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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

**V SEMESTER B.TECH. (INFORMATION TECHNOLOGY)**
**END SEMESTER EXAMINATIONS, NOVEMBER 2018**
SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS [ICT 3107]
**REVISED CREDIT SYSTEM**
**(19/11/2018)**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ALL** the questions.
- Missing data if any, may be suitably assumed.

**1A.** Find the shortest tour covering all the cities in a graph given in Fig. Q.1A using Backtracking approach with detailed steps and find its time complexity. **5**

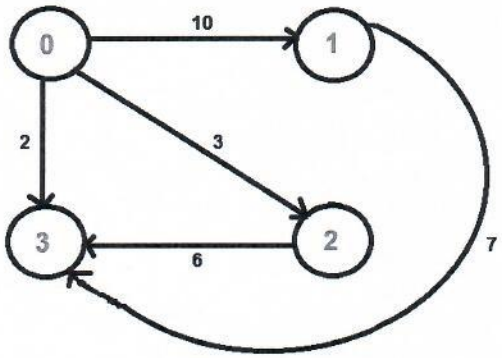


**Fig. Q.1A**

**1B.** Derive the average case time complexity analysis for the Quick sort algorithm. **3**

**1C.** How many 1's does the following procedure print when run with input n? Compute its asymptotic time complexity (best bound). **2**

```
Ones(n){
    if n = 0  print 1;
    else:
        for i = 1 to 2^n
            Ones(n-1);}
```

**2A.** Use the dynamic programming approach to solve the following 0/1 knapsack problem. **5**
Number of items =4, Capacity = 8, Weight = [1, 5, 3, 4] & Profit = [15, 10, 9, 5]

**2B.** Write an efficient algorithm to find the topological ordering among the subtasks of a given project. **3**

**2C.** Given an arbitrary connected graph G = (V, E) with positive edge weights, will the minimum cost edge in G (assume there is only one such edge in G) always be present in every MST of G? If YES, give a short justification, if NO, give a counter example. **2**

**3A.** Write a function for finding rank of an element in a sequence and find it's time complexity using operation count method. **5**

**3B.** Write an algorithm to find the path between given nodes in a graph and analyze the time complexity. **3**

**3C.** If the optimal solution for the 0/1 knapasck problem exists at the left most subtree of the solution space tree then what could be the time complexity of finding optimal solution using backtracking method (Note: using bounding function)? **2**

**4A.** Construct a 5-order B-tree for the data given below: **5**
3, 7, 9, 23, 45, 1, 5, 14, 25, 24, 13, 11, 8, 19, 4, 31, 35, 56

**4B.** The arrival and departure times of all trains that reach a railway station are given below. Apply greedy techniqúe to find the minimum number of platforms required for the railway station so that no train waits. **3**

Input: arrival [] = {9:00, 9:40, 9:50, 11:00, 15:00, 18:00}
departure [] = {9:10, 12:00, 11:20, 11:30, 19:00, 20:00}

**4C.** Explain NP-hard and NP-complete problems and give suitable examples. **2**

**5A.** Use Dijkstra's algorithm to find the shortest part from vertex 1 to all other vertices in the graph given in Fig. Q.5A. **5**

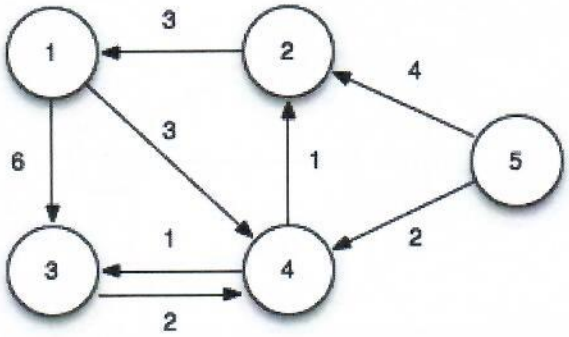


**Fig. Q.5A**

**5B.** Write an approximation algorithm for travelling sales person problem and calculate it's time complexity. Is travelling sales person problem NP-Complete? Justify your answer. **3**

**5C.** Given an unsorted array A of n integers, some of which may be duplicates, write an efficient algorithm to remove duplicate entries. What is the time complexity of the algorithm? **2**