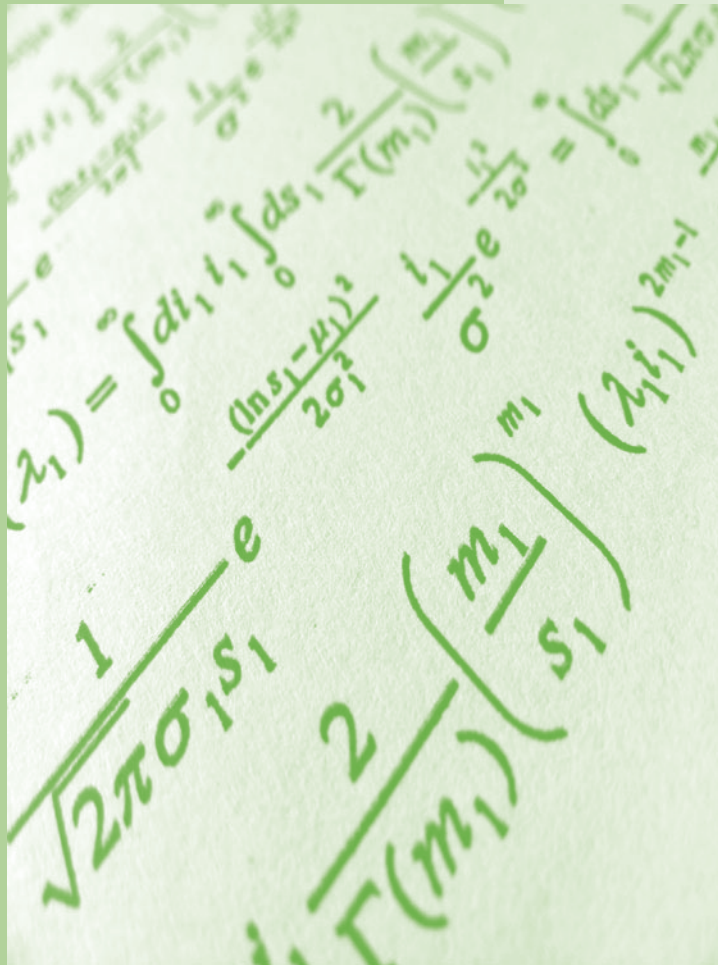


Chapter 19

Computing



REMEMBER

Before beginning this chapter, you should be able to:

- Use terms related to a computer
- Operate on a computer

KEY IDEAS

After completing this chapter, you would be able to:

- Understand characteristic and architecture of a computer
- Apply operators to perform various operations in a computer
- Study rules for declaration of variables
- Learn about conditional statements

INTRODUCTION

We are living in the age of information technology. Computers play a key role in our everyday life. These are extensively used in various fields, such as banking, insurance, transportation, science and technology, entertainment. Complex tasks can be easily solved with the help of computers.

A computer is a multipurpose electronic device which is used for storing information, processing large amount of information, and to accomplish tasks with high speed and absolute accuracy.

A computer can be defined as an electronic device which accepts input data, processes it following the set of instructions called 'programs', and gives the 'output information'.

The idea of a computer was first developed by **Charles Babbage** in the 18th century. Since the time computer was invented, its architecture has undergone numerous changes. At the initial structure of a computer vacuum tubes were used. Then, computers used to be large in size. Some computers were as large as that of a room. Thereafter, the vacuum tubes were replaced with transistors. That was the beginning of the second generation of computers. On the later years, small-scale integrated circuits (IC) were used in the third generation computers. With rapid advancements in the field of science and technology, very large-scale integrated (VLSI) circuits were fabricated. The present days computers use VLSI circuits to achieve high speed, small size, vast memory, and higher accuracy. Today, various types of mini-computers, such as laptops, notebooks, and PDAs (Personal Digital Assistants) are available in the market.

Historical Development of Computing

The method of computing began in the early 4000–1200 BC. By that time, people used to record transactions on clay tablets. Around 3000 BC, the Babylonians invented the Abacus from where computing started. No significant development took place until the 17th century. **Blaise Pascal** invented a machine which was named as **Pascalens**. It was the first mechanical adding machine in the history of computing. Then punch cards were used in the early 18th century. In 1822, Charles Babbage developed the first mechanical computer. For this reason, he is known as the father of the computer. In 1854, George Boole, developed the Boolean logic. It is the basis of computer design. Before 20th century, all machines were mechanical. The first electronic computer built in 1966, was named ENIAC (Electronic Numerical Integrator and Computer).

In 1962, instead of individual transistors integrated circuits were used in the computers. The most famous machine, at that time, was the IBM 360 and DEC DPBQ. Later, microprocessor was invented. It enabled reduction of size and performance enhancement of the computers. In 1981, IBM launched PC. Since then, there has been a significant development in the field of micro electronics and micro processors.

Today, we use computers with 2 to 3 GHz processors, with .5 to 1 GB of memory and 80 to 120 GB of storage space (while only 500 KB storage space was considered significant even till a few years ago.)

In the evolution of computers, major changes have occurred in both the structure and the functioning, which have a tremendous impact on the way these machines appear and the extent to which people use these. We refer to these changes as introducing a new

generation of computers. Till date, the following five generations of computers are readily identifiable:

First generation (1945–1956): The computers of this generation were mechanical or electro mechanical in which vacuum tubes were used. These computers were huge in size, inflexible and slow in comparison to the later generations of computers.

Second generation (1957–1963): In 1948, transistor was invented. It made a major impact on the development of computers. Transistors replaced the large vacuum tubes. This led to a significant reduction in the size of the computers. In the early 1960's, several commercially successful computers were used in business establishments and universities. Several high-level programming languages, such as COBOL, FORTRAN were introduced.

Third generation (1964–1971): By this time, integrated circuits (ICs) were manufactured. In an IC, hundreds of transistors were assembled in a tiny silicon chip. This led to the development of the third generation computers.

Fourth generation (1971 to the present): In this generation, LSI (large-scale integrated), VLSI (very large-scale integrated) and ULSI (ultra large-scale integrated) chips were introduced. These significantly increased the efficiency and reliability of the computers.

In 1981, IBM introduced personal computers (PCs) for use at home or office. These PCs could be linked together or networked to share both software and the hardware.

Fifth generation of computers (present days and beyond): With developments in artificial intelligence (AI), computers are enabled to hold conversation with humans. They can use visual inputs and learn from their own experience. A robot is one fine example of the application of artificial intelligence.

Characteristics of a Computer

Some of the characteristics of computers are:

1. Speed
2. Reliability
3. Storage Capacity
4. Productivity

Architecture of a Computer

A computer consists of three essential components. Those are:

1. Input device (e.g., key board)
2. Central Processing Unit (CPU)
3. Output device (e.g., Monitor)

The CPU is an important component in a computer. It consists of:

- (i) Memory unit
- (ii) Control unit
- (iii) Arithmetic and logic unit (ALU)

Block diagram of a computer is shown below:

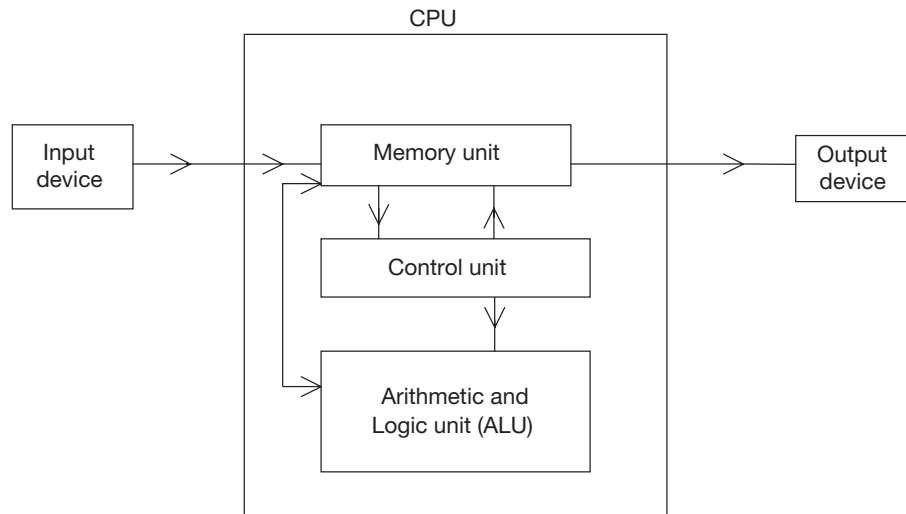


Figure 19.1

The instructions or processed data is received by computers the input devices. This information is stored in the memory unit. If arithmetical operations are to be performed, then with the help of the control unit, the arithmetic and logic unit (ALU) performs the operations and stores the result in the memory unit. Finally the results can be viewed through output devices.

