CHAPTER 1

PROGRAMMING TECHNIQUES

SHORT AND LONG QUESTIONS

Q1. Explain the criteria for measuring efficiency of an algorithm.

Ans: Measuring Efficiency of an Algorithm:

The efficiency of an algorithm Is the property which relate the algorithm to the amount of computational resources used in it. An Algorithm must be analyzed to determine its resources usage (e.g. time, memory and storage space)

For maximum efficiency we wish to minimize resources usage. However, the various resources cannot be compared directly, so which of two algorithms is considered to be more efficient often depends on which measure of efficiency is considered the most important e.g. the requirement for high speed, minimum memory usage is considered.

There may be several algorithms for solving a particular problem. How fast a problem can be solved, depends on efficient algorithm.

Therefore, analysis of algorithms is very important to compare algorithms and conclude that which one is better than the other.

Analyze the efficiency of algorithms means comparing efficient of different methods of solutions of a problem.

Q2. Problem: Find the Sum, Product and Average of Five given Numbers.

Ans   Planning the Solution:

Input: Five given numbers

Required Output: Sum, product and average of five numbers

Processing: Addition, multiplication and division of numbers

Algorithm

Step 1: Start

Let the five numbers be A=2, B=5, C-=8, D=4 and E=12

Step 2: Find the sum (SUM)

SUM=A+B+C+D+E

Step 3: FIND the product (PROD)

PROD=A*B*C*D*E

Step 4: FIND the average (AVG)

AVG=SUM/5

Step 5: Output SUM, PROD, AVG

Step 6: Stop

Q3. Problem: Find the largest of Three Unequal Numbers.

Ans: Planning the Solution:

Input Three unequal numbers

Required Output: The largest of three numbers

Processing Comparison of each number with the other two one by one

Algorithm

Step 1: Start

Let the three numbers be A=10, B=20 AND C=30

Step 2: Check if A is the largest number

If A>Band A>C THEN LARGEST=A otherwise GOTO Step 4

Step 3: GOTO Step 7

Step 4: Check if B is the largest number

　　　IF B>A and B>C THEN LARGEST=B otherwise GOTO Step 6

Step 5: GOTO Step 7

Step 6: LARGEST=C

Step 7: Output LARGEST

Step 8: Stop

Q4. Problem: Find Acceleration of a Moving Object for Given Mass and the Force applied.

Ans: Planning the Solution:

　　　Input Mass and the Force

　　　Required Output Acceleration of moving object

　　　Processing Divide the force by the mass

Algorithm:

　　　Step1 Start

　　　Let the mass (M) be 50 and the Force (F) be 12

　　　Step 2: CALCULATE the acceleration (A)

　　　　　　$A = F/M$

　　　Step 3 Output A

　　　Step 4: Stop

Q5. Problem: Find the Volume of a Cube.

Ans: Planning the Solution:

Input Length of side of cube

Required Output Volume of cube

Processing Side of cube raised to the power of three

Algorithm

Step 1 Start

Let the length of one side of cube. L be 12

Step 2 CALCULATE the volume V

Step 3 Output V

Step 4 Stop

Q6. Problem: Find the Area of a Triangle when the Lengths of Height and Base are given.

Ans: Planning the Solution:

Input Height and base of triangle

Required Output Area of triangle

Processing Multiply height with base and divide by two

Algorithm:

Step 1 Start

Let the Height H be 10 and base B be 15

Step 2 CALCULATE the area A

Step 3 Output A

Step 4 Stop

Q7. Problem: Read Marks (M) and Print Letter Grade According to the Following scheme:

Marks	Letter Grade
$M \geq 80$ and $M \leq 100$	A1
$M \geq 70$ and $M < 80$	A
$M \geq 60$ and $M < 70$	B
$M \geq 50$ and $M < 60$	C
$M \geq 40$ and $M < 50$	D
$M \geq 33$ and $M < 40$	E
$M \geq 0$ and $M < 33$	F

Ans: Planning the Solution:

Input Marks

Required Output Letter Grade

Processing Check in which range the marks fall and accordingly print the letter grade.

Algorithm:

Step 1 Start

Let the marks be M

Step 2 Compare the marks

IF $M \geq 80$ then print Grade A1 otherwise GOTO Step 4

Step 3 GOTO Step 13

Step 4 Compare the marks

IF M≥70 THEN print "Grade A" otherwise GOTO Step 6

Step 5 GOTO Step 13

Step 6 Compare the marks

IF M≥60 THEN print "Grade B" otherwise GOTO Step 8

Step 7 GOTO Step 13

Step 8 Compare the marks

IF M≥50 THEN print "Grade c" otherwise GOTO Step 10

Step 9 GOTO Step 13

Step 10 Compare the marks

IF M≥40 THEN print "Grade D" otherwise GOTO Step 12

Step 11 GOTO Step 13

Step 12 Compare the marks

IF M≥33 THEN print "Grade E" otherwise print Grade f

Step 13 Stop

Q8. Problem: Find Interest on a Given Amount:

Ans: Planning the Solution:

Input Loan Amount (P), Interest Rate (R) and Period of Loan in year (T)

Required Output: Interest

Processing Multiply Loan amount with Interest rate and Period of loan

Algorithm

Step 1 Start

Let the Loan Amount (P) be 35000, Interest Rate (R) be 10% and Period of Loan (T) be 5 years

Sep 2 CALCULATE the Interest

INTEREST=P*R*T

Step 3 Output INTEREST

Step 4 Stop

Q9. Problem: Find the Exponent of a Given Number

Exponent or power of a number means how many times to use the number in a multiplication. In other words, it is the products of a number that is multiplied as many times as its exponent.

Ans: Planning the Solution:

Input A number and its exponent

Required Output Exponent of given number

Processing: Multiply the number as many times as its exponent

Algorithm

Step 1 Start

Let the number, N be 8 and its exponent E be 5

Step 2 Initialize product (P) and K to 1

P=1, K=1

Step 3: FIND the product (P)

P=P*N

Step 4: Increment K by 1

K=K+1

Step 5: Check if the value of K is less than or equal to E

If K≤E THENGOTO Step 3 otherwise GOTO Step 6

Step: Output P

Step 7: Stop

Q10. Problem: Print Odd numbers from 1 to 100:

1 3 5 7 9 11.....99

Ans: Planning the Solution:

Input this problem has no input

Required Output Printing odd numbers from 1 to 100

Processing: Initialize a variable and keep printing it with an increment of 2 till 99

Algorithm

Step 1 Start

Initialize variable K to 1

K=1

Step 2 Output K

Step 3 Increment K by 2

K=k+2

Step 4 Check if the value of K is less than 100

IF K<100 THEN GOTO Step 2 otherwise GOTO Step 5

Step 5 Stop

Q11. Problem: Print the Following Sequence of Numbers in Descending Order:

27 24 21 28 15 12 9 3 0 -3 -6

Ans: Planning the Solution:

Input: This problem has no input

Required Output: Printing numbers from 27 to -6 in descending order with a step of -3

Processing: Initialize a variable to 27 and then keep printing it with a decrement of 3 till --6.

