
THIS WILL COST YOU .25 - PUT YOUR QUARTER ON THE TERMINAL

NOW MAKE YOUR SWING?P
YOU MOVED THE WEIGHT UP TO 4
YOUR TOTAL SCORE IS                9
YOU HAVE SPENT $.75
```

PROGRAM LISTING

```
100 DIM A$(1),B$(8)
105 LET B$ = "BCPQUVJK"
110 PRINT "YOU ARE TRYING TO WIN THE STRONG MAN CONTEST
      AT THE LOCAL CARNIVAL"
115 PRINT "YOU ARE GOING TO SWING THE SLEDGE HAMMER AND
      TRY TO RING THE BELL"
```

```

120 PRINT "TO SWING, TYPE A LETTER FROM A-Z"
125 LET T = 0
130 LET B = 0
135 PRINT "THIS WILL COST YOU .25 - PUT YOUR QUARTER
ON THE TERMINAL"
136 PRINT
137 PRINT "NOW MAKE YOUR SWING";
140 INPUT A$
145 LET B = B + .25
150 REM **CHECK FOR INPUT EQUAL TO ONE OF CHARACTERS
IN B$
155 FOR I = 1 TO 8
160 IF A$ = MID$ (B$,I,1) THEN 175
165 NEXT I
170 GOTO 185
175 LET C = INT ((I + 1) / 2)
180 GOTO 190
185 LET C = 0
190 LET D = INT ( RND (1) * 6 + 1)
195 LET S = C + D
200 ON S GOTO 210,220,250,230,240,260,270
205 GOTO 280
210 PRINT "BETTER EAT YOUR WHEATIES, YOU ONLY SCORED 1"
215 GOTO 300
220 PRINT "YOU CAN HARDLY PICK UP THE HAMMER, YOU
SCORED 2"
225 GOTO 300
230 PRINT "YOU MOVED THE WEIGHT UP TO 4"
235 GOTO 300
240 PRINT "YOU SCORED A 5 - YOU MUST BE PRACTICING
245 GOTO 300
250 PRINT "YOUR 90 YEAR OLD AUNT COULD HAVE SCORED 3"
255 GOTO 300
260 PRINT "YOU MUST BE DOING YOUR PUSHUPS, YOU SCORED 6"
265 GOTO 300
270 PRINT "YOU ALMOST MADE IT - YOU SCORED A 7"
275 GOTO 300
280 PRINT CHR$ (7)
285 PRINT "CONGRATULATIONS!! YOU RANG THE BELL!!"
290 PRINT "YOU GET 8 POINTS!!"
300 LET T = T + S
305 PRINT "YOUR TOTAL SCORE IS ",T
310 PRINT "YOU HAVE SPENT $";B
325 GOTO 135
330 END

```

Note: Lines 155-180: If the letter entered by the player is one of the 8 letters stored in B\$, this routine adds a bonus to the player's score.

Line 200: This GOTO statement replaces 7 single GOTO's. It is very useful when a variable such as S can have many different values.

VARIABLE LIST

T—Player's total score

B—Amount player has spent

A\$—Input character

B\$—Contains a list of letters that add a bonus to the player's score

D—Random number (1-6)

C—Bonus point if player enters one of the letters in B\$

S—Player's score for this game

COMPUTER NOTES

HP-2000 BASIC

The multiple GOTO on line 200 has a different format on the HP-200. Replace line 200 with:

200 GOTO S OF 210, 220, 250, 230,
240, 260, 270

Replace line 160 with:

160 IF A\$=B\$(I, I) THEN 175

Atari BASIC

Replace line 160 with:

160 IF A\$=B\$(I,I) THEN 175

TI-BASIC

Replace line 160 with:

160 IF A\$=SEG\$(B\$,I,1) THEN 175

9 FANCY PRINTING (TAB)

Writing It Your Way


This function makes it easy for you to draw designs with the computer. It works like the tab key on a typewriter. It tells the computer to move a certain number of spaces across the line and then print. You can use numbers, variables or numeric expressions inside the ().

PROBLEMS

1. Rectangle
2. Design-a-Scarf
3. HIHO
4. Lifeguard
5. Shape
6. Party
7. Fleet
8. Award

You can use the computer to draw lots of shapes. This program draws a rectangle. Use different numbers for the height and width and see what your rectangle looks like.

SAMPLE RUN



```

100 PRINT "THIS PROGRAM DRAWS A RECTANGLE"
110 PRINT "TYPE IN HEIGHT, WIDTH"
120 INPUT H,W
130 FOR I=1 TO W
140 PRINT "-";
150 NEXT I
160 PRINT
170 FOR I=1 TO H-2
180 PRINT "◆";TAB(W-1);"◆"
190 NEXT I
200 FOR I=1 TO W
210 PRINT "-";
220 NEXT I
230 END

```

122 • BASIC FUN

Line 180: This TAB function tells the computer to print the next * in column (W-1).

VARIABLE LIST

H—Height of rectangle

W—Width of rectangle

COMPUTER NOTES

Atari BASIC Does not have the TAB function. Appendix A describes a method of converting these programs for the Atari.

DESIGN-A-SCARF

Use your own initials to design a scarf. You can find a nice design using this program. Notice that it is very similar to the one that made a rectangle.

Try using something besides your initials for the design.

What must you change if you want to use 4 characters in your design?

SAMPLE RUN

DESIGN A SCARF WITH YOUR INITIALS

INITIALS

?MAZ

I		MAZ	I
I			I
I		MAZ	I
I			I
I		MAZ	I
I			I
I		MAZ	I
I			I
I		MAZ	I
I			I
I	MAZ		I
I			I
I	MAZ		I
I			I
I		MAZ	I
I			I

DONE

PROGRAM LISTING

```
100 DIM I$(3)
110 PRINT "DESIGN A SCARF WITH YOUR INITIALS"
120 PRINT "INITIALS"
130 INPUT I$
140 LET H = 20
150 LET W = 30
```

```

160 FOR I = 1 TO H
170 PRINT "-";
180 NEXT I
190 PRINT
200 FOR I = 1 TO H - 2 STEP 2
210 PRINT "I";
220 LET R = INT ( RND (1) * (W - 6)) + 1
230 PRINT TAB( R);I$; TAB( W - 1);"I"
240 PRINT "I"; TAB( W - 1);"I"
250 NEXT I
260 FOR I = 1 TO W
270 PRINT "-";
280 NEXT I
290 END

```

VARIABLE LIST

I—Characters to use in design
 H—Height of scarf outline
 W—Width of scarf outline
 R—Column to print design

HIHO

The TAB function helps make interesting patterns like this one.
Can you write a program that prints WIN in the shape of a V?

SAMPLE RUN

WATCH WHAT I CAN MAKE

```

HI      HO
 HI     HO
  HI    HO
   HI   HO
    HI  HO
     HI HO
      HIHO
       HI
      HOHI
     HO  HI
    HO   HI
   HO    HI
  HO     HI
 HO      HI
HO       HI

```

PROGRAM LISTING

```

100 PRINT "WATCH WHAT I CAN MAKE"
110 PRINT
120 PRINT
130 FOR K=1 TO 9
140 PRINT TAB(K); "HI"; TAB(20-K); "HO"
150 NEXT K
160 PRINT TAB(10); "HI"
170 FOR K=11 TO 20
180 PRINT TAB(20-K); "HO"; TAB(K); "HI"
190 NEXT K
200 END

```

LIFEGUARD

You can have some fun with the TAB function too. In this game, you hear a swimmer calling for help and you try to throw him a life ring. If you hit him, you can save him—otherwise—it is Davy Jones's locker for him.

Change the program so it only gives you four tries to save the swimmer.

SAMPLE RUN

```
YOU MISSED, TRY AGAIN!  
WHERE YOU WANT IT TO LAND?5  
  0  HELP
```

```
YOU MISSED, TRY AGAIN!  
WHERE YOU WANT IT TO LAND?6  
HELP 0
```

```
YOU MISSED, TRY AGAIN!  
WHERE YOU WANT IT TO LAND?3  
  0  HELP
```

```
YOU MISSED, TRY AGAIN!  
WHERE YOU WANT IT TO LAND?5  
THANKS! YOU SAVED MY LIFE!
```

PROGRAM LISTING

```
100 PRINT "USE THIS PROGRAM TO HELP A DROWNING SWIMMER"  
110 PRINT "TO THROW THE LIFE RING, INPUT 1-10"  
120 PRINT "WHERE YOU WANT IT TO LAND";  
130 LET X=INT(RND(1)*10+1)  
140 INPUT S  
150 IF S=X THEN 230  
160 IF S>X THEN 190  
170 PRINT TAB(S);"0";TAB(X);"HELP"  
180 GOTO 200  
190 PRINT TAB(X);"HELP";TAB(S);"0"  
200 PRINT  
210 PRINT "YOU MISSED, TRY AGAIN!"  
220 GOTO 120  
230 PRINT "THANKS! YOU SAVED MY LIFE!"  
240 END
```

VARIABLE LIST

S—Column where life ring is thrown

X—Column where swimmer is located

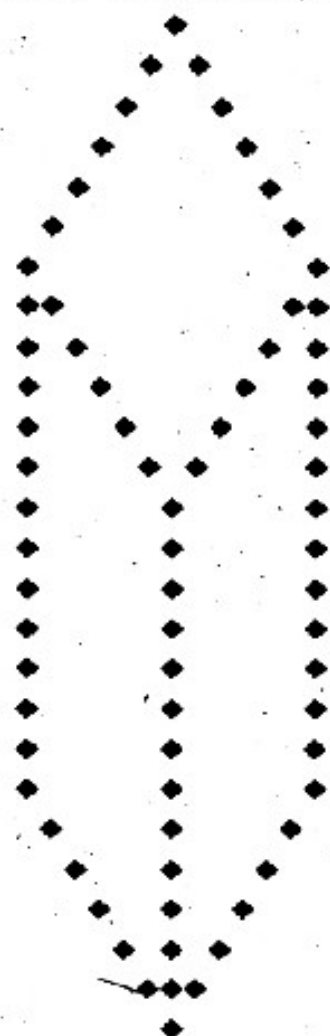
SHAPE

You can make 3-dimensional shapes like this one. The secret for success is to be very careful to count out each space.

Once you understand how this program works, modify it to make a shape of your own.

SAMPLE RUN

THIS PROGRAM PRINTS A VERY FAMILIAR SHAPE



PROGRAM LISTING

```
100 PRINT "THIS PROGRAM PRINTS A VERY FAMILIAR SHAPE"
110 PRINT TAB(15); "♦"
120 FOR S=1 TO 6
130 PRINT TAB(15-S); "♦"; TAB(15+S); "♦"
140 NEXT S
```