The three physical components, i.e., input devices, CPU, and output devices are together referred as '**hardware**' of a computer.

Software

To accomplish a particular task by using a computer, one requires writing a set of instructions in a language that can be understood by the computer. Any of our usual languages cannot be read or understood by a computer. So, we need to feed information into a computer using a language called 'programming language'. BASIC, PASCAL, C, C++, Java, etc., are some of the popular programming languages.

A set of instructions that are written in a language which can be understood by a computer is called a 'program'. A set of programs is called '**software**'.

A program is to be written to accomplish a particular task. This program is fed into the memory of a computer by using an input device (i.e., key board). The control unit reads the instructions (given in the program) from the memory and processes the data according to these instructions. The result can be displayed with a device, such as a monitor or a printer. These devices are called 'output devices'.

Note that the arithmetic and logic unit (ALU) performs all the arithmetic and logical operations, such as addition, subtraction, multiplication, division, comparison under the supervision of the control unit (CU). The CU decodes these instructions to execute and the output unit receives the results from the memory unit and converts these results into a suitable form which the user can understand.

Algorithm

A comprehensive and detailed step-by-step plan or a design that is followed to solve a problem is called an algorithm. Thus, an algorithm is a set of systematic and sequential steps in arriving at a solution to a problem.

For example, if you want to buy some articles from a grocery store, then the following steps are to be followed:

1. Make a list of articles which you intend to purchase.
2. Go to the grocery store.
3. Give the storekeeper the list of articles.
4. List the prices of the articles on paper. Add them to get the total amount of money you need to pay.
5. Pay the money and collect the articles.
6. Verify if you have received all the articles.
7. Return home with the groceries.

Steps (1) to (7) form the algorithm for the task of buying grocery items. Even though it is a simple task, we follow several steps in a systematic way to achieve the task. Similarly, to solve a task using a computer, at first, we need to make a blue print, i.e., algorithm of the steps that are to be followed. Once an algorithm is ready, we can represent it on a flow chart.

Flowchart

A flowchart is a pictorial representation of an algorithm. Flowchart clearly depicts the points of input, decision-making, loops and output. Thus, with the help of a flow chart, we can plan more clearly and logically, to solve a given task.

To draw a flowchart, we use certain symbols or boxes to represent the information appropriately. Following are the notations used in a flowchart.

1. **The operation box:** This box is used to represent the operations, such as addition, subtraction.
2. **The data box:** This box is used to represent the data that is needed to solve a problem, also to represent information regarding the output of solution.
Therefore this box is used for input and output.
3. **Decision box:** A diamond-shaped (or rhombus) box is used whenever a decision is to be taken. The points of decision can be represented by using this box. Usually, the answer to the decision is 'yes' or 'no'.
4. **Terminal box:** This box indicates the start or termination of a program.
5. **Flow lines '→':** The arrows which are used in flowcharts are known as flow lines. These arrows are very important in flow charts.

6. **Connectors:** The circle is a connector in a flowchart. The connector is used in the flowcharts only if it needs to be continued on the next page. Connectors are always used in pairs. The flowchart will have an outwards connector on a page which can be continued with an inwards connector in the next page.

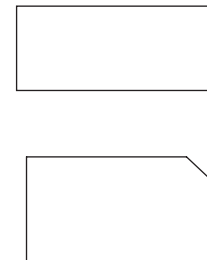


Figure 19.2

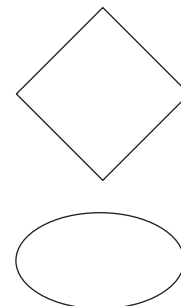


Figure 19.3

Both ‘in’ and ‘out’ connectors should contain the same alphabet.

Once a flowchart is ready, we can translate it into a programming language, and feed it into a computer’s memory.

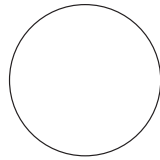


Figure 19.4

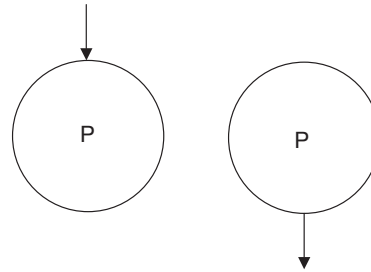


Figure 19.5

To accomplish a task on a computer, the following steps are to be followed:

1. Identify and analyze the problem.
2. Design a systematic solution to the problem, and write an algorithm.
3. Represent the algorithm in a flowchart.
4. Translate a flowchart into a program.
5. Execute the program and get the output.

Examples:

1. You are given the principle and the rate of simple interest (SI) per month. Write an algorithm to calculate the cumulative simple interest at the end of each year up to 10 years, and also draw a flowchart.

Algorithm:

Step 1: Read the values of principle (P), rate of interest (R).

Step 2: Take $T = 1$

Step 3: $SI = \frac{12 \times P \times T \times R}{100}$

Step 4: Print the SI

Step 5: Calculate $T = T + 1$

Step 6: If $T \leq 10$, then repeat Steps 3, 4, and 5.

Step 7: Otherwise, stop the program.

2. Write an algorithm and draw a flowchart to find the sum of first 50 natural numbers.

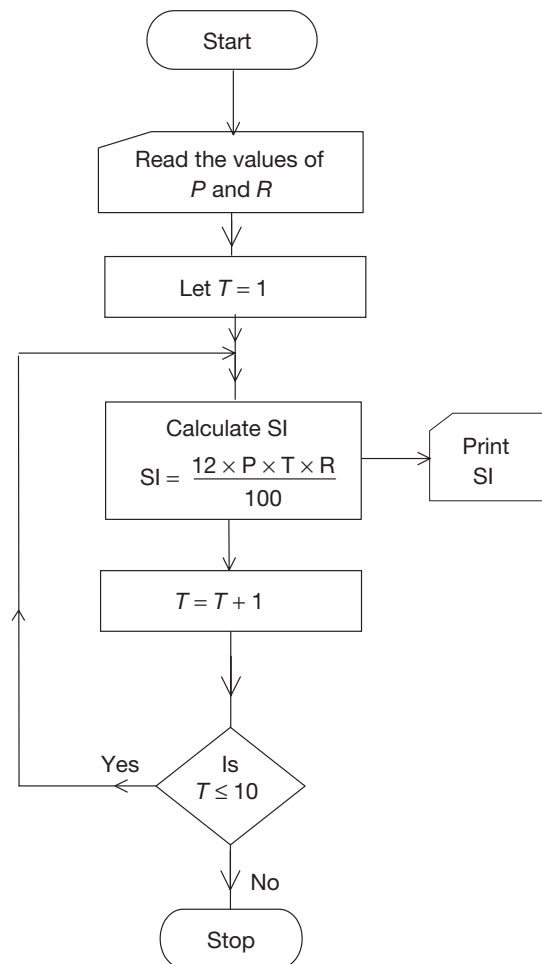


Figure 19.6

Algorithm:

Step 1: Set count = 1, Sum = 0.

Step 2: Add count to sum.

Step 3: Increase count by one, i.e., count = count + 1

Step 5: Check whether count is 51.

Step 6: In Step (5), if count is 51

Display the sum and stop the program else Go to Step (2)

From this flowchart, we can observe that there is a loop among Boxes 3, 4 and 5.

Operators

Operators are used to perform various types of operations.

Example: Addition can be done by '+' operator.

