

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH
BRANCH: CS/AIML

SEMESTER : IV
SESSION : SP/2024

SUBJECT: CS241 DESIGN AND ANALYSIS OF ALGORITHM

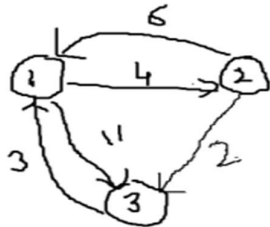
TIME: 3 Hours

FULL MARKS: 50

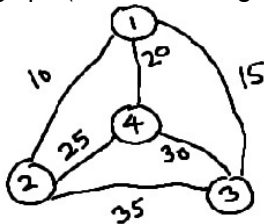
INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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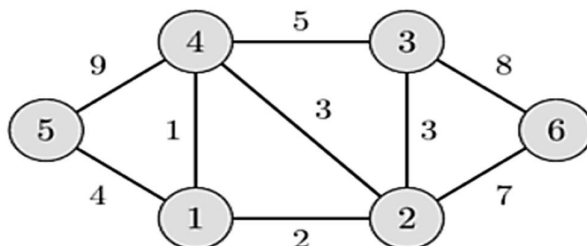
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|--------|---|-----|-----|----|
| Q.1(a) | Write an algorithm for insertion sort and find its complexity in best, average and worst cases. | [5] | CO1 | 4 |
| Q.1(b) | Use a recursion tree to determine a good asymptotic upper bound on the recurrence $T(n)=T(n/2)+n^2$. Use the substitution method to verify it. | [5] | CO1 | 4 |
| Q.2(a) | Write the algorithm to sort the following list in descending order using Quick sort technique and find its running time. $L=(1, 3, 5, 6, 8, 10, 13, 18)$. | [5] | CO2 | 5 |
| Q.2(b) | Write an algorithm to find the minimum and maximum element in the array using divide and conquer. Find the its time complexity and trace the algorithm for the given array $a=[22, 13, -5, -8, 15, 60, 17, 31, 47]$. (Note that if the divide and conquer approach is not used, two marks will be deducted). | [5] | CO2 | 3 |
| Q.3(a) | Write an algorithm to find the all pair shortest path using dynamic programming technique. Apply the same for the given graph. | [5] | CO3 | 2 |



- Q.3(b) Apply dynamic programming technique to solve the TSP Problem for the given graph. (Assume starting vertex is 1). [5] CO3 4



- Q.4(a) Write the kruskal's algorithm to find the MST, and trace the algorithm for the following graph to find the MST with cost. (Show the steps) [5] CO4 4



- Q.4(b) A networking company uses a compression technique to encode the message before transmitting over the network. Suppose the message contains the following characters with their frequency: [5] CO4 3

Character	Frequency
A	5
B	9
C	12
D	13
E	16
F	45

If the compression technique used is Huffman Coding, how many bits will be saved in the message? Draw the Huffman Tree. (Note that each character in input message takes 1 byte.)

- Q.5(a) Define the classes P, NP hard and NP -complete. What do you mean by decision and optimization problems? [5] CO5 3
- Q.5(b) How satisfiability problem can be used to prove any other problem is an NP - Hard class? Explain with suitable example. [5] CO5 4

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