```

150 FOR T=5 TO 1 STEP -1
160 PRINT TAB(9);"♦";TAB(15-T);"♦";TAB(15+T);"♦";
    TAB(21);"♦"
170 NEXT T
180 FOR U=1 TO 8
190 PRINT TAB(9);"♦";TAB(15);"♦";TAB(21);"♦"
200 NEXT U
210 FOR V=5 TO 1 STEP -1
220 PRINT TAB(15-V);"♦";TAB(15);"♦";TAB(15+V);"♦"
230 NEXT V
240 PRINT TAB(15);"♦"
250 END

```

Note: Notice that each FOR . . . NEXT loop prints a different section of the cube.

PARTY

Use this program to print party invitations for your next party. This one asks for your name, date and time of the party and your address.

Try making an invitation of your own.

SAMPLE RUN

MAKE UP YOUR OWN PARTY INVITATIONS
YOUR NAME?BECKY
YOUR ADDRESS?4525 ELMWOOD DRIVE
DAY OF THE PARTY?MAY 30
TIME OF THE PARTY?1:00 P.M.
O.K. HERE IS YOUR INVITATION

PLEASE COME

TO MY

BIRTHDAY PARTY

DATE: MAY 30
TIME: 1:00 P.M.
PLACE: 4525 ELMWOOD DRIVE

BY BECKY

PROGRAM LISTING

```
100 DIM A$(25),B$(25),C$(25),D$(25)
110 PRINT "MAKE UP YOUR OWN PARTY INVITATIONS"
120 PRINT "YOUR NAME:"
130 INPUT D$
140 PRINT "YOUR ADDRESS:"
150 INPUT A$
```

```

160 PRINT "DAY OF THE PARTY";
170 INPUT BS
180 PRINT "TIME OF THE PARTY";
190 INPUT CS
200 PRINT "O.K. HERE IS YOUR INVITATION"
210 PRINT
211 PRINT
212 PRINT
220 PRINT TAB(15); "PLEASE COME"
221 PRINT
222 PRINT
230 PRINT TAB(18); "TO MY"
231 PRINT
232 PRINT
240 PRINT TAB(14); "BIRTHDAY PARTY"
241 PRINT
242 PRINT
243 PRINT
250 PRINT TAB(15); "DATE: "; BS
260 PRINT TAB(15); "TIME: "; CS
270 PRINT TAB(15); "PLACE: "; AS
280 PRINT
281 PRINT
282 PRINT
290 PRINT TAB(15); "BY "; DS
300 END

```

FLEET

Watch this fleet of rocket ships blast off from your video terminal.
Try adding your own ships to this fleet.

SAMPLE RUN

WATCH THIS FLEET OF ROCKET SHIPS BLAST OFF!

```
  ^
 I I
 I I
 I I
/___\
```

```
  ^
 I I
 I I
 I I
/___\
```

PROGRAM LISTING

```
100 PRINT "WATCH THIS FLEET OF ROCKET SHIPS BLAST OFF!"
105 PRINT
106 PRINT
107 PRINT
108 PRINT
109 PRINT
110 LET R=INT(RND(1)*20+2)
120 PRINT TAB(R);"^";TAB(R+15);"^"
125 FOR I=1 TO 3
130 PRINT TAB(R-1);"I I";TAB(R+14);"I I"
135 NEXT I
140 PRINT TAB(R-2);"/___\";TAB(R+13);"/___\"
150 FOR J=1 TO 15
160 FOR I=1 TO 100
170 NEXT I
180 PRINT
190 NEXT J
200 GOTO 110
210 END
```

Note: Lines 150-190: These statements make the fleet of ships blast off your video screen.

Lines 160-170: Slows the computer down so you can see what happens.

AWARD

Award yourself a certificate of excellence in horseback riding camp. We designed this one for a friend.

Once you have this program working, try making up some of your own.

You can use a similar program to print blank checks or club forms.

SAMPLE RUN

INPUT YOUR NAME?LYN LIPSCOMB

DEER CREEK HORSE CAMP

THIS CERTIFICATE IS
AWARDED TO

LYN LIPSCOMB
FOR SUCCESSFULLY COMPLETING A PROGRAM
IN HORSEMANSHIP AND RIDING INSTRUCTION AT
HORSE CAMP IN PALO ALTO, CALIFORNIA

PROGRAM LISTING

[illegible]

[illegible]

A\$—Name to use on the form

10 SUBSCRIPTS

Where to Store Your Information

You can store more than one number in a numeric variable by using subscripts. A subscripted variable is written $A(3)$, where A is the variable name and the number inside the $()$ is the subscript. The subscript determines which of the numbers stored in the variables to use. For example: if you have 3 numbers in A , then $A(1)$ is the first number, $A(2)$ is the second, etc. You can input, print, and do calculations with subscripted variables just as with other numeric variables.

PROBLEMS

1. Most Valuable Player
2. Bank Statement
3. Pascal's Triangle
4. Sea Battle

MOST VALUABLE PLAYER

Help your coach pick the most valuable player on your soccer team. You rate each of the best 6 players in 3 categories, and this program calculates a MVP score.

Can you fix this program so it can use more than 6 players?

Can you change the program to add another rating category?

SAMPLE RUN

THIS PROGRAM HELPS YOU FIND THE
MOST VALUABLE PLAYER ON YOUR SOCCER TEAM
RATE EACH OF THE 6 PLAYERS YOU THINK ARE THE BEST
ON THE FOLLOWING CATEGORIES 1 - 5 (5 BEST)

SOCCER SKILLS

ATTITUDE

ATHLETIC ABILITY

THE COMPUTER WILL CALCULATE A MVP SCORE

PLAYER 1?1,2,3

PLAYER 2?2,2,5

PLAYER 3?1,5,5

PLAYER 4?4,3,4

PLAYER 5?2,3,4

PLAYER 6?5,3,4

THE RATINGS ARE AS FOLLOWS

PLAYER	SKILL	ATTITUDE	ABILITY	MVP
1	1	2	3	11
2	2	2	5	18
3	1	5	5	18
4	4	3	4	23
5	2	3	4	17
6	5	3	4	26

PROGRAM LISTING

```
95 DIM S(6),A(6),G(6),T(6)
100 PRINT "THIS PROGRAM HELPS YOU FIND THE"
110 PRINT "MOST VALUABLE PLAYER ON YOUR SOCCER TEAM"
120 PRINT "RATE EACH OF THE 6 PLAYERS YOU THINK ARE"
    PRINT "THE BEST"
130 PRINT "ON THE FOLLOWING CATEGORIES 1 - 5 (5 BEST)"
```

```

140 PRINT TAB( 10), "SOCCER SKILLS"
150 PRINT TAB( 10), "ATTITUDE"
160 PRINT TAB( 10), "ATHLETIC ABILITY"
170 PRINT "THE COMPUTER WILL CALCULATE A MVP SCORE"
180 PRINT
190 FOR I = 1 TO 6
200 PRINT "PLAYER "; I;
210 INPUT S(I), A(I), G(I)
220 NEXT I
230 FOR I = 1 TO 6
240 T(I) = S(I) * 3 + A(I) + G(I) * 2
250 NEXT I
260 PRINT "THE RATINGS ARE AS FOLLOWS"
265 PRINT
270 PRINT "PLAYER SKILL ATTITUDE ABILITY MVP"
300 FOR I = 1 TO 6
310 PRINT "      "; I; "      "; S(I); "      "; A(I); "
      "; G(I); "      "; T(I)
320 NEXT I
350 END

```

Note: Line 95: The DIM statement is used for numeric variables too. It saves space for you to store more than one number under the same name. Then, you use subscripts to get to each number.

Line 210: The ratings for player 1 are put in S(1), A(1) and G(1). The ratings for player 2 are in S(2), etc.

Line 240: Another name for a subscripted variable is an array.

VARIABLE LIST

S—Soccer skills ratings
A—Attitude ratings
G—Athletic ability ratings
T—MVP score

COMPUTER NOTES

The spacing produced by the , (comma) and the ; (semicolon) varies with each version of BASIC. Therefore, this program may not

line up on your computer as shown in the sample output. Experiment with the spaces used in the print statements in order to fix it for your computer.

Atari BASIC Does not allow subscripted variables in an input statement. To convert, replace line 210 with:

```
205 INPUT X, Y, Z
```

```
206 LET S(I) = X
```

```
207 LET A(I) = Y
```

```
210 LET G(I) = Z
```

BANK STATEMENT

Now you can print your own bank statement. Use this program to show how your money increased (or decreased) during the last few months.

SAMPLE RUN

BANKER'S PROGRAM - PRINTS A BANK STATEMENT
INPUT BEGINNING BALANCE?100
INPUT TOTAL NUMBER OF DEPOSITS AND WITHDRAWALS?4
NOW INPUT EACH DEPOSIT OR WITHDRAWAL
WITHDRAWALS ARE (-)
AMOUNT1?200
AMOUNT2?300
AMOUNT3?-500
AMOUNT4?100

**** BANK STATEMENT ****

BEGINNING BALANCE \$100

#	AMOUNT	ACCOUNT BALANCE
1	200	300
2	300	600
3	-500	100
4	100	200

ENDING BALANCE \$200

PROGRAM LISTING

```
100 DIM T(15),D(14)
110 PRINT "BANKER'S PROGRAM - PRINTS A BANK STATEMENT"
120 PRINT "INPUT BEGINNING BALANCE";
130 INPUT A
140 PRINT "INPUT TOTAL NUMBER OF DEPOSITS AND
    WITHDRAWALS";
```

```

150 INPUT N
160 PRINT "NOW INPUT EACH DEPOSIT OR WITHDRAWAL"
170 PRINT "WITHDRAWALS ARE (-)"
180 FOR I = 1 TO N
190 PRINT "AMOUNT"; I;
200 INPUT D(I)
210 NEXT I
220 T(1) = A
230 FOR I = 1 TO N
240 T(I + 1) = T(I) + D(I)
250 NEXT I
260 PRINT
261 PRINT
270 PRINT TAB(9); "****    BANK STATEMENT    ****"
280 PRINT
281 PRINT
290 PRINT TAB(13); "BEGINNING BALANCE $"; A
300 PRINT
301 PRINT
310 PRINT "#", "AMOUNT", "ACCOUNT"
320 PRINT TAB(29); "BALANCE"
323 PRINT
330 FOR I = 1 TO N
340 PRINT I, D(I), T(I+1)
350 NEXT I
360 PRINT
361 PRINT
370 PRINT TAB(15); "ENDING BALANCE $"; T(N + 1)
380 END

```

Note: Line 240: Try playing computer, and do this calculation yourself. Why does the program store the result in T (I + 1)?

VARIABLE LIST

A—Beginning balance
D—Deposits/withdrawals
T—Running balance

COMPUTER NOTES

Atari-BASIC Replace line 200 with:
 200 Input X
 205 D(I) = X

PASCAL'S TRIANGLE

The numbers in this program have an interesting relationship. Can you figure out what it is? This is called Pascal's triangle, named after the mathematician who invented this interesting arrangement of numbers.

SAMPLE RUN

HERE IS PASCAL'S TRIANGLE

