USN [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]   **17CS33**

Third Semester B.E. Degree Examination, June/July 2023
Data Structure 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. Explain how memory can be allocated dynamically using different techniques.   **(06 Marks)**
   b. What is an abstract data type? Give the ADT for sparse matrix. Express the given sparse matrix in triplet form and find its transpose.   **(10 Marks)**

$$\begin{bmatrix} 15 & 0 & 0 & 22 & 0 & -15 \\ 0 & 11 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & -6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 & 0 & 0 \end{bmatrix}$$

   c. Explain structure and union and how a union is different from a structure.   **(04 Marks)**

OR

2 a. Define pointers. How to declare and initialize pointers. Explain with examples.   **(04 Marks)**
   b. List and explain the three types of structures used to store the strings.   **(10 Marks)**
   c. Define polynomial and degree of a polynomial. Write a function to add two polynomials.   **(06 Marks)**

Module-2

3 a. What is a stack? Explain the various operations that can be performed on a stack.   **(08 Marks)**
   b. Write the postfix form of the following expressions:
       (i) $((a / (b - c + d)) * (e - a) * c)$
       (ii) $a / b - c + d * e - a * c$
       (iii) $(a + b) * d + e / (f + a * d) + c$ **(06 Marks)**
   c. Write a recursive function for : (i) Tower of Hanoi problem (ii) Factorial of a number   **(06 Marks)**

OR

4 a. Describe the model of maze where 0 represents open paths and 1 represents barriers. Given an example MAZE together with its allowable moves and table of moves.   **(08 Marks)**
   b. Write an abstract data type for a queue. Give junctions for CreateQ, AddQ and deleteQ operations.   **(12 Marks)**

Module-3

5 a. What is a linked list? Explain the different types of linked lists with diagram.   **(09 Marks)**
   b. Write C functions for the following for singly linked list:
       (i)   Inserting into front of a list
       (ii) Deleting from a list
       (iii) Printing a list   **(07 Marks)**
   c. Describe the advantages and disadvantages of doubly linked list over singly linked list.   **(04 Marks)**

OR

6 a. Explain how different operations are performed using Linked Stacks and Queues. **(10 Marks)**
   b. Write C functions to perform the following:
       (i)   Inverting a singly linked list
       (ii)   Concatenating the singly linked list
       (iii) Traversing a linked list   **(10 Marks)**

Module-4

7 a. What is a binary tree? How is it represented using array and linked list? Explain. **(10 Marks)**
   b. Explain the different methods of traversing a binary tree. Give the traversals for the binary tree shown in Fig.Q7(b).
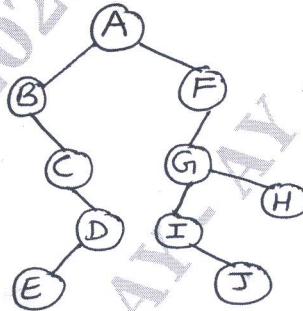

Fig.Q7(b)   **(10 Marks)**

OR

8 a. Define binary search tree. Write Recursive Search and Iterative Search Algorithms for a binary search tree. **(10 Marks)**
   b. What are threaded binary trees? List out the advantages of threaded binary tree over binary tree. **(04 Marks)**
   c. Write functions to illustrate the following:
       (i)   Copying binary trees
       (ii)   Testing equality of binary trees   **(06 Marks)**

Module-5

9 a. Write C functions to perform Depth First Search and Breadth First Search of a graph. **(10 Marks)**
   b. Explain adjacency matrix and Adjacency list representation of graphs. Write the adjacency matrix and adjacency list for the graph shown in Fig.Q9(b).
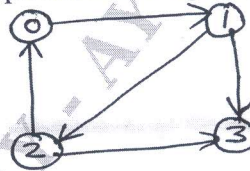

Fig.Q9(b)   **(10 Marks)**

OR

10 a. Explain briefly the basic operations that can be performed on a file. Explain Indexed-Sequential file organization. **(06 Marks)**
    b. Write a note on static and dynamic hashing. **(06 Marks)**
    c. Write an algorithm for an insertion sort. Also, discuss the complexity of insertion sort. **(08 Marks)**

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