There are different types of operators:

1. Shift operators
2. Logical operators
3. Relational operators
4. Arithmetic Operators

Computer performance is measured in three ways:

1. Storage Capacity
2. Processing Speed
3. Data transfer Speed

Storage Capacity is measured in Bits, Bytes, Kilobytes, Megabytes, or Giga Bytes.

1 nibble = 4 bits

1 Byte = 8 bits

1 Kilo Byte (KB) = 1024 Bytes = 2^{10} Bytes

1 Mega Byte (MB) = 1024 KB = 2^{20} Bytes

1 Giga Byte (GB) = 1024 MB. = 2^{30} Bytes

1 Tera Byte (TB) = 1024 GB. = 2^{40} Bytes

Processing Speed is measured in Hertze, i.e., cycles/second. It explains about the processor speed.

Example: 800 MHz, 1.5 GHz.

Data transfer speed is measured in Bytes per second.

Example: 256 KB/second, 128 KB/second.

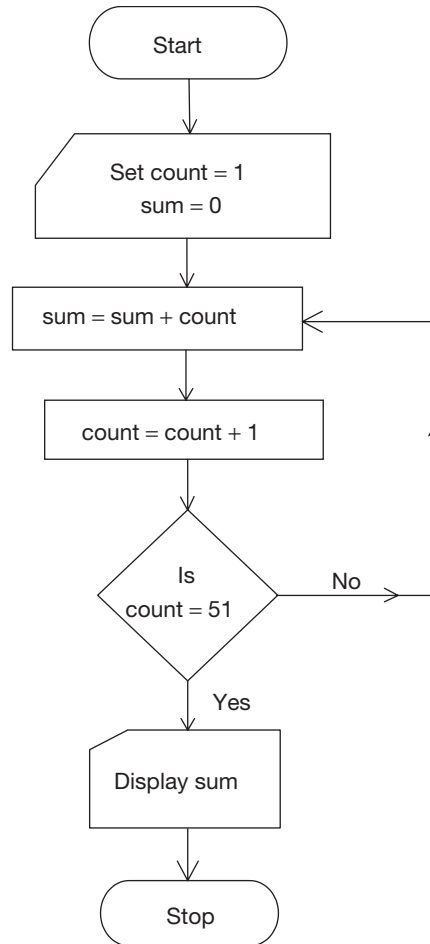


Figure 19.7

Examples:

1. Write an algorithm to calculate the sum of the squares of the first five natural numbers, and also draw the flowchart.

Algorithm:

- Step 1:** Take $N = 0$, $\text{Sum} = 0$
Step 2: Calculate $N = N + 1$
Step 3: Calculate $\text{Temp} = N * N$
Step 4: Calculate $\text{Sum} = \text{Sum} + \text{temp}$.
Step 5: If $N < 5$ repeat Steps 2, 3 and 4. Otherwise, print the sum and stop the program.
2. Write an algorithm to generate the Fibonacci series up to n terms, and also draw a flowchart.

Algorithm:

- Step 1:** Let $F_1 = 0$, $F_2 = 1$ and $K = 2$
Step 2: Read N for number of terms
Step 3: Print F_1 and F_2
Step 4: Calculate $F_3 = F_1 + F_2$
Step 5: Print F_3
Step 6: Calculate $K = K + 1$
Step 7: $F_1 = F_2$ and $F_2 = F_3$
Step 8: If $K < N$, then go to Step 4, else stop the program.

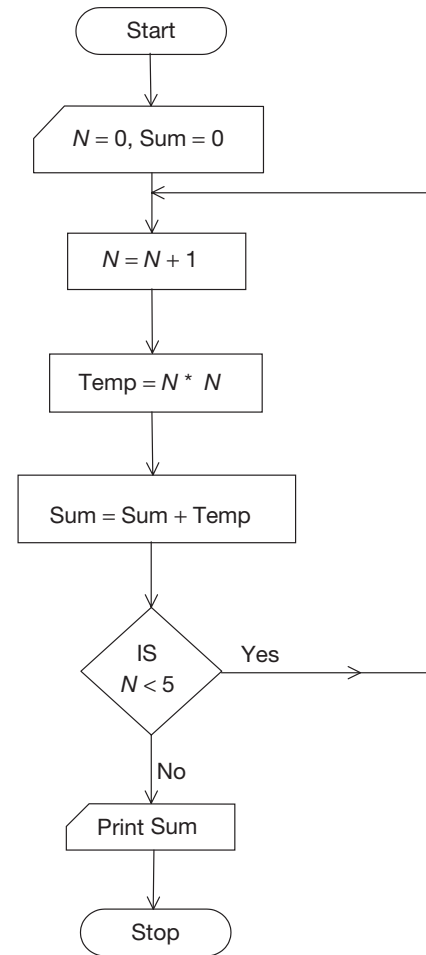


Figure 19.8

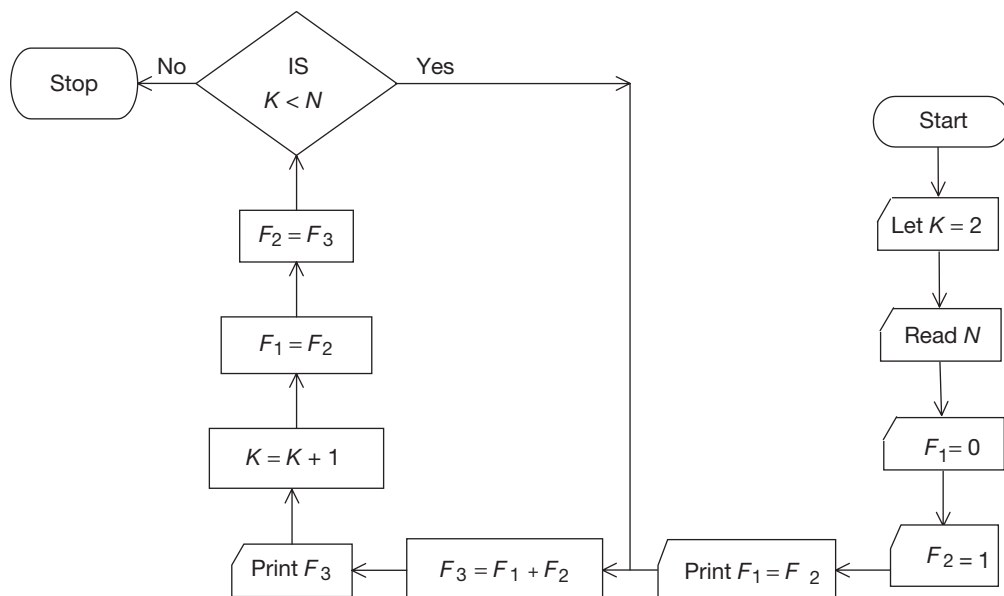


Figure 19.9

Basic

Basic (Beginners all purpose symbolic Instruction code) is a high-level and user-friendly language. The instructions can be given in simple English language along with some keywords and specific syntax. This language is useful in the field of Business, Engineering, Mathematics and other applications.

Constants

Constants are those which do not change their values in the program. They can be classified as:

1. Numeric Constants
2. Alphanumeric Constants

Numeric

All the whole numbers ranging between -32767 to $+32767$ are numeric constants.

Note Commas are not allowed in a constant. For an example, 23,456 are not valid.

Alphanumeric

Set of alphabets or numeric's or alphanumeric's which are enclosed within double quotation marks are treated as alphanumeric or string constants.

Example: 'A', '576', 'AP007'

Variables

A variable is a name that represents a number, a character or a string. Variables are of two types:

Numeric variable

It must start with a letter.

Example: A, BASIS.

Alphanumeric variables or string variables

It must begin with a letter. It can be followed by other letters or numbers, but must end with a dollar sign (\$).

Example: A\$, NAME 2\$.

Rules for Declaration of Variables

1. A variable must start with an alphabet.
2. Keywords should not be used as a variable name.
3. In a variable name declaration, commas and blank spaces are not allowed.
4. The variable length should not exceed 40 characters.
5. The special characters, like %, #, and \$ are not allowed in variables.