```

                                0
                              1 1
                             1 2 1
                            1 3 3 1
                           1 4 6 4 1
                          1 5 10 10 5 1
                         1 6 15 20 15 6 1
                        1 7 21 35 35 21 7 1
                       1 8 28 56 70 56 28 8 1
                      1 9 36 84 126 126 84 36 9 1
                     1 10 45 120 210 252 210 120 45 10 1
                    1 11 55 165 330 462 462 330 165 55 11 1
                   1 12 66 220 495 792 924 924 792 495 220 66 12 1
                  1 13 78 286 715 1287 1716 1716 1287 715 286 78 13 1
                 1 14 91 378 1001 2002 2709 2709 2002 1001 378 91 14 1
                1 15 105 495 1365 2730 3771 3771 2730 1365 495 105 15 1
               1 16 120 630 1848 3771 5005 5005 3771 1848 630 120 16 1
              1 17 136 780 2431 5005 7429 7429 5005 2431 780 136 17 1
             1 18 153 954 3060 6435 9009 9009 6435 3060 954 153 18 1
            1 19 171 1140 3876 8568 12870 12870 8568 3876 1140 171 19 1
           1 20 190 1360 5100 11628 19449 19449 11628 5100 1360 190 20 1
          1 21 210 1530 6188 14560 24310 24310 14560 6188 1530 210 21 1
         1 22 231 1716 7140 17710 31927 31927 17710 7140 1716 231 22 1
        1 24 252 1920 8008 20349 37338 37338 20349 8008 1920 252 24 1
       1 26 273 2184 9009 23034 41664 41664 23034 9009 2184 273 26 1
      1 28 296 2478 10095 26130 46868 46868 26130 10095 2478 296 28 1
     1 30 320 2796 11440 29820 53130 53130 29820 11440 2796 320 30 1
    1 32 345 3136 12650 33642 59128 59128 33642 12650 3136 345 32 1
   1 34 371 3512 13800 36798 65800 65800 36798 13800 3512 371 34 1
  1 36 399 3916 14940 39891 70543 70543 39891 14940 3916 399 36 1
 1 38 429 4348 16170 42427 73833 73833 42427 16170 4348 429 38 1
1 40 460 4806 17520 45150 77942 77942 45150 17520 4806 460 40 1
1 42 492 5292 18980 48620 81900 81900 48620 18980 5292 492 42 1
1 44 526 5812 20568 51480 85980 85980 51480 20568 5812 526 44 1
1 46 561 6368 22296 54776 90090 90090 54776 22296 6368 561 46 1
1 48 598 6960 24168 59871 94370 94370 59871 24168 6960 598 48 1
1 50 637 7590 26180 65800 98880 98880 65800 26180 7590 637 50 1
1 52 678 8256 28344 70543 103680 103680 70543 28344 8256 678 52 1
1 54 721 8960 30660 75814 108780 108780 75814 30660 8960 721 54 1
1 56 766 9704 33136 81726 114186 114186 81726 33136 9704 766 56 1
1 58 813 10488 35770 88360 120960 120960 88360 35770 10488 813 58 1
1 60 861 11312 38576 95766 128130 128130 95766 38576 11312 861 60 1
1 62 911 12176 41552 103968 136384 136384 103968 41552 12176 911 62 1
1 64 962 13080 44704 113136 145728 145728 113136 44704 13080 962 64 1
1 66 1015 14024 48032 123408 156240 156240 123408 48032 14024 1015 66 1
1 68 1069 15008 51544 134736 168000 168000 134736 51544 15008 1069 68 1
1 70 1125 16032 55240 147240 180960 180960 147240 55240 16032 1125 70 1
1 72 1182 17096 59120 161160 195120 195120 161160 59120 17096 1182 72 1
1 74 1241 18200 63184 176496 210560 210560 176496 63184 18200 1241 74 1
1 76 1301 19344 67432 193280 227280 227280 193280 67432 19344 1301 76 1
1 78 1363 20528 71872 212544 245280 245280 212544 71872 20528 1363 78 1
1 80 1427 21752 76504 229344 264480 264480 229344 76504 21752 1427 80 1
1 82 1493 23016 81328 248640 285120 285120 248640 81328 23016 1493 82 1
1 84 1561 24320 86352 269600 307200 307200 269600 86352 24320 1561 84 1
1 86 1631 25664 91584 292320 330720 330720 292320 91584 25664 1631 86 1
1 88 1703 27048 97024 316800 355680 355680 316800 97024 27048 1703 88 1
1 90 1777 28472 102672 343104 382080 382080 343104 102672 28472 1777 90 1
1 92 1853 29936 108536 371200 409920 409920 371200 108536 29936 1853 92 1
1 94 1931 31440 114616 401920 439200 439200 401920 114616 31440 1931 94 1
1 96 2011 32984 120928 426240 470880 470880 426240 120928 32984 2011 96 1
1 98 2093 34568 127472 453280 503920 503920 453280 127472 34568 2093 98 1
1 100 2177 36192 134256 481920 538400 538400 481920 134256 36192 2177 100 1
1 102 2263 37856 141280 512160 574400 574400 512160 141280 37856 2263 102 1
1 104 2351 39560 148544 544000 611840 611840 544000 148544 39560 2351 104 1
1 106 2441 41304 156048 577600 651680 651680 577600 156048 41304 2441 106 1
1 108 2533 43088 163792 612800 693920 693920 612800 163792 43088 2533 108 1
1 110 2627 44912 171776 649600 738400 738400 649600 171776 44912 2627 110 1
1 112 2723 46776 179992 688000 785120 785120 688000 179992 46776 2723 112 1
1 114 2821 48680 188432 728000 834240 834240 728000 188432 48680 2821 114 1
1 116 2921 50624 197096 769600 885760 885760 769600 197096 50624 2921 116 1
1 118 3023 52608 205984 812800 939840 939840 812800 205984 52608 3023 118 1
1 120 3127 54632 215096 858400 996480 996480 858400 215096 54632 3127 120 1
1 122 3233 56696 224432 905600 1055680 1055680 905600 224432 56696 3233 122 1
1 124 3341 58800 233992 955360 1117600 1117600 955360 233992 58800 3341 124 1
1 126 3451 60944 243776 1007680 1182240 1182240 1007680 243776 60944 3451 126 1
1 128 3563 63128 253784 1062720 1249600 1249600 1062720 253784 63128 3563 128 1
1 130 3677 65352 263912 1120480 1319040 1319040 1120480 263912 65352 3677 130 1
1 132 3793 67616 274256 1180960 1390560 1390560 1180960 274256 67616 3793 132 1
1 134 3911 69920 284816 1244160 1464160 1464160 1244160 284816 69920 3911 134 1
1 136 4031 72264 295592 1309920 1540800 1540800 1309920 295592 72264 4031 136 1
1 138 4153 74648 306592 1378240 1620480 1620480 1378240 306592 74648 4153 138 1
1 140 4277 77072 317816 1449120 1704000 1704000 1449120 317816 77072 4277 140 1
1 142 4403 79536 329264 1522560 1790400 1790400 1522560 329264 79536 4403 142 1
1 144 4531 82040 340936 1599600 1879680 1879680 1599600 340936 82040 4531 144 1
1 146 4661 84584 352832 1679360 1971840 1971840 1679360 352832 84584 4661 146 1
1 148 4793 87168 364952 1761600 2066880 2066880 1761600 364952 87168 4793 148 1
1 150 4927 89792 377296 1846400 2164800 2164800 1846400 377296 89792 4927 150 1
1 152 5063 92456 389856 1933760 2265600 2265600 1933760 389856 92456 5063 152 1
1 154 5201 95160 402632 2023840 2369280 2369280 2023840 402632 95160 5201 154 1
1 156 5341 97904 415632 2116640 2475840 2475840 2116640 415632 97904 5341 156 1
1 158 5483 100688 428856 2212160 2585280 2585280 2212160 428856 100688 5483 158 1
1 160 5627 103512 442296 2309440 2697600 2697600 2309440 442296 103512 5627 160 1
1 162 5773 106376 455952 2408480 2812800 2812800 2408480 455952 106376 5773 162 1
1 164 5921 109280 469824 2509280 2930880 2930880 2509280 469824 109280 5921 164 1
1 166 6071 112224 483912 2611840 3051840 3051840 2611840 483912 112224 6071 166 1
1 168 6223 115208 498224 2716160 3175840 3175840 2716160 498224 115208 6223 168 1
1 170 6377 118232 512752 2822240 3302880 3302880 2822240 512752 118232 6377 170 1
1 172 6533 121296 527496 2930080 3432960 3432960 2930080 527496 121296 6533 172 1
1 174 6691 124400 542456 3039600 3566080 3566080 3039600 542456 124400 6691 174 1
1 176 6851 127544 557632 3150880 3702240 3702240 3150880 557632 127544 6851 176 1
1 178 7013 130728 572928 3263680 3841440 3841440 3263680 572928 130728 7013 178 1
1 180 7177 133952 588344 3378080 3983680 3983680 3378080 588344 133952 7177 180 1
1 182 7343 137216 603880 3494080 4128960 4128960 3494080 603880 137216 7343 182 1
1 184 7511 140520 619536 3611600 4277280 4277280 3611600 619536 140520 7511 184 1
1 186 7681 143864 635312 3730640 4428640 4428640 3730640 635312 143864 7681 186 1
1 188 7853 147248 651216 3851040 4582080 4582080 3851040 651216 147248 7853 188 1
1 190 8027 150672 667248 3972880 4738560 4738560 3972880 667248 150672 8027 190 1
1 192 8203 154136 683408 4096160 4898080 4898080 4096160 683408 154136 8203 192 1
1 194 8381 157640 699696 4220800 5060640 5060640 4220800 699696 157640 8381 194 1
1 196 8561 161184 716112 4346800 5226240 5226240 4346800 716112 161184 8561 196 1
1 198 8743 164768 732752 4474080 5394880 5394880 4474080 732752 164768 8743 198 1
1 200 8927 168392 749512 4602560 5566560 5566560 4602560 749512 168392 8927 200 1
1 202 9113 172056 766392 4732240 5741280 5741280 4732240 766392 172056 9113 202 1
1 204 9301 175760 783496 4863120 5919040 5919040 4863120 783496 175760 9301 204 1
1 206 9491 179504 800728 4995200 6099840 6099840 4995200 800728 179504 9491 206 1
1 208 9683 183288 818088 5128480 6283680 6283680 5128480 818088 183288 9683 208 1
1 210 9877 187112 835568 5262880 6470560 6470560 5262880 835568 187112 9877 210 1
1 212 10073 190976 853168 5398400 6660480 6660480 5398400 853168 190976 10073 212 1
1 214 10271 194880 870896 5535040 6853440 6853440 5535040 870896 194880 10271 214 1
1 216 10471 198824 888752 5672720 7049520 7049520 5672720 888752 198824 10471 216 1
1 218 10673 202808 906736 5811440 7248640 7248640 5811440 906736 202808 10673 218 1
1 220 10877 206832 924848 5951280 7451840 7451840 5951280 924848 206832 10877 220 1
1 222 11083 210896 943088 6092240 7658080 7658080 6092240 943088 210896 11083 222 1
1 224 11291 214992 961456 6234400 7867360 7867360 6234400 961456 214992 11291 224 1
1 226 11501 219128 979952 6377600 8080640 8080640 6377600 979952 219128 11501 226 1
1 228 11713 223304 998576 6522800 8297040 8297040 6522800 998576 223304 11713 228 1
1 230 11927 227520 1017328 6669920 8516480 8516480 6669920 1017328 227520 11927 230 1
1 232 12143 231776 1036208 6818880 8739040 8739040 6818880 1036208 231776 12143 232 1
1 234 12361 236072 1055216 6969520 8963680 8963680 6969520 1055216 236072 12361 234 1
1 236 12581 240408 1074352 7121840 9190400 9190400 7121840 1074352 240408 12581 236 1
1 238 12803 244784 1093616 7275680 9419200 9419200 7275680 1093616 244784 12803 238 1
1 240 13027 249200 1113008 7430960 9650080 9650080 7430960 1113008 249200 13027 240 1
1 242 13253 253656 1132528 7588480 9883040 9883040 7588480 1132528 253656 13253 242 1
1 244 13481 258152 1152168 7747200 10118080 10118080 7747200 1152168 258152 13481 244 1
1 246 13711 262688 1171928 7907040 10355200 10355200 7907040 1171928 262688 13711 246 1
1 248 13943 267264 1191808 8068000 10594400 10594400 8068000 1191808 267264 13943 248 1
1 250 14177 271880 1211808 8230080 10835680 10835680 8230080 1211808 271880 14177 250 1
1 252 14413 276536 1231928 8393280 11079040 11079040 8393280 1231928 276536 14413 252 1
1 254 14651 281232 1252160 8557600 11324480 11324480 8557600 1252160 281232 14651 254 1
1 256 14891 285968 1272512 8723040 11571920 11571920 8723040 1272512 285968 14891 256 1
1 258 15133 290744 1292984 8889520 11821440 11821440 8889520 1292984 290744 15133 258 1
1 260 15377 295560 1313576 9057040 12073040 12073040 9057040 1313576 295560 15377 260 1
1 262 15623 300416 1334288 9225600 12326720 12326720 9225600 1334288 300416 15623 262 1
1 264 15871 305312 1355120 9395200 12582560 12582560 9395200 1355120 305312 15871 264 1
1 266 16121 310248 1376072 9565840 12840480 12840480 9565840 1376072 310248 16121 266 1
1 268 16373 315224 1397144 9737440 13099520 13099520 9737440 1397144 315224 16373 268 1
1 270 16627 320240 1418336 9909920 13359680 13359680 9909920 1418336 320240 16627 270 1
1 272 16883 325296 1439648 10083200 13621920 13621920 10083200 1439648 325296 16883 272 1
1 274 17141 330392 1461080 10257280 13886240 13886240 10257280 1461080 330392 17141 274 1
1 276 17401 335528 1482632 10432000 14152640 14152640 10432000 1482632 335528 17401 276 1
1 278 17663 340704 1504296 10607360 14420080 14420080 10607360 1504296 340704 17663 278 1
1 280 17927 345920 1526072 10783360 14688560 14688560 10783360 1526072 345920 17927 280 1
1 282 18193 351176 1547960 10959920 14958080 14958080 10959920 1547960 351176 18193 282 1
1 284 18461 356472 1569968 11137040 15228640 15228640 11137040 1569968 356472 18461 284 1
1 286 18731 361808 1592096 11314720 15499200 15499200 11314720 1592096 361808 18731 286 1
1 288 19003 367184 1614344 11492960 15770720 15770720 11492960 1614344 367184 19003 288 1
1 290 19277 372600 1636712 11671680 16043200 16043200 11671680 1636712 372600 19277 290 1
1 292 19553 378056 1659192 11850880 16316640 16316640 11850880 1659192 378056 19553 292 1
1 294 19831 383552 1681784 12030400 16591040 16591040 12030400 1681784 383552 19831 294 1
1 296 20111 389088 1704488 12210240 16866400 16866400 12210240 1704488 389088 20111 296 1
1 298 20393 394664 1727296 12390400 17142720 17142720 12390400 1727296 394664 20393 298 1
1 300 20677 400280 1750208 12570880 17419920 17419920 12570880 1750208 400280 20677 300 1
1 302 20963 405936 1773232 12751680 17697920 17697920 12751680 1773232 405936 20963 302 1
1 304 21251 411632 1796368 12932800 17976720 17976720 12932800 1796368 411632 21251 304 1
1 306 21541 417368 1819512 13114080 18256240 18256240 13114080
```

Note: Line 190: This statement calculates each row of numbers. Notice that you can add together numbers in the same array.
Line 110: The array E has 2 subscripts. This is called a 2 dimensional array. A 2 dimensional array has rows and columns. In this case, the array E has 10 rows and 10 columns.

VARIABLE LIST

E—Contains the numbers for Pascal's Triangle

N—Number of rows to print

SEA BATTLE

In this program you and the computer play the Sea Battle game. Deploy your ships on a 4 x 4 grid with each ship occupying one square, and the computer will do the same. Then fire away!

If this gets too tame for you, see if you can change the program to increase the size of the grid or the number of ships.

SAMPLE RUN

BATTLESHIP

WOULD YOU LIKE INSTRUCTIONS(Y/N)?Y
YOU HAVE A FLEET OF 6 SHIPS. EACH SHIP IS NUMBERED 1,
2, OR 3(2 OF EACH NUMBER). USING A 4 X 4 GRID
YOU AND THE COMPUTER FIRE TORPEDOES AT EACH OTHER.
WHEN YOU ARE ASKED, INPUT YOUR SHOT(SUCH AS 2,3
STAYING WITHIN 4). WHEN THE COMPUTER SHOOT, IF
IT HITS A SHIP, INPUT WHICH SHIP IT HIT. WHEN THE COMPUTER
MISSES, INPUT A 4. THE FIRST ONE TO DESTROY THEIR OPPONENT'S
FLEET, WINS. GOOD LUCK!!!

SHOOTING AT 2 , 1

?4

I HAVE A SCORE OF 0

NOW YOU TRY - INPUT YOUR SHOT?2,3

YOU MISSED

SHOOTING AT 1 , 3

?4

I HAVE A SCORE OF 0

NOW YOU TRY - INPUT YOUR SHOT?1,1

◆ ◆ ◆ ◆ B O O M ◆ ◆ ◆ ◆

YOU HIT A 3

YOUR SCORE IS 3

SHOOTING AT 2 , 2

?3

◆ ◆ ◆ ◆ B A N G ◆ ◆ ◆ ◆

I HAVE A SCORE OF 3

NOW YOU TRY - INPUT YOUR SHOT?2,2

YOU MISSED

SHOOTING AT 3 , 1

74

I HAVE A SCORE OF 3
NOW YOU TRY - INPUT YOUR SHOT?3,3

♦ ♦ ♦ ♦ B O O M ♦ ♦ ♦ ♦
YOU HIT A 1
YOUR SCORE IS 4

PROGRAM LISTING