Algorithm

Step 1: Start

Initialize variable K to 27

K=27

Step 2: Output K

Step 3: Decrement K by 3

Step 4: Check if the value of K is greater than or equal to -6

If k≥-6 THEN GOTO Step 2 otherwise GOTO Step 5

Step 5: Stop

Q12. Problem: Find the Sum of Even numbers up to 100:

SUM= 2 + 4 + 6 + 8 + 10 + 12 + 14 + ... + 100

Ans: Planning the Solution

Input: This problem has no input

Required Output: Sum of even numbers up to 100

Processing: Add all the even numbers from 2 to 100

Algorithm:

Step 1: Start

Initialize SUM to 0 and K to 2

        SUM=0, K=2

Step 2 ADD K to SUM

        SUM= SUM + K

Step 3: Increment K by 2

        K=K+2

Step 4 Check if the value of K is less than or equal to 100

        IF K≤100 THEN GOTO Step 2 otherwise GOTO Step 5

Step 5 Output SUM

Step 6 Stop

Q13. Problem: Print a Multiplication Table of a Given Number:

Ans: Planning the Solution

        Input: Number whose table is required

        Required Output: Printing table of given number

        Processing: Initialize a variable to 1 and print its product with the given number. Increment the variable by 1 and print the product continue the process till print the product of 12 and the given number.

Algorithm:

Step 1: Start

Let be the number N be 7

Step 2 Initialize K to 1

K=1

Step 1 Find the product

P=N*K

Step 4 Output N,K,P

Step 5 Increment K by 1

K=K+1

Step 6 Check the value of K

IF K≤12 THEN GOTO Step 3 otherwise GOTO Step 7

Step 7 Stop

Q14. Problem: Convert Temperature from Fahrenheit to Celsius:

Ans: Planning the Solution

Input Temperature in Fahrenheit

Required Output Temperature in Celsius

Processing Compute the temperature in Celsius from Fahrenheit using conversion formula

Algorithm

Step 1 Start

Let the temperature in Fahrenheit. F be 100

Step 2 CALCULATE temperature in Celsius (C)

$$C = 5/9(F-32)$$

Step 3 Output C

Step 4: Stop

Q15. Problem: Find Factorial of a Given Number:

Ans: Planning the Solution

Input Given Number

Required Output: Factorial of given number

Processing: Find the product of all the numbers from 1 to the given number

Algorithm

Step 1 Start

   Let the number, N be 5

Step 2 Initialize loop variable K and factorial F to 1

K=1, F=1

Step 3 CALCULATE the product

F=F*K

Step 4 Increment K by 1

K=K+1

Step 5 Check the value of K

If K≤N THEN GOTO Step 3 otherwise GOTO Step 6

Step 6 Output F

Step 7 Stop

Q16. Determine the flowchart requirements of a given problem or algorithm by the flowchart, developer before drawing a flowchart

Ans: Steps for Drawing Flowchart:

The flowchart developer must determine the following requirements for the given problem or algorithm before drawing a flowchart

- Input to the flowchart
- Type of processing required
- Decisions to be taken
- The output to be produced after processing

Input:

The flowchart developer must know what exactly the input to the flowchart is. The input is determined from the problem statement. For example, the given problem is to convert temperature from Fahrenheit to Celsius. Here the input will be the temperature in Fahrenheit.

Processing:

The flowchart developer must decide what type of calculation is to be performed or which formula is to be applied to obtain the required result. For example, to find the area of triangle the following formula is to used

Area= (Base+Height)/2

Decision:

The flowchart developer must decide which control structures (sequence repetition or selection) are to be applied for the solution of the problem. For example, selection structure must be applied to print letter grade of a student based on the marks obtained. The selection structure will check in which range the marks fall and accordingly print the grade.
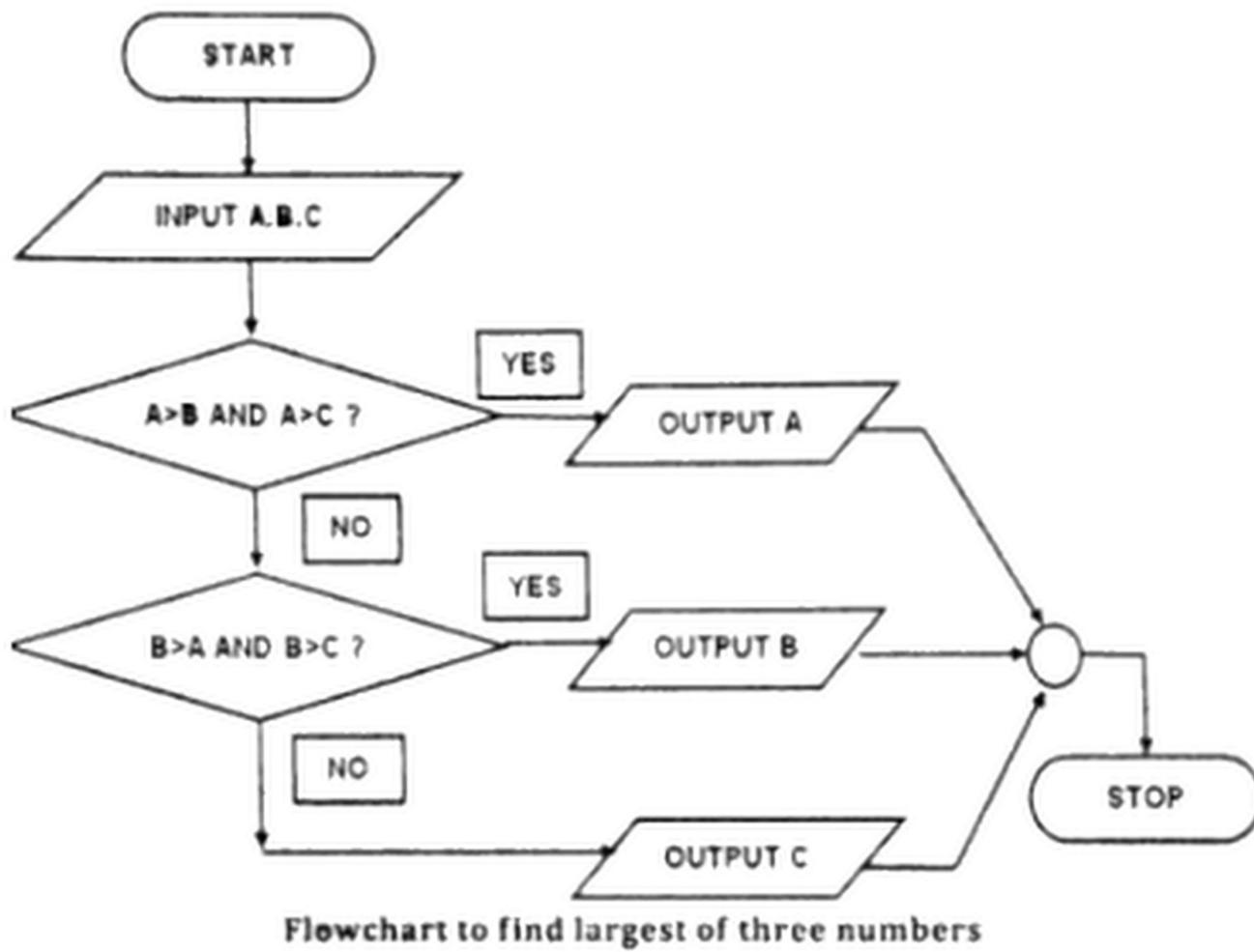
Output: The flowchart must provide the required output.

