USN

18CS32

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. **(10 Marks)**
   iv) Display the list contents.
   b. Write the functions for : i) Finding the length of the list   ii) Concatenate two lists **(10 Marks)**
   iii) Reverse a list.

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. **(04 Marks)**

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

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

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 **(06 Marks)**
      i) Pre – Order traversal   ii) Post – Order traversal. **(04 Marks)**

    c. Write the recursive search algorithm for a Binary Search tree.

**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 : **(10 Marks)**
      i) Copying of binary trees   ii) Testing equality of binary trees.

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)
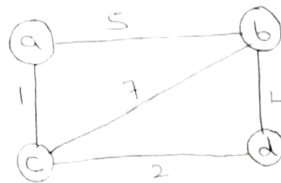
    b. Write the algorithm for following Graph Traversal methods :
      i) Breadth first search   ii) Depth first search. **(08 Marks)**

    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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