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Texas Instruments 99/4A Edition

**by
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and
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P R E F A C E

One of the first questions asked by a beginning user of a microcomputer system is "How do I make it work?" There are usually manuals and booklets supplied with the new system, but to the novice, these technically written materials are often difficult to understand. Moreover, after the initial excitement of playing games supplied with the system dies, one is anxious to learn how to program the system to solve the user's own problems. Again one is often referred to user's manuals supplied with the system.

The electronic computer has been proven to be an excellent educational tool. "Computer Assisted Instruction" (CAI) is a term used to explain the technique of utilizing the computer to assist in the instruction on a particular topic. CAI is also referred to as "Computer Based Instruction," or CBI. One obvious topic for CAI or CBI, is that of computer usage and computer programming. The idea is simple, use the computer to teach about the computer.

This workbook is designed to be used in conjunction with a series of CBI tutorials on using and programming the Texas Instruments 99/4A microcomputer system. These tutorials are available through Sterling Swift Publishing Company on diskettes.

The tutorials assume absolutely no knowledge of computer usage or programming skills. Tutorial number one discusses the keyboard operation and elementary system control. Tutorial number two discusses elementary commands while num-

ber three introduces BASIC language programming. The user then progresses through the other tutorials at his/her own speed covering various programming features such as program input and output, string variables, subscripted variables, etc.

The instruction on programming in BASIC is compatible with the following books published by Sterling Swift Publishing Company:

COMPUTER LITERACY

authored by Carin E. Horn and James L. Poirot, and

BEGINNING COMPUTER SCIENCE

COMPUTERS AND MATHEMATICS

COMPUTERS AND DATA PROCESSING

all authored by Dr. James L. Poirot and David Groves. Two workbooks "Practice in Data Processing," and "Practice in Computer Mathematics" published by Swift Publishing contain "HANDS OFF" materials that also are compatible with the books.

Materials supplied in this workbook reinforce the tutorial instruction and tests the user's understanding of the tutorial material. For the instructor using the tutorials in a classroom setting, the exercises in this workbook may be used for classroom assignments.

The authors also wish to acknowledge the original contribution of Donald A. Retzlaff in the development of this tutorial approach to the teaching of BASIC, with appreciation.

The authors gratefully acknowledge the help and support of our family and friends.

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LOADING A TUTORIAL
FROM A DISKETTE

0. Read all instructions first.
1. Turn on the Video Monitor.
2. Turn on the Floppy Disk Unit.
3. Turn on the Disk Controller Unit.
4. Locate the "ALPHA LOCK" key on the T.I. console. Be sure this key is positioned in the locked, depressed position.
5. Turn on the T.I. console. Listen for the spinning sound of the floppy disk unit. (If there is no spinning sound from the floppy disk unit, turn the console off and check to see if all components are properly attached.)
6. Once the spinning sound has ceased, open the door of the floppy disk unit. Remove the diskette you would like to use from its cover with your thumb and forefinger. The label on the diskette should be facing up and close to you. Insert the diskette carefully into the floppy disk unit. Do this by gently pushing the diskette into the floppy disk unit until it is completely in the unit, taking care not to bend or force it. Close the door on the disk unit.
7. Follow the instructions given on the monitor:
 - a) Press any key to begin...
 - b) Type 1 for Beginning BASIC...
8. Type: OLD DSK1.CAT and press the ENTER key. This command will make the disk unit spin for a few seconds. When the blinking light, called a cursor, reappears on the video monitor, a program that includes all tutorial program names has been loaded into the computer. (If the diskette will not load, a message will appear indicating an I/O (input/output) error. Remove the diskette then place it back in the disk unit; it may not have been in the disk unit correctly. Begin with Step 8 again.)
9. Type: RUN and press the ENTER key. The tutorial program names on the diskette will be listed. Please be patient; it will take about 20 seconds for the program to begin.
10. Type: OLD DSK1.program name, where 'program name' is the name of the tutorial you want to run, and press the ENTER key. (For example: OLD DSK1.TUTOR-01 and press the ENTER key.)
11. Once the cursor reappears to the video monitor, type: RUN and press the ENTER key. Please be patient; it will take about 20 seconds for the program to begin.

LOADING A TUTORIAL FROM
A CASSETTE TAPE

0. Read all instructions first.
1. Turn on the Video Monitor.
2. Turn on the T.I. console. The computer should make an audible beep.
3. Follow the instructions given on the monitor:
 - a) Press any key to begin...
 - b) Type 1 for Beginning BASIC...
4. Insert the cassette into the recorder. Rewind the tape to the beginning.
5. Type: OLD CSC1.program name, where 'program name' is the name of the tutorial you want to run, and press the ENTER key.

This command will prompt the computer to return a series of instructions to be viewed from the monitor. Follow all visual instructions carefully.

(If the cassette will not load, a message will appear indicating an I/O (input/output) error. Remove the cassette then put it back in the recorder; it may not have been in the recorder correctly. Begin with Step 4.)

6. Once all visual instructions have been accomplished, the program is loaded into the computer.

Type: RUN and press the ENTER key. The tutorial will then begin.

BASIC TUTORIAL - ONE

THE KEYBOARD

INSTRUCTIONS: Study the 99/4A keyboard. Write the symbols that are not familiar to you.

Load and run the program TUTOR-01 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES:

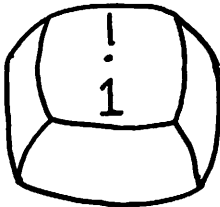
1. List all the keys that perform a second job. Also, indicate that second job; for example, 1 and !.

2. What symbol(s) are used for the zero and one? (Circle the correct responses.)

Ø 1

□ L

3. When the "ALPHA LOCK" key is depressed, all alphabetic symbols are
- A) lower case.
 - B) upper case.
 - C) upper and lower case.
4. When the "ALPHA LOCK" key is up, all alphabetic symbols are
- A) lower case.
 - B) upper case.
 - C) upper and lower case.
5. Are the number and punctuation keys affected when the "ALPHA LOCK" key is down?
6. Study the diagram below. How is the top symbol accessed?