Examples:

1. 9ALSAB Invalid, it should start with an alphabet.
2. 201 Valid
3. SAP GIM No space is allowed in variable name, hence it is invalid.
4. K21A \$ Invalid, \$ cannot be used here.
5. R, PT20 Invalid, commas are not allowed.

Basic Operators

Operators are used to relate variables and constants to form expressions.

Operators are of three types:

1. Arithmetic operators
2. Logical operators
3. Relational operators

Arithmetic Operators

These are used for mathematical operations.

For addition '+'

Subtraction '-'

Multiplication '*'

Division '/'

Exponential '^'

Logical Operators

There are three logical operators:

1. AND: AND expression will be executed when both of the conditions are true.
2. OR: OR expression will be executed when any one of the conditions is true.
3. NOT: NOT expression will be executed when a condition has to be negated.

Relational Operators

These operators are used to form a relational expression. These are:

'=' equality, '<' less than, '>' greater than, '<=' less than or equal to, '>=' greater than or equal to, '<>' Not equal to.

Example: $x < y$, $A > B$

Order in which Arithmetic Operators are Evaluated

1. Parenthesis ()
2. Exponentiation ^, ↑
3. Multiplication or division *, /
4. Addition or subtraction

Operations of equal priority are performed from left to right.

Basic Statements

BASIC statements are primarily of two types: (1) executable, and (2) non-executable. Executable statements are those which are executed by the computer, while non-executable statements are those which are ignored by the computer and used for the user to understand the nature of the program. The following statements are generally used in BASIC Programming.

1. REM
2. LET
3. INPUT
4. READ ... DATA
5. END
6. GOTO
7. PRINT
8. BRANCHING
9. STOP

REM

To declare non-executable statements, REM statement is used.

Syntax: Ln REM comment

Example: 10 REM ** BASIC LANGUAGE**

LET

To assign numeric or string values to a variable LET statement is used.

Syntax: Ln LET variable = constant/expression

Example: 20 Let X = 10

30 Let SI = $P * T * R / 100$

INPUT

To enter data into the computer during the process of execution is called INPUT. The entered value will be stored in memory variable.

Syntax: Ln INPUT variables

Example: 10 INPUT X

Note A single INPUT statement can have many variables either same data type or different data type.

The user has to enter the values in the same order in which the variable appears.

Input statement also allows the user to enter relevant data at the time of its execution.

10 INPUT 'enter marks of student'; A.

READ ... DATA

It is used to assign the values to the variables. In READ statement variables are declared and in DATA statement, the respective values are provided for the declared variables.

Syntax: Ln READ list of variables

Ln DATA list of values

Notes

1. The number values given through DATA should be more or equal to the number of variables of same data type or different data type declared in READ statement. Otherwise, an error message will be displayed in the program and it will be terminated.
2. The constants in DATA statement must match the variable type.
3. The string constant in the DATA statement need not be enclosed within quotes.
4. There can be many READ and DATA statements in a program.

Example: 10 READ P, Q, R
20 DATA 10, 20, 30.

PRINT

It is used to display the output of the program.

Syntax: Ln PRINT variables

Examples:

1. 100 PRINT x, 4\$
2. 100 PRINT A\$, B\$ when A\$ = NEW and B\$ = YORK
Result NEWYORK

3. 100 PRINT A; B; C when A = 15, B = -4 and C = 25
Result: b15b - 4b - 25b

Where b denotes blank space.

Print statement can also be written with message enclosed within double quotes.

150 PRINT 'THIS IS AN ANIMAL'; B\$.

END

It is used to terminate the execution of the program.

Syntax: Ln END

Example: 100 END

STOP

It terminates the execution of the program temporarily; it can be re-executed by typing CONT or by pressing the F5 key.

Syntax: Ln STOP

Example: 100 STOP

CONDITIONAL STATEMENTS

The statements which are dependent on certain conditions are known as conditional statements. Only if the test of expression is true, the statements which are dependent on conditions will be executed. Otherwise, they will be skipped.

Conditional statements are of two types:

1. Branching statements
2. Looping statements

Branching Statements

1. IF–THEN statement
2. IF–THEN–ELSE statement

IF–THEN Statement

This is a conditional branching statement. A condition will be specified here, and if it is true the action is carried out.

Syntax: Ln IF conditional THEN actions.

EXAMPLE 19.1

5 REM OPERATION ON TWO NUMBERS.

10 Let $A = 8$

20 Let $B = 20$

30 IF $B > A$ THEN $C = B - A$

40 IF $A = B$ THEN $C = B + A$

50 IF $A > B$ THEN $C = A - B$

60 Print C

70 END.

SOLUTION

Here, $A = 8$, $B = 20$,

i.e., $A < B$.

$C = B - A = 20 - 8 = 12$.

∴ The output of program is 12.

IF–THEN–ELSE

It is a conditional statement. If a condition is satisfied, then a particular action is executed. Otherwise, another action is executed.

Syntax: Ln IF conditional

THEN action1

ELSE action 2

EXAMPLE 19.2

5 REM Arranging the two numbers in ascending order.

10 Let $A = 10$

20 Let $B = 20$

30 IF $A > B$ THEN

40 PRINT B ; A ;

50 ELSE

60 PRINT A ; B ;

SOLUTION

Here,

$A = 10, B = 20,$

i.e., $A < B$

Control is transferred to else block.

$\therefore$ The output of the program 10, 20.

Looping Statements

Here, a condition is specified with a set of statements. The statements will be executed until the condition gets violated. Generally, an incrementing or a decrementing statement will keep track of the loop.

Syntax: In variable $[u = e_1]$ TO $[e_2]$ STEP $[e_3]$

EXAMPLE 19.3

```
5 REM Summing of squares of odd numbers
10 LET S = 0
20 FOR N = 1 to 10 STEP 2
30 LET S = S + N * N
40 NEXT N
50 PRINT S
60 END
```

SOLUTION

Here, in the first time, the value of S is $1 \times 1 = 1$. STEP 2 implies that the value of N increases by 2 and becomes 3. This process keeps on going and, finally, prints the value of S as 165.

Unconditional Statements

GO TO

It transforms the control to another part of the program which will be executed.

It is unconditional branching statement.

Syntax: Ln GOTO line number

Example: 50 GOTO 200

EXAMPLE 19.4

Find the output of the following program.

```
10 Let A = 1
20 READ P, Q
30 DATA 2, 8
40 Let R = P
50 Let R = R * P
60 Let A = A + 1
```

70 If $A = Q$, then GOTO 80 ELSE GOTO 50

80 PRINT R

90 END

(a) 64 (b) 256 (c) 512 (d) 128

SOLUTION

Initial $A = 1$

Initial $R = 2$

Next $R = (2)(2) = 4$

Next $A = 2$

$A \neq Q \therefore$ GOTO 50 takes place

Next $R = (4)(2) = 8 = 2^3$

Next $A = 3$

$A \neq Q$

$\therefore$ GOTO 50 takes place

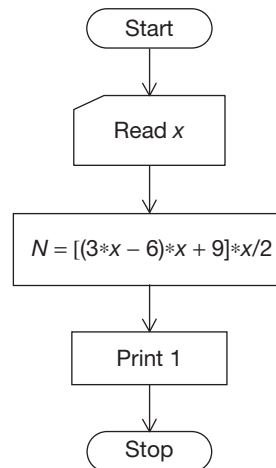
Next $R = (8)(2) = 16 = 2^4$

Similarly when $A = 7$ $A \neq Q$, $R = 2^7$

Next $A = 8$

$\therefore$ GoTo 80, OUTPUT is $2^8 = 256$.

EXAMPLE 19.5



If $x = 12$, then find the output of the flowchart given above.