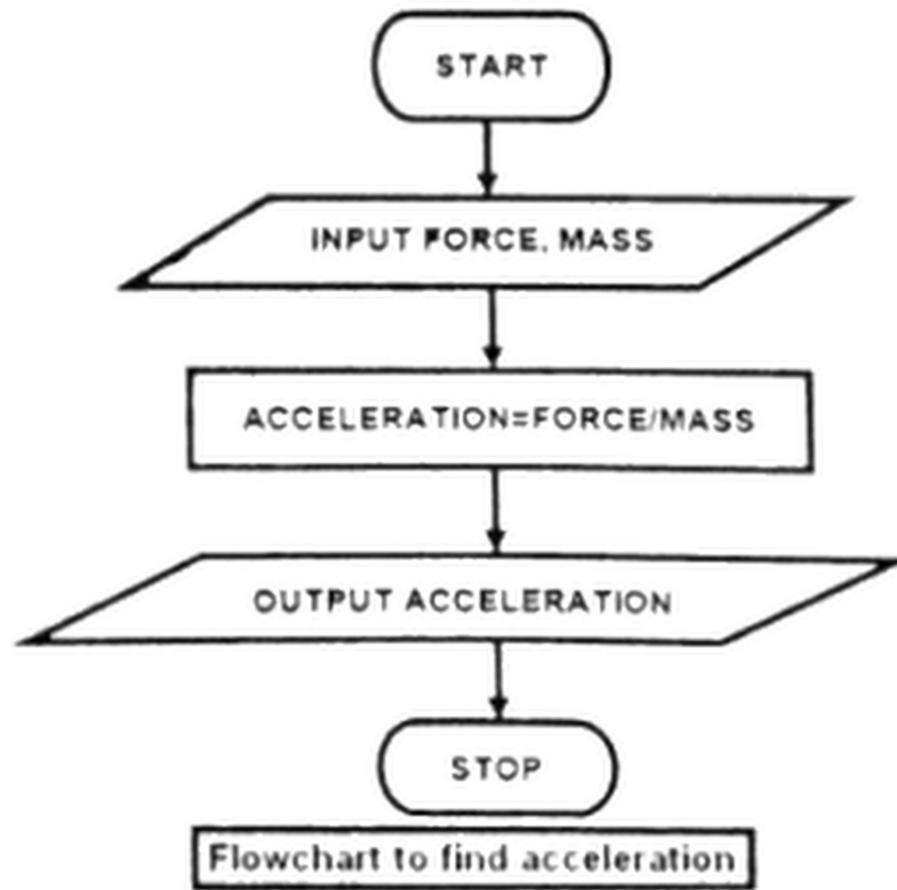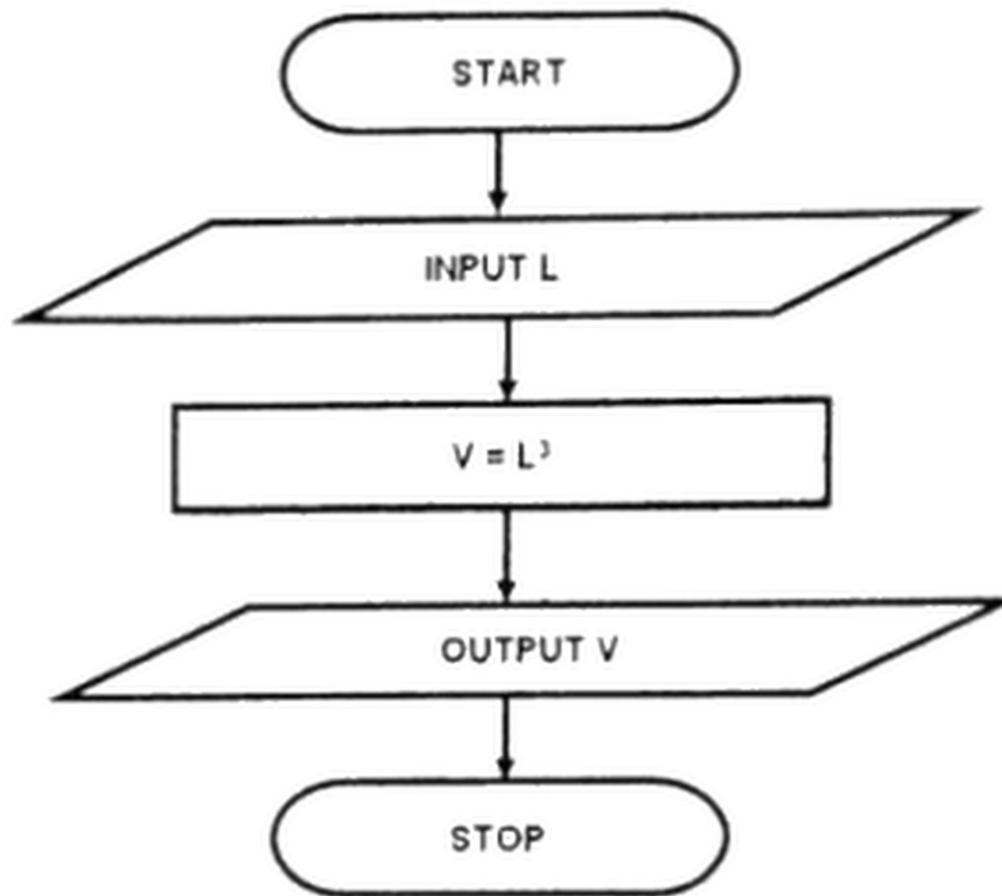**Q17. Draw/Develop a Flowchart to find sum, product and average of five numbers.**

