DD Sanjeeta Cham 5/12/2022 (116) (12)

Name of student: **Scholar No.:**

National Institute of Technology Hamirpur
Department of Computer Science & Engineering
End-Semester Exam November-2022

Course: BTech
Subject: Analysis and Design of Algorithms **Max Marks: 50**
Code: CS-311 **Max Time: 3:00 hrs.**

Note: 1. All questions are compulsory.
2. Draw neat diagrams wherever necessary.
3. Direct answers will not be evaluate, only completely described answers will be consider.
4. In case of any confusion in any terminology, preference will be given to whatever has been taught in the class.
5. Handwriting should be clean. The answers will not be checked if handwriting is not legible.
6. Write all the answers in the sequence of question numbers.

Q.1 Consider the following recurrence relation $T(n) = 2T(n/2) + n$ and $T(1) = 1$. Then, what is the value for T(2048). [3 Marks]

Q.2 Consider the following instance of fractional knapsack problem in terms of (item, weight, and profit) is (I_1, 3, 3), (I_2, 6, 9), (I_3, 2, 7), (I_4, 8, 10), (I_5, 4, 18), (I_6, 7, 14), (I_7, 2, 9), (I_8, 15, 6), (I_9, 5, 8), (I_{10}, 13, 32.5). Let the maximum capacity of the knapsack is 25 then what is the maximum profit? [4 Marks]

Q.3 Consider the following instance of job sequencing problem with deadlines in terms of (job, deadline, profit) is (J1, 1, 3), (J2, 3, 5), (J3, 4, 20), (J4, 3, 18), (J5, 2, 1), (J6, 1, 6), (J7, 2, 30). Every job takes one unit of time for its completion. Find the maximum profit? [4 Marks]

Q4. What is the main purpose of studying NP-Completeness? What is the difference between NP Hard and NP-Complete problem? How to prove a problem to be NP Hard? Give example of NP-Complete problem, which can be polynomial time reducible to some other well-known problem. [5 Marks]

Q5. (a) What do you mean by relaxing an edge in a graph? Write the Dijkstra's algorithm, and explain it properly. Also, calculate its time complexity. What do you mean by negative weight cycle. Is Dijkstra's algorithm able to detect negative weight cycle. If the answer is no then name the algorithm which detect negative weight cycle and its complexity. [5 Marks]

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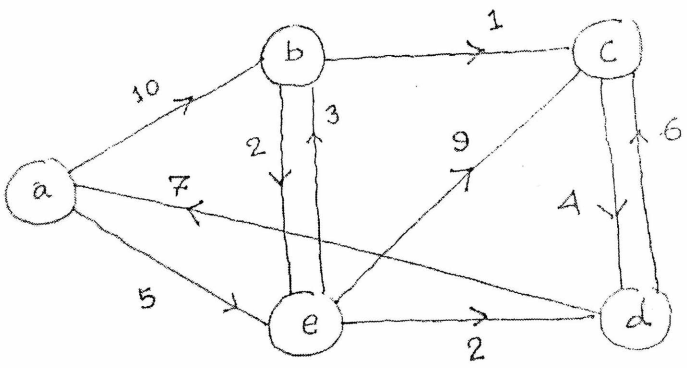
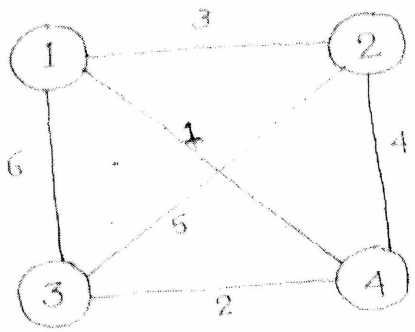
(b) Apply Dijkstra's algorithm on the node **a** of the graph and give the cost of the shortest path from node **a** to all other nodes. Write all steps. [5 Marks]



Q.6. Apply Floyd-Warshall algorithm in the following graph and find the cost matrix, which calculates the cost of the shortest path among each pair of vertices. Also, write the steps of Floyd-Warshall algorithm and its time complexity. [6 Marks]



Q.7 Let a chain of matrices is {A1 A2 A3 A4} with dimensions 2x5, 5x4, 4x2, 2x4, respectively. Compute the optimal parenthesization and optimal number of multiplications? [6 Marks]

Q8. Consider the following pair of strings: X= ACDABA and Y=BACCDB
Calculate all longest common subsequences. [6 Marks]

Q9. Consider the following array: [6 Marks]

38, -3, 47, 55, 1, 58, 16, 96, -84, 7

(a) Find the sorting algorithm which gives -84, -3, 1, 55, 47, 58, 16, 96, 38, 7 as a result of one of its passes?

(b) Find the sorting algorithm which gives 7, -3, -84, 16, 1, 38, 55, 96, 47, 58 as a result of one of its passes?

(c) Find the sorting algorithm which gives -3, 1, 38, 16, 47, -84, 7, 55, 58, 96 as a result of one of its passes?

(d) Find the sorting algorithm which gives -3, 1, 38, 47, 55, -84, 7, 16, 58, 96 as a result of one of its passes?