```
100 DIM US[1]
105 REM♦♦THIS PROGRAM SIMULATES A GAME OF BATTLESHIP♦♦
110 PRINT TAB(27)"BATTLESHIP"
115 PRINT
120 PRINT
125 PRINT
130 PRINT "WOULD YOU LIKE INSTRUCTIONS(Y/N)";
135 INPUT US
140 IF US="N" THEN 205
145 PRINT "YOU HAVE A FLEET OF 6 SHIPS. EACH SHIP IS
    NUMBERED 1,"
150 PRINT "2, OR 3(2 OF EACH NUMBER). USING A 4 X 4 GRID"
155 PRINT "YOU AND THE COMPUTER FIRE TORPEDOES AT EACH
    OTHER."
160 PRINT "WHEN YOU ARE ASKED, INPUT YOUR SHOT(SUCH AS
    2,3"
165 PRINT "STAYING WITHIN 4). WHEN THE COMPUTER SHOOT,
    IF"
170 PRINT "IT HITS A SHIP, INPUT WHICH SHIP IT HIT.
    WHEN THE COMPUTER"
175 PRINT "MISSES, INPUT A 4. THE FIRST ONE TO DESTROY
    THEIR OPPONENT'S"
180 PRINT "FLEET, WINS. GOOD LUCK!!!"
185 PRINT
190 PRINT
195 PRINT
200 REM♦♦SET SIZE OF GRID♦♦
205 DIM C[4,4],P[4,4]
210 DIM T[2]
215 REM♦♦SET ARRAYS TO ZERO♦♦
220 FOR I=1 TO 4
225 FOR J=1 TO 4
230 C[I,J]=0
235 P[I,J]=0
240 NEXT J
245 NEXT I
250 T[1]=0
255 T[2]=0
```

```

260 REM♦♦SET L TO SIZE OF GRID♦♦
265 L=4
270 M=0
275 REM♦♦SET UP COMPUTER'S SHIPS ON L X L GRID♦♦
280 FOR J=1 TO 2
285 FOR I=1 TO 3
290 R=INT(RND(1)*L)+1
295 S=INT(RND(1)*L)+1
300 C[R,S]=I
305 NEXT I
310 NEXT J
315 REM♦♦GET COMPUTER'S TARGET♦♦
320 M=M+1
325 IF M>L*L THEN 465
330 R=INT(RND(1)*L)+1
335 S=INT(RND(1)*L)+1
340 IF P[R,S]>0 THEN 330
345 PRINT "SHOOTING AT ";S,"";R
350 INPUT H
355 P[R,S]=H
360 IF H=4 THEN 380
365 PRINT "♦ ♦ ♦ ♦ ♦ B A N G ♦ ♦ ♦ ♦ ♦"
370 T[1]=T[1]+H
375 IF T[1]>11 THEN 465
380 PRINT "I HAVE A SCORE OF ";T[1]
385 PRINT "NOW YOU TRY - INPUT YOUR SHOT";
390 INPUT R,S
395 IF C[R,S]=5 THEN 415
400 IF C[R,S]>0 THEN 425
405 PRINT "YOU MISSED"
410 GOTO 320
415 PRINT "SPLASH! YOU ALREADY SHOT THERE!!!"
420 GOTO 320
425 PRINT CHR$(7)
430 PRINT "♦ ♦ ♦ ♦ ♦ B O O M ♦ ♦ ♦ ♦ ♦"
435 PRINT "YOU HIT A ";C[R,S]
440 T[2]=T[2]+C[R,S]
445 PRINT "YOUR SCORE IS ";T[2]
450 C[R,S]=5
455 IF T[2]>11 THEN 465
460 GOTO 320
465 PRINT TAB(23)"GAME OVER"
470 IF T[2]>T[1] THEN 485
475 PRINT "!!!COMPUTER WINS!!!"
480 GOTO 490
485 PRINT "!!!YOU WIN!!!"
490 PRINT

```

