8. Menu-driven programs as follows:
   - They present options for the user in the form of menus
   - They use a multiple-alternative structure to handle the user's option selection

Review Exercises

Fill in the Blank

1. A single-alternative structure is also known as a(n) _____ structure.

2. A dual-alternative structure is also known as a(n) _____ structure.

Multiple Choice

3. A multiple-alternative structure cannot be implemented by using which of the following:
   a. A single If-Then statement
   b. Several If-Then statements
   c. Several If-Then-Else statements
   d. A single Case statement

4. If Char1 = "/" and Char2 = "?", which of the following expressions are true?
   a. Char1 < Char2
   b. Char1 <= Char2
   c. Char1 > Char2
   d. Char1 >= Char2

5. The term defensive programming refers to which of the following:
   a. Ensuring that input data are in the proper range
   b. Ensuring that a division by 0 does not take place
   c. Ensuring that the square root operation is valid
   d. Techniques that include all the above points

True or False

6. If X = 0, determine whether each of the following expressions is true or false.
   a. **T** F X >= 0
   b. T **F** 2 * X + 1 != 1

7. If First = "Ann", determine whether each of the following expressions is true or false.
   a. T **F** First == "ann"
   b. T **F** First != "Ann"
   c. **T** F First < "Nan"
   d. T **F** First >= "Anne"

8. If `X` = 0 and `Response` = `"Yes"`, determine whether each of the following expressions is true or false.
   a. **T** F `(X == 1) OR (Response == "Yes")`
   b. T **F** `(X == 1) AND (Response == "Yes")`
   c. T **F** `NOT (X == 0)`

9. If `Num1` = 1 and `Num2` = 2, determine whether each of the following expressions is true or false.
   a. **T** F `(Num1 == 1) OR (Num2 == 2) AND (Num1 == Num2)`
   b. T **F** `((Num1 == 1) OR (Num2 == 2)) AND (Num1 == Num2)`
   c. T **F** `NOT (Num1 == 1) AND NOT (Num2 == 2)`
   d. T **F** `NOT (Num1 == 1) OR NOT (Num2 == 2)`

10. **T** F The ASCII coding scheme associates a number between 0 and 127 with every lowercase and uppercase letter, as well as many other characters.

11. **T** F If `Char1` and `Char2` are characters, then `Char1 == Char2` if and only if their ASCII codes are the same.

12. T **F** If `Name` = `"John"`, then `Name > " John"`.

13. **T** F If `Name` = `"John"`, then `Name >= "JOHN"`.

14. T **F** `"**?" < "***"`.

15. **T** F `"** " < "***"`.

16. **T** F A `Case` statement can be used to select an alternative based on the value of a variable of character type.

17. T **F** A menu-driven program requires the user to memorize a list of commands in order to select options offered by the program.

18. **T** F In a menu-driven program, the options on the main menu usually correspond to separate program modules.

Short Answer

19. Suppose that `X` = 0. What is displayed when code corresponding to the following program segment is run?

```
If X == 1 Then
   Write "Hi"
End If
Write "Bye"
```
Bye

20. Suppose that `X` = 0. What is displayed when code corresponding to the following program segment is run?

```
If X == 1 Then
   Write "Hi"
Else
   Write "Why?"
End If
Write "Bye"
```
**Why?**
Bye

21. Give the ASCII code for each of the following characters:
    a. "&"
    b. "2"
    c. " "

22. What character corresponds to each of the following ASCII codes?
    a. 33
    b. 65
    c. 126

23. If the string "}123*" is less than the string S (according to the ASCII code), with which character must S begin?

24. Give the ASCII code for each of the following words, character by character:
    a. "why?"
    b. "Oh my!"

25. Write a program segment that inputs Age and displays "You are too young to vote" if Age is less than 18 (and displays nothing else).

26. Draw a flowchart that corresponds to Exercise 25.

27. Write a program segment that inputs Age, displays "Yes, you can vote" if Age is 18 or older and displays "You are too young to vote" if Age is less than 18, and displays nothing else. Remember to use the comparison operator when checking the value of Age in your If-Then-Else statements.

28. Draw a flowchart that corresponds to Exercise 27.

29. Write a program segment that contains two If-Then statements and which inputs Num, then displays "Yes" if Num == 1 and displays "No" otherwise. Remember to use the comparison operator when checking the value of Num in your If-Then-Else statements.