Ans:

Flowchart to find sum product and average
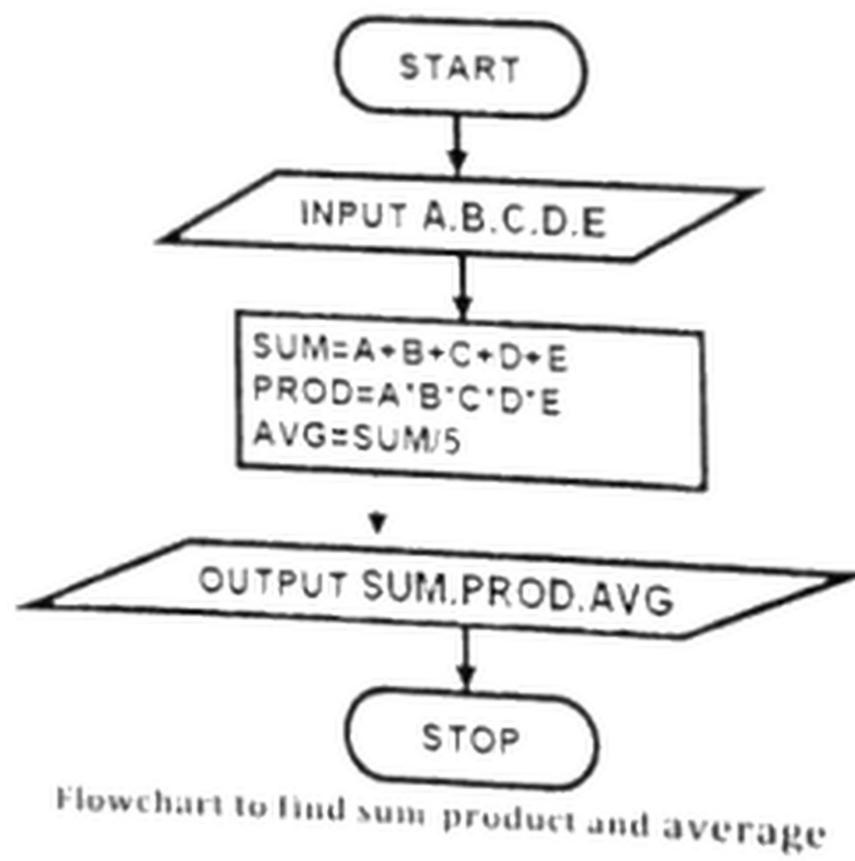
Q18. Draw/Develop a Flowchart to find the largest of three unequal numbers.

Flowchart to find largest of three numbers

Q19. Draw/Develop a Flowchart to find acceleration of a moving object given mass and the force applied.
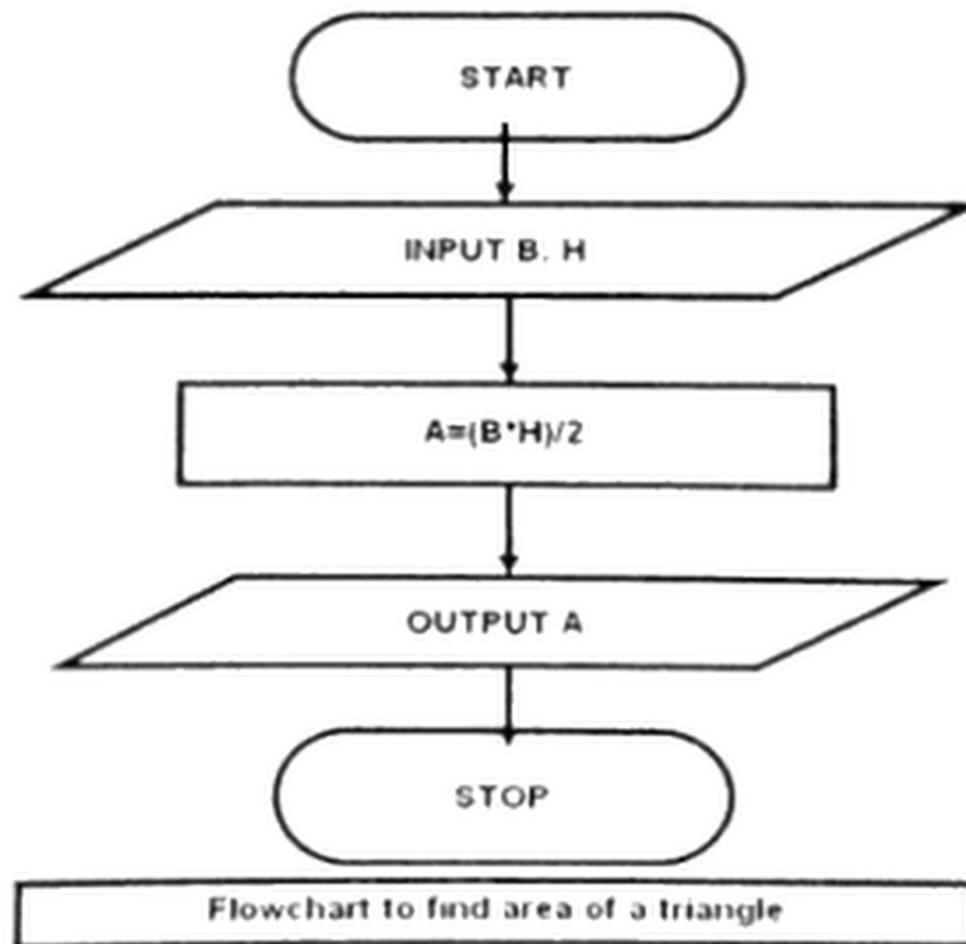
Flowchart to find acceleration

Q20. Draw/Develop a Flowchart to input the length of one side of cube and print its volume.