```

495 PRINT
500 PRINT
505 PRINT "WANT A NEW FLEET AND A NEW GAME (Y/N) ";
510 INPUT US
515 IF US="Y" THEN 115
520 PRINT
525 PRINT "BETTER LUCK NEXT TIME!"
530 PRINT
535 END

```

Note: Line 130: When the instructions to a game are long, this statement gives the player the option of skipping the instructions.

Line 205: C and P are called 2 dimensional arrays. These arrays look like the grid you use to play this game. Each number occupies one cell in the grid.

Line 355: Each time the computer shoots, the result of the shot is put in the player's array. This keeps the computer from shooting at the same place twice.

VARIABLE LIST

C—Computer's ships on the 4 x 4 grid

P—Player's ships on the 4 x 4 grid

T—Score for each side

11 SUBROUTINES

How the Pros Do It

Subroutines are small programs that a larger program uses over and over. Instead of including them every time you need them, they only appear once near the end of a program. A GOSUB statement in the large program tells the computer to leave that program and go to the subroutine. When the subroutine is finished, a RETURN statement tells the computer to go back to where it came from in the main program.

PROBLEMS

1. Birthday
2. Math Quiz
3. Tennis

BIRTHDAY

How many days before your birthday? How many days between now and Christmas? This program can tell you. It converts each date into a Julian date and then calculates the difference. The Julian date is the number of days since some predetermined date, and in this program, that date is 1960. Notice that the program has to add extra days for leap years.

SAMPLE RUN

USE THIS PROGRAM TO FIND OUT HOW MANY DAYS UNTIL YOUR BIRTHDAY

INPUT TODAY'S DATE AS FOLLOWS

YEAR?1981

MONTH(1-12)?11

DAY?4

INPUT DATE OF YOUR NEXT BIRTHDAY

YEAR?1982

MONTH(1-12)?4

DAY?1

THERE ARE 147 DAYS UNTIL YOUR BIRTHDAY AGAIN

?Y

INPUT DATE OF YOUR NEXT BIRTHDAY

YEAR?1981

MONTH(1-12)?11

DAY?30

THERE ARE 26 DAYS UNTIL YOUR BIRTHDAY AGAIN

?N

PROGRAM LISTING

```
100 DIM A$(1),D(12)
105 PRINT "USE THIS PROGRAM TO FIND OUT HOW MANY DAYS
      UNTIL YOUR BIRTHDAY"
110 PRINT "INPUT TODAY'S DATE AS FOLLOWS"
115 GOSUB 195
120 GOSUB 270
125 REM NOW FIND OUT HOW MANY DAYS SINCE 1960
130 GOSUB 310
135 C=T
```

```

140 PRINT "INPUT DATE OF YOUR NEXT BIRTHDAY"
145 GOSUB 270
150 GOSUB 310
155 N=T-C
160 PRINT "THERE ARE ";N;" DAYS UNTIL YOUR BIRTHDAY"
165 PRINT "AGAIN"
170 INPUT AS
175 IF AS="Y" THEN 140
180 GOTO 360
185 REM♦♦ SUBROUTINE
190 REM♦♦ SETS D=TO NUMBER OF DAYS IN EACH MONTH
195 LET D[1]=31
200 LET D[2]=28
205 LET D[3]=31
210 LET D[4]=30
215 LET D[5]=31
220 LET D[6]=30
225 LET D[7]=31
230 LET D[8]=31
235 LET D[9]=30
240 LET D[10]=31
245 LET D[11]=30
250 LET D[12]=31
255 RETURN
260 REM♦♦ SUBROUTINE
265 REM♦♦ INPUTS YEAR MONTH AND DAY
270 PRINT "YEAR";
275 INPUT Y
280 PRINT "MONTH(1-12)";
285 INPUT M
290 PRINT "DAY";
295 INPUT A
300 RETURN
305 REM♦♦ SUBROUTINE
310 REM♦♦ CALCULATES NUMBER OF DAYS SINCE 1960
315 T=Y-1960
320 L=INT(T/4)
325 T=(T-L)*365+L*366
330 FOR I=1 TO M-1
335 T=T+D[I]
340 NEXT I
345 REM♦♦ ADD IN DAYS OF THIS MONTH
350 T=T+A
355 RETURN
360 END

```

Note: Line 115: This GOSUB statement tells the computer to execute statement number 195 next.

Line 255: The RETURN statement tells the computer to go back and execute the line after the GOSUB statement. Subroutines are useful when you want to do the same calculation with different numbers.

Lines 315-320: This statement figures out how many leap years since 1960.

Lines 330-340: Add in all the days of each month of the current year.

Lines 195-250: Since the number of days in each month won't change, it is easier to put these values into the program. Otherwise, you would have to input them every time.

VARIABLE LIST

D—Array containing the number of days for each month in the year

Y—Year

M—Month

A—Day

T—Number of days since 1960 for today's date

C—Number of days since 1960 for next birthday

N—Number of days between T and C

L—Number of leap years since 1960

MATH QUIZ

Here is a chance to test your math skills on the computer. You can do addition, subtraction, multiplication and division. The computer gives you the problem, and you input the answer.

Can you change this program so it keeps track of the number of correct answers?

SAMPLE RUN

```
INPUT MATH OPERATION YOU WANT TO TRY
+ ADDITION
- SUBTRACTION
* MULTIPLICATION
/ DIVISION
X STOP
TO CHANGE OPERATIONS TYPE -1 AS A ANSWER
INPUT OPERATION SYMBOL?+
INPUT LIMITS OF YOUR NUMBERS?1,10
INPUT NUMBER OF INCORRECT RESPONSES?2
5 + 3 =?8
YOU ARE RIGHT!
5 + 2 =?6
SORRY . . . TRY AGAIN?5
THAT IS 2 TRIES
THE CORRECT ANSWER IS 7
4 + 1 =?-1
INPUT OPERATION SYMBOL?-
INPUT LIMITS OF YOUR NUMBERS?1,10
INPUT NUMBER OF INCORRECT RESPONSES?2
6 - 1 =?5
YOU ARE RIGHT!
3 - 1 =?2
YOU ARE RIGHT!
7 - 5 =?-1
INPUT OPERATION SYMBOL?X
```

PROGRAM LISTING

```
100 DIM O$(10),A$(1)
105 LET O$="+-* /X"
110 PRINT "INPUT MATH OPERATION YOU WANT TO TRY"
115 PRINT "+ ADDITION"
120 PRINT "- SUBTRACTION"
```

```

125 PRINT "* MULTIPLICATION"
130 PRINT "/ DIVISION"
135 PRINT "X STOP"
140 PRINT "TO CHANGE OPERATIONS TYPE -1 AS AN ANSWER"
145 PRINT "INPUT OPERATION SYMBOL ";
150 INPUT A$
155 REM ***FIND OUT WHAT OPERATION NUMBER
160 GOSUB 505
165 PRINT "INPUT LIMITS OF YOUR NUMBERS(L,H) "
170 INPUT J,K
175 PRINT "INPUT NUMBER OF INCORRECT RESPONSES";
180 INPUT T
185 REM ***GET 2 RANDOM NUMBERS M AND N
190 GOSUB 370
195 I=0
200 ON A GOTO 210,245,285,325
205 REM ***ADDITION***
210 L=M+N
215 PRINT M; " + " ; N ; " = ";
220 INPUT P
225 IF P<0 THEN 145
230 IF P=L THEN 435
235 GOSUB 455
240 GOTO 220
245 REM ** SUBT
250 L=M-N
255 PRINT M; " - "; N; " = ";
260 INPUT P
265 IF P<0 THEN 145
270 IF P=L THEN 435
275 GOSUB 455
280 GOTO 260
285 REM ** MULT
290 L=M*N
295 PRINT M; " * "; N; " = ";
300 INPUT P
305 IF P<0 THEN 145
310 IF P=L THEN 435
315 GOSUB 455
320 GOTO 300
325 REM ** DIV
330 L=M/N
335 PRINT M; " / "; N; " = ";
340 INPUT P
341 IF E>=T THEN 305
342 PRINT
343 IF W=6 THEN 250
345 IF P<0 THEN 145
350 IF P=L THEN 435

```

