JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024

MTech-I Semester (CSE)

COURSE CODE (CREDITS): 10M11CI111

MAX. MARKS: 35

COURSE NAME: Advanced Data Structure

COURSE INSTRUCTORS:

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.No	Question	Marks
Q1	A two-dimensional array defined as A $[-4 \ldots 6]$ $[-2 \ldots 12]$ requires 2 bytes of storage for each element. If the array is stored in row major order form with the address $A[4][8]$ as 4142. Compute the address of $A[0][0]$.	4
Q2	What are splay trees? Consider an empty splay tree and Perform the following sequence of operations and determine the final structure of the tree: $i10, i20, i30, i40, a10, i50, a20$, where iN is insert operation and aN is an access operation. What is the final structure of the tree after all the operations?	4
Q3	Consider an external memory algorithm for searching in a large sorted dataset stored in disk. Discuss the trade-offs between using a binary search vs a linear scan in terms of I/O complexity. Under what conditions would a linear scan be preferable?	7
Q4	Consider the following tree-based data structures: Binary Trees, Binary Search Trees (BST), AVL Trees, and Red-Black Trees. You are tasked with designing an efficient search algorithm for a dataset of size $N = 10^6$, and you must choose between these tree structures based on its time complexities of search operations, tree manipulation operations (insert, delete and update).	7
Q5	Explain the following: a) Wavelets and its application to Engineering problems b) Sliding windows data structure and its applications	6
Q6	Describe the implementation of a distributed stack and the challenges involved in ensuring that push and pop operations are consistent across multiple nodes. How would you handle failure recovery for a distributed stack?	7