(a) 2126 (b) 2348 (c) 2214 (d) 2434

SOLUTION

$$\text{Output} = [(3)(12) - 6]12 + 9 \left(\frac{12}{2} \right)$$

$$= [(36 - 6)12 + 9] \times 6$$

$$= (369)(6) = 2214.$$

EXAMPLE 19.6

Find the output of the following program.

```
10 Let  $a = 3$   
20 Let  $b = 2$   
30 Let  $\text{sum} = a + b$   
40 Let  $b = a$   
50 Let  $a = \text{sum}$   
60 If  $\text{sum} < 90$  THEN GOTO 30 ELSE GOTO 70  
70 PRINT 'The sum is';  $\text{sum}$   
80 END
```

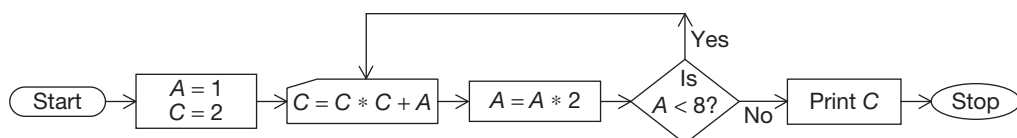
(a) The sum is 134 (b) The sum is 124 (c) The sum is 144 (d) The sum is 154

SOLUTION

Initial $a = 3$
Initial $b = 2$
Initial $\text{sum} = 3 + 2 = 5$
Next $b = 3$
Next $a = 5$
Next $\text{sum} = 5 + 3 = 8$
 $\text{sum} < 90$
Next $b = 5$
Next $a = 8$
Next $\text{sum} = 5 + 8 = 13$
 $\text{sum} < 90$
In this manner, the next sums are
 $8 + 13 = 21$
 $13 + 21 = 34$, $21 + 34 = 55$, $34 + 55 = 89$,
 $55 + 89 = 144$
 $144 > 90$
GOTO 70 will take place when
 $\text{sum} = 144$.
 $\therefore$ Output: The sum is 144.

EXAMPLE 19.7

Find the output of the flowchart.



(a) 212 (b) 532 (c) 244 (d) 733

SOLUTION

Initially, $A = 1$, $C = 2$

$$C = 2^2 + 1 = 5$$

$$A = 1 \times 2 = 2$$

$$A < 8$$

$$\therefore C = 5 \times 5 + 2 = 27$$

$$\text{As } A = 2 \times 2 = 4$$

$$A < 8$$

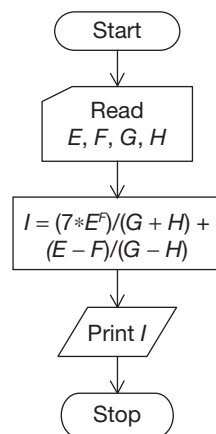
$$\therefore C = 27^2 + 4 = 733$$

$$A = 4 \times 2 = 8$$

$$\text{As } A = 8$$

$\therefore$ The output is '733'.

EXAMPLE 19.8



If the values of E , F , G and H are 2, 10, 9 and 5 respectively, then find the output of the flowchart.

- (a) 510 (b) 520 (c) 500 (d) 490

SOLUTION

$$\text{Output} = \frac{7 * 2^{10}}{9 + 5} + \frac{2 - 10}{9 - 5}$$

$$= \frac{7(1024)}{14} + \left(\frac{-8}{4} \right)$$

$$= \frac{1024}{2} - 2 = 512 - 2 = 510.$$

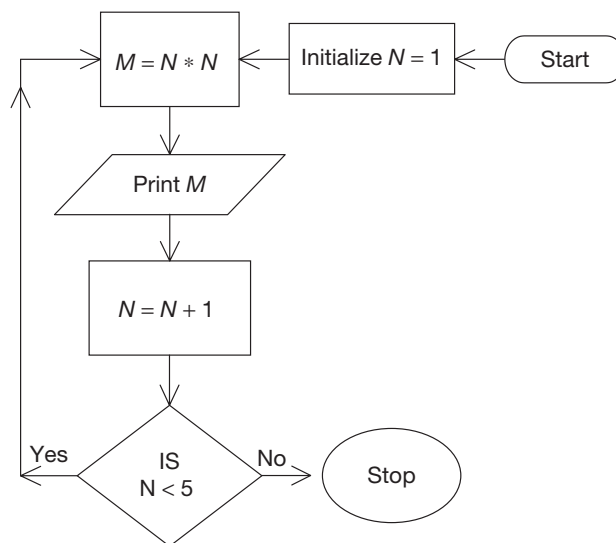
TEST YOUR CONCEPTS

Very Short Answer Type Questions

- Computer works according to instructions. This set of instructions is called a _____.
- What are the basic units of CPU?
- The language understood by the computer is called a _____.
- In first generation of computers, _____ are used.
- Software acts as a mediator between the user and computer hardware. [True/False]
- Numeric variables must begin with _____ in BASIC language.
- In fourth generation of computers, _____ are used.
- RAM is a secondary memory. [True/False]
- To display the output of the program, _____ keyword is used.
- 1 MB = _____ KB.
- The box indicating the decision in a flowchart is called a _____.
- Every statement in BASIC language input starts with a _____.
- In BASIC language, REM keyword is used to write _____.
- _____ is pictorial representation of algorithm.
- To assign any value to the variable, _____ key word is used.
- BASIC is a _____ language.
- To enter numerical or string data during the time of execution, _____ keyword is used.
- Go to is used to skip the _____.
- The maximum length of numeric constant in BASIC language is _____.
- The usage of numbers that are allowed in BASIC language is _____ to _____.

Short Answer Type Questions

- Write an algorithm to find the sum of squares of the first ten natural numbers.
- Write an algorithm to find $S = 1 + 3 + 3^2 + 3^3 + 3^4 + 3^5$.
- Write a program in BASIC to find the centroid of a triangle.
- Write a program in BASIC to find the sum of the first N natural numbers without using the formula $\frac{N(N+1)}{2}$.
- What will be the output of the following flowchart?

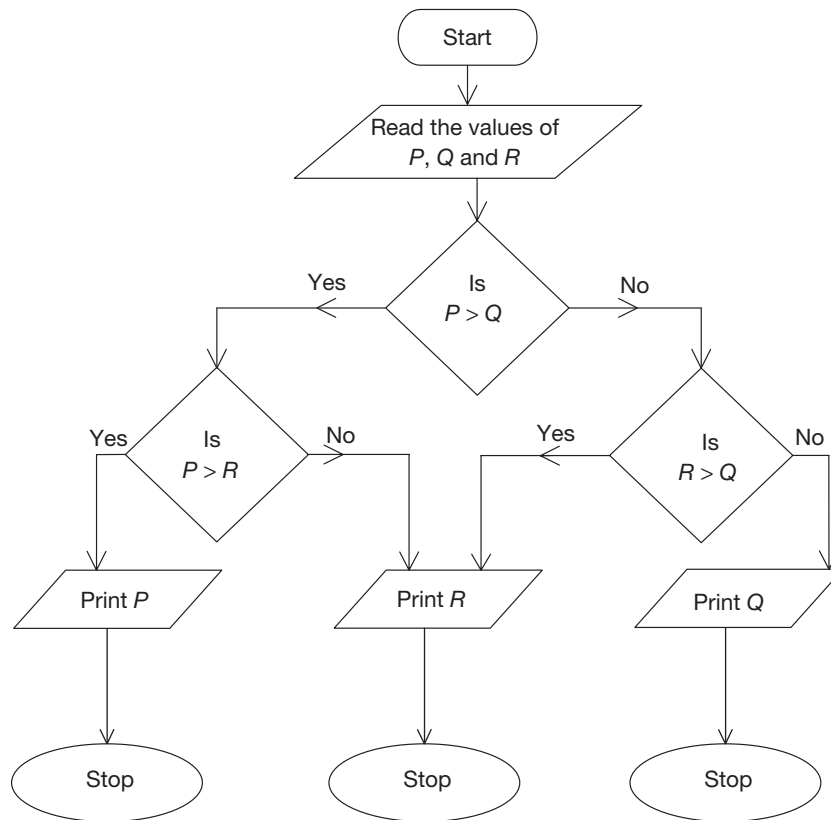


Essay Type Questions

- Write an algorithm to calculate the value of the expression $S = a * c - d * e + f \div m$, if the values of a, b, c, d, e, f and m are given.
- Write an algorithm to calculate the value of the expression $R = \sqrt{x^2 + y^2 + z^2}$.



