Display appropriate message in the calling program.

(For ex. $6 = 1 + 2 + 3 = 6$ is a perfect number as its sum of divisors equals the number itself).

(b) Discuss the storage classes auto, register, static and extern with an appropriate snippet of C code for each.

(c) Describe the memory layout of a C program and elaborate on different sections of its segments. Indicate which segment of the C memory block is used by dynamic memory allocation module.

TCS–101

B. TECH. (FIRST SEMESTER) END SEMESTER EXAMINATION, Dec., 2023

FUNDAMENTALS OF COMPUTERS AND INTRODUCTION TO PROGRAMMING

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each sub-question carries 10 marks.

1. (a) Explain the Von Neumann architecture with a neat sketch depicting the essential units of a computer system.

(b) Draw a flow chart to generate prime numbers between a range (between R1 to R2) of numbers accepted from the user to the output screen.

(c) Write an algorithm to find whether a positive integer accepted from the user is Armstrong number or not. Validate the user is input for reading only positive integers.

2. (a) Discuss the use of ternary operator. Write a C program to find the biggest of three integers using a ternary operator.

(b) Draw a flowchart and design a program in C to swap to integers read from the keyboard using bit-wise operators.

(c) Write short notes on the following :

   (i) Features of C language

   (ii) Special operators

   (iii) Implicit Conversion Hierarchy

   (iv) Switch case statement

3. (a) Design an algorithm and develop a C program to compute and print the sum of the following series :

$$1 + (1 + 2) + (1 + 2 + 3) + (1 + 2 + 3 + 4) + \dots\dots\dots (1 + 2 + 3 \dots\dots N)$$

(b) Differentiate between Entry controlled and Exit controlled loops with appropriate examples. Design a C program to find and display the square root of numbers read from the user. The program stops i.e., exits whenever the user types in a negative number.

(c) Predict the output of the following code with proper justification of the same :

$$2\frac{1}{2} \times 4 = 10$$

Note : All the given C programs are free of syntax errors. Assume appropriate tokens if a missing.

(i)
```c
#include <stdio.h>
void main()
{       char ch= '9';
        ch=(ch–'0') +'A';
        switch(ch)
        {       case 70 :
                case 71 :
                case 72 :
                        printf("%ch", ch + 2);
        }
}
```

(ii)
```c
#include <stdio.h>
void main()
{   int n=– 1;
    if(! n)
            printf("%c", n + 10);
    else
            printf("%d",! n);
```

(iii)
```c
#include<stdio.h>
void main()
{    int False=4;
     while(! False)
     {
            printf("World of C");
            False _ _;
     }
     printf("%d", ! False );
}
```

(iv)
```c
#include<stdio.h>
void main()
{   int x[4]={0},y;
    x[0]=2; x[1]=3;
    for(; ! x[2];)
    {  y=x[2] + 1;
       printf("%d \n",y);
       x[2]=y;
    }
}
```

4. (a) Illustrate with an example the compile time and run time initialization of 2-D arrays. Implement a C program using arrays to read N characters from the keyboard and then convert them into uppercase if in lowercase and vice-versa. Print the modified array to the con sole.

(b) Write a C program to search an element using Binary Search algorithm. Read the N numbers and search Rev element from the user.

(c) Design a C program to swap the elements about the principal diagonal of a square matrix of order M × M. After swapping display all the elements of the matrix to the output screen.

5. (a) List the categories of user defined functions (UDF) based on their return types. Design a UDF that returns 1 if the integer is a Perfect number else returns 0 to the calling program.