

INDIAN STATISTICAL INSTITUTE
Semester I Supplementary Examination: (2025-2026)
M. Tech. (QR & OR) – I Yr. (E-Stream)
Programming Techniques and Data Structures

Date: 16.12.2025

Maximum marks: 100

Duration: 3 hrs.

1. (a) Draw a flow chart to obtain the perimeter of the circumcircle of a rectangle of sides of lengths ' a ' and ' b '.
(b) Write an algorithm to find the minimum of 03 nos. of input integer values.
(c) Write a pseudocode to determine the value of a given 3×3 determinant. [8+8+8 = 24]
2. Perform the following conversions: (i) $(99)_{10} = (?)_2$, and (ii) $(110)_2 = (?)_{10}$ [3+3 = 06]
3. Consider the following part of a C program and write the remaining part of it to check whether the four points (1,1), (1,3), (4,3) and (4,1) are the vertices of a rectangle.

// C program to check whether given 04 points are the vertices of a rectangle

#include <stdio.h>

int main () {

 // Coordinates of points in 2D

struct point {

 int x;

 int y;

};

//Four vertices of rectangle

struct number {

 struct point V1, V2, V3, V4;

 int Flag;

} Quad1, Quad2;

//Four sides of rectangle

int V1V2, V2V3, V3V4, V4V1;

[10]

4. (a) Name two mathematical library functions of C along with their respective input and return types.
(b) Write down the maximum and minimum values that may be stored in an unsigned short type variable of C language.
(c) Write down an example of a for loop in C in which the loop control variable increases by 2 after each iteration.
(d) Construct a do...while () loop which should iterate for only 10 times during which an integer variable should increase its value from 10 to 20.

[(2+2)+(1+1)+2+2=10]

5. (a) Name two derived data types of C language.
 (b) What are the sizes of double and long double variables of C?
 (c) State two main differences between global and local C variables?
 (d) Write necessary C programming statements to open a text file in two different modes.
 (e) What are the input arguments of C library functions strcpy() and strcat().

[5×2 = 10]

6. (a) Write C programming language statements declaring a suitable integer array type variable to store a 2-D matrix of integer values.
 (b) Write C statements to read integer values from the keyboard, filling the above matrix.
 (c) Write C statements to store the above matrix into a text file.

[2+4+4 = 10]

7. (a) Read the following C program and identify its logical error(s), if any exists.

```
#include <stdio.h>
#include <ctype.h>

int main() {
    char ch;

    printf("Enter an alphabet: ");
    scanf("%c", &ch);

    if (isalpha(ch)) {
        switch (ch) {
            case 'a':
            case 'A':
            case 'e':
            case 'E':
            case 'i':
            case 'I':
            case 'o':
            case 'O':
            case 'u':
            case 'U':
                printf("Input alphabet %c is a vowel.\n", ch);
            default:
                printf("Input alphabet %c is a consonant.\n", ch);
                break;
        }
    } else {
        printf("%c is not an alphabet.\n", ch);
    }

    return 0;
}
```

- (b) What is a binary search tree? Write down the steps of a search operation in a binary search tree.

[3+(2+5) = 10]

8. (a) Declare a singly linked list of C language.
 (b) Write necessary C statements to insert N values into this linked list.
 (c) What are the advantages of using singly linked list instead of a C array?

[2+6+2 = 10]

9. (a) Write the differences between the two data structures. stack and queue.
 (b) What are the best case, average case and worst case time complexities of the bubble sort algorithm?

$$\{(2 \times 2^{1/2}) + (2 \times 2^{1/2}) = 10\}$$

$$[4 + (3 \times 2) = 10].$$
10. Draw a tree data structure of your choice and write down the results of its preorder, postorder and inorder traversals.

$$[4 + (3 \times 2) = 10]$$