30. Write a program segment that contains a single If-Then-Else statement and which inputs Num, then displays "Yes" if Num == 1 and displays "No" otherwise. Remember to use the comparison operator when checking the value of Num in your If-Then-Else statements.

31. List the programming symbols for the relational operators.

32. List three logical operators used in programming.

33. Write expressions equivalent to the following without using the NOT operator:
    a. NOT (N > 0)
    b. NOT ((N >= 0) AND (N <= 5))

34. Write expressions equivalent to the following using a single *relational*

operator:

a. $(X > 1)$ AND $(X > 5)$

b. $(X == 1)$ OR $(X > 1)$

35. Write 3 short program segments that input Num; then display "Yes" if Num == 1, display "No" if Num == 2, and display "Maybe" if Num == 3. Implement this program segment by

a. A sequence of If-Then statements.

b. Nested If-Then-Else statements.

c. A Case statement.

36. Write a program segment that inputs a number X and does all of the following:

a. Displays the reciprocal of its square root, $1/\text{sqrt(x)}$, if $X > 0$

b. Displays "Error: Division by zero", if $X = 0$

c. Displays "Error: Square root of negative number", if $X < 0$

37. Which type of selection structure does the flowchart in Figure 3.9 represent?

38. Write pseudocode that uses If-Then statements to achieve the same

Figure 3.9 Flowchart for Exercises 37–40
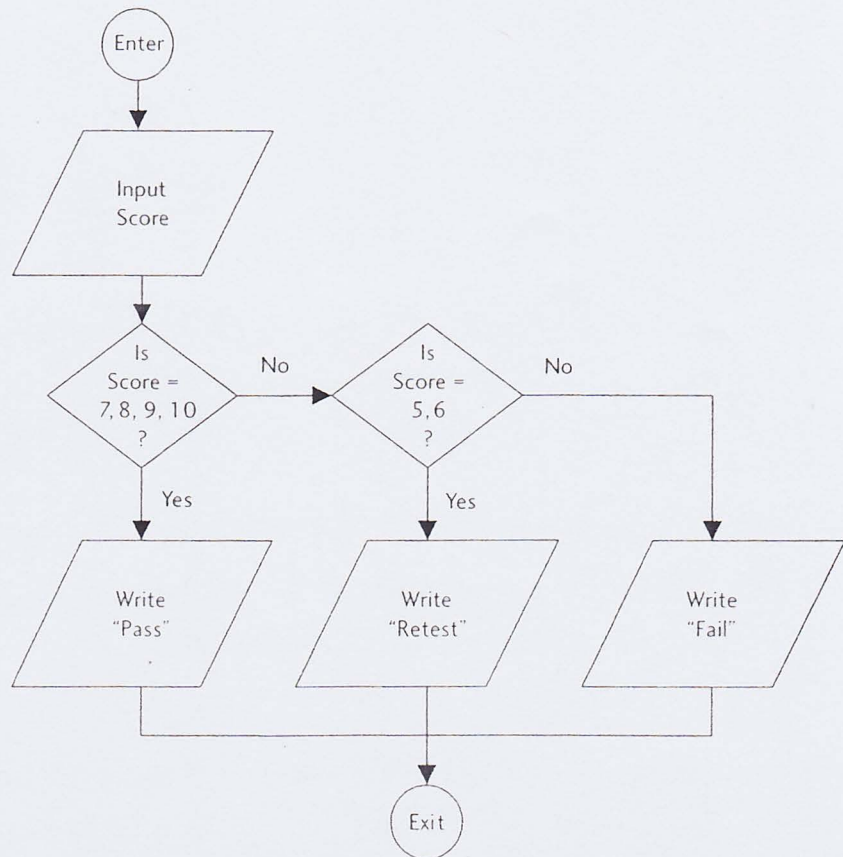
action as that indicated by the flowchart shown in Figure 3.9. Assume that Score is an integer between 1 and 10 inclusively.

39. Write pseudocode that uses nested If-Then-Else statements to implement the flowchart in Figure 3.9. Assume that Score is an integer between 1 and 10 inclusive.

40. Write pseudocode that uses a Case statement to achieve the same action as that indicated by the flowchart in Figure 3.9. Assume that Score is an integer between 1 and 10 inclusively.

