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## Third Semester B.E. Degree Examination, Feb./Mar. 2022

**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. Define Data Structures. Explain the various operations on Data structures. (06 Marks)
- b. Define Structures. Explain the types of structures with examples for each. (07 Marks)
- c. List and explain the functions supported in C for Dynamic Memory Allocation. (07 Marks)

**OR**

- 2 a. Define Pattern Matching. Write the Knuth Morris Pratt Pattern matching algorithm and apply the same to search the pattern 'abcdabcy' in the text 'abcxabcdabxabcdabcy'. (10 Marks)
- b. Write the Fast Transpose algorithm to transpose the given Sparse Matrix. Express the given Sparse Matrix as triplets and find its transpose.

$$A = \begin{bmatrix} 10 & 0 & 0 & 25 & 0 \\ 0 & 23 & 0 & 0 & 45 \\ 0 & 0 & 0 & 0 & 32 \\ 42 & 0 & 0 & 31 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 30 & 0 & 0 \end{bmatrix}$$

(10 Marks)

**Module-2**

- 3 a. Define Stacks. List and explain the various operations on stacks using arrays with stack overflow and stack underflow conditions. (10 Marks)
- b. Write an algorithm to convert an infix expression to postfix expression and also trace the same for the expression  $(a + b) * d + e/f + c$ . (10 Marks)

**OR**

- 4 a. Define Recursion. Explain the types of recursion. Write the recursive function for
  - i) Factorial of a number
  - ii) Tower of Hanoi.
 (10 Marks)
- b. Give the Ackermann function and apply the same to evaluate  $A(1, 2)$ . (04 Marks)
- c. Explain the various operations on Circular queues using arrays. (06 Marks)

**Module-3**

- 5 a. Give the node structure of create a single linked list of integers and write the functions to perform the following operations :
  - i) Create a list containing three nodes with data 10, 20, 30 using front insertion.
  - ii) Insert a node with data 40 at the end of list.
  - iii) Delete a node whose data is 30.
  - iv) Display the list contents. (10 Marks)
- b. Write the functions for :
  - i) Finding the length of the list
  - ii) Concatenate two lists
  - iii) Reverse a list. (10 Marks)

**OR**

- 6 a. Write the node representation for the linked representation of a polynomial. Explain the algorithm to add two polynomials represented as linked list. (08 Marks)
- b. For the given Sparse matrix, write the diagrammatic linked list representation.

$$A = \begin{bmatrix} 3 & 0 & 0 & 0 \\ 5 & 0 & 0 & 6 \\ 0 & 0 & 0 & 0 \\ 4 & 0 & 0 & 8 \\ 0 & 0 & 9 & 0 \end{bmatrix}$$

(04 Marks)

- c. List out the differences between single linked list and double linked list. Write the functions to perform following operations on double linked list :
- Insert a node at rear end of the list
  - Delete a node at rear end of the list
  - Search a node with a given key value.
- (08 Marks)

#### Module-4

- 7 a. Define a Tree. With suitable example explain i) Binary tree ii) Complete binary tree  
iii) Strict binary tree iv) Skewed binary tree. (10 Marks)
- b. Write the routines to traverse the given tree using  
i) Pre – Order traversal ii) Post – Order traversal. (06 Marks)
- c. Write the recursive search algorithm for a Binary Search tree. (04 Marks)

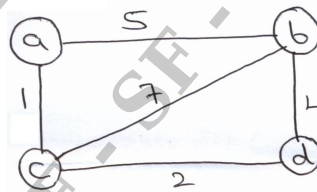
**OR**

- 8 a. Draw a Binary tree for the following expression :  $((6 + (3-2) * 5) ^ 2 + 3)$ .  
Traverse the above generated tree using Pre – order and Post – order and also write their respective functions. (10 Marks)
- b. Write the routines for :  
i) Copying of binary trees ii) Testing equality of binary trees. (10 Marks)

#### Module-5

- 9 a. Define Graphs. Give the Adjacency matrix and Adjacency list representation for the following graph in Fig. Q9(a). (08 Marks)

Fig. Q9(a)



- b. Write the algorithm for following Graph Traversal methods :  
i) Breadth first search ii) Depth first search. (08 Marks)
- c. Write an algorithm for insertion sort. (04 Marks)

**OR**

- 10 a. Define Hashing. Explain any three Hash functions. (08 Marks)
- b. Explain Static and Dynamic hashing in detail. (08 Marks)
- c. Define the term File Organization. Explain indexed sequential File Organization. (04 Marks)

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