7. Study the diagram below. How is the "/" accessed?



8. What key is used to let the computer know you have completed your response?
9. Explain what is meant by the 'automatic repeat key'.
10. Match the special keys in column 1 with the functions that they perform in column 2.
- | <u>COLUMN 1</u> | <u>COLUMN 2</u> |
|-----------------|--|
| _____ 1. FCTN S | A. Inserts character(s) |
| _____ 2. FCTN D | B. Stops program execution without clearing memory |
| _____ 3. FCTN 1 | C. Erases an entire line |
| _____ 4. FCTN 2 | D. Deletes a single line |
| _____ 5. FCTN 3 | E. Stops execution and clears memory |
| _____ 6. FCTN 4 | F. Back spaces |
| _____ 7. FCTN = | G. Forward spaces |
11. Which two function keys listed above give the user the opportunity to type over previous characters?
12. During the editing process, what must be done to stop the effect of inserting additional characters?

13. Study the following sentence.

TODY IS A BEAUTIFUL DAY.

You will notice that the "A" is missing in the word TODAY. If you were editing on the 99/4A, what steps are involved in correcting this error?

14. Study the following sentence.

TODAAAY IS A BEAUTIFUL DAY.

You will notice that an additional "A" in the word TODAY exists. If you were editing on the 99/4A, what steps are involved in correcting this error?

15. Explain when the CTRL key is used.
16. What is meant by the term "cursor"?
17. How many lines can a statement have on the 99/4A?

BASIC TUTORIAL - TWO

INTRODUCTION TO BASIC

INSTRUCTIONS: Load and run the program TUTOR-02 from your cassette or diskette as described in the LOADING section of this workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES :

1. Once the computer is turned on, what steps are necessary to place the computer in BASIC mode?

2. What does BASIC stand for?

3. Where was BASIC developed?

4. What is meant by the 'immediate mode' of the computer?
5. Why should a person decide to use the programming mode instead of the immediate mode?
6. How are alphabetic and special characters printed using the immediate mode?
7. How are numeric values printed using the immediate mode?

8. Using the immediate mode, write the correct statements that will print the following. Use the computer to check your answers.

A) THIS IS A STRING

B) XY1234*-

C) Y+X

D) Value of: 4 + 3

9. Can blanks, or spaces, be printed? Explain your answer.

10. Fill in the below chart.

<u>SYMBOL</u>	<u>ARITHMETIC OPERATION</u> <u>THE SYMBOL PERFORMS</u>	<u>OTHER SYMBOL LOCATED</u> <u>ON THAT KEY</u>	<u>OPERATION</u> <u>PRIORITY</u>
+			
-			
*			
/			

11. Using the correct operation priority rules, predict the output of the following calculations. Verify your answer by using the computer.

A) PRINT $2+3*4$

B) PRINT $3/4*2$

C) PRINT $8-7+2$

D) PRINT $2*3-4*2$

E) PRINT $3*2^4$

F) PRINT $(2+3)*6$

G) PRINT $(4-7*4)/2$

H) PRINT $14/(3+4)$

I) PRINT $(4+2)^{(2+1)}$

J) PRINT $4/3*3/2$

12. Give two methods of typing fractions into a computer.

13. Define the term 'variable name'.

14. Indicate whether the variable names below are legal or illegal. If they are illegal, specify why they are illegal.

- A) FOX
- B) S1
- C) TEST
- D) KONT
- E) 23K
- F) SUM
- G) X4
- H) TOTAL
- I) A+
- J) X
- K) AFERTIYHELSEKR
- L) @45
- M) AFISHMMAYBITEYYOU
- N) RAT_S
- O) 5YR
- P) _\$

15. In the below program, are all words mandatory for program execution? Explain your answer.

```
10 LET A = 5
20 LET X = 10
30 PRINT A + X
40 END
```

16. In the following example, will the computer accept 155 as a numeric value or as characters?

```
PRINT "155"
```

17. Values are assigned to variables in the below examples. Specify what would be printed for each set of commands below. Verify your answer by typing the commands on your computer.

A) 10 LET A = 2
20 LET B = 7
30 PRINT A+B

B) 10 LET A = 7
20 LET B = 4
30 LET C = 2
40 PRINT A-B+C

C) 10 LET A = 4
20 LET B = 10
30 LET C = A+B
40 PRINT C + 4

D) 10 LET X = 6
20 LET Y = 3
30 LET Z = X/Y+2
40 PRINT Z

E) 10 LET A = 9
20 LET B = A + 3
30 LET C = A
40 PRINT A
50 PRINT B
60 PRINT C

F) 10 LET A = 8
20 LET B = 2
30 PRINT A\B

```

G)  10  LET X = 26
     20  LET A = 9
     30  LET B = (X+1)/A
     40  PRINT B

H)  10  LET T = 5
     20  LET X3 = T + 4
     30  LET YA = X3 - T + 1
     40  PRINT X3
     50  PRINT YA

I)  10  LET I = 3
     20  LET I = I + 2
     30  PRINT I

J)  10  LET J = 5*2
     20  LET K = J^2
     30  LET L = J+K
     40  PRINT L

```


BASIC TUTORIAL - THREE
PROGRAMMING - A BEGINNING

INSTRUCTIONS: Load and run the program TUTOR-03 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES:

1. Define the term "program".

2. Line numbers are typed in front of each BASIC statement. What is the largest line number that can be used?

3. In what order are the line numbers executed in the following example?

```
30  A = 3
20  C = 1
50  PRINT A * B
60  PRINT A + B - C
10  B = 2
40  PRINT A
```

4. Determine the difference(s) between a system command and a BASIC programming statement.

5. Define the following terms.

RUN

NEW

NUM

LIST

EDIT

6. Which of the following are legal assignment statements?

A) LET B = 9

B) LET C = C + 3

C) V = 99* RATS

D) G - E = T

E) LET \$DOL = YES/NO

7. Is 'PRINT' considered to be a system command or a BASIC programming statement? Explain your answer.
8. During the edit process, can a line number be changed?
9. Other than using the edit processes, how can a programming statement be deleted?