Flowchart to find volume of a cube

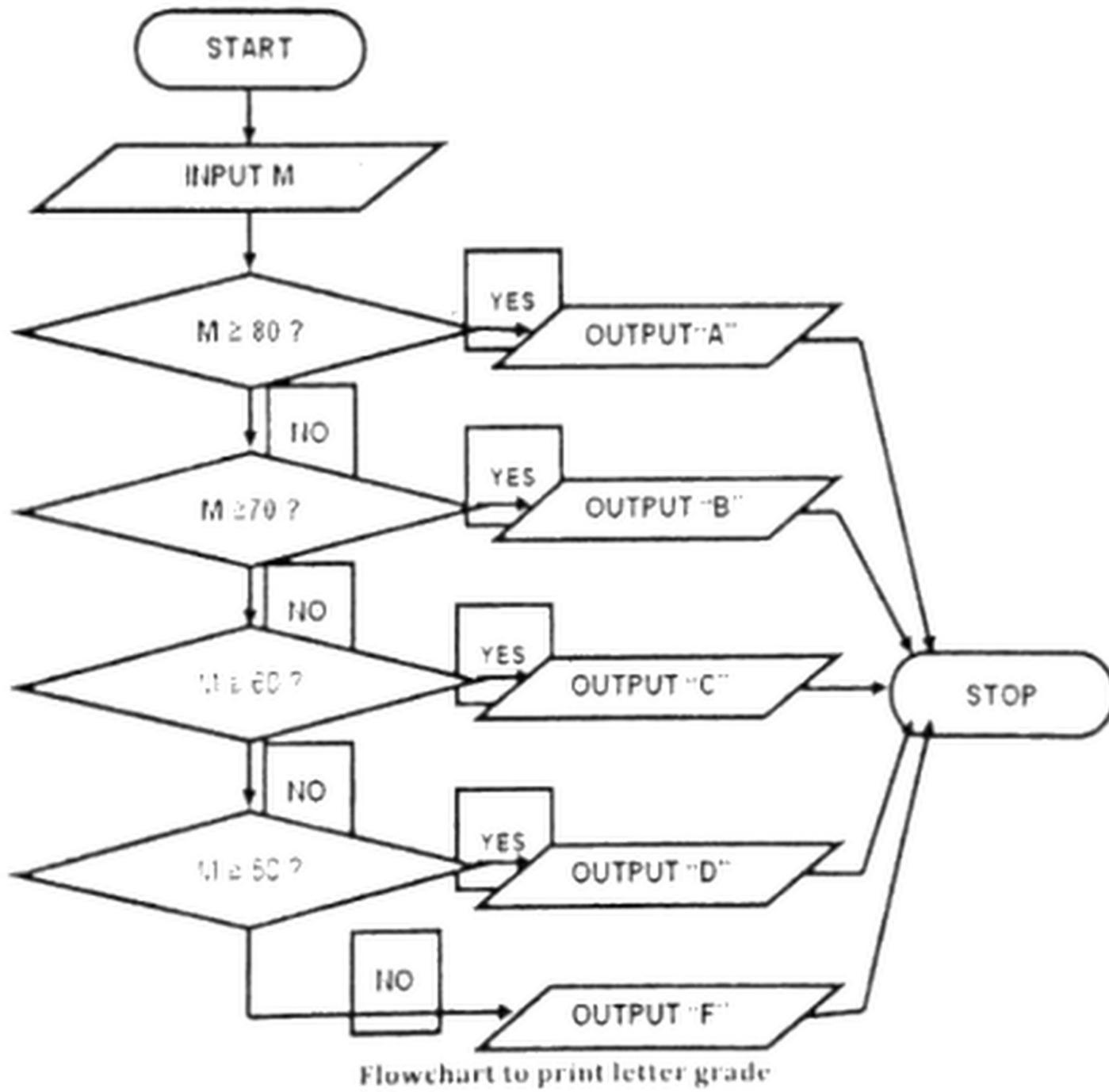**Q21.** Draw/Develop a Flowchart to find the area of a triangle when the lengths of height and base are given.

Flowchart to find area of a triangle

Q22. Draw/Develop a Flowchart to read Marks (M) and print letter grade according to the following scheme

Marks	Letter Grade
----------	-----------------
M≥80 AND M≤100	A
M≥70 and M<80	B
M≥60 and M<70	C
M≥50 and M<70	D
M<50	F

Ans: Flowchart to print letter grade is shown in Fig

Flowchart to print letter grade

Q23. Draw/Develop a Flowchart to find interest on a given amount and period of loan in years.

Flowchart to find interest
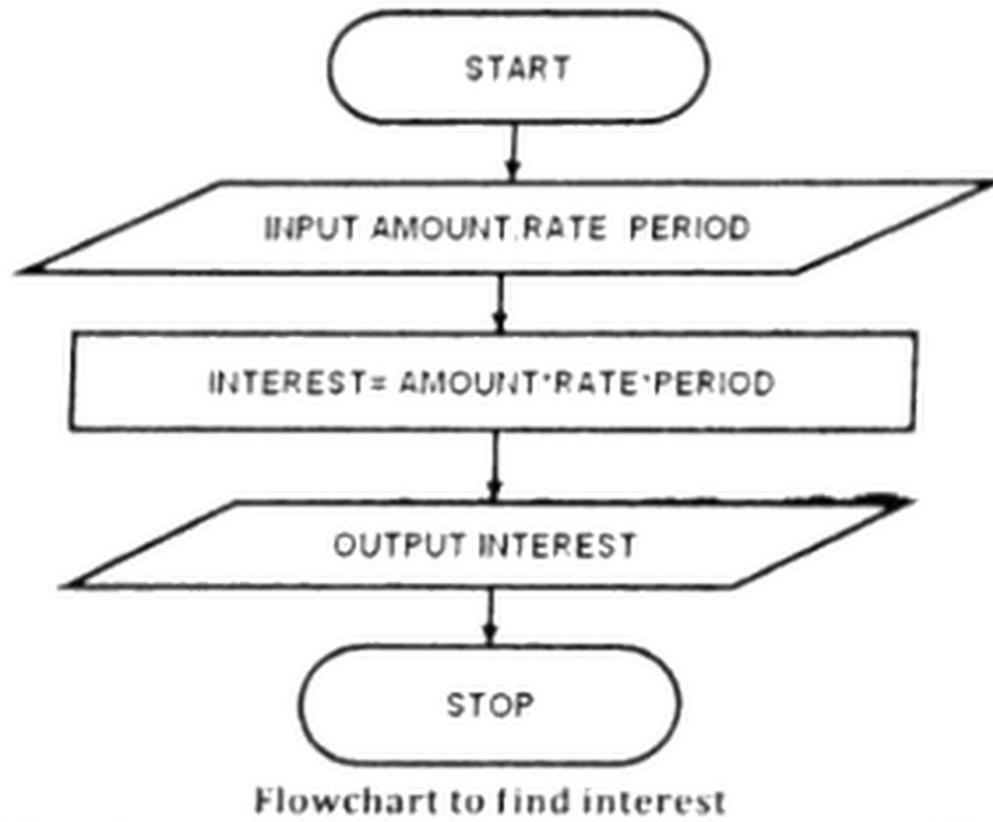
Q24. Draw/Develop a Flowchart to find the exponent (E) of a given number (N) in this flowchart, the value P represents N raised to the power E.

