

V SEMESTER B.TECH. (COMPUTER AND COMMUNICATION ENGINEERING) MAKEUP EXAMINATIONS, DECEMBER 2019

SUBJECT: FUNDAMENTALS OF ALGORITHM ANALYSIS AND DESIGN [ICT 3151]

REVISED CREDIT SYSTEM (19 /12/2019)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data, if any may be suitably assumed.
- **1A.** Write an algorithm to find the topological sequence using Greedy technique. Mention the Greedy criterion. Apply the same to find the topological sequence for the graph shown in Figure 1A.



Figure 1A

- **1B.** Write an algorithm to find the maximum and minimum element of an array using divide and conquer technique. Also analyze the complexity of the same.
- **1C.** Give the ADT representation for the graph and digraph.
- 2A. Find the minimum cost tour for the travelling sales person for the graph shown in Figure 2A using backtracking technique. Also analyze the time complexity. [With bound functions]
- 2B. Consider the Knapsack instance n=3, W=[10,10,15], P=[100,100,20] and C=16. Find the optimal packing of the Knapsack using Dynamic programming approach.
 2C. List and explain the basic efficiency classes used to represent the complexity of the 2
- **2C.** List and explain the basic efficiency classes used to represent the complexity of the algorithms.
- **3A.** Find the maximum clique for the graph shown in Figure 3A. using branch and bound technique. [With bounding functions]

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3B. Use the formal definitions of O, \Box and Θ and prove the following assertions.

- i. $15n^2 + 10n + 20 = \Theta(n^2)$ ii. $6*2^n + n^2 = \Box(n^2)$ iii. 3n + 2 = O(n) **3C.** Explain the relationship between P, NP-hard and NP-complete problems using Venn 2
- **4A.** Write an algorithm to sort the elements of an array using Merge Sort. Write the recurrence relation and find the complexity using Substitution method and Master's method.
- 4B. Write an algorithm to find the number of components of the graph and apply the same for the graph shown in Figure 4B.
- **4C.** Define Bipartite graph and minimal cover. Give an example
- **5A.** Consider the Algorithm 5A. Find the best case, average case and worst case complexity using steps per execution method. Also find the space complexity.

Algorithm 5A

int Search(int [] a, int n, int x)
{
 int i;
 for (i = 0; i < n & x != a[i]; i++);
 if (i == n)
 return -1;
 else
 return i;
}</pre>

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- **5B.** What are properties of an optimization problem? Justify that Machine scheduling is an optimization problem.
- **5C.** Write the recurrence relations to find the shortest path between every pair vertices using dynamic programming technique. Also analyze the time complexity for the same.



diagram.





Figure 2A