8. During the edit process, can a line number be changed?

9. Other than using the edit processes, how can a programming statement be deleted?

Type the program below into your computer. You will be using this program to answer the next set of questions.

```

40  D = A * B
50  PRINT "THE ANSWER IS:"
70  PRINT C + B * A
10  A = 20
30  C = 5
60  PRINT D
80  END
20  B = 2

```

10. Indicate the order of execution in the above program by listing the line numbers in execution sequence.
11. Type the command that will display the program statements. Indicate below what the computer printed.
12. Are the program statements in the same order as you typed them?

13. Type the command that will execute the program statements.
Indicate below what the computer printed.

14. Type the following command.

LIST 50

Indicate below what the computer printed.

15. Write the commands that will list the following programming statements.

A) Line statement number 10

B) Line statement number 70

16. Type the following command.

LIST 30-50

Indicate below what the computer printed.

17. Write the commands that will selectively list the following programming statements.

A) Line statement numbers 10 through 30

B) Line statement numbers 20 through 50

18. Type the following command.

LIST 50-

Indicate below what the computer printed.

19. Type the following command.

LIST -50

Indicate below what the computer printed.

20. Write the commands that will list the following programming statements.

A) From the beginning of a program through 30

B) From line statement number 40 to the end of a program

21. Study the following commands. Which commands will list the same programming statements?

A) LIST 40

B) LIST -40

C) LIST 10-40

D) LIST 40-

22. Explain how you add additional statements to a program after it has been LISTed and/or RUN.

23. Type the following statements into the computer and then LIST the program. Write the program as it currently appears.

45 E = D * 7

75 PRINT E

24. List the computer program on the computer. How do you delete line number 50? Proceed deleting line number 50 on the computer. List the program again to verify that the line was successfully deleted.

25. Clear memory and the screen by using the correct system command. Type the following statement.

```
10 PRINT "HELLO."
```

Suppose that you want to change line 10 to read as follows:

```
10 PRINT "HELLO THERE."
```

Using the edit procedure, write the steps involved in making this change. Verify your steps by editing the line on the computer.

26. Explain in full detail what the system command 'NUM' will accomplish.

27. If the command, NUM 10,2, will produce line numbers beginning with 10 and proceed every two (10,12,14,16,etc.) then write a command that will do the following.

A) produce line numbers beginning with 100 and increase every 10

B) produce line numbers beginning with 33 and increase every 5

BASIC TUTORIAL - FOUR

INPUT STATEMENTS

INSTRUCTIONS: Load and run the program TUTOR-04 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES:

1. In an assignment statement, which of the following can be positioned on the right side of the equals sign?
 - A) Constant
 - B) Expression
 - C) Variable
2. In an assignment statement, which of the following can be positioned on the left side of the equals sign?
 - A) Constant
 - B) Expression
 - C) Variable
3. What is the purpose of the assignment statement?

4. Discuss the input commands that were identified in this Tutorial.
5. Can several variables be read by using a single READ command? Explain your answer.
6. Where do the DATA commands have to be located in your program in relation to the READ statements?
7. In what order are the values in the DATA statement assigned?
8. Will an error be generated if there are more variables in READ statements than there are values in DATA statements? Explain your answer.

9. Will an error be generated if there are more values in DATA statements than there are variables in READ statements? Explain your answer.
10. In the space provided, tell which of the following are acceptable READ/DATA combinations.
- | | |
|-------|--------------------------------------|
| _____ | A) READ X,Y,Z
DATA 5,6 |
| _____ | B) DATA 6
DATA 7
READ A,B |
| _____ | C) READ T*T
DATA 55 |
| _____ | D) DATA 5,99
READ A,B,C
DATA 8 |
11. In each of the following examples, what value is given to "A"?
- A) READ A,T,F
DATA 55,3,44
- B) DATA 4
DATA 6,99
READ T,Y,A
- C) DATA 89,55
DATA 55,7,8,6,3,4
READ R,T,Y,T
READ E,U,A,V

12. Type the following example into your computer and RUN it.

```
10 READ A,B,T
20 DATA 55,6,7
30 LET A = A+B+T
40 PRINT R
50 END
```

When the program was RUN, what was printed?

13. Edit line 10 in the above program so that it will look like the following:

```
10 READ A;B;T
```

When the program was RUN, what was printed? Explain why.

14. What program statement stops program execution and waits for the user to enter one or more values?

15. What is the difference between the READ command and the INPUT command?

16. Rewrite the below program using the READ/DATA statements.

```
10 LET Y = 44
20 LET B = 6
30 LET K = 94
40 LET R = Y * B * K
50 PRINT R
60 END
```

17. Rewrite the above program using the INPUT statement.

18. Type the program that was written for Exercise # 17 into the computer. RUN the program and explain what exactly happens.
19. Write a program that will input a number and prints its square. Test your program by running it on the computer. Use several values.
20. Can more than one value be inputted from the keyboard by using the INPUT statement? Explain your answer.

21. Type the following program into the computer.

```
10 INPUT A,B,C
20 PRINT A+B+C
30 END
```

When you RUN this program, use the following values for input:

4 and 6

What was printed? Explain why.

22. Run the above program again. Use 6,7,3,44 as input values. What was printed this time?

23. How many values are expected to be input in the program in Exercise # 21?

24. This Tutorial explained how to take a PRINT and INPUT statement and combine them. Using the below examples of PRINT and INPUT statements, combine them into one statement.

```
10 PRINT "INPUT A NUMBER FROM 1 TO 100."  
20 INPUT N
```

25. Does the INPUT statement have a DATA statement included in the program?

BASIC TUTORIAL - FIVE
PROGRAMMING BRANCHING STATEMENTS

INSTRUCTIONS: Load and run the program TUTOR-05 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES:

1. In an assignment statement, is the word LET optional?

2. Do both sides of an assignment statement have to be mathematically equal? Explain your answer.

3. Explain why branching statements are important in programming.

4. Describe the two branching techniques that were discussed in this Tutorial.
5. What is meant by a continuous or an "infinite" loop? Give an example of an infinite loop within your explanation.
6. How do you stop the execution of a program when it is in an infinite loop?
7. Is there any method on the TI 99/4A computer to stop the execution temporarily and then continue the execution at a later time? If so, explain the procedure.

