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18CS32

Third Semester B.E. Degree Examination, July/August 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 classification of data structures with examples. **(06 Marks)**

b. Explain the dynamic memory allocation functions supported by 'C' with syntax and examples. **(06 Marks)**

c. Consider the pattern P = ababab. Construct the table and the corresponding labeled directed graph used in the fast or second pattern matching algorithm. Trace it for the input text T = abaababababba. **(08 Marks)**

OR

2 a. Differentiate between structures and unions. Show examples for both. **(06 Marks)**

b. Explain any four string handling functions supported by 'C' with syntax and examples. **(06 Marks)**

c. Explain the representation of linear arrays in memory. Also, consider the linear arrays AAA (5:50) and BBB(-5:10).

i) Find the number of elements in each array.

ii) Suppose Base (AAA) = 300, Base (BBB) = 500 and 4 words per memory cell for AAA, 2 words per memory cell for BBB, find the address of AAA[15], AAA[55], BBB[8] and BBB[0]. **(08 Marks)**

Module-2

3 a. Define a stack. Explain the different operations that can be performed on stacks with suitable 'C' functions and examples. **(07 Marks)**

b. Convert the following infix expression into postfix expression using stack.
A + (B * C – (D / E ^ F) * G) * H. **(05 Marks)**

c. Develop a C recursive program for tower of Hanoi problem. Trace it for 3 disks with schematic call tree diagram. **(08 Marks)**

OR

4 a. Develop C functions to implement insertion, deletion and display operations of a circular queue. **(07 Marks)**

b. Write an algorithm to evaluate a postfix expression. Trace the algorithm for the following expression showing the stack contents 6 5 1 – 4 * 23 ^ / +. **(06 Marks)**

c. Define Ackermann function recursively and evaluate A(3, 0). Also, develop C code for the same. **(07 Marks)**

Module-3

5 a. Write the differences between arrays and linked lists. **(04 Marks)**

b. Develop C functions to implement the following in a singly linked list:
i) Delete a node from the front ii) Concatenate two linked lists. **(08 Marks)**

c. Develop a C function to add two polynomials using singly linked list. **(08 Marks)**

OR

6 a. Show the diagrammatic linked representation for the following sparse matrix:

$$\begin{bmatrix} 0 & 1 & 2 \\ 3 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

(04 Marks)

b. Develop C functions to implement the following in a doubly linked list:
   i) Insert a node at the front
   ii) Delete a node from the end. **(08 Marks)**

c. Develop C functions to implement the various operations of queues using linked list. **(08 Marks)**

Module-4

7 a. With suitable examples, define the following:
   i) Degree of a node
   ii) Level of a binary tree
   iii) Complete binary tree
   iv) Full binary tree. **(06 Marks)**

b. Construct binary search tree for the given set of values 14, 15, 4, 9, 7, 18, 3, 5, 16, 20. Also, perform inorder, preorder and postorder traversals of the obtained tree. **(06 Marks)**

c. Explain threaded binary trees and their representation with a neat diagram. Also, develop a C function to do the inorder traversal of a threaded binary tree. **(08 Marks)**

OR

8 a. Explain the array and inked representation of binary trees with suitable examples. **(06 Marks)**

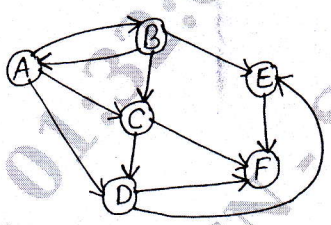
b. A binary tree has 9 nodes. The inorder and preorder traversals yield the following sequences of nodes:
   Inorder: E A C K F H D B G
   Preorder: F A E K C D H G B
   Draw the binary tree. Also, perform the post order traversal of the obtained tree. **(06 Marks)**

c. Develop C functions to implement the following:
   i) Search a key value in a binary search tree
   ii) Copying a binary tree. **(08 Marks)**

Module-5

9 a. Define a graph. For the graph shown in Fig.Q.9(a), show the adjacency matrix and adjacency list representations. **(06 Marks)**

Fig.Q.9(a)



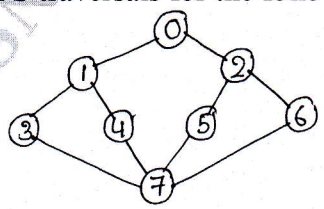
b. Suppose an array contains 8 elements as follows: 77, 33, 44, 11, 88, 22, 66, 55. Sort the array using insertion sort algorithm. **(06 Marks)**

c. What is hashing? Explain the following hash functions with proper examples:
   i) Division ii) Midsquare iii) Folding. **(08 Marks)**

OR

10 a. Briefly explain Breadth-First Search (BFS) and Depth-First Search (DFS) traversal of a graph. Also, show the BFS and DFS traversals for the following graph in Fig.Q.10(a).

Fig.Q.10(a)



(06 Marks)

b. Suppose 9 cards are punched as follows: 348, 143, 361, 423, 538, 128, 321, 543, 366. Apply radix sort to sort them in 3.phases. **(06 Marks)**

c. What is Collision? Explain the collision resolution techniques with proper examples. **(08 Marks)**

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