CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   21CS32

Third Semester B.E. Degree Examination, June/July 2023
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. Classify data structures in various features. **(06 Marks)**

    b. Write algorithms to insert a data element into array and delete an element from the array. **(07 Marks)**

    c. Explain various memory allocation and de-allocation function supported in C. **(07 Marks)**

OR

2 a. Explain user defined structures with respect to C. Give structure definition and declaration for STUDENT data with the following information: USN and Name. Also give self referential structure. **(04 Marks)**

    b. Show array representation of two polynomials. Write a C function to add two polynomials $A(x)$ and $B(x)$ term by term to produce $D(x)$ where $D(x) = A(x) + B(x)$, $A(x) = 2x^{10} + x + 3$, $B(x) = x^5 + 10x^3 + 3x^2 + 12$. **(08 Marks)**

    c. Obtain triplet representation for the given sparse matrix. Write fast transpose algorithm to obtain transpose of sparse matrix.

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

(08 Marks)

Module-2

3 a. How recursion uses stack during its execution. Give algorithm to simulate Tower of Henoi. Trace the algorithm for a total of 3 disc which are placed in source pole. **(06 Marks)**

    b. Write C routines to implement operations on stack. Also incorporate useful routines to check the stack status for full and empty. Also include global declarations. **(07 Marks)**

    c. Write algorithm to convert infix expression to prefix form. Apply the algorithm to obtain equivalent prefix form. Infix expression : $6 * 2 \wedge 2 \wedge 3/(9-3)$ **(07 Marks)**

OR

4 a. Design circular queue using dynamically allocated arrays. Give steps to relocate elements in dynamic array for proper insertion and deletion. **(04 Marks)**

    b. With the help of algorithm, evaluate the postfix expression $6223\wedge\wedge*3/$ using stack. **(08 Marks)**

    c. What is the advantage circular queue over ordinary queue? Give ADT to perform various operations on circular queue. Also give ADTs to check for empty and full. **(08 Marks)**

Module-3

5 a. Give structure representation in C to create a single linked list. Give C routine to implement following operations on SLL:
   (i) Create SLL of integer data
   (ii) Insert a node at rear end
   (iii) Delete a node from front end
   (iv) Display all nodes neatly
   (v) Search for a suitable data in SLL and display appropriate message. (12 Marks)

   b. What is the advantage of doubly linked list? Give suitable steps to insert a node between A and B (consider A is NULL, B is NULL and A & B are not NULL) in SLL. (08 Marks)

OR

6 a. Write the node representation of the linked representation of a polynomial. Also give algorithm to perform addition on two polynomials. (10 Marks)

   b. Differentiate between SLL, DLL, circular linked list and header linked list. Give algorithm to insert anode circular linked list and traverse the list. (10 Marks)

Module-4

7 a. Define tree. For the given tree, explain terminologies and write the answer:
   (i) Degree   (ii) Non terminal   (iii) Sibling
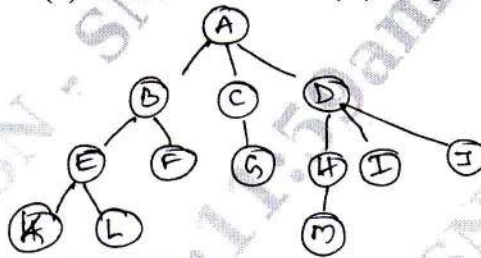   (iv) Ancestor   (v) Level   (vi) Height

Fig.Q7(a) (06 Marks)

   b. Give C routine to create BST for the data 12, 0, −90, 5, 3, 10, 0, 8, 18. Give 3 traversals of BST constructed from above data. (07 Marks)

   c. Given in order sequence DJHBEAFICG and post order sequence JHDEBIFGCA, construct binary tree and give pre-order traversal. (07 Marks)

OR

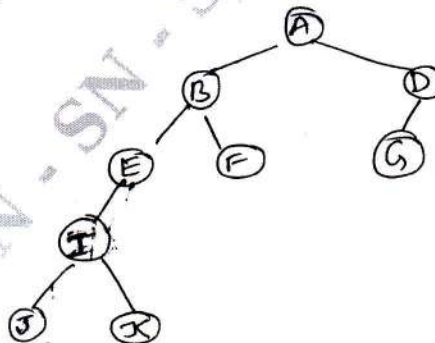8 a. Give array and linked list representation for the binary tree.

Fig.Q8 (06 Marks)

   b. Write iterative and recursive search function to search a key in BST. (08 Marks)

   c. Draw a binary tree for the following expression $3 + 4 * (7 − 6) / 4 + 3$. Traverse the tree and obtain pre-order and post order expression. (06 Marks)

Module-5

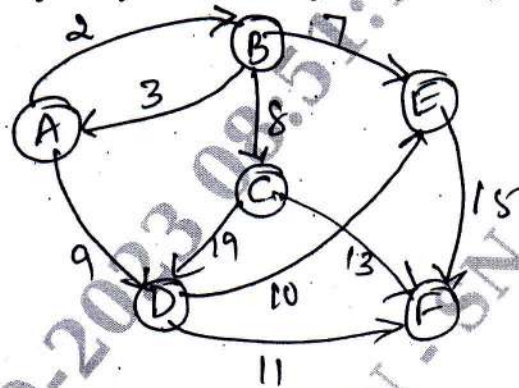**9** a. For the given graph show adjacency matrix and adjacency list representation.

Fig.Q9(a)   **(06 Marks)**

  b. Write BSF and DFS algorithm for graph traversal.   **(10 Marks)**

  c. Write a note on AVL tree.   **(04 Marks)**

OR

10 a. What is hashing? Explain different hashing function with suitable numerical example.
                                                                               (08 Marks)

  b. What is collision? Explain the method to resolve collision with suitable algorithm of liner probing. Insert keys 72, 27, 36, 24, 63, 81, 92, 101 into table [size = 10].   **(08 Marks)**

  c. Write a note on B-tree.   **(04 Marks)**

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