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18CS32

Third Semester B.E. Degree Examination, Jan./Feb. 2021
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 with neat block schematic different types of data structures with examples. What are the primitive operations that can be performed? **(10 Marks)**

   b. Define sparse matrix. Express the following matrix in triplet form and find its transpose.

   (10 Marks)

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

OR

2 a. Explain any four dynamic memory allocation functions with syntax and example. **(10 Marks)**

   b. What do you mean by pattern matching? Outline the KMP algorithm. Implement the same to find out the occurrence of following pattern.
   P:ABCDABD
   S:ABC ABCDAB ABCDABCDABDE **(10 Marks)**

Module-2

3 a. Define Recursion. Let A and B be nonnegative integers. Suppose a function GCD is recursively defined on follows:
   GCD(A, B) = GCD (B, A) if A < B
   $\qquad\qquad$ = A if B = 0
   $\qquad\qquad$ = GCD(B, MOD(A, B)) otherwise
   Here MOD(A, B) read as A Modulo B. Evaluate GCD(20, 28). **(04 Marks)**

   b. Write C function for push( ), pop( ) and display( ) routine of STACK. **(08 Marks)**

   c. Outline the algorithm for infix to postfix. Using the same algorithm convert following INFIX expression to equivalent POSTFIX.
   $((H * ((((A + ((B + C) * D)) * F) * G) * E)) + J)$ **(08 Marks)**

OR

4 a. Write a C function CQInsert( ) and CQDelete( ) operations on circular queue. **(08 Marks)**

   b. Outline the algorithm for infix to prefix. Using the same algorithm convert following INFIX to equivalent PREFIX.
   $((H * ((((A + ((B + C) * D)) * F) * G) * E)) + J)$ **(08 Marks)**

   c. Evaluate the following postfix expression by showing the contents of the stack.
   5 4 6 + * 4 9 3 / + * **(04 Marks)**

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Module-3

5 a. Write C functions for the following operations on linked list:
      i)   Insertion at the beginning
      ii)   Insertion at the end
      iii)   Deletion at the beginning
      iv)   Deletion at the end.   **(12 Marks)**

    b. Explain concept of sparse matrix representation using linked list. Represent the following sparse matrix in linked list format.   **(08 Marks)**

$$A = \begin{bmatrix} 0 & 0 & 3 & 0 & 4 \\ 0 & 0 & 5 & 7 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 6 & 0 & 0 \end{bmatrix}$$

OR

6 a. Write C function to add two polynomials. Show the linked list representation of below two polynomials and in addition.
      POLY 1: $5x^2 + 4x + 2$
      POLY 2: $3x^2 + 2x + 5$ **(08 Marks)**

    b. Write C functions for following operations on circular linked list:
      i)   Insertion at the beginning
      ii)   Insertion at the end
      iii)   Deletion at the beginning
      iv)   Deletion at the end.   **(12 Marks)**

Module-4

7 a. Define Binary tree with an example. Write C recursive routine to traverse the given tree using inorder, preorder and postorder.   **(08 Marks)**

    b. Define binary search tree. Draw the BST for the following input:
      14 15 4 9 7 18 3 5 16 20 17 9
      Give recursive search function to search an element in that tree.   **(06 Marks)**

    c. Given the following traversal, draw a binary tree:
      i) Inorder : 4 2 5 1 6 7 3 8
         Postorder : 4 5 2 6 7 8 3 1
      ii) Preorder : A B C E I F J D G H K L
         Inorder : E I C F J B G D K H L A   **(06 Marks)**

OR

8 a. Represent the below given tree in Fig.Q.8(a), using
      i)   Linked list representation
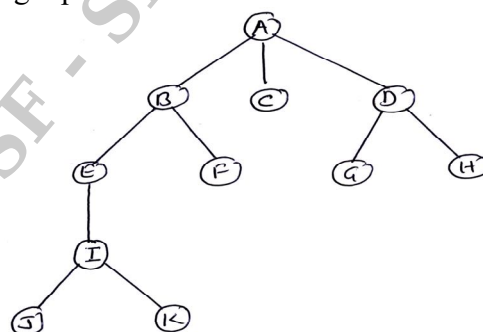   ii)   Left child right sibling representation.   **(08 Marks)**

Fig.Q.8(a)

b. Define threaded binary tree. List its advantages and disadvantages. Draw the one way threading and two way threading of the following binary tree. (Refer Fig.Q.8(b)). **(08 Marks)**
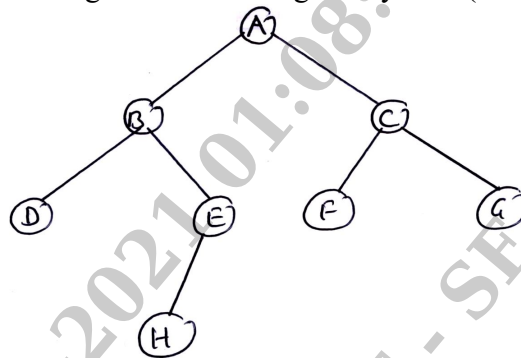

Fig.Q.8(b)

c. Write function to insert an element in a binary search tree. **(04 Marks)**

Module-5

9 a. Define the following terminologies with examples:
   i) Digraph   ii) Weighted graph   iii) Self loop   iv) Parallel edges **(08 Marks)**

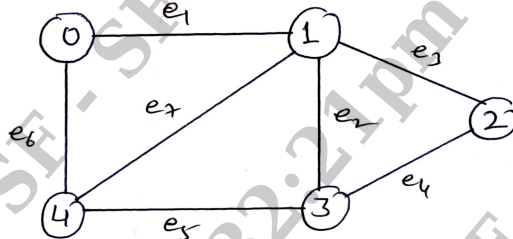b. Give the adjacency matrix, incidence matrix and linked list representation of the following undirected graph. **(06 Marks)**

Fig.Q.9(b)

c. Arrange the following elements in ascending order using RADIX SORT
   151, 60, 875, 342, 12, 477, 689, 128, 15 **(06 Marks)**

OR

10 a. Explain different types of HASH function with example. **(10 Marks)**

b. Explain any five file operations along with syntax and example. **(10 Marks)**

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