8. Type the program that you wrote for Exercise # 5 into the computer. Run the program. During its looping process, stop the program execution and, if it is possible, continue the execution again.
9. In most programs, an infinite loop should not be present. When might you want to have an infinite loop?
10. Which of the two branching techniques discussed in this Tutorial is considered to be the "unconditional" branching statement? Explain why.
11. Using line number 55, tell the computer to branch to:
 - A) line number 70
 - B) line number 30
 - C) line number 200

12. The conditional branching statement allows you to make an algebraic comparison of two values. What are the symbols that are used for the six possible comparisons? Explain what each symbol means.
13. In the below examples, which line would be executed if the answer is false?
- A) 40 IF K = 10 THEN 55
50 PRINT K
- B) 66 T = T + 1
70 IF T > 15 THEN 100
75 GOTO 66
- C) 30 IF A = 2 THEN 60 ELSE 50
- D) 60 IF B <> 90 THEN 20 ELSE 200
14. In the above examples, which line would be executed if the answer is true?
15. After evaluating your answers to Exercise # 13, if the comparison results in a false condition, what is the next command that will be executed?

16. Predict the output of the program below. Check your prediction by typing the program into the computer and RUN it.

```
NEW
10  A = 0
20  A = A + 1
30  PRINT A
40  IF A <= 10 THEN 20
50  END
```

15. Modify the above program so that it will print the even numbers to 10. RUN your program on the computer to verify your written program.

18. Modify the program so that it will print the odd numbers to 10. RUN your program to verify that it will work. Write your correct program in the below space.

19. How would you modify the program to print the odd numbers up to an INPUTed value? Make the program modifications, verify that it works, and LIST it. Write the program in the space below.

Write and RUN programs that will meet the following specifications. Document the programs and write them in the space provided.

20. Input three values and print the largest.

21. Input three values and print the smallest.

22. Print the sum of the first 10 positive integers, using the looping procedure.

BASIC TUTORIAL - SIX
FOR/NEXT LOOPS

INSTRUCTIONS: Load and run the program TUTOR-06 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES:

1. In the space below, write the general form of the FOR/NEXT statements.

2. Using the example below, match the variables in column A with its purpose in column B.

<u>COLUMN A</u>	<u>COLUMN B</u>
_____ 1) A	Variable that holds current loop count
_____ 2) X	Variable that holds the starting value
_____ 3) Y	Variable that holds the test value
_____ 4) Z	Variable that holds the increment value

3. Which variable listed above should be placed in the blank below?

NEXT _____

4. What is the purpose of the NEXT statement?

5. Modify the below program using the FOR/NEXT statement.

```
5  TOTAL = 0
10 COUNTER = 0
20 COUNTER = COUNTER + 1
30 INPUT "TYPE A NUMBER": N
40 TOTAL = TOTAL + N
50 IF COUNTER = 10 THEN 60 ELSE 20
60 PRINT TOTAL
70 END
```

Predict the output of the following program segments. Type each of the segments into the computer to verify your answers.

6. 10 FOR I = 1 TO 5 STEP 1
 20 PRINT I
 30 NEXT I

7. 10 FOR J = 1 TO 5 STEP 2
 20 PRINT J
 30 NEXT J

8. 10 FOR J = 5 TO 1 STEP -1
 20 PRINT J
 30 NEXT J

9. Determine the logic error in the following program segments. Explain each.
- A) 10 FOR I = 7 TO 2 STEP 1
20 PRINT I
30 NEXT I
- B) 10 FOR I = 2 TO 7 STEP -1
20 PRINT I
30 NEXT I
10. If the STEP segment of the FOR statement is not used, what is the default for the STEP value?
11. Is there a default value for the other variables used in the FOR statement? Explain your answer.
12. If there are three FOR statements in a program how many NEXT statements should there be?
13. Using the following program segment, what is the maximum value that will be printed? Explain your answer.
- 10 FOR I = 1 TO 10 STEP 2
20 PRINT I
30 NEXT I

14. If you add the following statement to the program above, what value will line 40 print? Verify your answer by typing the program into the computer and RUN it.

```
40 PRINT I
```

Explain why the computer printed the value it did.

15. Identify two methods of exiting a FOR/NEXT loop before it is finished. Write a program segment for each method. Use the computer to verify your work.

16. Why would you want to have a program prematurely exit an executing FOR/NEXT loop?

17. Can you branch into a FOR/NEXT loop? Explain your answer.

18. Explain why the following program segments have illegal "nested" FOR/NEXT loops.

```
A)  10  FOR J = 1 TO 10
      20  PRINT J
      30  FOR K = 3 TO 5
      40  PRINT K
      50  NEXT J
      60  NEXT K
```

```
B)  10  FOR I = 1 TO 10
      20  FOR T = 2 TO 5
      30  LET J = T * I
      40  PRINT J
      50  NEXT I
      60  NEXT T
```

19. Predict the correct format and output of the following programs. Use the computer to verify your answers.

```
A)  10  FOR I = 1 TO 5
      20  FOR J = 1 TO 2
      30  PRINT J
      40  NEXT J
      50  NEXT I
      60  END
```

```
B)  10  FOR I = 1 TO 5
      20  FOR J = 1 TO 2
      30  PRINT I,J
      40  NEXT J
      50  NEXT I
      60  END
```

```

C)  10  FOR I = 1 TO 5
      20  FOR J = 1 TO 5
      30  PRINT "*";
      40  NEXT J
      50  PRINT
      60  NEXT I
      70  END

D)  10  FOR I = 1 TO 3
      20  FOR J = 1 TO 4
      30  FOR K = 3 TO 1 STEP -1
      40  PRINT I,J,K
      50  NEXT K
      60  NEXT J
      70  NEXT I
      80  PRINT I,J,K
      90  END

```

20. Study the following programs carefully. Predict the correct format and output and verify by using the computer.

```

A)  10  FOR I = 1 TO 5
      20  FOR J = 1 TO I
      30  PRINT J
      40  NEXT J
      50  PRINT
      60  NEXT I
      70  END

B)  10  FOR I = 1 TO 5
      20  FOR J = I TO I+3
      30  PRINT J
      40  NEXT J
      50  PRINT
      60  NEXT I
      70  END

```

21. Study the following programs. What happens if you modify the counter variable within the FOR/NEXT loop?

Type each example into the computer. Run the programs and explain the printed results.

```
A)  10  FOR I = 1 TO 10
      20  PRINT I
      30  I = I + 2
      40  PRINT I
      50  NEXT I
      60  END
```

```
B)  10  FOR J = 1 TO 5
      20  J = 3
      30  PRINT J
      40  NEXT J
      50  END
```


Write and RUN programs that will meet the following specifications. Document the programs and write them in the space provided.

