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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Computer Science and Engineering **Duration: 3 hrs.**
Course Code: 20CS5PEADS **Max Marks: 100**
Course: Advanced Data Structures

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

SUPPLEMENTARY EXAMS 2023

UNIT - I

1 a) Explain the concept of Path Compression with reference to Disjoint sets with an example. **6**

b) Given a set of 'n' jobs where each job 'i' has a deadline di >=1 and profit pi>=0. Only one job can be scheduled at a time. Each job takes 1 unit of time to complete. We earn the profit if and only if the job is completed by its deadline. Develop a program to find the subset of jobs that maximizes profit using disjoint sets. **10**

Sample Input: Four Jobs with following deadlines and profits

Job ID	Deadline	Profit
A	4	20
B	1	10
C	1	40
D	1	30

Expected Output: Following is maximum profit sequence of jobs: C, A

c) Compare move to front method and transpose method for self-organizing list and analyze which method gives better results. **4**

OR

2 a) Write a program to implement the following operations on a memory efficient linked list: **10**

(a) A function to insert a new node at the beginning of the list
(b) A function to traverse the list in forward direction

b) Given a tree and weights of nodes where weights are non-negative integers, write a program using disjoint sets to find maximum size of a subtree of a given tree such that all nodes are even in weights. **10**

Sample Input: Number of nodes = 7
Weights of nodes = 1 2 6 4 2 0 3
Edges = (1, 2), (1, 3), (2, 4), (2, 5), (4, 6), (6, 7)
Sample Output: Maximum size of the subtree with even weighted nodes = 4

UNIT - II

3 a) Construct a B-tree of order 5 for the following numbers. **10**
217, 89, 117, 113, 115, 61, 511, 213, 718, 77, 34
Delete the numbers 117 and 61 and show the updated B-tree.

b) What is preorder traversal of AVL tree that results after each of the integer keys 9, 27, 50, 15 are inserted in the given order into an initially empty AVL tree? In the constructed tree further insert the values 2, 21, and 36 and show the preorder traversal of the final tree. Also, explain the 4 types rotations of AVL tree **10**

OR

4 a) Construct an AVL tree for the following numbers: **8**
34, 67, 78, 12, 13, 41, 43, 56, 69, 98, 87, 81

b) Construct a Red Black Tree for the following numbers: **8**
8, 76, 12, 33, 36, 45, 61, 91
Show all the steps clearly.

c) Analyze the time complexity for a 2-3 tree and show how it is better than a Binary Search tree in terms of time efficiency. Give an example for the same. **4**

UNIT - III

5 a) Construct Segment Tree for the following values {0, -3, 4, 6, 1, 2, -2, 1} and show how maximum of (1,5) is computed. **6**

b) Construct 2-dimensional tree for the following values: **6**
(1,12), (5, 16), (7,1), (9,8), (2,14), (9,11)

c) Construct Fenwick tree for the following values: **8**
{1, 4, 3, -1, 2, 6, 7, -2, 0, -1, 3}
Show how the sum from (0,3) is computed.

UNIT - IV

6 a) Explain linear probing technique used to handle collisions while constructing hash tables. Consider a scenario in which all the given keys hash to same index position, would you prefer linear probing to resolve collisions? Justify your answer. **4**

b) Construct a Hash table for the following numbers: **8**
10, 31, 41, 21, 56, 78, 89, 75, 13, 11, 8, 9, 57, 3
Show how collision is resolved using Extendible Hashing with each step demonstrated clearly. Also, mention how directory expansion and bucket splitting happens.

c) Construct a Hash table for the following numbers: **8**
13, 78, 54, 33, 12, 89, 76, 67, 66, 61, 31, 41
Show how collision is resolved using the following techniques:
(1) Linear Probing
(2) Quadratic Probing
(3) Double Hashing

SUPPLEMENTARY EXAMS 2023

UNIT - V

7	a)	Describe the properties of a Binomial Tree.	**4**
	b)	Demonstrate the process of decreasing a key and deleting a key in a Binomial Heap with an example.	**8**
	c)	Demonstrate extracting minimum value in a Fibonacci Heap with an example. Show all the steps clearly.	**8**

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SUPPLEMENTARY EXAMS 2023