

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

M.Tech-I Semester (CSE/IT)

COURSE CODE (CREDITS): 10M11CI111(3)

MAX. MARKS: 25

COURSE NAME: Advanced Data Structures

COURSE INSTRUCTORS: Saurav Singh

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

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

(c) Calculator is not allowed.

Q.No	Question	CO	Marks
Q1	Consider a B+ Tree of order = 3. The following keys are inserted in sequence: 10, 20, 30, 40, 50, 60, 70, 80, 90. Show the structure of the B+ Tree after each insertion that causes a split. State the final tree structure clearly.	CO2	5
Q2	A hash table of size 13 uses double hashing with $h_1(k) = k \bmod 13$ and $h_2(k) = 7 - (k \bmod 7)$. Insert the keys 18, 41, 22, 44, 59, 32, 31 in this order. Show the index position of each key after resolving collisions. Also calculate total number of collisions.	CO3	5
Q3	A logistics company "FastCargo" delivers goods between five cities: A, B, C, D, and E. Each directed road between the cities has a transportation cost (can be positive or negative depending on fuel subsidy or toll rebates). The cost between cities is as follows: $A \rightarrow B = 6$ $A \rightarrow C = 5$ $A \rightarrow D = 5$ $B \rightarrow E = -1$ $C \rightarrow B = -2$ $C \rightarrow E = 3$ $D \rightarrow C = -2$ $E \rightarrow D = 3$ The company wants to find the least cost to transport goods from its main warehouse at city A to all other cities. Represent the above road network as a directed weighted graph. Using the Bellman-Ford algorithm, compute the shortest cost from city A to every other city. Check whether any negative weight cycle exists in the network.	CO4	5

Q4	You are given an array of n elements, and you need to convert it into a min-heap using the bottom-up heap construction method (also called heapify). Prove that the time complexity of building a min heap is $O(n)$ and not $O(n \log n)$.	CO2	5
Q5	Write a program to find the number of connected components in an undirected graph using BFS. Input: Number of vertices and edges, followed by edge pairs. Output: Total connected components.	CO4	5