22. Use a FOR/NEXT loop that will add the first 10 positive whole numbers.

23. Use the FOR/NEXT loop that will find the product of the first ten positive whole numbers.

24. Modify the above program so that it will find the product of the first n positive integers (n is INPUT).

25. Use a FOR/NEXT loop to input five numbers. After each number is input, the current sum is to be printed.

26. Write a program that will INPUT n numbers. After each number is INPUT, the current sum is to be printed. After the numbers have been summed, the average is to be printed. Use a FOR/NEXT loop to control the program loop.

27. Write a program that will sum a series of positive INPUT values. The actual number of values is not known when the program begins execution. A negative input value is to be used as the flag to end input. The average of the input values (not counting the negative value) is to be printed. Use a FOR/NEXT loop to control the program loop.

ARRAYS

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

1. What is an array?

2. Why should we use the array concept?

3. What notation is used to denote the subscripts in an array?

4. What is the smallest subscript for every array?

5. What statement will make all subscripts in a program begin at 1?

6. Using a FOR/NEXT loop, write and RUN a program that will assign the number 7 to all the elements of an array. There are 9 elements in the array.

7. If there are more than ten elements in an array, what statement must be added to the program?

8. Change the program in Exercise 6 so that it has twelve elements in the array. DO NOT include the dimension statement.

RUN the program. What are the printed results?

9. What elements of the array X will be printed in the program below?

```
10 DIM X(20)
20 FOR I = 1 TO 20 STEP 3
30 PRINT X(I)
40 NEXT I
50 END
```

10. What does DIM stand for?

11. Study the program in Exercise # 9. Are there specific values assigned to the elements in the X array?

What value will the computer assume for each element in the X array? Use the computer to verify your answer.

12. What are two advantages of the array concept?

13. The TI 99/4A allows for one-, two-, and three-dimensional arrays. Tell if the below examples are one-, two-, or three dimensional arrays.

- A) Z(3,5)
- B) T(14)
- C) CAT(2,2)
- D) D(3,6,9)
- E) DE(23)
- F) TL(2,4)
- G) PAUL(12,26,4)
- H) HI(10,20)

14. Using the given statement below, match the letters in Column A with their correct description in Column B.

DIM K(R,C,W)

COLUMN A		COLUMN B
A)	_____ R	1. represents how many columns
B)	_____ C	2. represents what the array width is
C)	_____ W	3. represents how many rows

15. Which of the following program segments are correct? Run them on the computer to verify your answer. If the program did not run correctly, explain why.

A) 10 DIM X(11)
20 FOR K = 1 TO 11
30 INPUT X(K)
40 NEXT K

B) 10 FOR C = 1 TO 22
20 DIM X(22)
30 INPUT X(C)
40 NEXT C

C) 10 FOR J = 1 TO 15
20 INPUT X(J)
30 NEXT J
40 DIM X(15)

D) 10 INPUT "HOW MANY NUMBERS":N
20 DIM X(N)
30 FOR I = 1 TO N
40 INPUT X(I)
50 NEXT I

16. Determine which of the following sets of numbers would need a dimension statement if the numbers would be the values input into a program. For those that need dimension statements, write them to the side of each set.

A) 3,5,66,7,8,5,4,3

B) 77,99,887,56,44,555,4,66,777,88

C) 4,5,3,6,7,8,3,4,5,7,9,8,9,7,5

D) 7,6,5,3,4,5,7,8,9,3

E) 5,6,7,8,64,3,4,5
3,4,5,6,77,8,4,5
2,3,4,5,66,7,5,4

BASIC TUTORIAL - EIGHT

CHARACTER STRINGS

INSTRUCTIONS: Load and run the program TUTOR-Ø8 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES:

1. What is meant by a "character string"?
2. How do you PRINT a character string in a program?
3. What notation is used to define a character string variable?

4. Study the following examples.

A) 100 LET A = 160

B) 100 LET A\$ = "160"

In each example tell if the 160 is stored in memory as a value or as a character string. Explain your answer.

5. Determine which of the following are legal numeric or character string variables.

A) TEST\$

B) INK

C) \$THE

D) @FIVE

E) YES\$

6. What is the length of the longest character string possible in TI BASIC?

7. What is meant by "concatenation"?

8. Concatenate and print the following.

S\$ = "THIS IS A BUSY"

D\$ = "DAY."

9. Is it possible to concatenate character strings and numeric values?

10. Match the print separators with the descriptions.

<u>PRINT SEPARATOR</u>	<u>DESCRIPTION</u>
A) _____ ;	1. places output at the left edge and at center on the screen
B) _____ ;	2. places output next to each other without preset spacing
C) _____ ;	3. places the next output to be located on the next line

11. If A = 15, B = 117, and C = 10, write PRINT statements that will allow the below output to occur.

A)	15	10
B)	1511710	
C)	10	117 15

12. Match the Built-In Character Functions in Column A with their correct descriptions in Column B.

COLUMN A		COLUMN B
A)	_____ LEN	1. converts a numeric value into a character string
B)	_____ SEG\$	2. gives the current length of a character string
C)	_____ POS	3. determines whether a string is present in another string; the number position will be returned
D)	_____ STR\$	4. converts a numeric that is stored as a character string into a numeric value
E)	_____ VAL	5. gives a portion of another character string

13. Write and RUN a program that will input a character string and print the current length of that string. The program should loop to accept any number of character strings.

