

# Nirma University

## Institute of Technology

Semester End Examination (IR), December - 2021  
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: [15]  
Q 1 (a) Prove that:  $(n \log n - 2n + 13) = \Omega(n \log n)$ . Assume base of [5]  
CLO1 log to be 2.  
BL4,5

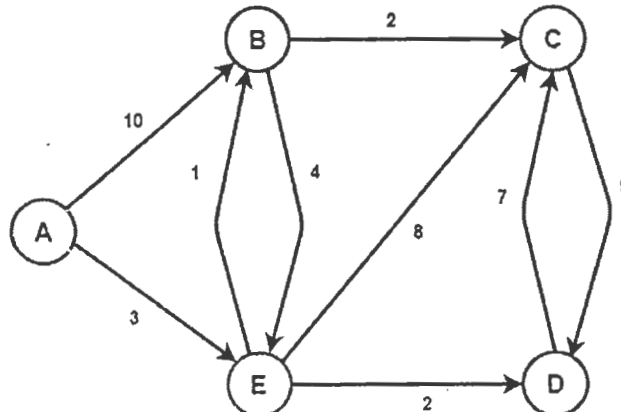
OR

- Q 1 (a) Prove that  $\sum_{i=1}^n \log(i)$  is  $\theta(n \log n)$ . Assume base of log to be [5]  
CLO1 2.  
BL4,5  
Q 1 (b) Can we improve the time complexity of multiplying large [10]  
CLO2,3 integers using Divide and Conquer? Prove your answer  
BL3,4 with a suitable example of multiplying 381 and 5234.

OR

- Q 1 (b) An array contains  $n$  distinct elements. Write an algorithm [10]  
CLO2,3 for finding the median of the array, by forming groups of  
BL3,4 seven elements. Derive the expression of running time of the algorithm. Also derive the expression of running time, if groups of three elements are formed.

- Q 2 Answer the following: [20]  
Q 2 (a) Write Dijkstra's algorithm for single source shortest path. [12]  
CLO2,3 What is the time complexity of this algorithm? Assuming  
BL3,4 "A" as the source vertex, find the shortest path for the following algorithm. Show computation for each step.



- Q 2 (b) Given a sequence of matrices A, B, C, D with dimensions [8]  
CLO2,3 40x20, 20x30, 30x10, and 10x30, find the most efficient  
BL3,4 way to multiply these matrices together. The most efficient  
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.
- Q 3 Answer the following: [15]  
Q 3 (a) Assume a 0/1 knapsack problem with four types of [12]  
CLO2,3 objects, whose weights are respectively 2, 3, 4 and 5 units,  
BL3,4 and whose values are 3, 5, 6, and 10. The knapsack can  
carry a maximum of 8 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.
- Q 3 (b) Critically compare divide and conquer and dynamic [3]  
CLO1 programming techniques.  
BL2
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