Flowchart to find exponent of a number

Q25. Draw/Develop a Flowchart to print odd numbers from 1 to 100
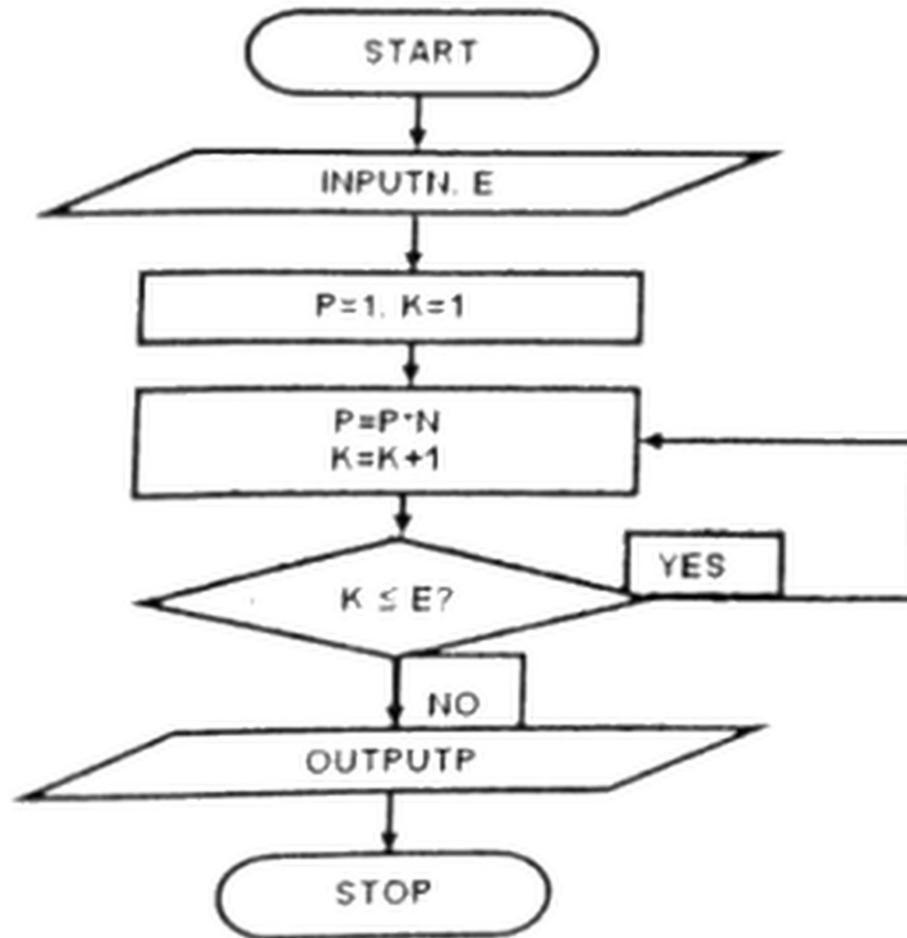
Flowchart to print odd numbers
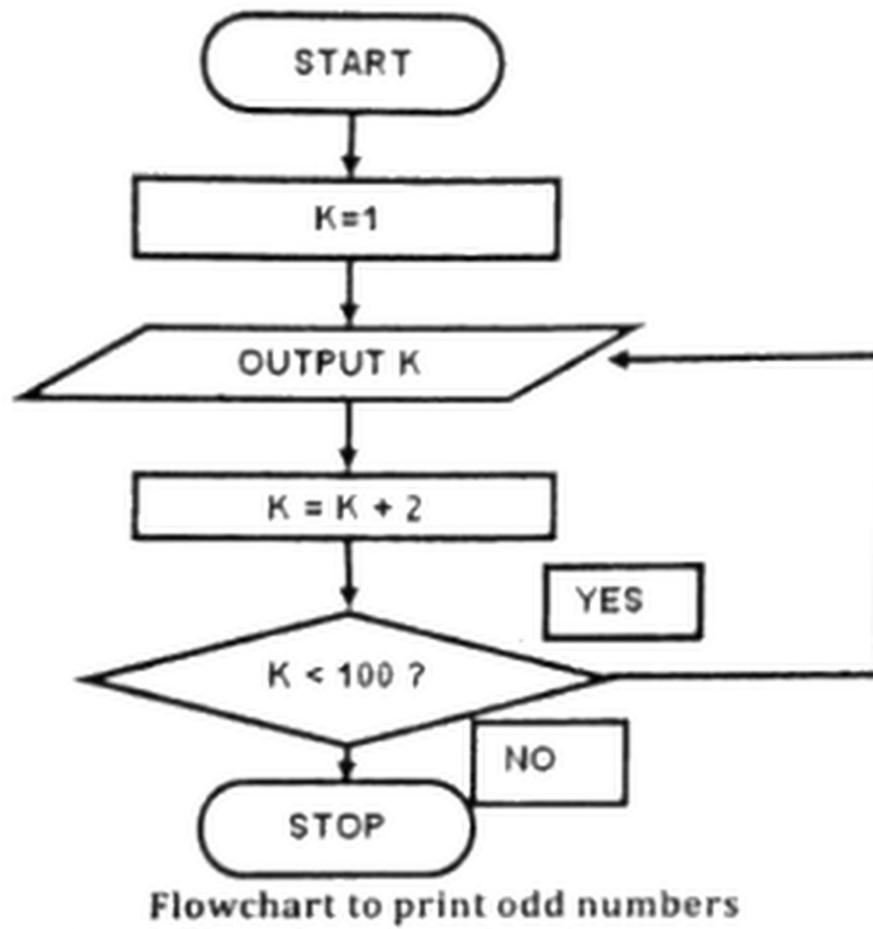
Q26. Draw/Develop a Flowchart to print the given sequence of numbers in descending order.

