

Indian Statistical Institute

Course name: M.TECH(CS)-1st Year (2022-2023)

Subject: Introduction to Programming

Date 23.10.2024

Full Marks 90

Time: 3 Hrs

Answer all the questions

1. ~~(a)~~ Write the output of the following C program when executed and give reasons of such output.

```
#include <stdio.h>
int x =7;
int function1(int counter){
    x++;
    if (counter==0){
        return x;
    }
    x = x+counter--;
    return x;
}
int function2(int val){
    static int x = -3;
    x++;
    if (val==0){
        return x;
    }
    x = val--;
    return x;
}
int main (void) {
    int x=7;
    int i=0;
    printf("Output of Function_1 is: %d\n", function1(x));
    for (; i<10; i=i+2){
        x = function2(0);
        printf("Output of %d iteration is %d\n",i, x);
    }
}
```

[6]

2. What is a flowchart? Draw a flowchart to compute the sum of the following series for given values of x and k .

$$1 - \frac{x}{1!} + \frac{x^2}{1! \times 2!} - \frac{x^3}{2! \times 3!} + \dots + (-1)^k \frac{x^k}{(k-1)! \times k!}$$

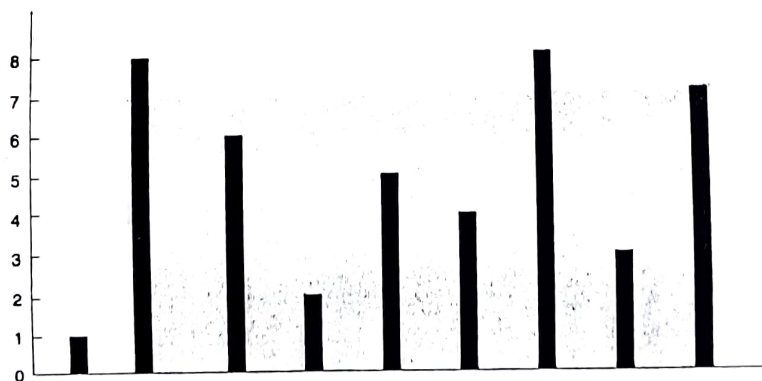
[2+8]

3. Given two strings in lowercase characters. Write a C program to check whether the given two strings are Anagram or not. An Anagram of a string (say S) is any of the strings obtained by rearranging the characters of S. For example, dabfce is one of the Anagrams of the string abcdef. [12]
4. Given a text file, INPUT.TXT, containing words of English alphabet only. Write an efficient C program so that for each word of the file, all the vowels of the word will come at the beginning of the word in sorted order and then consonants in sorted order also. Write these modified words in an output file (OUTPUT.TXT). [15]

5. Given a height array {2, 9, 4, 5, 6, 3, 8, 7, 1, 4, 6, 8, 3, 7, 2, 5} where each element represents the height of a vertical line drawn on the x-axis. The two endpoints of the line at the i -th index are represented as coordinates $(i, 0)$ and $(i, \text{height}[i])$. Find two lines that together with the x-axis form a container, such that the container can hold the maximum amount of water. Print the maximum amount of water a container can store along with the index of the lines of the imaginary container.

Note: you cannot slant the container.

Example –



Sample Input: height = [1,8,6,2,5,4,8,3,7]

Sample Output:

The maximum area of the container (marked in blue here) is: 49

The indices of the two heights forming the largest container for this example are: 1 and 8. These heights are marked in red.

Explanation: The above vertical lines are represented by array [1,8,6,2,5,4,8,3,7]. In this case, the max area of water (blue section) the container can contain is 49.

[11]

6. Given an array $A[M][N]$ whose values lies between $[-K, K]$, K is an integer. Write an efficient C program to print those numbers in the array whose occurrence frequency in the array is a non-prime as well as Fibonacci number. If there is no such value print null. [10]

7. Write an efficient C program to rotate a linked list to the right by N places. N will be taken as input. The linked list should be modified in such a way that after rotation, the last N nodes of the list are moved to the front, and the rest of the nodes are shifted to the right. The linked list will also be taken as input from the user and must have more than N nodes. The linked list should be modified without using any other linked-list/*any other nodes*.

For Example:

Input:

Linked List: 10 -> 20 -> 30 -> 40 -> 50

N : 2

Output:

Rotated Linked List: 40 -> 50 -> 10 -> 20 -> 30

[12]

8. Write an efficient C program to find the number of integer coordinates that lie inside the intersection portion of two circles. The circles are defined by their centers and radii as follows.
- Circle 1: Center at (x_1, y_1) and radius r_1 .
 - Circle 2: Center at (x_2, y_2) and radius r_2 .

[8]

9. (a) What will be the content of "file.c" after executing the following program?

```
#include<stdio.h>
int main()
{
    FILE *fp1, *fp2;
    fp1=fopen("file.c", "w");
    fp2=fopen("file.c", "w");
    fputc('A', fp1);
    fputc('B', fp2);
    fclose(fp1);
    fclose(fp2);
    return 0;
}
```

- (b) Write down the equivalent statement of the `rewind(fp)` using `fseek` function

[3+3]