28. Write a program in BASIC to find the area of a triangle when the lengths of three sides are given.
29. Write an algorithm to find the largest number among the given ten natural numbers.
30. If 12, 120 and 105 are the values of P , Q and R respectively, then what is the output of the following flow chart?



CONCEPT APPLICATION

Level 1

- BASIC is
 - Business Arithmetic System Instruction Code.
 - Beginners All Purpose Symbolic Instruction Code.
 - Basic All Purpose System Instruction Code.
 - Beginners All Purpose System Instruction Code.
- Which of the following is correct?
 - LET $A = 20, 420$
 - LET $B = 21, 445$
 - LET $A = 40$
 - None of these
- Low-level languages or machine languages use strings of
 - Zero's and two's
 - One's and two's
 - Zero's and One's
 - Both (b) and (c)
- PRINT keyword is useful to assign the values during
 - compilation
 - program
 - the process of execution
 - None of these



5. Evaluate the expression, as done by a computer:

$$13 - 7 \times 4 \div 2 + 3 - 2 \times 5 - 8$$

- (a) 0 (b) 57
(c) -16 (d) -3

6. Which of the following statements is true?

- (a) Every variable in the INPUT statement must have a corresponding constant or value in the READ statement.
(b) Every variable in the READ statement must have a corresponding constant or value in the DATA statement.
(c) There can be one READ statement and many Data statements.
(d) Every variable in the DATA statement must have many corresponding constants.

7. What is the output of the following program?

10 Read P , R and N

20 Data 1000, 10, 2;

30 Let $A = P * \left(1 + \frac{N * R}{100}\right)$

40 Print A

50 End

- (a) 1050 (b) 1120
(c) 1230 (d) 1200

8. Which of the following is not an alphanumeric?

- (a) 'S'
(b) 'SIX'
(c) 'S92'
(d) '123'

9. Which of the following is correct?

- (a) 10 READ x \$, y
20 DATA 20, 'TIME'
(b) 10 READ x \$, y
20 DATA 'TIME', 20
(c) 10 READ x \$, y \$.
20 DATA 20, 30
(d) None of these

10. Find the result of the following program.

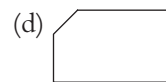
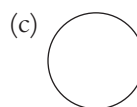
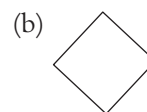
10 LET $A = 20$, $B = 30$ 20 LET $C = (A + B)/2$

30 PRINT C

40 END

- (a) 50 (b) 25
(c) 10 (d) None of these

11. In a flowchart representation, to connect a flow diagram from one page to another page of a program, which of the following diagram is used?



12. What will be the output of the following program?

10 REM AREA OF TRIANGLE IF

THREE SIDES ARE GIVEN.

20 READ a , b , c , s

30 DATA 12, 18, 10

40 LET $D = [s * (s - a) * (s - b) * (s - c)]^{\frac{1}{2}}$

50 PRINT 'THE VALUE OF $D =$ '; D

60 PRINT D

70 END

- (a) 1850 (b) 3200
(c) 6400 (d) Error

13. What will be the output of the following program?

10 REM DISCRIMINANT OF THE QUADRATIC EQUATION

20 READ a , b , c

30 DATA 10, 20, 5

40 LET $D = b^2 - 4 * a * c$

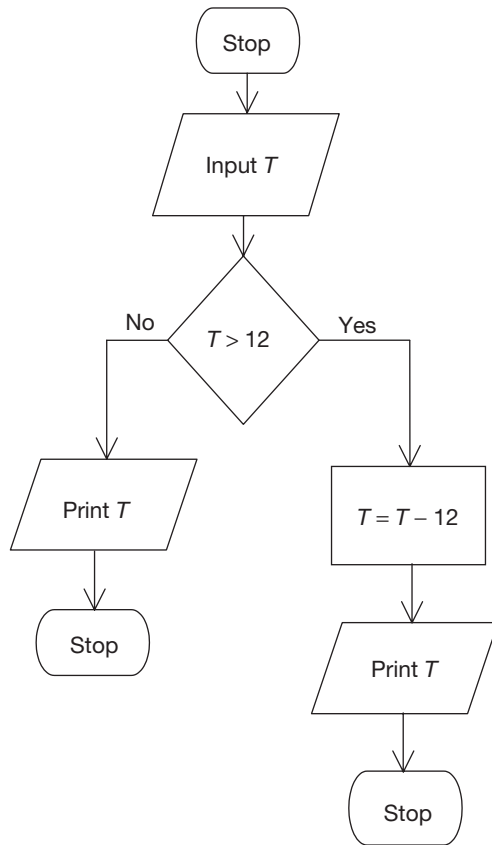
50 PRINT 'THE VALUE OF D IS ='; D

60 END

- (a) 400 (b) 200
(c) 300 (d) 150



14. What will be the output of the following flowchart, if $T = 15$?



- (a) 3 (b) 12
(c) 15 (d) 5
15. Evaluate the following expressions as a computer would do.
I. $(l + m)/n + q \times t \div 5$
II. $80 + 30 - 27 * 4 - 25 / (5 * 5)$
- (a) $(m + l)/n + \frac{qt}{5}, 1$
(b) $(m + l)/n + qt/5, 2$
(c) $(m + l)/n, 3$
(d) $(m + l)/n + qt/5, 2$
16. Which of the following is an algorithm to find the area of a square?
- (a) (i) Read an arm of the square.
(ii) Find the area by using $A = 4 * a$.
(iii) Display the area.
(b) (i) Find the area by using $A = 4 * a$.
(ii) Display the area.
(iii) Read an arm of square (a).

- (c) (i) Read an arm of square (a).
(ii) Find the area using $A = (a * a)$.
(iii) Display the area.
(d) (i) Read an arm of the square (a).
(ii) Display the area.
(iii) Find the area by using $A = (a * a)$.

17. REM is non-executable statement and is short for _____.

- (a) REMAT
(b) REMSTATE
(c) REMARKDATA
(d) REMARK

18. What will be the output of the following program?

```

10 Read A, B, C, D
20 Data 8, 10, 6, 2
30 Let S = D - A/(B - C) + A
40 PrintS
50 End
  
```

- (a) 0.5 (b) 10
(c) 8 (d) 9

19. Find the output of the following program.

```

10 LET A = 36, B = 4
20 LET C = (A/B) ^ (1/2)
30 PRINT C
40 END
  
```

- (a) 9 (2) 36
(c) 3 (d) None of these

20. What will be the output of the following program?

```

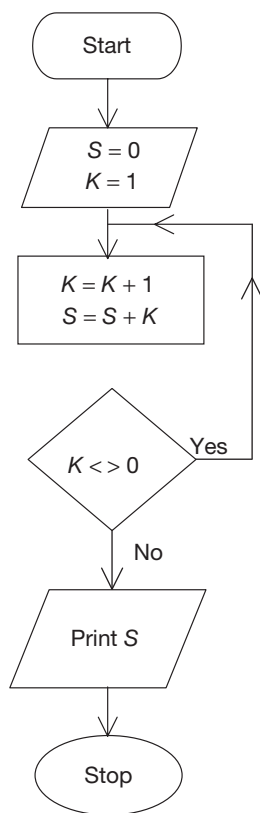
10 REM AVERAGE OF FOUR
   NUMBERS
20 READ N, N1, N2, N3, N4
30 DATA 4, 16, 40, 42, 90
40 PRINT 'AVERAGE = (N1 + N2 + N3 + N4)/N
50 END
  
```

- (a) AVERAGE = 43
(b) AVERAGE = 47
(c) AVERAGE = 39
(d) Error



Level 2

21. What will be the output of the following flowchart?



- (a) 1 (b) Infinite loop
(c) 27 (d) 54

22. Read the following algorithm:

```

10 Let P = 1, Sum = 0
20 If P ≤ N, then (N is the given Number)
30 Sum = Sum + P
40 P = P + 1
50 Repeat this loop
60 End
  
```

Above algorithm is used to _____.

