MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

V SEMESTER B.TECH.(INFORMATION TECHNOLOGY)
MAKEUP EXAMINATIONS, DECEMBER 2016

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS [ICT 3107]
REVISED CREDIT SYSTEM
(27/12/2016)

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

❖ Answer **ALL** the questions.

❖ Missing data may be suitable assumed.

1A.	Write a function for inserting an element into a sorted array and find its best, average and worst and case time complexity.	**5**
1B.	Write Kruskal's algorithm for finding minimum spanning tree and find its time complexity.	**3**
1C.	Write an approximation algorithm for TSP and find its time complexity.	**2**
2A.	Find shortest path from vertex 1 to all other vertices in the graph shown in Figure Q.2A using Dijkstra's algorithm.	**5**
2B.	Using backtracking method solve the TSP problem shown in Figure Q.2B. Make use of appropriate bounding function.	**3**
2C.	With a suitable example prove the following : i) $0 <= e <= n(n-1)$ (for directed graph) ii) $\sum_{i=0}^{n} d_i = 2e$ (for undirected graph)	**2**
3A.	Create an AVL tree with the following elements. Show each insertion step clearly and find its time complexity. 100, 90, 80, 70, 150, 200, 250, 300, 50, 350, 75, 325	**5**
3B.	Solve the following 0/1 knapsack problem using greedy heuristics. N = 4, C = 15, W = [12, 4, 7, 9], P = [45, 15, 35, 40]	**3**
3C.	Solve the following recurrence equation using substitution method. $T(n) = T(\sqrt{n}) + c$, Assume $n = 2^k$ and $T(1) = T(2) = 1$	**2**
4A.	Store the values given below in a hash table (size 13) using the hash function $H(x) = x \bmod 13$. Use double hashing technique to avoid the collision with the hashing function $H_2(x) = 7 - x \bmod 7$ 12, 78, 129, 46, 155, 233, 90, 59, 91	**5**
4B.	Write the steps involved in merge sort technique to sort elements and derive its time complexity.	**3**
4C.	What are NP problems? Prove that set of P problems is the subset of NP problems.	**2**

5A. Find the optimal way to multiply $A_1* A_2* A_3* A_4* A_5$ where A_1, A_2, A_3 A_4 and A_5 **5**
are matrices with order 5 x 9, 9 x 20, 20 x 10, 10 x 17 and 17 x 13 respectively.

5B. Apply quick sort technique by selecting pivot element as a median for the data given
below. Also find its worst case time complexity.
15, 20, 5, 1, 50, 43, 18, 55, 60, 25, 14, 29 **3**

5C. Write a recurrence relation for finding time complexity of binary search and solve it. **2**
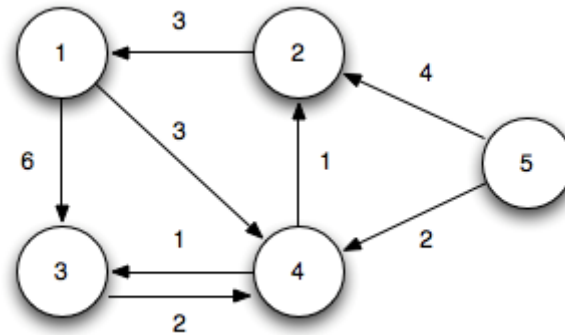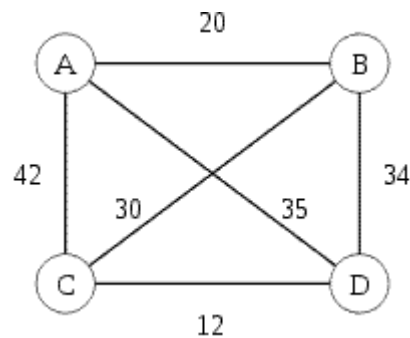

Figure Q.2A

Figure Q. 2B