```

355 GOSUB 455
360 GOTO 300
365 REM ***SUBROUTINE
370 REM ***FINDS 2 RANDOM NUMBERS WITHIN
    THE LIMITS OF J & K
375 M=INT(RND(1)*K+1)
380 IF M<J THEN 375
385 N=INT(RND(1)*K+1)
390 IF N<J THEN 385
395 IF A=1 THEN 425
400 IF A=3 THEN 425
405 IF M<=N THEN 375
415 IF INT(M/N)*N=(M/N)*N THEN 425
420 GOTO 375
425 RETURN
430 REM ***SUBROUTINE
435 REM ***PRINTS IF THE RESPONSE IS CORRECT
440 PRINT "YOU ARE RIGHT!"
445 GOTO 190
450 REM ***SUBROUTINE
455 REM ***PRINTS IF THE RESPONSE WAS WRONG
460 I=I+1
465 IF I>=T THEN 480
470 PRINT "SORRY . . . TRY AGAIN";
475 RETURN
480 PRINT "THAT IS ";I;" TRIES"
485 PRINT "THE CORRECT ANSWER IS ";L
490 GOTO 190
495 REM ***SUBROUTINE
500 REM ***GETS THE OPERATION NUMBER FROM A$
505 FOR A=1 TO 5
510 IF A$=MID$(O$,A,1) THEN 530
515 NEXT A
520 PRINT "TYPE +,-,*, OR /"
525 GOTO 145
530 IF A=5 THEN 540
535 RETURN
540 END

```

Note: Line 365: It is smart to set your subroutines off with REM statements. Then you can find them quickly if you are changing your program.

Lines 415-420: These statements force the result of M/N to be a whole number.

VARIABLE LIST

A\$ —Math operation code
J —Lower limit of numbers
K —Upper limit of numbers
T —Number of incorrect responses
I —Number of responses
A —Operation number
M,N —Numbers used in calculation
L —Result of calculation
P —User's response

COMPUTER NOTES

Atari-BASIC	Replace line 510 with: 510 IF A\$ = O\$(A,A) THEN 530
HP-2000 BASIC	Replace line 510 with: 510 IF A\$ = O\$(A,A) THEN 530
TI-BASIC	Replace line 510 with: 510 IF A\$ = SEG\$(O\$,A,1) THEN 530

TENNIS

Try playing tennis with the computer. Each time the ball is hit to you, type in a number from 1 to 4. Watch out! the computer has been taking lessons.

Try changing the program to keep track of the set score.

Can you add other shots to the game or change it so the rally can go longer?

SAMPLE RUN

DO YOU WANT INSTRUCTIONS?

?Y

YOU ARE PLAYING /NO ADD/ TENNIS WITH THE COMPUTER.

THE FIRST PLAYER TO GET 4 POINTS WINS THE GAME.

OK...THE COMPUTER IS SPINNING THE RACQUET

THE COMPUTER WINS THE SPIN AND ELECTS TO SERVE.

READY...BEGIN!!

COMPUTER SERVES SMASH TO BACKHAND

YOU -INPUT YOUR SHOT(1-4) ?1

HIT SOFT BALL SHORT

COMPUTER LOB HIGH TO FOREHAND

YOU -INPUT YOUR SHOT(1-4) ?3

HIT BLAZING FOREHAND TO WIN POINT

SERVER: 0

OPPONENT: 1

COMPUTER SERVES SMASH TO FOREHAND

YOU -INPUT YOUR SHOT(1-4) ?2

HIT SOFT BALL SHORT

COMPUTER HIT BALL OUT OF COURT

SERVER: 0

OPPONENT: 2

COMPUTER SERVES FAULT

COMPUTER SERVES FAULT

DOUBLE FAULT

SERVER: 0

OPPONENT: 3

COMPUTER SERVES HIT SOFT SHOT

YOU -INPUT YOUR SHOT(1-4) ?1

HIT BALL OVER FENCE

SERVER: 1
OPPONENT: 3

COMPUTER SERVES HIT SOFT SHOT
YOU -INPUT YOUR SHOT(1-4) ?2
HIT BALL DEEP TO BACKHAND
COMPUTER LOB HIGH TO FOREHAND
YOU -INPUT YOUR SHOT(1-4) ?1
SMASH OVERHEAD INTO NEXT COURT
SERVER: 2
OPPONENT: 3

PROGRAM LISTING

```
95  DIM A$(1)
100 PRINT "TENNIS"
101 PRINT "DO YOU WANT INSTRUCTIONS?"
102 INPUT A$
103 IF A$ = "N" THEN 105
104 GOSUB 650
105 DIM C(5)
106 T = 1
107 O = 0
108 S = 0
110 PRINT
111 F = 0
115 ON T GOTO 120,180
120 PRINT "COMPUTER SERVES ";
125 R = INT ( RND (1) * 5 + 1)
130 GOSUB 340
131 IF N = 0 THEN 135
132 IF N = 1 THEN 115
133 IF N = 2 THEN 275
135 PRINT "YOU ";
140 GOSUB 230
145 GOSUB 425
146 IF N = 1 THEN 275
150 PRINT "COMPUTER ";
155 R = INT ( RND (1) * 5 + 1)
160 GOSUB 495
161 IF N = 1 THEN 275
165 PRINT "YOU ";
170 GOSUB 230
175 GOSUB 565
176 GOTO 275
180 PRINT "YOU SERVE ";
185 GOSUB 230
190 GOSUB 340
```

```

191 IF N = 0 THEN 195
192 IF N = 1 THEN 115
193 IF N = 2 THEN 275
195 PRINT "COMPUTER ";
196 R = INT ( RND (1) * 5 + 1)
200 GOSUB 425
201 IF N = 1 THEN 275
205 PRINT "YOU ";
210 GOSUB 230
215 GOSUB 495
216 IF N = 1 THEN 275
220 PRINT "COMPUTER ";
221 R = INT ( RND (1) * 5 + 1)
225 GOSUB 565
226 GOTO 275
229 REM **SUBROUTINE
230 REM ** GETS PLAYER'S SHOT
235 PRINT "-INPUT YOUR SHOT(1-4) ";
240 INPUT B
241 IF B > 4 THEN 243
242 GOTO 245
243 PRINT "INPUT A NUMBER FROM 1 TO 4"
244 GOTO 240
245 FOR I = 1 TO 4
250 J = INT ( RND (1) * 5 + 1)
255 C(I) = J
260 NEXT I
265 R = C(B)
270 RETURN
275 REM ** PRINTS SCORE
280 PRINT "SERVER: ";S
285 PRINT "OPPONENT: ";O
286 PRINT
290 IF S = 4 THEN 305
295 IF O = 4 THEN 315
300 GOTO 111
305 PRINT "SERVER WINS"
310 GOTO 320
315 PRINT "OPPONENT WINS"
320 IF T = 1 THEN 330
325 GOTO 106
330 T = 2
335 GOTO 107
339 REM ** SUBROUTINE
340 REM ** RESULT OF SERVE
341 N = 0
345 ON R GOTO 350,360,370,405,415
350 PRINT "SMASH TO BACKHAND"
355 RETURN

```

```

360 PRINT "SMASH TO FOREHAND"
365 RETURN
370 PRINT "FAULT"
375 F = F + 1
380 IF F = 2 THEN 390
384 N = 1
385 RETURN
390 PRINT "DOUBLE FAULT"
395 O = O + 1
399 N = 2
400 RETURN
405 PRINT "HIT SOFT SHOT"
410 RETURN
415 PRINT "FAULT INTO NET"
420 GOTO 375
424 REM ** SUBROUTINE
425 REM ** RESULT OF RETURN
426 N = 0
430 ON R GOTO 435,445,455,470,485
435 PRINT "HIT BALL LOW TO FOREHAND"
440 RETURN
445 PRINT "HIT SOFT BALL SHORT"
450 RETURN
455 PRINT "HIT BALL INTO NET"
460 S = S + 1
461 N = 1
465 RETURN
470 PRINT "HIT BALL OVER FENCE"
475 S = S + 1
479 N = 1
480 RETURN
485 PRINT "HIT BALL DEEP TO BACKHAND"
490 RETURN
494 REM ** SUBROUTINE
495 REM ** SECOND ROUND OF HITS
499 N = 0
500 ON R GOTO 505,520,530,540,550
505 PRINT "RUSH NET AND MISS VOLLEY"
510 O = O + 1
514 N = 1
515 RETURN
520 PRINT "SMASH OVERHEAD DEEP TO BACKHAND"
525 RETURN
530 PRINT "HIT FOREHAND SHORT"
535 RETURN
540 PRINT "LOB HIGH TO FOREHAND"
545 RETURN
550 PRINT "HIT BALL OUT OF COURT"
551 N = 1

```

```

555 O = O + 1
560 RETURN
564 REM ** SUBROUTINE
565 REM ** FINAL POINT
570 ON R GOTO 575,590,605,620,635
575 PRINT "HIT WINNER DOWN LINE"
580 O = O + 1
585 RETURN
590 PRINT "FALL DOWN SLIDING FOR A VOLLEY"
595 S = S + 1
600 RETURN
605 PRINT "SMASH OVERHEAD INTO NEXT COURT"
610 S = S + 1
615 RETURN
620 PRINT "HIT BLAZING FOREHAND TO WIN POINT"
625 O = O + 1
630 RETURN
635 PRINT "RUN INTO FENCE TRYING TO HIT BALL"
640 S = S + 1
645 RETURN
650 REM **INSTRUCTION SUBROUTINE
655 PRINT "YOU ARE PLAYING /NO ADD/ TENNIS WITH THE
    COMPUTER."
660 PRINT "THE FIRST PLAYER TO GET 4 POINTS WINS THE
    GAME."
665 PRINT "OK...THE COMPUTER IS SPINNING THE RACQUET"
670 PRINT "THE COMPUTER WINS THE SPIN AND ELECTS TO
    SERVE."
675 PRINT "READY...BEGIN!!"
680 RETURN
685 END

```

Note: Lines 240-265: This subroutine uses a little trick in order to get a random number for the player's response.

Notice how each subroutine does one task: that is, a subroutine gets the result of a serve, or result of a return. This makes it easier for you to add to or change the program later on.

VARIABLE LIST

T—Determines who serves
 T = 1 Computer serves
 T = 2 Player serves

S—Score for server
O—Score for receiver of serve
F—Number of faults from serve
R—Random number determining result of hit
B—Player's input
A—Result of player's shot
N—Determines when point is over

12

GAMES

Now You Can Do Your Own Thing

Now you are ready to write your own computer games. Most computer games contain a set of instructions, some player options, random consequences and a scoring system. Try these games first and then make up one of your own.

PROBLEMS

1. Ski Weekend
2. Backpack

SKI WEEKEND

Your parents say you may join your friends for a ski weekend in 6 weeks if you earn enough money for the trip. Your share of the weekend will cost \$145. See if you can make it.

You can change the program to a game saving money for a ten speed, some camping equipment or something else special. Try changing the jobs also.

SAMPLE RUN

WANT INSTRUCTIONS? ?Y

YOU HAVE 6 WEEKS TO EARN \$145 FOR A SKI WEEKEND

YOU HAVE A CHOICE OF 3 JOBS

1. PAPER ROUTE - YOU CAN EARN \$25 PER WEEK

2. BABYSITTING - YOU CAN EARN \$1.25 PER HOUR

3. CAR WASH - YOU CAN EARN \$2.00 PER CAR

INPUT THE JOB NUMBER 1 - 3 TO CHOOSE A JOB

IF YOU WORK HARD AND HAVE A LITTLE LUCK

YOU WILL HIT THE SLOPES IN 6WEEKS

HAPPY HOLIDAYS

CHOOSE JOB ?2

2. BABYSITTING - YOU CAN EARN \$1.25 PER HOUR

WEEK 1

THE PARENTS LOVE YOU

ADD \$4.00 IN TIPS

YOU HAVE EARNED \$ 29 SO FAR

CHANGE JOBS ?N

WEEK 2

THE PARENTS LOVE YOU

ADD \$4.00 IN TIPS

YOU HAVE EARNED \$ 58 SO FAR

CHANGE JOBS ?

WEEK 3

THE CHILD HAS A FRIEND OVER

YOUR WAGES ARE INCREASED TO \$31.50
YOU HAVE EARNED \$ 89.5 SO FAR

CHANGE JOBS ?N

WEEK 4

YOUR EXTRA-CURRICULAR ACTIVITIES INTERFERE WITH YOUR JOB
YOU LOSE \$8.00 IN EXPECTED INCOME
CHOOSE ANOTHER JOB
YOU HAVE EARNED \$ 106.5 SO FAR

CHOOSE JOB ?1

1. PAPER ROUTE - YOU CAN EARN \$25 PER WEEK

WEEK 5

YOU HAVE SEVERAL HEAVY TIPPERS WHEN YOU COLLECT
INCREASE YOUR WAGES TO 29
YOU HAVE EARNED \$ 135.5 SO FAR

CHANGE JOBS ?N

WEEK 6

RAIN RUINS HALF OF YOUR PAPERS
YOU LOSE HALF OF YOUR WEEK'S EARNINGS
YOU HAVE EARNED \$ 148 SO FAR

HAPPY HOLIDAYS!!!

YOU EARNED \$ 148 IN 6 WEEKS

WANT TO TRY AGAIN?

?Y

CHOOSE JOB ?3

3. CAR WASH - YOU CAN EARN \$2.00 PER CAR

WEEK 1

YOU GET A FRIEND TO HELP YOU
TOGETHER YOU DO 32 CARS. YOUR SHARE IS \$32.00
YOU HAVE EARNED \$ 32 SO FAR

CHANGE JOBS ?N

WEEK 2

YOU GET A FRIEND TO HELP YOU
TOGETHER YOU DO 32 CARS. YOUR SHARE IS \$32.00
YOU HAVE EARNED \$ 64 SO FAR

PROGRAM LISTING