- (a) find first N natural numbers
(b) find sum of first N natural numbers
(c) find the sum of first N even numbers
(d) find the sum of first N odd numbers

23. 10 REM 'Scholarship Test'

20 INPUT 'Enter marks secured',

S 30

40 If $S > 50$ AND $S < 60$ THEN

Let 50 $S = S + 1000$

60 If $S > 70$ AND < 80 THEN

Let 70 $S = S + 2000$

80 If $S > 75$ THEN $S = S + 2500$

90 If $S > 80$ THEN $S = S + 3000$

100 If $S < 50$ THEN

110 PRINT 'You are not eligible for the Scholarship Test'

120 PRINT 'Your Scholarship amount is:'

S 100 END

If $S = 72$, then what is the scholarship that a student gets?

- (a) ₹2572 (b) ₹3072
(c) ₹2072 (d) ₹4572

24. Study the following program:

10 LET $P = 0$

20 LET $a = 0$

30 LET $a = a + 1$

40 Read M

50 If $P > M$ then Go to 70

60 LET $P = M$

70 If $a < 5$ then Go to 30

80 Print P ;

90 DATA 3, 5, 4, 2, 6

100 END

What is the output of the above program?

- (a) 2 (b) 4 (c) 6 (d) 5

25. What is the output of the following program?

20 Let $I = 1$

30 Read x, y ;

40 Data 5, 4;

50 Let $S = X$

60 Print S

70 If $I = Y$, then go to 100

80 Let $S = S * X$

90 Let $I = I + 1$

100 Go to 60

110 End



- (a) 5 25 625 (b) 625 25 5
(c) 5 25 125 625 (d) 125 25 5

26. Find the output of the program given below.

10 Read P, N, R

20 Data 2000, 2, 20

30 Let $A = P \left[\left(\frac{1+R}{100} \right)^N \right]$

40 Print A

50 END

- (a) 3240 (b) 2880
(c) 3840 (d) 3360

27. BASIC stands for

- (a) beginners all purpose system instruction code.
(b) business arithmetic system instruction code.
(c) basi call purpose symbolic instruction code.
(d) beginners all purpose symbolic instruction code.

28. Find the output of the program given below.

10 READ P, Q, R, S

20 DATA 5, 12, 58, 30

20 $T = [(Q + R) / (P + S)] + P$

40 PRINT T

50 End

- (a) 7 (b) 9 (c) 6.5 (d) 8.5

29. Find the output of the program given below.

10 Let $P = 7$

20 Let $Q = P$

30 Let $Q = Q - 1$

40 Let $P = P * Q$

50 If $Q > 2$, then GOTO 30 else PRINT P

60 End

- (a) 720 (b) 5040
(c) 120 (d) 40320

30. Find the output of the program given below, if $x = 48$ and $y = 60$.

10 READ x, y

20 Let $x = \frac{x}{3}$

30 Let $y = x + y + 8$

40 $z = \frac{y}{4}$

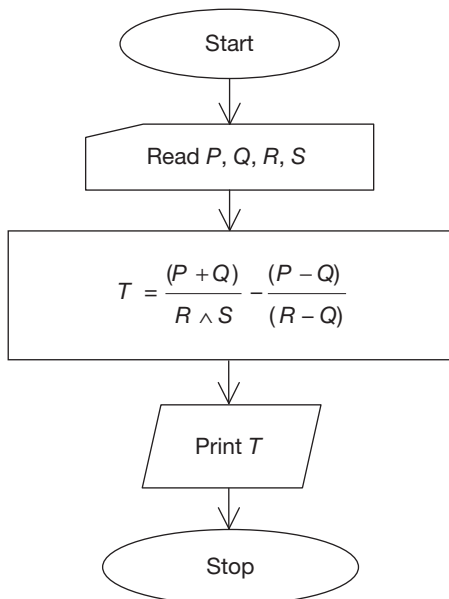
50 PRINT z

60 End

- (a) 21 (b) 22
(c) 23 (d) 24

Level 3

31.



If the values of P, Q, R and S are 8, 6, 7 and 2, then what is the output of above flowchart?

- (a) $\frac{12}{7}$ (b) $\frac{14}{5}$
(c) $\frac{-12}{7}$ (d) $\frac{-27}{8}$

32. 10 Read A, B, C

20 Read S

30 Read L, M, N, X

40 Read P, Y

50 Data 5, 6, 7

60 Data 9

70 Data 2, $\sqrt{6}$, 2, 4



80 Data $\sqrt{6}$, 2

90 Let $R = [S*(S - A)*(S - B)*(S - C)]^{0.5}$

100 Let $T = L * M / (N * P) + X \wedge Y$

110 Let $Z = R / T$

120 Print Z

130 End

(a) $\frac{6\sqrt{3}}{17}$ (b) $\frac{6\sqrt{6}}{17}$

(c) $\frac{6\sqrt{5}}{17}$ (d) $\frac{6\sqrt{2}}{17}$

33. 10 LET $x = 0$

20 LET $S = 1$

30 $x = x + 1$

40 $y = x * x$

50 $S = S + y$

60 INPUT 'Enter the value for K'; K

70 If $x < K$ THEN GOTO 30 ELSE

PRINT 'Sum of the squares of the numbers'; S

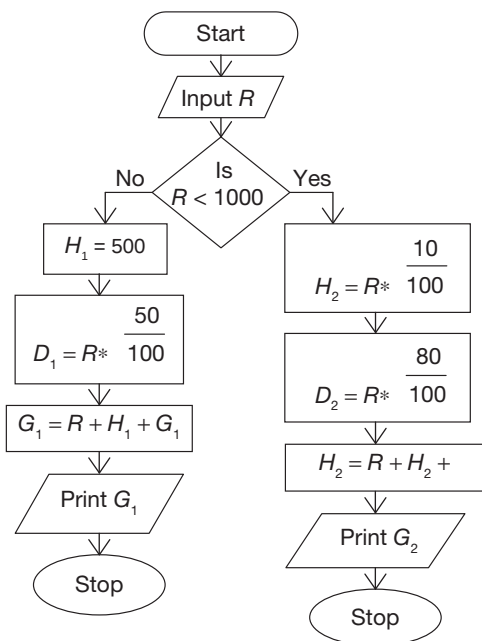
80 END

What is the output of the above program if $K = 8$?

(a) 120 (b) 204

(c) 140 (d) 205

34. Study the following flowchart.



In the above flowchart, what will be the output, if $R = 800$?

(a) 1044 (b) 844

(3) 735 (d) 1520

35. What is the output of the following program?

10 Let Sum = 0

20 Let $N = 8$

30 if $N < 1$ then Go to 70

40 Let Sum = Sum + $N * N$

50 Let $N = N - 2$

60 Go to 30

70 Print Sum

80 end

(a) 120 (b) 125

(c) 145 (d) 170

36. Find the output of the following program.

10 REM Area of a triangle when the sides are given

20 READ x, y, z

30 DATA 8, 15, 17

40 Let $S = (x + y + z) / 2$

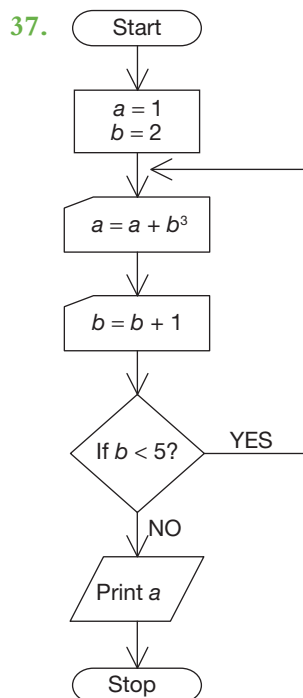
50 Let $A = [S*(S - x) * (S - y) * (S - z)]^{1/2}$

60 PRINT 'The area = ', A

70 END

(a) 120 (b) 60

(c) 90 (d) The triangle is not feasible



Find the output of the given flowchart.

