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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**
Course Code: 22AM3PCDST **Max Marks: 100**
Course: Data Structures **Date: 08.05.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) Is it possible to use unstructured data in a structured programming environment? Explain. **5**

b) Dynamic memory allocation functions allow the developers to handle memory more efficiently by requesting for it only when required. Using code snippets and syntaxes, elaborate on any 2 dynamic memory allocation functions and their applications in detail. **5**

c) Write a C program to implement a Singly Linked List (SLL) with a header node to perform the following basic operations: **10**

i) Insert at the front end
ii) Search for a key in the list
iii) Display the contents of the list

UNIT - II

2 a) Using the diagrammatic representations and C coding sequence, explain how to perform the following operations on a Doubly Linked List (DLL): **10**

i) Insert an element after the given key element
ii) Concatenate two DLLs

b) Which data structure would you prefer to validate parenthesis matching in the given input string and Why? Take a sample input string and trace the validation process. **10**

OR

3 a) Write a C program to implement the following operations on a Circular Doubly Linked List (CDLL): **10**

i) Count the number of nodes
ii) Delete a node at the rear end
iii) Display

b) Illustrate how Stack can be used to convert given infix expressions to their postfix equivalent form. **10**

i. (a+b)*c/d^e*(f-g)
ii. (a*b+(c^e))/(f*g)

UNIT - III

4 a) Consider a circular queue with maximum storage capacity of 5, operating on the index variables: F-front index and R-rear index. Assume that presently it has 3 elements 10, 20 and 40 inserted from its rear end and the index variables hold the values F=2 & R=4. Identify the values of the index variables at each step by performing the following operations: **10**

i) Insert 50
ii) Insert 60
iii) Insert 30
iv) Delete 10
v) Delete 2 elements sequentially and insert 70, 80, 90

Show the operation of every step pictorially.

b) How does recursion help to add the elements in an array? Write the stack trace and explain the algorithmic steps of the recursive process applied while computing the summation. **10**

UNIT - IV

5 a) For a search based application most of the developers prefer non-linear representation of data. However, non-linear data can also be stored in linear data structures and data can be accessed comfortably. Explain how? **05**

b) Explain Post-Threaded Binary Tree representation in memory and its working using a graphical representation. **05**

c) By considering the given Post-order: 5, 7, 6, 12, 16, 10, 9, 20, 23, 21, 18 & **10**

In-order: 5, 6, 7, 9, 10, 12, 16, 18, 20, 21, 23 traversals

i) Construct the respective Binary Search Tree (BST).
ii) For the tree obtained in the above step, write the Pre-order traversal sequence.

UNIT - V

6 a) Write algorithmic steps followed by a Red-Black tree to balance itself after every insert or delete operation. Explain its important properties which will be verified every time when the tree is modified / updated. **10**

b) Create an AVL tree using the following sequence of elements: 20, 31, 13, 15, 40, 58, 85, 67, 76. Show all intermediate steps and rotations applied while creating the tree. **10**

OR

7 a) By applying the appropriate rules, create a Red-Black tree for the given set of items: 10, 85, 15, 70, 20, 60, 30, 50. **10**

b) What is the use of splaying a Binary tree? Construct a BST of your own consisting of 6 elements and explain how splaying happen after every insert operation. **10**

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