41. What is displayed when code corresponding to the following program segment is run?

```
Set X = 5
If X > 0 Then
  Write X
End If
If NOT ((X == 0) OR (X < 0)) Then
  Write "Not"
End If
If (X ^ 2 >= 0) AND ((2 * X - 1) != 0) Then
  Write "And"
End If
```

42. Suppose that we replace the first statement in Exercise 41 by

```
Set X =  -5
```

What would be displayed when the code is run using this value?

43. Using the code shown below, what will be displayed when the input is as follows:

a. −1

b. 0

c. 1

```
Input Number
If Number < 0 Then
  Write "1"
Else
  If Number == 0 Then
    Write "2"
  Else
    Write "3"
  End If
End If
Write "DONE"
```

44. What is displayed when code corresponding to the following program segment is run and the input is as follows:

a. −1

b. 0

c. 1

```
Set Number1 = 1
```

```
Input Number2
Select Case Of Number2
  Case: -1
    Write "A"
  Case: 0
    Write "B"
  Case: Number1
    Write "C"
End Case
```

45. This program segment is supposed to display HELLO if Grade == "A" and display GOODBYE, otherwise. Correct the logic error so that it works correctly.

```
If Grade != "A" Then
  Write "HELLO"
Else
  Write "GOODBYE"
End If
```

46. This program segment is supposed to display NEGATIVE if Number is less than 0, SMALL if Number lies between 0 and 5 (inclusive), and LARGE if Number is greater than 5. Correct the logic error so that this pseudocode works correctly.

```
If Number < 0 Then
  Write "NEGATIVE"
Else
  If Number > 5 Then
    Write "SMALL"
  Else
    Write "LARGE"
  End If
End If
```

47. What is displayed when code corresponding to the following program segment is run?

```
Set Y = 1
If Sqrt(Y-1) == 0 Then
  Write "YES"
Else
  Write "NO"
End If
```

48. What is displayed when code corresponding to the program segment below is run with the following:

a. X = 4

b. X = 0

```
If X != 0 Then
```

```
    Write 1/X
  Else
    Write "The reciprocal of 0 is not defined."
  End If
```

49. Which block of statements, the Then clause or the Else clause, provides the error trap in Exercise 48?

50. Consider the following statement:

    ```
    Set Number3 = Sqrt(Number1)/Number2
    ```

    If Number1 and Number2 were input by the user and properly validated to ensure that Number1 is greater than or equal to 0 and Number2 is not zero, is any additional defensive programming necessary?

Programming Problems

For each of the following Programming Problems, use the top-down modular approach and pseudocode to design a suitable program to solve it. Where appropriate, use defensive programming techniques.

1. Input a number entered by the user and display "positive" if it is greater than zero, "negative" if it is less than zero, and "zero" if it is equal to zero.

2. Develop a menu-driven program that inputs two numbers and, at the user's option, finds their sum, difference, product, or quotient.

3. Input a number (X) and find the area (Area) of each of the following:
   - A square with side X, Area = X * X
   - A circle with radius X, Area = 3.14 * X^2
   - An equilateral triangle with side X, Area = Sqrt(3/4) * X^2

   Note: Because X represents a dimension, we require that X > 0. Be sure to include this requirement in your program.

4. Develop a menu-driven program that inputs a number, (X) and, at the user's option, finds the area of a square with side X, the area of a circle with radius X, *or* the area of an equilateral triangle with side X. (See Programming Problem 3.)

5. Consider the equation $Ax^2 + B = 0$.
   - If B/A < 0, this equation has two solutions. The solutions are:
     1. X1 = Sqrt(-B/A)
     2. X2 = -Sqrt(-B/A)
   - If B/A = 0, this equation has one solution which is X = 0
   - If B/A > 0, this equation has no real number solutions

   Write a program to have the user input any numbers for the coefficients, A and B, for this equation. If A = 0, terminate the program. Otherwise, solve the equation.

6. Compute the income tax due on a taxable income entered by the user, given the data as shown in the following table:

Taxable Income		Tax Due
From	To	
$0	$50,000	$0 + 5% of amount over $0
$50,000	$100,000	$2,500 + 7% of amount over $50,000
$100,000	...	$6,000 + 9% of amount over $100,000

The solutions to Programming Problems 7 and 8 assume that Chapter 4 has been covered prior to Chapter 3. The solutions to these problems require the use of repetition structures (loops).

7. Find and display the largest of a list of positive numbers entered by the user and terminated by 0.

8. For a list of numbers entered by the user and terminated by 0, find the sum of the positive numbers and the sum of the negative numbers.