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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: Information Science and Engineering   **Duration: 3 hrs.**
Course Code: 20IS5PEADS   **Max Marks: 100**
Course: Advanced Data Structures and Algorithms   **Date: 19.09.2023**

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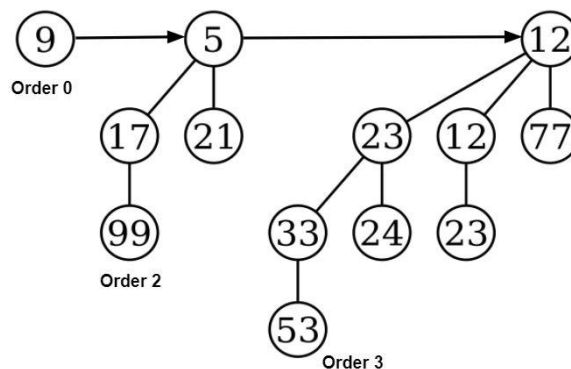2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Define a B-Tree and illustrate its properties with an example. Why are B-trees preferred over Binary Tree? **08**

b) Build suffix trie for the text "ATGCATTT". Identify the longest repeated substring of this text. **05**

c) Given the array {3, 8, -2, 1, -5, 9, -4}, generate the segment tree to identify minimum value of a given range. Give the pseudocode to construct the segment tree for this purpose. **07**
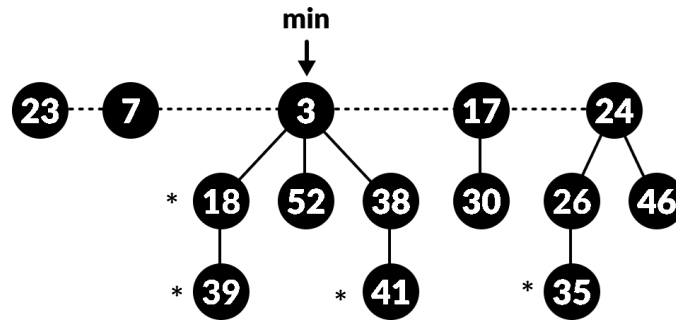
OR

2 a) To an initially empty B-tree of order 5, add the following numbers in sequence: 32, 89, 45, 54, 21, 90, 58, 77, 16, 25, 40 and construct the B-tree. **05**

b) Define Interval Trees and how they differ from segment trees. How can the operations on interval trees be done in O(log n) running time ? **07**

c) Generate optimized trie with path compression for the following words of a dictionary – {TALK, ART, CHESS, ARMY, ATOM, ATOP, CHIN, TAB}. Also describe the two trie node definition approaches. **08**

UNIT - II

3 a) Explain the algorithm of deleting minimum value from a Binomial Heap along with the pseudocode. Trace the same on the given Binomial Heap to delete the minimum value. **08**

b) Define 'Potential' of a Fibonacci Heap Tree. Calculate the same for the given heap, with marked nodes being denoted with ∗ . **04**

c) Demonstrate the steps involved in inserting the following values into an empty leftist heap : 25, 15, 40, 10, 30, 75, 20 **08**

UNIT - III

4 a) Using Dynamic programming, solve the matrix chain multiplication problem where sequence of dimensions of five matrices A, B, C, D, E is <2, 3, 6, 1, 9, 4 > **10**

b) Justify why Huffman Tree generates prefix codes? Generate Huffman codes for the given alphabets and their respective frequency using greedy approach. **10**

Alphabet	A	B	C	D	E
Frequency	20	15	5	15	45

OR

5 a) Explain the recurrence relation derived for Longest Common Subsequence (LCS) problem using Dynamic Programming. Using the same, determine the LCS of two DNA sequences: ACTAGCTA and TCAGGTAT **10**

b) What are the advantages of generating optimal BST using Dynamic programming than with Brute-force approach? Construct an optimal BST by applying dynamic programming to the four-key set given below: **10**
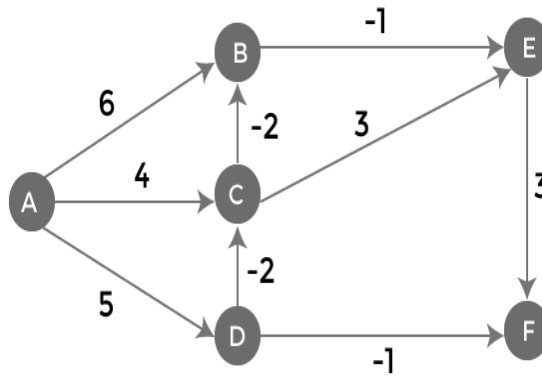
Keys	10	20	30	40
Frequency	4	2	6	3

UNIT - IV

6 a) What are the features of Rabin Karp string matching algorithm which makes it most suitable for plagiarism checking application? Justify with an example. **05**

b) Design the Finite Automata transition table for the Pattern: "**abcca**" **05**

c) Explain with pseudo code, Knuth Morris Pratt (KMP) algorithm for string matching. Generate the LPS table for the pattern **ababaca**. **10**

7   a)   Using Bellman Ford Algorithm, identify the shortest path from source node A to the remaining nodes of the given graph.   **07**

   b)   Draw the group operation tables for the groups $(Z_5, +_5)$ and $(Z^*_{14}, \cdot_{14})$ **06**

   c)   Using Chinese Remainder Theorem, find all integers that leave remainders 2, 4, 5 when divided by 3, 5, 7 respectively.   **07**

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