27 24 21 18 15 12 9 6 3 0 -3 -6

Flowchart to print numbers in descending order

Q27. Draw/Develop a Flowchart to find the sum of even numbers up to 100

```
            ┌─────────────┐
            │    START    │
            └──────┬──────┘
            ┌──────┴──────┐
            │ SUM=0. K=2  │
            └──────┬──────┘
         ┌─────────┴──────────┐
         │  SUM=SUM+K         │◄─────────┐
         │  K=K+2             │          │
         └─────────┬──────────┘          │
                   │                     │
              ◇────┴────◇      ┌─────────┤
             ╱  K ≤ 100 ? ╲────┤   YES   │
              ╲────┬────╱      └─────────┘
                   │     ┌──────┐
              ┌────┴─────│  NO  │
             ╱ OUTPUT SUM╱
            └─────┬─────┘
            ┌─────┴──────┐
            │    STOP    │
            └────────────┘
```
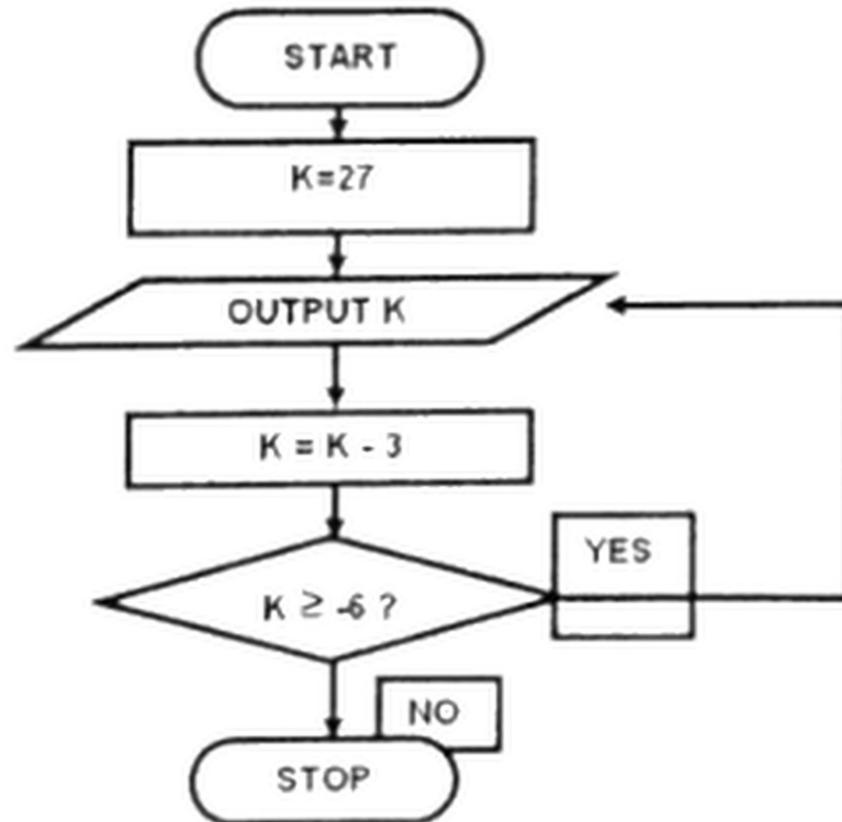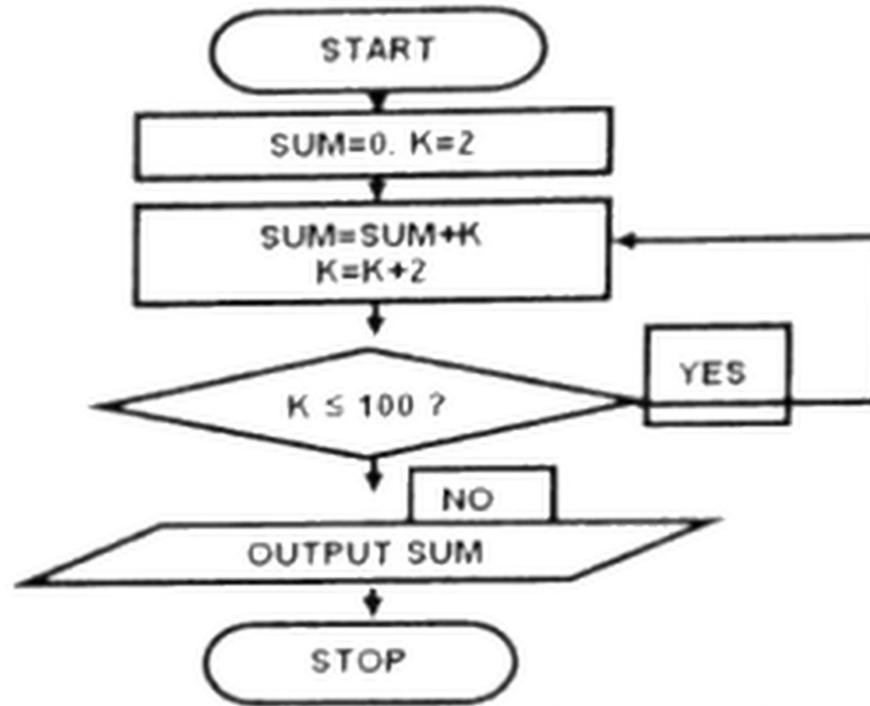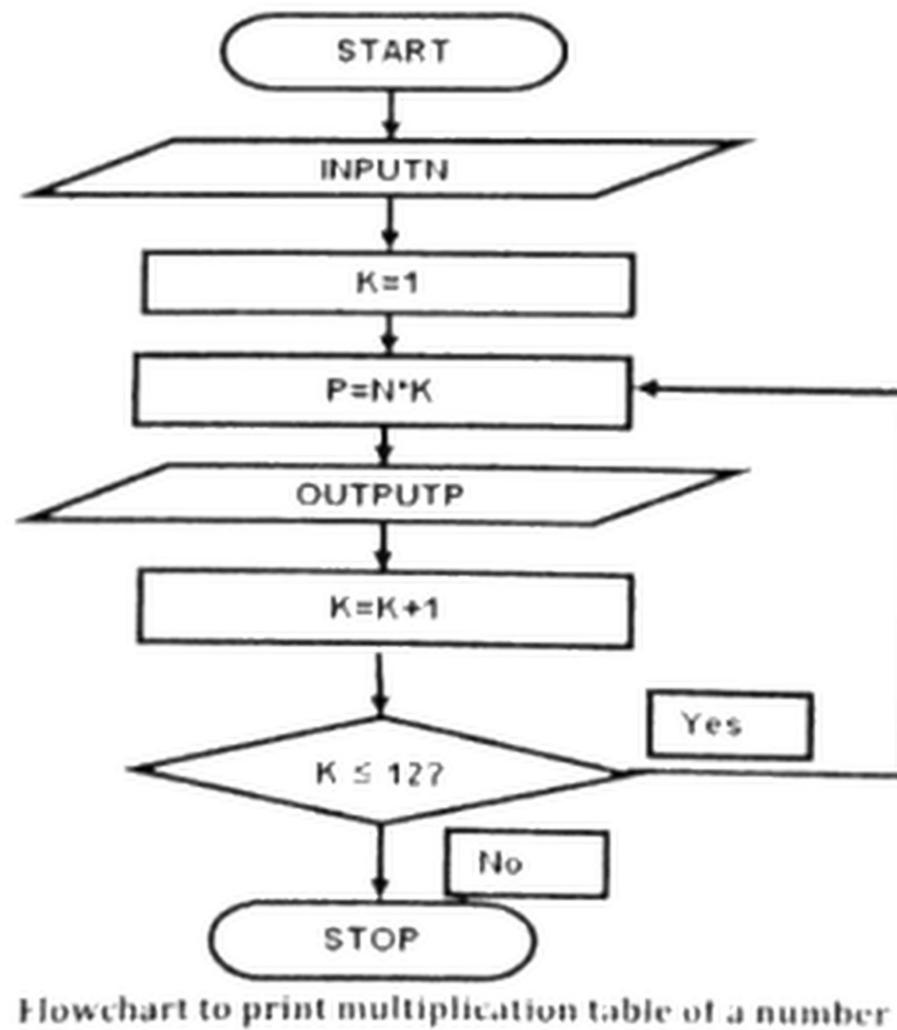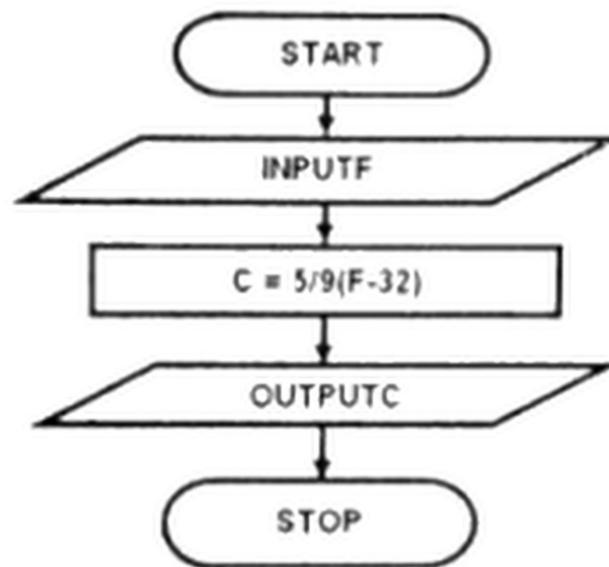
Flowchart to find the sum of even numbers