```
95  DIM A$(1)
100 PRINT "WANT INSTRUCTIONS? ";
110 INPUT A$
120 IF A$ = "Y" THEN 800
130 LET T = 145
140 LET W = 0
145 E = 0
150 PRINT "CHOOSE JOB ";
160 INPUT J
165 GOSUB 400
170 REM WEEK NUMBER
180 W = W + 1
185 PRINT
200 PRINT "WEEK ";W
210 ON J GOTO 500,600,700
250 PRINT "YOU DIDN'T MAKE IT - SORRY"
260 PRINT "MAYBE NEXT YEAR"
270 PRINT "WANT TO TRY AGAIN? "
280 INPUT A$
290 IF A$ = "Y" THEN 130
300 GOTO 999
305 PRINT
306 PRINT "HAPPY HOLIDAYS!!!"
310 PRINT "YOU EARNED $ ";E;" IN ";W;" WEEKS"
315 PRINT
320 GOTO 270
340 PRINT "YOU HAVE EARNED $ ";E;" SO FAR"
341 IF E > = T THEN 305
342 PRINT
343 IF W = 6 THEN 250
345 IF F = 1 THEN 150
350 PRINT "CHANGE JOBS ";
360 INPUT A$
370 IF A$ = "Y" THEN 150
380 GOTO 180
395 REM *** SUBROUTINE
400 REM ** DESCRIBES JOBS
410 ON J GOTO 415,430,445
415 PRINT "1. PAPER ROUTE - YOU CAN EARN $25 PER WEEK"
420 RETURN
430 PRINT "2. BABYSITTING - YOU CAN EARN $1.25 PER
    HOUR"
441 RETURN
445 PRINT "3. CAR WASH - YOU CAN EARN $2.00 PER CAR"
455 RETURN
500 REM ** PAPER ROUTE
510 R = INT ( RND (1) * 6 + 1)
```

```

515 F = 0
520 ON R GOTO 525,545,560,575,585,592
525 PRINT "YOU SELL 10 EXTRA PAPERS THIS WEEK"
526 PRINT "YOUR WAGES INCREASE TO $28.50"
530 E = E + 28.5
540 GOTO 340
545 PRINT "YOU HAVE SEVERAL HEAVY TIPPERS WHEN YOU
COLLECT"
546 PRINT "INCREASE YOUR WAGES TO "29.00"
550 E = E + 29
555 GOTO 340
560 PRINT "YOU WIN A CASH BONUS FROM THE PAPER"
561 PRINT "ADD AN EXTRA $25.00 TO YOUR EARNINGS"
565 E = E + 50
570 GOTO 340
575 PRINT "YOU ARE WAIT-LISTED FOR A ROUTE"
576 PRINT "LOSE 1 WEEK'S SALARY"
580 F = 1
581 GOTO 340
585 PRINT "RAIN RUINS HALF OF YOUR PAPERS"
586 PRINT "YOU LOSE HALF OF YOUR WEEK'S EARNINGS"
590 E = E + 12.5
591 GOTO 340
592 PRINT "THE NEWSPAPER FOLDS AND YOU ARE OUT OF WORK"
593 PRINT "YOU GET HALF A WEEK'S SALARY - CHOOSE
ANOTHER JOB"
595 F = 1
599 GOTO 340
600 REM ** BABYSITTING
601 R = INT ( RND (1) * 6 + 1)
602 F = 0
603 ON R GOTO 605,615,630,645,660,675
605 PRINT "THE CHILD GETS SICK AND YOU ONLY WORK HALF
A WEEK"
610 PRINT "YOU EARN $12.5 AND MUST CHOOSE ANOTHER JOB"
611 E = E + 12.5
612 F = 1
613 GOTO 340
615 PRINT "THE PARENTS AREN'T SATISFIED WITH YOUR WORK"
616 PRINT "AND HIRE SOMEONE ELSE - CHOOSE ANOTHER JOB"
617 PRINT "YOU ONLY EARN $10.00"
620 E = E + 10
622 F = 1
625 GOTO 340
630 PRINT "YOUR EXTRA-CURRICULAR ACTIVITIES INTERFERE
WITH YOUR JOB"
631 PRINT "YOU LOSE $8.00 IN EXPECTED INCOME"
632 PRINT "CHOOSE ANOTHER JOB"
633 F = 1

```

```

635 E = E + 17
640 GOTO 340
645 PRINT "THE PARENTS LOVE YOU"
646 PRINT "ADD $4.00 IN TIPS"
650 E = E + 29
655 GOTO 340
660 PRINT "THE CHILD HAS A FRIEND OVER"
661 PRINT "YOUR WAGES ARE INCREASED TO $31.50"
665 E = E + 31.5
670 GOTO 340
675 PRINT "THE PARENTS WERE GONE LATER THAN PLANNED"
676 PRINT "YOUR WAGES ARE $30.00"
680 E = E + 30
685 GOTO 340
700 REM ** CAR WASH
701 R = INT ( RND (1) * 6 + 1)
705 F = 0
706 ON R GOTO 710,720,730,745,765,780
710 PRINT "YOU GET SOME BIG TIPS"
711 PRINT "YOUR WAGES RISE TO $35.00"
715 E = E + 35
716 GOTO 340
720 PRINT "YOU HAVE LOTS OF CUSTOMERS"
721 PRINT "YOUR EARNINGS ARE $38.00"
725 E = E + 38
726 GOTO 340
730 PRINT "YOU GET A FRIEND TO HELP YOU"
731 PRINT "TOGETHER YOU DO 32 CARS. YOUR SHARE IS
    $32.00"
735 E = E + 32
740 GOTO 340
745 PRINT "IT RAINS AND YOU GET NO CUSTOMERS"
746 PRINT "YOU EARN NO MONEY - CHOOSE ANOTHER JOB"
750 F = 1
755 GOTO 340
765 PRINT "BUSINESS IS BOGGING"
766 PRINT "YOU ONLY EARN $18.00"
770 E = E + 18
775 GOTO 340
780 PRINT "SOME CUSTOMERS ARE UNHAPPY WITH STREAKED
    WINDOWS"
781 PRINT "YOU ONLY CAN CHARGE $1.25 PER CAR"
785 E = E + 20.75
790 GOTO 340
800 REM ** INSTRUCTIONS FOR GAME
805 PRINT "YOU HAVE 6 WEEKS TO EARN $145 FOR A SKI
    WEEKEND"
810 PRINT "YOU HAVE A CHOICE OF 3 JOBS"
815 FOR J = 1 TO 3

```



```

820 GOSUB 400
821 PRINT
825 NEXT J
826 PRINT "INPUT THE JOB NUMBER 1 - 3 TO CHOOSE A JOB"
830 PRINT "IF YOU WORK HARD AND HAVE A LITTLE LUCK"
835 PRINT "YOU WILL HIT THE SLOPES IN 6 WEEKS"
840 PRINT "HAPPY HOLIDAYS"
845 GOTO 130
999 END

```

Note: This is a typical computer game. You can write one like this with the programming statements you learned in the earlier chapters.

Lines 100-120: Allows a person familiar with this game to skip the instructions.

Lines 130-145: Initializes (sets the starting values of) the variables used in the game.

Lines 150-210: Gets job choice and branches to that job in program.

Lines 500-599: If player chooses the paper route, the computer randomly determines the money earned.

Lines 600-685: If player chooses baby-sitting, the computer randomly determines the money earned.

Lines 700-790: If player chooses the car wash, the computer randomly determines the money earned.

Lines 800-825: Prints the instructions.

Lines 826-845: Player won, prints congratulations.

VARIABLE LIST

T—Total amount needed to earn for vacation

W—Week number

E—Money earned so far

J—Job number input

F—Used to control player's options; if $F = 1$ the player has to change jobs

R—Random number determining outcome for each week

Special credit to Bill Rehor and Slaton Lipscomb

BACKPACK

You are in a backpack race across the Sierras. In your pack, you have 5 days of food and a canteen of water. See if you can be the first hiker at the finish line!

You can add other obstacles to this game if you want to make it really tough.

SAMPLE RUN

BACKPACK RACE

WANT INSTRUCTIONS?

YOU ARE IN A 50 MILE CROSS-COUNTRY BACKPACK RACE

YOU START WITH 5 DAYS OF FOOD AND 1 DAY OF WATER

YOU CHOOSE YOUR HIKING SPEED EACH DAY AS FOLLOWS

1 - HIKE LESS THAN 10 MILES

2 - HIKE 10 MILES

3 - HIKE MORE THAN 10 MILES

4 - STAY IN CAMP

YOU LOSE AND HAVE TO RADIO FOR HELP IF

YOU GO WITHOUT WATER FOR 2 DAYS

OR YOUR FOOD SUPPLY IS LOW FOR 2 DAYS

DAY 1

CHOOSE YOUR SPEED?

HIKING AT THE RATE OF 11 MILES/DAY

YOU TAKE THE WRONG TRAIL - LOSE 2 MILES

YOU MEET OTHER HIKERS - THEY GIVE YOU FOOD AND WATER

AFTER A HARD DAY, YOU MAKE CAMP

YOU MADE 9 MILES TODAY

YOU HIKED 9MILES TOTAL

YOU SLEPT WELL - READY FOR A GOOD DAY OF HIKING

DAY 2

CHOOSE YOUR SPEED?

HIKING AT THE RATE OF 10 MILES/DAY

YOU TAKE THE WRONG TRAIL - LOSE 2 MILES

YOU FIND A SHORTCUT - GAIN 2 MILES

AFTER A HARD DAY, YOU MAKE CAMP

YOU MADE 10 MILES TODAY

YOU HIKED 19MILES TOTAL

YOU SLEPT WELL - READY FOR A GOOD DAY OF HIKING

DAY 3

CHOOSE YOUR SPEED?

HIKING AT THE RATE OF 14 MILES/DAY

YOU FIND A SHORTCUT - GAIN 2 MILES

YOU CROSS A STREAM AND FILL YOUR CANTEEN

AFTER A HARD DAY, YOU MAKE CAMP
 YOU MADE 16 MILES TODAY
 YOU HIKE 35 MILES TOTAL
 YOU SLEPT WELL - READY FOR A GOOD DAY OF HIKING
 DAY 4
 CHOOSE YOUR SPEED?2
 HIKING AT THE RATE OF 10 MILES/DAY
 YOU FIND A SHORTCUT - GAIN 2 MILES
 YOU TAKE THE WRONG TRAIL - LOSE 2 MILES
 AFTER A HARD DAY, YOU MAKE CAMP
 YOU MADE 10 MILES TODAY
 YOU HIKE 45 MILES TOTAL
 BEAR CARRIES OFF YOUR PACK - LEAVES YOUR CANTEEN
 DAY 5
 CHOOSE YOUR SPEED?3
 HIKING AT THE RATE OF 12 MILES/DAY
 YOU CROSS A STREAM AND FILL YOUR CANTEEN
 YOU TAKE THE WRONG TRAIL - LOSE 2 MILES
 AFTER A HARD DAY, YOU MAKE CAMP
 YOU MADE 10 MILES TODAY
 YOU HIKE 55 MILES TOTAL
 CONGRATULATIONS!! YOU REACHED THE FINISH LINE!!
 YOU WON - FIRST PLACE!!
 WANT TO TRY AGAIN?N

PROGRAM LISTING

