Nirma University

Institute of Technology

Semester End Examination (IR) / Supplementary Examination, May - 2022

B. Tech. in Computer Science and Engineering, Semester-V

2CS503 Design and Analysis of Algorithms

Roll / Exam No.		Supervisor's initial with date	

Time: 2 Hours | Max. Marks: 50

Instructions:
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Assume suitable data wherever applicable and clearly mention them.
5. CLO_ and BL_ have been mentioned against each question to map it as per Course Learning Objective and Bloom's taxonomy.

Q 1 Answer the following: [16]

Q 1 (a) CLO1 BL2 Order the following functions by growth rate: N, $\sqrt{N}$, $N^{1.5}$, N^2, N logN, N loglogN, N $\log^2$ N, N log(N^2), 2/N, 2^N, $2^{N/2}$, 37, N^2 logN, N^3. Indicate which functions grow at the same rate. [7]

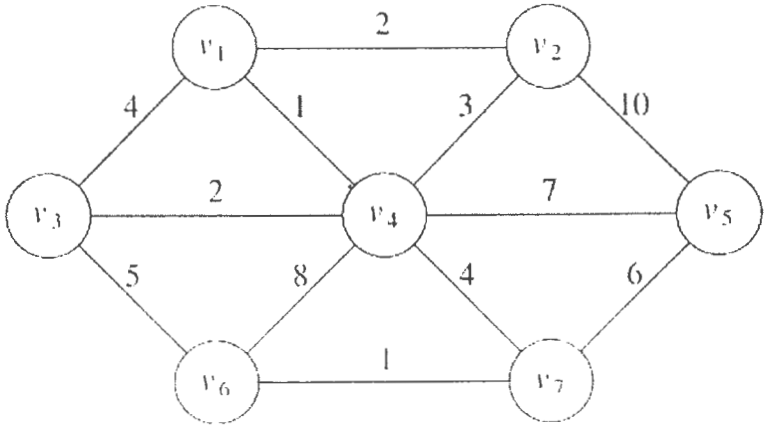
OR

Q 1 (a) CLO1 BL2 Find two functions f(N) and g(N) such that neither f(N) = O(g(N)) nor g(N) = O(f(N)). Justify your answer. [7]

Q 1 (b) CLO3 BL3,4 Show the result of inserting 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13, and 2, one at a time, into an initially empty binary heap. Show the result of performing three deleteMin operations on the heap after all insert operations. Show the process stepwise. [9]

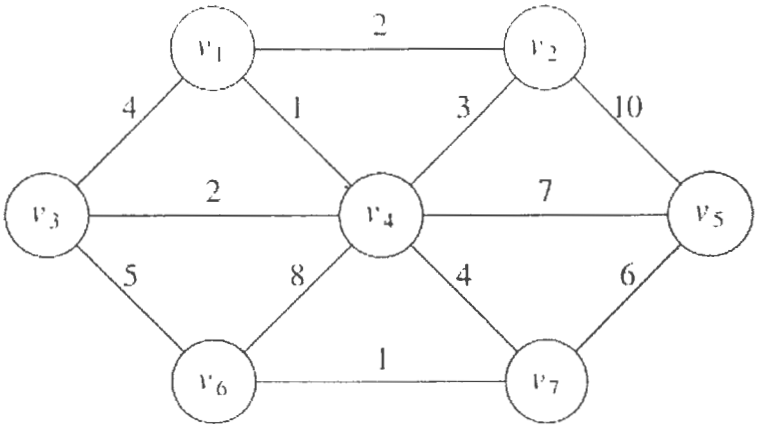
Q 2 Answer the following: [18]

Q 2 (a) CLO2,3 BL2,3,4 Write Prim's algorithm to find minimum spanning tree (MST). Find MST using Prim's algorithm for the following graph. Show computation for each step. [8]



OR

Q 2 CLO2,3 BL2,3,4 (a) Write Kruskal's algorithm to find MST. Find MST using Kruskal's algorithm for the following graph. Show computation for each step. [8]



Q 2 CLO2,3 BL3,4 (b) What is the optimal way to compute A1*A2*A3*A4*A5*A6, where the dimensions of the matrices are: A1: 10 × 20, A2: 20 × 1, A3: 1 × 40, A4: 40 × 5, A5: 5 × 30, A6: 30 × 15? The optimal way is the one that involves the least number of scalar multiplications. Report the optimal parenthesization and minimum number of scalar multiplications. Show computation for each step. [10]

Q 3 Answer the following: [16]

Q 3 CLO2,3 BL3,4 (a) Assume a 0/1 knapsack problem with four types of objects, whose weights are respectively 3, 4, 5 and 6 units, and whose values are 3, 5, 6, and 10. The knapsack can carry a maximum of 10 units of weight. Assume that an adequate number of objects of each type are available. Solve this problem using backtracking. Show computation in each step. [12]

Q 3 CLO1 BL2 (b) Discuss the general template of divide and conquer algorithm [4]