14. What is meant by a "substring"?
15. In the space below, use the substring function to code the following substrings. Verify by using the computer.
- A) character positions 3 to 5 in X\$
 - B) character positions 10 to 20 in Y\$
 - C) the rest of the string starting in position 5 in Z\$
 - D) the first position only in A\$
 - E) the last position in B\$
16. Determine whether the following substring is in A\$. The computer should return the position that the substring begins. Use the computer to verify your work.
- A\$ = "SPRING IS A NICE TIME OF THE YEAR"
- A) search for: NICE
begin search: position # 1
 - B) search for: FLOWER
begin search: position # 1
 - C) search for: IS
begin search: position # 10

BASIC TUTORIAL - NINE
NUMERIC FUNCTIONS

INSTRUCTIONS: Load and run the program TUTOR-09 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES:

1. What is a function?

2. What are the three types of functions?

3. Which type of function deals with arithmetic operations?

4. Which function returns the absolute value of a numeric expression?
5. The SQR function returns what?
6. Explain, in detail, the INT function.
7. What value would be returned? Verify your answer by using the computer.
 - A) `A = ABS(-10)`
 - B) `A = ABS(3.2)`
 - C) `A = SQR(25)`
 - D) `A = ABS(-300)`
 - E) `A = SQR(4)`
 - F) `A = SQR(ABS(-16))`
 - G) `A = INT(-6.7)`
 - H) `A = INT(3.4)`
 - I) `A = SQR(INT(3.7))`
 - J) `A = SQR(ABS(INT(-5.9)))`

8. Write a program that will accept single numbers as input and print the numbers' absolute value by using the ABS function. The program should have a loop in order to accept any number of input values. Test your program by running it on the computer.

9. Name and describe the four trigometric functions available on the TI 99/4A.
10. What numeric function gives the
- A) value of "E to the X power"?
 - B) natural logarithm of X if X is greater than 0?
11. The SGN function gives the algebraic sign of a specified value. What value and sign will be displayed for the following?
- A) PRINT SGN(-55)
 - B) PRINT SGN(45)
 - C) PRINT SGN(0)
12. Using the RND function in the below example will display what range of numbers?
- ```
10 FOR I = 1 TO 5
20 PRINT RND
30 NEXT I
```
13. Write a program statement that will
- A) print any 2-digit random number
  - B) print any 3-digit random integer

14. Write a BASIC program and RUN that will generate 50 random numbers in the range of 10 to 20 inclusive.

15. Write and RUN a BASIC program that will use the RND function to generate 100 integer random numbers in the range of 1 to 6 inclusive.

16. Write a BASIC program that will simulate the rolling of a pair of dice. They are to be rolled 100 times.

An array is to be used to count the number of occurrences of the sum of the die values.

The program should print the indices of the array and the values stored in each index.

Test your program by using the computer.

17. If  $A = 4$ ,  $B = 7$ ,  $C = -2$ , and  $D = A + B$ ; what would be printed in the below examples?

A) PRINT SGN(A-B)

B) PRINT SGN(D) - 5

C) PRINT SGN(B\*C+10)

18. When would a programmer use the "RANDOMIZE" statement?  
Why would a programmer use the "RANDOMIZE" statement?





BASIC TUTORIAL - TEN  
USER DEFINED FUNCTIONS

INSTRUCTIONS: Load and run the program TUTOR-10 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

EXERCISES:

1. What is a "User-Defined" function?
  
  
  
  
  
  
  
  
  
  
2. What is the "DEF" statement?
  
  
  
  
  
  
  
  
  
  
3. Where must the "DEF" statement be located in the BASIC program?

4. Which of the following are correct "DEF" statements? If they are incorrect, explain why.

A) DEF AGU = 5\*Y+3

B) DEF AGU = T\$

C) DEF AGU\$ = T\$

D) DEF AGU\$ = 9\*3\*B+Z

5. Predict the output of the following program. Verify by using the computer.

```
10 REM AVERAGE CALCULATION
20 DEF AVERAGE = (TEST + DAILY + QUIZ) / 3
30 FOR C = 1 TO 20
40 INPUT TEST, DAILY, QUIZ
50 PRINT AVERAGE
60 NEXT C
70 END
```

6. What is a "parameter"?

7. Predict the output of the following program. Verify by using the computer.

```
10 DEF X(Z) = Z * (3 + Z)
20 FOR C = 1 TO 5
30 INPUT Z
40 PRINT X(Z)
50 END
```

8. Write a program using a User-Defined Function. The program should calculate the area of a circle for five different input values. The equation for calculating the area is:

$$\text{AREA} = \pi R^2$$

Input values for R and use 3.14 for  $\pi$ . Print each result.



# BASIC TUTORIAL - ELEVEN

## SUBROUTINES

INSTRUCTIONS: Load and run the program TUTOR-11 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

### EXERCISES :

1. What is a "subroutine"?
2. Briefly describe the use of subroutines.

3. Describe the purpose of the following subroutine statements.

GOSUB

RETURN

4. Study the below program.

```
10 FOR C = 1 TO 5
20 INPUT ORANGES,APPLES,PEARS
30 GOSUB 70
40 PRINT OCOST,ACOST,PCOST
50 NEXT C
60 GOTO 120
70 REM COST SUB
80 OCOST = ORANGES * .10
90 ACOST = APPLES * .05
100 PCOST = PEARS * .15
110 RETURN
120 TOTAL = OCOST + ACOST + PCOST
130 PRINT "TOTAL IS "; TOTAL
140 END
```

After execution of the subroutine, what line number will be executed next?

5. In the above example, how many times will the subroutine be executed?

6. What are two commonly used programming statements that connect the main program with the END statement, or connects the segments of the main program together?
7. Rewrite the program listed below using a subroutine to perform the functions of statements 10 through 40 and 80 through 110.

```
10 I = 7
20 J = 4
30 INPUT K
40 PRINT I,J,K
50 I = 4
60 J = J + 3
70 PRINT I,J,K
80 I = 7
90 J = 4
100 INPUT K
110 PRINT I,J,K
120 I = K + J
130 J = J + I
140 PRINT I,J,K
150 END
```



8. Rewrite the program listed below using a subroutine to perform the repetitive functions.

```
10 DIM A(12)
20 FOR I = 1 TO 12
30 A(I) = I * 2
40 NEXT I
50 FOR I = 1 TO 9
60 A(I) = A(I) + A(I+1)
70 NEXT I
80 FOR I = 1 TO 10
90 PRINT A(I)
100 NEXT I
110 FOR I = 1 TO 12
120 A(I) = I * 2
130 NEXT I
140 FOR I = 1 TO 12
150 PRINT A(I)
160 NEXT I
170 END
```

9. Explain the following programming statement.

ON X GOSUB 100,150,200,250

10. Using the above ON/GOSUB statement, tell what line number each subroutine would begin.
11. Using the ON/GOSUB statement, modify the program in Exercise # 4 so that each type of fruit will have its own subroutine to calculate the cost.



