**SUBJECT: (CE 414) DESIGN AND ANALYSIS OF ALGORITHMS**

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| **Examination** | **: Third Sessional** | **Seat No** | **: CE 103** |
| **Date** | **: 31/03/2017** | **Day** | **: Friday** |
| **Time** | **: 10:30 to 11:45** | **Max. Marks** | **: 36** |

**INSTRUCTIONS:**

1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.



**Q.1** **Do as directed.**

(a) Write a non deterministic algorithm to solve 0/1 knapsack problem in polynomial time. [2]

(b) State true or false and justify your answer, 'All NP-Hard problems are verifiable' [2]

(c) Write decision and optimization version of Traveling Salesman's Problem. [2]

**Q.2** Attempt ***Any Two*** from the following questions.

(a) Describe P, NP, NP-C and NP-H classes with example. [6]

(b) Prove that the Decision version of the problem of finding largest independet set of a graph is NP-Complete. [6]

(c) Prove using reduction technique that the problem of finding set cover (from the given sets s1, s2… sn and universal set U) is at least as hard as the problem of finding vertex cover in a graph. [6]

**Q. 3** **Do as directed.**

(a) In branch and bound method, which is a better search technique for node selection? Discuss about it briefly. [2]

(b) For 15-puzzle problem, Can it be decided in advance whether goal arrangement is reachable from given initial arrangement or not? Justify your answer. [2]

(c) For an array containing n elements, please write tightest lower bound on the number of comparisons, in the worst case, for comparison-based searching and sorting problem. [2]

**Q.4** (a) Write and explain backtracking algorithm to find Hamiltonian cycle from a given graph. [6]

(b) Solve the following job-assignment problem for four agents (A, B, C, D) and four tasks (1, 2, 3, 4) using branch-and-bound method and find the optimal assignments of jobs to agents. [6]

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| A | 29 | 19 | 17 | 12 |
| B | 32 | 30 | 26 | 28 |
| C | 3 | 21 | 7 | 9 |
| D | 18 | 13 | 10 | 15 |

**OR**

**Q.4** (a) Given a 3×3 board with 8 tiles (every tile has one number from 1 to 8) and one empty space. The objective is to place the numbers on tiles to match final configuration using the empty space. We can slide four adjacent (left, right, above and below) tiles into the empty space. Discuss about a cost function for this problem. Solve the following problem using branch and bound method. [4]

**Initial Configuration**

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 5 | 6 | |
| 7 | 8 | 4 |

**Final Configuration**

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 5 | 8 | 6 |
| | 7 | 4 |

(b) Find Least-cost tour for Traveling Sales Person using Branch and Bound method. Following is the distance matrix to consider : [8]

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | ∞ | 6 | 24 | 17 | 12 | 18 |
| 2 | 11 | ∞ | 18 | 4 | 9 | 16 |
| 3 | 26 | 24 | ∞ | 13 | 14 | 10 |
| 4 | 6 | 24 | 8 | ∞ | 7 | 15 |
| 5 | 4 | 13 | 14 | 25 | ∞ | 23 |
| 6 | 17 | 18 | 24 | 20 | 18 | ∞ |