- (a) 100 (b) 73
(c) 120 (d) 144

38. Find the output of the following program.

10 REM Average of ten numbers

20 READ $n_1, n_2, n_3, n_4 \dots n_{10}$

30 DATA 2, 4, 14, 8, 22, 32, 44, 58, 74, 92

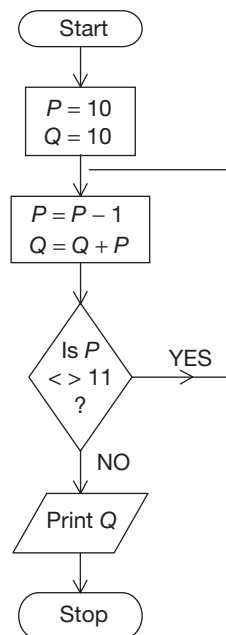
40 Let Average = $(n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + n_7 + n_8 + n_9 + n_{10})/10$

50 PRINT 'Average = '; Average

60 END

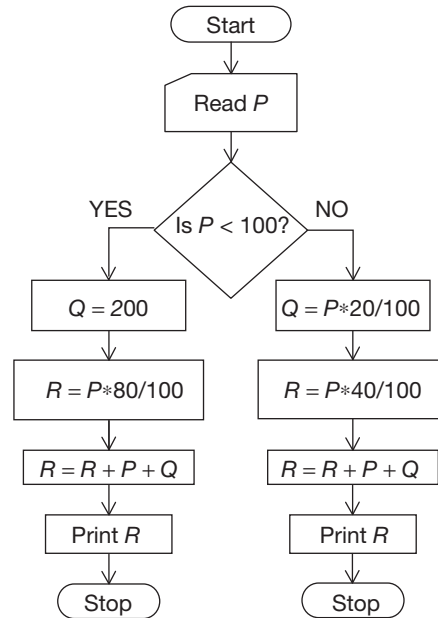
- (a) Average = 30 (2) Average = 35
(c) Average = 38 (4) Average = 42

39. Find the output of the flowchart below.



- (a) 20
(b) 19
(c) 18
(d) Infinite loop exists

40.



Find the output of the above flowchart, if $P = 500$.

- (a) 750
(b) 700
(c) 900
(d) 800



TEST YOUR CONCEPTS

Very Short Answer Type Questions

1. program
2. Control unit, ALU and memory unit.
3. machine level language or binary language or low-level language.
4. vacuum tubes
5. True
6. a letter or alphabet
7. VLSI (very large-scale integrated circuits)
8. False
9. PRINT
10. 1024 KB
11. decision box
12. statement number
13. non-executable statements
14. Flowchart
15. LET
16. high level
17. INPUT
18. Statements
19. 8 digits
20. -32768 to 32767

Short Answer Type Questions

25. 1 4 9 16.

Essay Type Questions

30. 120.

CONCEPT APPLICATION

Level 1

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (b) | 2. (c) | 3. (c) | 4. (c) | 5. (c) | 6. (b) | 7. (d) | 8. (d) | 9. (b) | 10. (b) |
| 11. (c) | 12. (d) | 13. (b) | 14. (a) | 15. (a) | 16. (c) | 17. (d) | 18. (c) | 19. (c) | 20. (b) |

Level 2

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 21. (b) | 22. (b) | 23. (c) | 24. (c) | 25. (c) | 26. (b) | 27. (d) | 28. (a) | 29. (b) | 30. (a) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

Level 3

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 31. (c) | 32. (b) | 33. (d) | 34. (d) | 35. (a) | 36. (b) | 37. (a) | 38. (b) | 39. (d) | 40. (d) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|



CONCEPT APPLICATION

Level 1

2. We cannot assign two values to a single variable.
5. Use the order of priority of the arithmetic expressions and evaluate the expression.
6. Identify the syntax of READ and DATA keywords and also their assignments.
7. Use the order of priority of the arithmetic expressions and evaluate the expression.
9. A string constant should be within double quotation marks.
12. (i) Value of s is not given.
(ii) Observe the statement numbered 50. Here, identify the task to be done by operator $\uparrow$ and $*$ and their priorities and precedence.
13. (i) It calculates $D = b^2 - 4ac$.
(ii) Observe the statement numbered 50. Here, identify the task to be done by operator $\uparrow$ and $*$ and their priorities and precedence.
14. The given program prints $T = T - 12$, as $T > 12$.
15. Use BODMAS rule.
16. Steps of algorithms must be in précised order. So, read the statements carefully and complete the task in proper sequence.
17. Recall the keywords of BASIC.
18. Use BODMAS rule.
20. (i) The program prints the average of given numbers.
(ii) Keep track of each statement. Solve clearly the statement numbered 40.

Level 2

21. $K \neq 0$ in every loop.
23. (i) Given $S = 72$, Statement 60, i.e., $S > 70$ and $S < 80$ executes.
(ii) Keep track of the order of the statements that is to be executed and follow with the conditional statements.
24. Keep track of the keyword GOTO which is unconditional branching statement. Be careful when the loop is to be terminated.
25. Find the values in every iterative loop.
26. $P = 2000$, $N = 2$ and $R = 20$

$$A = P \left[\left(1 + \frac{R}{100} \right)^N \right]$$

$$\therefore A = 2000 \left(1 + \frac{20}{100} \right)^2 = 2000(1.2)^2$$

$$= 2000(1.44) = 2880.$$
27. BASIC stands for 'beginners all purpose symbolic instruction code'.
28. The first statement conveys P , Q , R and S are numeric quantities. The second statement conveys $P = 5$, $Q = 12$, $R = 58$ and $S = 30$.
 The third statement conveys $T = \frac{12 + 58}{5 + 30} + 5$

$$= \frac{70}{35} + 5 = 7.$$
29. Initial $P = 7$
 Initial $Q = 7$
 Next $Q = 6$
 Next $P = 7 \times 6 = 42$
 $Q > 2$
 $\therefore$ Next $Q = 5$
 Next $P = 42 \times 5 = 210$.
 $Q > 2$.
 $\therefore$ Next $Q = 4$
 Next $P = 210 \times 4 = 840$.
 $Q > 2$.
 $\therefore$ Next $Q = 3$



Next $P = 840 \times 3 = 2520$

$Q > 2$

$\therefore$ Next $Q = 2$

Next $P = 2520 \times 2 = 5040$.

Q is not greater than 2.

$\therefore$ Output is 5040.

30. Initial $x = 48$

Initial $y = 60$

Next $x = \frac{48}{3} = 16$.

Next $y = 16 + 60 + 8 = 84$

$z = \frac{84}{4} = 21$.

Level 3

31. Substitute the values of P , Q , R and S in T and follow the operator precedence.

32. (i) Calculate R , T and R/T .

(ii) Use the order of priority of the arithmetic expressions and evaluate the expression.

35. Keep track of the key word GOTO which is unconditional branching statement. Be careful when the loop is to be terminated.

36. $x = 8$, $y = 15$ and $z = 17$

$$S = \frac{8 + 15 + 17}{2} = 20$$

$$A = [(20) \cdot (20 - 8) \cdot (20 - 15) \cdot (20 - 17)]^{\frac{1}{2}}$$

$$= [(20)(12)(5)(3)]^{\frac{1}{2}} = \sqrt{3600} = 60$$

Output is = 60.

37. Initial $a = 1$

Initial $b = 2$

Next $a = 1 + 2^3 = 1 + 8 = 9$

Next $b = 3$

$b < 5$

$\therefore$ Next $a = 9 + 3^3 = 9 + 27 = 36$

Next $b = 3 + 1 = 4$

$b < 5$. Next $a = 36 + 4^3 = 100$

Next $b = 5$

$\therefore$ Output = $a = 100$.

38. Average

$$= \frac{2 + 4 + 8 + 14 + 22 + 32 + 44 + 58 + 74 + 92}{10}$$

$$= \frac{350}{10} = 35$$

$\therefore$ Output is average = 35.

39. As P decreases, P never be 11

$\therefore$ The loop represents an infinite loop.

The output would be displayed only if the loop execution stops, i.e., when $P = 11$.

$\therefore$ No output would be displayed.

40. $P = 500$, it is not less than 100.

$\therefore$ The loop on the right of the flowchart will be executed.

$$\therefore Q = (500) \left(\frac{20}{100} \right) = 100 \text{ and initial.}$$

$$R = (500) \left(\frac{40}{100} \right) = 200$$

Next $R = 200 + 500 + 100 = 800$.

$\therefore$ Output = 800.