## BASIC TUTORIAL - TWELVE

### SOUND

INSTRUCTIONS: Load and run the program TUTOR-12 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

#### EXERCISES:

1. Explain the following terms:

DURATION

FREQUENCY

VOLUME

2. What is the numeric range for:
  - A) the duration?
  - B) the frequency for musical notes?
  - C) the frequency for noises?
  - D) the volume?
3. Do positive durations play slower or faster than negative durations?
4. Is a higher volume number louder or softer than a lower volume number?
5. Fill in the below sound format with the words DURATION, FREQUENCY, and VOLUME so that they are in proper programming order.  
  
CALL SOUND (                      ,                      ,                      )
6. How many notes, or tones, can be played at one time?

7. Using the same type of sound format as shown in Exercise # 5, write a format for the playing of 2 notes simultaneously.
8. Using the sound list in the back of this Workbook (Appendix A) determine the frequencies for the following notes.
- A) Middle C
  - B) F Above Middle C
  - C) High C
  - D) G Below Middle C
  - E) B Above Middle C
  - F) F Below Middle C
  - G) Low C
9. Explain the following statements in terms of what sound will be played, how long the sound will play, and the loudness of the sound.
- A) 10 CALL SOUND(2000,262,3)
  - B) 10 CALL SOUND(1000,131,22)
  - C) 10 CALL SOUND(3500,659,10)
  - D) 10 CALL SOUND(500,494,2)
  - E) 10 CALL SOUND(3000,-3,1)

10. Write and RUN a program that will play your favorite tune.

## BASIC TUTORIAL - THIRTEEN

### COLOR GRAPHICS

INSTRUCTIONS: Load and run the program TUTOR-13 from your cassette or diskette as described in the LOADING section of this Workbook.

DO NOT perform the exercises in this Workbook until you have completed the Tutorial, or unless so instructed by the Tutorial.

#### EXERCISES:

1. Explain what the following subprograms do.

A) CALL CLEAR

B) CALL COLOR

C) CALL SCREEN



2. Does the CALL CLEAR subprogram clear memory?

3. In each example below, determine the character set that will be printed, its character color, and the background color. Use Appendix B and Appendix C for reference. Verify your work by using the computer.

A) 10 CALL COLOR(1,2,10)

B) 10 CALL COLOR(3,6,8)

C) 10 CALL COLOR(4,16,13)

4. What is the standard screen color?

5. What is the standard screen color code?

6. Identify the color that the screen will change to in the following examples. Refer to Appendix C. Verify your work by using the computer.

A) 10 CALL SCREEN(11)

B) 10 CALL SCREEN(6)

C) 10 CALL SCREEN(7)

7. Write the program statements that will change the entire screen to the below colors.

A) Black

B) Light Red

C) Dark Green

D) Medium Green

8. Write a program that will change the color of the screen five different times during its execution. Run the program to verify your work.

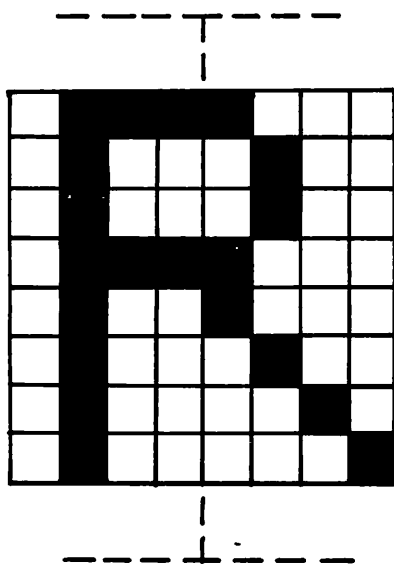
9. What is the CALL CHAR subprogram used for?

10. In the below example, what represents the "character code"?

```
CALL CHAR(31,"FFFFFFFFFFFFFFFF")
```

11. What is the "character code"?
12. What represents the "pattern" in Exercise # 9?
13. How many positions are always needed in the "pattern"?
14. How many characters can be defined in a single CALL CHAR statement?
15. How many dots make up a single character?
16. Each position in the "pattern" of the CALL CHAR statement represents how many dots?

17. Study the below 8X8 grid. It has been shaded to represent a character. Using the "1 and 0" method of representing "on's and off's", give the 4-digit representations for each group. The first two groups have been coded for your reference.



| 1st 4 | 2nd 4 |
|-------|-------|
| 0111  | 1000  |

18. Each of the above 4-digit codes are translated into what type of code?
19. Place each of the 4-digit codes in the blocks provided below. Be sure to place the 1st 4 then the 2nd 4 each time.

[illegible]

20. Using Appendix D in the back of this Workbook, determine the hexadecimal code for each of the blocks in Exercise # 19. Place each hexadecimal code in the below pattern.

```
CALL CHAR(33,"_/_")
```

21. Using the Appendix D in the back of this Workbook, take the following "pattern" and decode it into correct sets of 1's and 0's.

A) CALL CHAR(31,"0,A,3,B,6,5,9,C,E,6,5,F,F,F,F,F")

B) CALL CHAR(34,"F,D,B,A,2,5,4,7,7,7,8,4,4,3,3,0")

22. The display screen is set up into a graph of \_\_\_\_\_ rows and \_\_\_\_\_ columns.

23. What are the two subprograms used in graphics that display characters on the screen?

24. In the following example, define "R", "C", "CHAR", and "REP".

CALL HCHAR(R,C,CHAR,REP)

25. What is the difference between HCHAR and VCHAR?

26. Define a character as:



Use this character and draw a line beginning at column 3,  
row 12 and continue it to column 15.

27. Write a BASIC program that will draw a large square in any color in the center of the screen.



28. Write a BASIC program that will draw a series of vertical lines, each one in a different color (similar to color bars you see on the beginning frame when you turn the 99/4A on).

