

MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL 576104 (Constituent College of Manipal University)

FIFTH SEMESTER B.TECH. (IT) DEGREE MAKEUP EXAMINATION, DEC – 2015 SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS - ICT 309 (REVISED CREDIT SYSTEM)

TIME: 3 HOURS

29/12/2015

MAX. MARKS: 50

Instructions to candidates

- Answer any **FIVE FULL** questions.
- Missing data, if any, may be suitably assumed.
- 1A. Find the minimum cost spanning tree for the graph given in Figure Q.1A using Prim's and Kruskal's algorithms. Show all the steps clearly.



Figure Q.1A

- 1B. Give the pseudo-code for component labelling problem. Write the condition to determine whether a given graph is connected or not.
- 1C. What do you mean by NP completeness and NP hard problem? Explain with example.

[5+3+2]

2A. Find the optimal way of multiplying the following matrix multiplication chain. Give the recurrence equation for the same.

N= 5, r= 10, 5, 1, 10, 2, 10.

- 2B. Write the pseudo-code for the Dynamic Programming version of the 0/1 Knapsack problem. Justify the time complexity for Trace-Back function for the same.
- 2C. Give the proof for the total number of degrees for a Graph G, with 'n' number of nodes and 'e' number of edges.

[5+3+2]

- 3A. Demonstrate the working of "Closest pair of point" problem with suitable example. Analyse the time complexity.
- 3B. Write a pseudo-code to find the bipartite cover. Mention it's time complexity.
- 3C. The median of n elements can be found in O(n) time. What is the time complexity of quick sort, in which median is selected as pivot?

[5+3+2]

- 4A. Write the pseudo-code for the Backtrack technique version of the Max-Clique problem. Analyse the time complexity for the same.
- 4B. List and explain components of Time and Space complexity.
- 4C. An undirected graph G has n nodes. Its adjacency matrix is given by an $n \times n$ square matrix whose diagonal elements are 0's and non-diagonal elements are 1's, which specifies the edge cost. How many MST's can be constructed and what is the cost of each MST?

[5+3+2]

5A. Find the worst and average case time complexity for the following code using step-per execution method.

> void Insert (int a[], int &n, const int & x){ for (int i=n-1; i>=0; i--) a[i+1]=a[i];a[i+1] = x;n++; }

- 5B. Discuss all types of graph representations with example for each. Mention the time complexity to perform different operations in each representation.
- 5C. Define the following with suitable example.

- 6A. Solve the following recurrence equation using substitution method. $T(n) = 4T(n/2) + n^3$; Assume $n=2^k$ and T(1)=1.
- 6B. Give the pseudo-code for binary search algorithm. Analyse the time complexity for the same.
- 6C. Give the general procedure for big-O run-time analysis.

[5+3+2]