```

95  DIM A$(1)
100 PRINT "BACKPACK RACE"
105 PRINT "WANT INSTRUCTIONS";
110 INPUT A$
115 IF A$ = "Y" THEN GOTO 650
120 F = 5
122 G = 0
125 A = 1
130 W = 1
135 D = 5
140 M = 0
145 S = 0
150 E = 0
155 PRINT "DAY ";A
160 A = A + 1
185 PRINT "CHOOSE YOUR SPEED";
190 INPUT J
195 ON J GOTO 200,215,230,300
200 LET S = INT ( RND (1) * 8 + 1)
205 PRINT "HIKING AT THE RATE OF ";S;"MILES/DAY"
210 GOTO 350
215 LET S = 10
  
```

```

220 PRINT "HIKING AT THE RATE OF ";S;" MILES/DAY"
225 GOTO 350
230 LET S = INT ( RND (1) * 15 + 1)
235 IF S < 11 THEN 230
240 PRINT "HIKING AT THE RATE OF ";S;" MILES/DAY"
245 LET R = INT ( RND (1) * 6 + 1)
250 ON R GOTO 255,270,350,350,350,350
255 PRINT "GET BLISTERS - ONLY MAKE 4 MILES"
260 S = 4
265 GOTO 470
270 PRINT "SLIP ON A LOG - LOSE PACK IN STREAM"
275 F = 0
280 GOTO 470
300 LET S = 0
305 PRINT "STAYING IN CAMP TODAY"
310 LET R = INT ( RND (1) * 3 + 1)
315 ON R GOTO 320,330,485
320 PRINT "RANGERS ARRIVE AND CARRY YOU OUT"
325 GOTO 765
330 PRINT "YOU RECUPERATE QUICKER THAN YOU THOUGHT"
335 PRINT "YOU CAN HIKE 4 MILES TODAY"
340 S = 4
345 GOTO 350
350 REM **WHAT HAPPENS TO YOU DURING YOUR DAY
355 FOR I = 1 TO 2
360 LET R = INT ( RND (1) * 6 + 1)
365 ON R GOTO 370,385,400,415,430,450
370 PRINT "YOU TAKE THE WRONG TRAIL - LOSE 2 MILES "
375 S = S - 2
380 GOTO 465
385 PRINT "YOU FIND A SHORTCUT - GAIN 2 MILES"
390 S = S + 2
395 GOTO 465
400 PRINT "THE TRAIL IS WASHED OUT - LOSE 4 MILES"
405 S = S - 4
410 GOTO 465
415 PRINT "YOU CROSS A STREAM AND FILL YOUR CANTEEN"
420 W = 1
421 E = 0
425 GOTO 465
430 PRINT "YOU SLIP OFF THE TRAIL - HURT YOUR LEG"
435 PRINT "YOU CAN ONLY HIKE 4 MILES"
440 S = 4
445 GOTO 485
450 PRINT "YOU MEET OTHER HIKERS - THEY GIVE YOU FOOD
AND WATER"
455 F = 5
460 W = 1
461 E = 0

```

```

462 G = 0
465 NEXT I
470 PRINT "AFTER A HARD DAY, YOU MAKE CAMP"
475 IF S > 0 THEN 485
480 S = 0
485 M = M + S
490 PRINT "YOU MADE ";S;" MILES TODAY"
495 PRINT "YOU HIKEED ";M;"MILES TOTAL"
500 IF M > = 50 THEN 720
505 D = D - 1
510 F = F - 1
515 IF F + 1 > = D THEN 540
521 IF G > 0 THEN 525
522 G = 1
523 GOTO 535
525 PRINT "YOU RAN OUT OF FOOD"
530 GOTO 705
535 PRINT "YOU ARE RUNNING LOW ON FOOD - BETTER SPEED
      UP TOMORROW"
540 IF S > 6 THEN 585
545 PRINT "YOU HIKEED LESS THAN 7 MILES TODAY"
550 PRINT "YOU MUST MAKE A DRY CAMP AND DRINK FROM YOUR
      CANTEEN"
555 IF W > 0 THEN 575
565 PRINT "WHOOOPS - YOU DON'T HAVE ANY WATER IN YOUR
      CANTEEN!!"
567 IF E = 1 THEN 705
570 PRINT "YOU HAVE TO GET WATER TOMORROW OR YOU LOSE"
575 E = 1
580 W = 0
581 GOTO 585
582 W = 1
583 E = 0
585 LET R = INT ( RND (1) * 6 + 1)
590 ON R GOTO 595,610,640,640,640,640
595 PRINT "BEAR CARRIES OFF YOUR PACK - LEAVES YOUR
      CANTEEN"
600 F = 0
605 GOTO 155
610 PRINT "SQUIRRELS GET INTO YOUR PACK - EAT 2 DAYS
      OF FOOD"
615 F = F - 2
620 GOTO 155
640 PRINT "YOU SLEPT WELL - READY FOR A GOOD DAY OF
      HIKING"
645 GOTO 155
650 PRINT "YOU ARE IN A 50 MILE CROSS-COUNTRY BACKPACK
      RACE"

```

```

655 PRINT "YOU START WITH 5 DAYS OF FOOD AND 1 DAY OF
    WATER"
660 PRINT "YOU CHOOSE YOUR HIKING SPEED EACH DAY AS
    FOLLOWS"
665 PRINT "      1 - HIKE LESS THAN 10 MILES"
670 PRINT "      2 - HIKE 10 MILES"
675 PRINT "      3 - HIKE MORE THAN 10 MILES"
680 PRINT "      4 - STAY IN CAMP"
690 PRINT "YOU LOSE AND HAVE TO RADIO FOR HELP IF"
695 PRINT "YOU GO WITHOUT WATER FOR 2 DAYS"
696 PRINT "OR YOUR FOOD SUPPLY IS LOW FOR 2 DAYS"
700 GOTO 120
705 REM **HAVE TO DROP OUT OF RACE
710 PRINT "RADIO FOR HELP, YOU AREN'T GOING TO MAKE IT"
715 GOTO 765
720 REM **YOU REACH THE FINISH LINE
725 PRINT "CONGRATULATIONS!! YOU REACHED THE FINISH
    LINE!!"
730 R = INT ( RND (1) * 3)
735 R = R * 10
740 IF R > 0 THEN 755
745 PRINT "YOU WON - FIRST PLACE!!!"
750 GOTO 765
755 PRINT "THERE ARE ";R;" HIKERS AHEAD OF YOU"
760 PRINT "BETTER LUCK NEXT TIME"
765 PRINT "WANT TO TRY AGAIN";
770 INPUT A$
775 IF A$ = "Y" THEN 100
780 END

```

Note: Notice that different things can happen depending on how fast the hiker chooses to travel.

VARIABLE LIST

- F —Days of food left — starts with 5
- W —Water in canteen — starts with 1
- D —Days left to hike
- M —Total miles traveled
- S —Miles traveled during the current day
- T —Flag used to control options, if $T > 0$, program specifies speed
- J —Hiking speed input
- E —Set to 1 if player runs out of water. If player is out of water for 2 days in a row, forces player to radio for help.
- G —Set to 1 if player runs out of food. Forces player to radio for help if player is out of food for 2 days in a row.

APPENDIX A

Differences Between the Versions of BASIC

BREAK KEY Every computer has a break—or program interrupt—key. However, some use a different name, or require a combination of keys. Use the programmer's reference manual included with your computer to determine what it uses. In this text, we have adopted the convention of referring to this key as the break key.

RANDOM NUMBER FUNCTION (RND) The format for this function varies. The Apple, HP-2000, Atari, Osborn and IBM use RND(1), the TRS-80 uses RND(0), and the TI uses RND. The Osborn and IBM computers also require the statement RANDOMIZE in the beginning of the program in order to get a different series of random numbers each time the program is run.

PRINT statement using , (comma) or ; (semicolon) The spacing produced by the , and the ; varies with each version of BASIC. Therefore, some of the programs, such as MVP in Chapter 10, which print a heading and columns of numbers, may not line up on your computer as shown in the sample output. Experiment with your own computer to determine the proper spacing.

IBM BASICA, Osborn CBASIC, BASIC-Plus and Altair Extended Basic These versions of BASIC allow string arrays. The programs in this text use standard BASIC which does not have string arrays. In order to run these programs, leave out the string variables in the DIM statements.

Atari-BASIC Does not have a TAB function. You can convert programs that use this function as follows:

a) replace TAB(10);""

-with-

PRINT "(10 spaces)";""

b) replace TAB(W);""

-with-

FOR I=1 TO W-1

PRINT " ";

NEXT I

PRINT ""

TI-BASIC Does not allow use of DIM statement with string variables. In order to run the programs in this text, simply eliminate the string variables in the DIM statement in each program.

—Does not have string functions needed in order to combine strings. Therefore, the following programs in Chapter 5 cannot be run on the TI:

RHYME

AUTHOR

Radio Shack—TRS-80 Color BASIC Does not use the word LET in assignment statements. Therefore, leave this word out when entering these statements. For example:

Instead of: LET A=B + 1

Use: A=B + 1

HP-2000 BASIC The format for the multiple GOTO statement is different from the one used in the programs in this text.

Instead of: ON X GOTO line #,line#,...etc

Use: GOTO X OF line#,line#,...etc

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