# A P P E N D I X    A S O U N D

| NOTE                            | FREQUENCY | NOTE                            | FREQUENCY |
|---------------------------------|-----------|---------------------------------|-----------|
| A                               | 110       | A (above Middle C)              | 440       |
| A <sup>#</sup> , B <sup>b</sup> | 117       | A <sup>#</sup> , B <sup>b</sup> | 466       |
| B                               | 123       | B                               | 494       |
| Low C                           | 131       | High C                          | 523       |
| C <sup>#</sup> , D <sup>b</sup> | 139       | C <sup>#</sup> , D <sup>b</sup> | 554       |
| D                               | 147       | D                               | 587       |
| D <sup>#</sup> , E <sup>b</sup> | 156       | D <sup>#</sup> , E <sup>b</sup> | 622       |
| E                               | 165       | E                               | 659       |
| F                               | 175       | F                               | 698       |
| F <sup>#</sup> , G <sup>b</sup> | 185       | F <sup>#</sup> , G <sup>b</sup> | 740       |
| G                               | 196       | G                               | 784       |
| G <sup>#</sup> , B <sup>b</sup> | 208       | G <sup>#</sup> , A <sup>b</sup> | 831       |
| A (below Middle C)              | 220       | A (above High C)                | 880       |
| A <sup>#</sup> , B <sup>b</sup> | 233       | A <sup>#</sup> , B <sup>b</sup> | 932       |
| B                               | 247       | B                               | 988       |
| Middle C                        | 262       | C                               | 1047      |
| C <sup>#</sup> , D <sup>b</sup> | 277       | C <sup>#</sup> , D <sup>b</sup> | 1109      |
| D                               | 294       | D                               | 1175      |
| D <sup>#</sup> , E <sup>b</sup> | 311       | D <sup>#</sup> , E <sup>b</sup> | 1245      |
| E                               | 330       | E                               | 1319      |
| F                               | 349       | F                               | 1397      |
| F <sup>#</sup> , G <sup>b</sup> | 370       | F <sup>#</sup> , G <sup>b</sup> | 1480      |
| G                               | 392       | G                               | 1568      |
| G <sup>#</sup> , A <sup>b</sup> | 415       | G <sup>#</sup> , A <sup>b</sup> | 1661      |
|                                 |           | A                               | 1760      |

APPENDIX B

ASCII CHARACTER CODES  
AND CHARACTER SETS

| <u>ASCII CHARACTER CODES</u> | <u>CHARACTER</u> | <u>SET</u> |
|------------------------------|------------------|------------|
| 32                           | Blank Space      | 1          |
| 33                           | :                |            |
| 34                           | "                |            |
| 35                           | #                |            |
| 36                           | \$               |            |
| 37                           | %                |            |
| 38                           | &                |            |
| 39                           | '                | 2          |
| 40                           | (                |            |
| 41                           | )                |            |
| 42                           | *                |            |
| 43                           | +                |            |
| 44                           | ,                |            |
| 45                           | -                |            |
| 46                           | .                | 3          |
| 47                           | /                |            |
| 48                           | 0                |            |
| 49                           | 1                |            |
| 50                           | 2                |            |
| 51                           | 3                |            |
| 52                           | 4                |            |
| 53                           | 5                | 4          |
| 54                           | 6                |            |
| 55                           | 7                |            |
| 56                           | 8                |            |
| 57                           | 9                |            |
| 58                           | :                |            |
| 59                           | ;                |            |
| 60                           | <                | 4          |
| 61                           | =                |            |
| 62                           | >                |            |
| 63                           | ?                |            |

APPENDIX B  
CONTINUED

| <u>ASCII CHARACTER CODES</u> | <u>CHARACTER</u> | <u>SET</u> |
|------------------------------|------------------|------------|
| 64                           | @                | 5          |
| 65                           | A                |            |
| 66                           | B                |            |
| 67                           | C                |            |
| 68                           | D                |            |
| 69                           | E                |            |
| 70                           | F                |            |
| 71                           | G                |            |
| 72                           | H                | 6          |
| 73                           | I                |            |
| 74                           | J                |            |
| 75                           | K                |            |
| 76                           | L                |            |
| 77                           | M                |            |
| 78                           | N                |            |
| 79                           | O                |            |
| 80                           | P                | 7          |
| 81                           | Q                |            |
| 82                           | R                |            |
| 83                           | S                |            |
| 84                           | T                |            |
| 85                           | U                |            |
| 86                           | V                |            |
| 87                           | W                |            |
| 88                           | X                | 8          |
| 89                           | Y                |            |
| 90                           | Z                |            |
| 91                           | [                |            |
| 92                           | \                |            |
| 93                           | ]                |            |
| 94                           | ^                |            |
| 95                           | _                |            |

A P P E N D I X    C  
C O L O R    C O D E S

| <u>COLOR</u> | <u>CODE NUMBER</u> |
|--------------|--------------------|
| Transparent  | 1                  |
| Black        | 2                  |
| Medium Green | 3                  |
| Light Green  | 4                  |
| Dark Blue    | 5                  |
| Light Blue   | 6                  |
| Dark Red     | 7                  |
| Cyan         | 8                  |
| Medium Red   | 9                  |
| Light Red    | 10                 |
| Dark Yellow  | 11                 |
| Light Yellow | 12                 |
| Dark Green   | 13                 |
| Magenta      | 14                 |
| Gray         | 15                 |
| White        | 16                 |

APPENDIX D  
PATTERN - IDENTIFIER CONVERSIONS

| <u>BINARY CODE</u><br>(0=off/1=on) | <u>HEXIDECIMAL CODE</u> |
|------------------------------------|-------------------------|
| 0000                               | 0                       |
| 0001                               | 1                       |
| 0010                               | 2                       |
| 0011                               | 3                       |
| 0100                               | 4                       |
| 0101                               | 5                       |
| 0110                               | 6                       |
| 0111                               | 7                       |
| 1000                               | 8                       |
| 1001                               | 9                       |
| 1010                               | A                       |
| 1011                               | B                       |
| 1100                               | C                       |
| 1101                               | D                       |
| 1110                               | E                       |
| 1111                               | F                       |