Q28. Draw/ Develop a Flowchart to print a multiplication table of a given number.

```
            ┌─────────────┐
            │    START    │
            └──────┬──────┘
          ╱────────┴────────╲
         ╱     INPUTN        ╱
         └────────┬─────────┘
            ┌─────┴──────┐
            │    K=1     │
            └─────┬──────┘
            ┌─────┴──────┐
            │   P=N*K    │◄──────────┐
            └─────┬──────┘           │
          ╱───────┴────────╲         │
         ╱    OUTPUTP       ╱        │
         └───────┬─────────┘         │
            ┌────┴───────┐           │
            │   K=K+1    │           │
            └────┬───────┘           │
                 │           ┌───────┤
            ◇────┴────◇      │  Yes  │
           ╱  K ≤ 12?  ╲─────└───────┘
            ╲────┬────╱
                 │   ┌──────┐
            ┌────┴───│  No  │
            │  STOP  │
            └────────┘
```

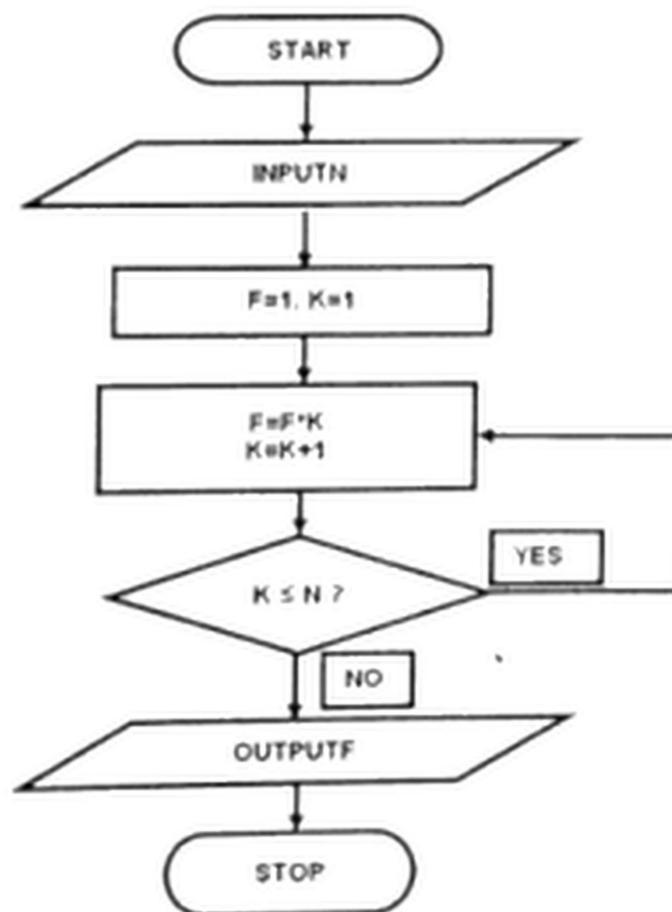**Flowchart to print multiplication table of a number**

Q29. Draw/ Develop a Flowchart to convert temperature from Fahrenheit to Celsius.

Flowchart to convert temperature

Q30. Draw/ Develop a Flowchart to find factorial of a number.

Flowchart to print factorial of a number

KEY POINTS

- **Computer** is a general-purpose electronic machine invented to help people solve various problems.
- **Candid Solutions** of a problem are all the possible solutions for a problem.
- **Algorithm** is a step by step problem solving method that is easy to understand and follow. It is a set of steps that clearly defines a sequence of operations to solve a problem.
- **Flowchart** is a diagrammatic representation of algorithm.
- **Sequential Structure** refers to the execution of operations in the order in which they appear.
- **Repetition Structure** or **loop** provides a way to repeat one or more operations as many times as required to solve a problem.
- **Selection Structure** allows a choice among various options while solving a problem.