Nirma University

Institute of Technology

Supplementary Examination (SPE), March - 2023

M. Tech. in Computer Science and Engineering, Semester-I

6CS201 Complexity Theory and Algorithms

Roll / Exam No.		Supervisor's initial with date	

Duration: 3 Hours | Max. Marks: 100

Instructions:

1. **All questions are compulsory. (No Optional Questions)**
2. **Use section-wise separate answer book.**
3. Figures to right indicate full marks.
4. Assume suitable data if required and specify them clearly.
5. Draw neat sketches wherever necessary.

SECTION-I

Q.1 **Answer the following.** **[16]**

A Discuss Prim's minimum spanning tree (MST) algorithm and present its running time analysis. Show the complete trace of Prim's algorithm to find minimum spanning tree for the graph shown in Figure 1. Assume node 0 as the root of the MST. **(10)**

CLO2

BL4

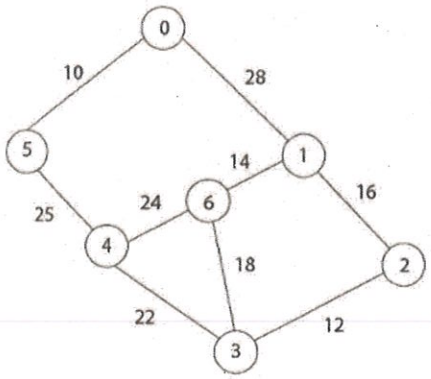

Figure 1: An undirected graph

B Define Big O, Big Omega and Theta notations. Depict the same graphically and explain the same. **(06)**

CLO1

BL1

Q.2 Write any two sorting algorithms which are based on divide and conquer approach and discuss time complexity for each algorithm. **[16]**

CLO2

BL4

Q.3 **Answer the following.** **[18]**

A Let $f(n) = n^2 + 5n + 10$ and $g(n) = n^3$. Is $f(n) \in O(g(n))$? Justify your answer. **(04)**

CLO1

BL3

B Use contradiction to prove that there exist no integers a and b for which $18a + 6b = 1$. **(04)**

CLO1

BL3

C Solve the following recurrence relations. **(10)**

CLO1 1) $T(n) = 9T(n/3) + n^2$

BL3 2) $T(n) = 3T(n/4) + n\lg n$

SECTION-II

Q.4 **Answer the following.** **[20]**

A Find the optimal order of multiplying following matrices using dynamic programming approach (complete trace expected). $A_{Total}=A_1A_2A_3A_4A_5A_6$ where A_1:2x10, A_2:10x5, A_3:5x13, A_4:13x3, A_5:3x2, A_6:2x6 **(12)**

CLO3

BL3

B Find an optimal Huffman code for the following set of frequency. **(08)**

CLO2

BL3

Character	A	B	C	D	E	F
Frequency	22	12	24	6	27	9

Q.5 **Answer the following.** **[14]**

A Find longest common subsequence in given two strings A and B using dynamic programming approach (complete trace expected), where A=abbcabcd and B=cdabcdcdab. **(12)**

CLO3

BL3

B Differentiate between greedy and dynamic programming. **(02)**

CLO1

BL2

Q.6 **Answer the following.** **[16]**

A What is making change problem? Write an algorithm to solve making change problem using greedy approach. Derive time complexity of your algorithm. **(08)**

CLO3

BL4

B Write Floyd's algorithm to find the shortest path between every pair of vertices of a graph. Also, discuss time complexity of Floyd's algorithm. **(08)**

CLO3

BL4