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

No. 19BCE271 Supervisor's initial with date 1/12/21.

2 Hours Max. Marks: 50

ctions:
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) CLO1 BL4,5 Prove that: $(n\log n - 2n + 13) = \Omega(n\log n)$. Assume base of log to be 2. [5]

OR

Q 1 (a) CLO1 BL4,5 Prove that $\sum_{i=1}^{n} \log(i)$ *is* $\theta(n\,logn)$. Assume base of log to be 2. [5]

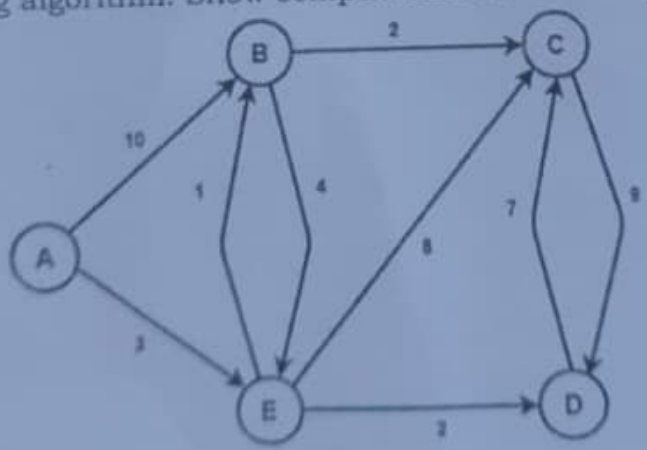
Q 1 (b) CLO2,3 BL3,4 Can we improve the time complexity of multiplying large integers using Divide and Conquer? Prove your answer with a suitable example of multiplying 381 and 5234. [10]

OR

Q 1 (b) CLO2,3 BL3,4 An array contains n distinct elements. Write an algorithm for finding the median of the array, by forming groups of 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. [10]

Q 2 Answer the following: [20]

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



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