Graphic Era
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination December 2025

Roll no.....

Name of the Course and semester: M.Tech CSE 1 Semester
Name of the Paper: Data Structures & Algorithms
Paper Code: MCS-141

Time: 3 hour Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (CO1) (2X10=20 Marks)

a. Illustrate the operation of MAX-HEAP-INSERT(A,10) on the heap A={15,13,9,5,12,8,7,4,0,6,2,1}. What is the running time of HEAPSORT on an array A of length n that is already sorted in increasing order? What about decreasing order? Show that the worst-case running time of HEAPSORT is O (n log n).

b. What is the running time of QUICKSORT when all elements of array A have the same value? Solve the recurrence $T(n)= T(n-1) + \theta(n)$.

c. Apply Quick sort to sort the list M, E, R, G, E, S, O, R, T in alphabetical order. Find the element whose position is unchanged in the sorted list. Why it is worth stopping the scans after encountering an element equal to the pivot?

Q2. (CO2) (2X10=20 Marks)

a. Discuss the properties of Binary search tree. List the different cases of insertion and deletion in a BST. Draw a BST with the following keys {36,7,10,12,14,15, 16,17,26,28,30,38,39,41,47} and find the Inorder, preorder and postorder?

b. Write a function to create a linked list and delete the first node and insert that node at a particular location given by user.

c. What is a graph? Differentiate between Breadth first search and Depth first search and then apply it on the graph represented by the following matrix as:

	A	B	C	D	E	F
A	0	1	0	1	0	0
B	0	0	0	0	1	0
C	0	0	0	0	1	1
D	0	1	0	0	0	0
E	0	0	0	1	0	0
F	0	0	0	0	0	1

Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

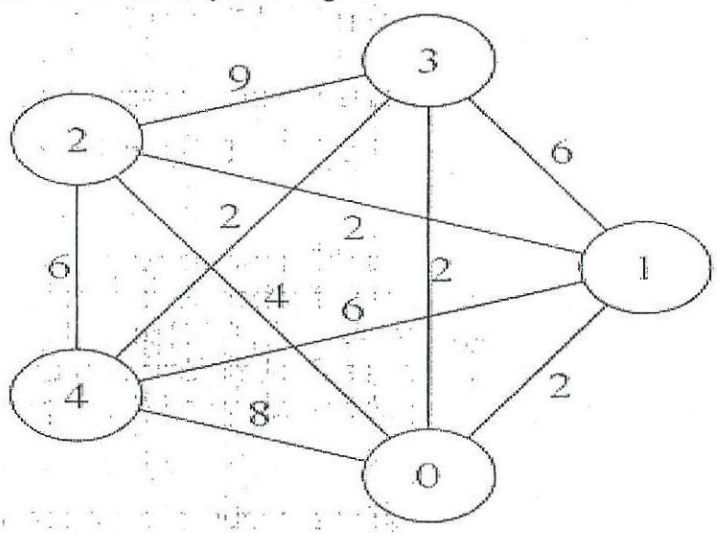
End Term (Odd) Semester Examination December 2025

Q3. (CO3) (2X10=20 Marks)

a. Find an optimal parenthesization of a matrix chain product whose sequence of dimension is (5,3,7,2,5) using dynamic approach.

b. Differentiate between Dynamic and Greedy approach. Let S= {a,b,c,d,e,f,g} be a collection of objects with benefit-weight values as follows a: (12,3) , b: (10,4), c: (8,3), d: (11,7), e: (14,3), f: (15,5) and g: (18,4). What is an optimal solution to the fractional knapsack problem for S assuming we have sack that can hold objects with total weight 20? Show your work.

c. What is a minimum spanning tree (MST)? What are the different methods to find the MST? Write any one algorithm to find the MST and apply it on the following graph.



Q4. (CO4) (2X10=20 Marks)

a. Write an algorithm for sting matching using brute force approach. Find the number of character comparison that will be made by this matching for the pattern ABABC in the following text:- BAABABABCCA

b. Given the Keys {10, 70, 60, 20, 110, 40, 80, 130, 100, 50, 190, 90, 180, 240, 30, 120, 140, 160} create a B-Tree of order 5 and then delete the Keys { 90, 30, 140}.

c. What do mean by string matching? What are different algorithms for string matching? Write an algorithm for Rabin Karp matching and apply on given string and pattern. Also find the number of spurious hits.

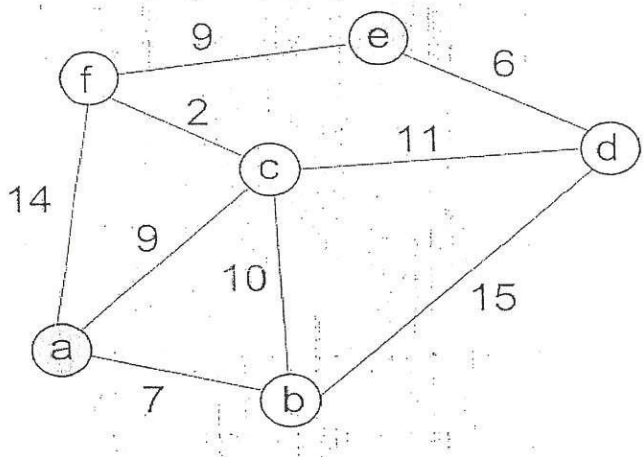
String = ABCDDACEBCDA, Pattern = CDA, q=13
(Assume that A=1, B=2.....E=5)

Graphic Era
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination December 2025

Q5. (CO5) (2X10=20 Marks)

a. What is Travelling Salesman Problem? Solve the travelling salesman problem for the following graph by using the branch and bound algorithm, the tour must be start from vertex a and generate only tour in which f is visited before c.



b. What is Backtracking? Let n=6 and w [1:6]={5,10,15,20,25,12} and m=35. Find all possible subsets of w that sum to m. Draw the state space tree that is generated using backtracking approach.

c. Define Class P and NP problems? Write an approximation algorithm for the vertex cover problem and apply it on the following graph?