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## Third Semester B.E. Degree Examination, June/July 2025 Data Structures and Applications

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. What is a structure? Compare and contrast between structure, union and array. Explain different types of structure declarations with examples. (10 Marks)
- b. Describe usability of dynamic memory allocation functions using C program. (06 Marks)
- c. How sequential mapping is classically performed on linear list? (04 Marks)

### OR

- 2 a. Develop Knuth Morris Pratt pattern matching algorithm and apply the same to search the pattern 'a b c d f' in the text 'a b c d a b c a b c d f'. (08 Marks)
- b. Write functions in C for the following operations without using built-in functions.
  - i) Compare two strings
  - ii) Concatenate two strings
  - iii) Reverse a string. (06 Marks)
- c. Write the ADT of sparse matrix and give the triplet form of a given matrix and also find its transpose.

$$A = \begin{bmatrix} 7 & 0 & 0 & 0 & 0 \\ 0 & 0 & 9 & 0 & 0 \\ 3 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 5 \end{bmatrix}$$

(06 Marks)

### Module-2

- 3 a. Write an algorithm to evaluate postfix expression and trace the same on given below expression.
  - i)  $536 + * 635 - + *$
  - ii)  $532 + -293 / = * 32 +$  (08 Marks)
- b. What is recursion? Describe the concept of call stack in recursion by applying on Tower of Hanoi. How does it affect memory usage? (12 Marks)

### OR

- 4 a. Write a program in C to implement push, pop, and display operations for Dequeues using array. (10 Marks)
- b. Explain a mazing problem. (10 Marks)

### Module-3

- 5 a. Write C functions to perform following on doubly linked list.
  - i) Inserting a node at the beginning
  - ii) Inserting a node at the given position
  - iii) Inserting a node at the end. (10 Marks)
- b. Write a program in C to implement push, pop and display operations for circular queues using linked list. (10 Marks)

OR

- 6 a. Write a C program to implement insertion, deletion and display operations on a stack. (10 Marks)
- b. Write the C function to add two polynomials, show the linked representation of the below two polynomials and their addition using a circular singly linked list  $P_1 : 5x^3 + 4x^2 + 7x + 3$ ,  $P_2 : 6x^2 + 5$ . Output: add the above two polynomials and represent them using the linked list. (10 Marks)

**Module-4**

- 7 a. Demonstrate storage of binary trees using linked list. (04 Marks)
- b. Define binary search tree. Construct a Binary Search Tree (BST) for the following elements: 100, 85, 45, 55, 120, 20, 70, 90, 115, 65, 130, 145. Traverse using in-order, pre-order and post-order traversal techniques, write recursive C functions for the same. (08 Marks)
- c. Define the leftist tree and declaration in C. Check whether the given binary tree is a leftist tree or not for graph in Fig.Q.7(c) below. (08 Marks)

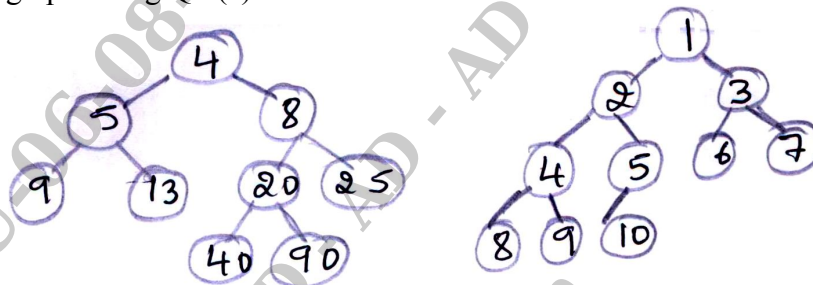


Fig.Q.7(c)

OR

- 8 a. What is a tree? With a suitable example define the following:
- Binary tree
  - Level of binary tree
  - Complete binary tree
  - Degree of the tree.
- (10 Marks)
- b. What are the advantage and disadvantage of the threaded binary tree over binary tree? Explain the construction of threaded binary tree for A, B, C, D and E. (10 Marks)

**Module-5**

- 9 a. Describe traversal techniques involved in DFS, BFS with examples. (10 Marks)
- b. Illustrate with an example sorting steps involved in insertion sort and address calculation sort. (10 Marks)

OR

- 10 a. What is chained hashing? Discuss its pros and cons. Construct the hash table to insert the keys: 7, 24, 18, 52, 36, 54, 11, 23 in a chained hash table of 9 memory locations. Use  $h(k) = k \text{ mod } m$ . (10 Marks)
- b. Summarize any 3 widely used file organization and indexing techniques. (10 Marks)

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