Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL 576104

(Constituent College of Manipal University)

SECOND SEMESTER M.TECH (S/W Engg.) DEGREE END SEMESTER EXAMINATION MAY – 2016

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS – ICT 524

(REVISED CREDIT SYSTEM)

TIME: 3 HOURS **07/05/2016** **MAX. MARKS: 50**

Instructions to candidates

- Answer any **FIVE FULL** questions.
- Missing data, if any, may be suitably assumed.

1A. Write the basic principles of a skip list. Construct a skip list with pointers to 4 cells ahead for the following elements:
12, 22, 34, 35, 47, 52, 65, 70, 75, 86, 92, 98.
Also insert an element 58 into the skip list using randomized algorithm. Comment on the time complexity of constructing a skip list.

1B. Show the result of inserting the following keys into an initially empty 2-3-4 tree:
4, 7, 12, 11, 16, 13, 6, 18, 4, 19, 21, 9, 35, 23, 44, 27, 55, 33, 1, 57
Discuss the time requirement for constructing the above tree.

1C. Discuss the space required to represent an unweighted graph using an array. [5+3+2]

2A. Write an algorithm to delete an element from a Binary Search Tree considering all the cases. Also discuss on the time complexity of the algorithm.

2B. Mention the applications of red-black trees. If the length of a root-to-external node path is the number of pointers on the path and P and Q are two root-to-external node paths, then prove that length(P) $\leq$ 2. Length(Q).

2C. Derive an equation to compute the minimum number of nodes in an AVL tree of height 'h'. [5+3+2]

3A. Write the necessary functions to insert elements into an AVL tree. Determine the time complexity of insertion operation. Trace your functions to construct an AVL tree with the following elements: 8, 9, 4, 5, 19, 27, 13, 14,16, 17, 22

3B. Determine the max-flow in the network shown in Figure Q. 3B.

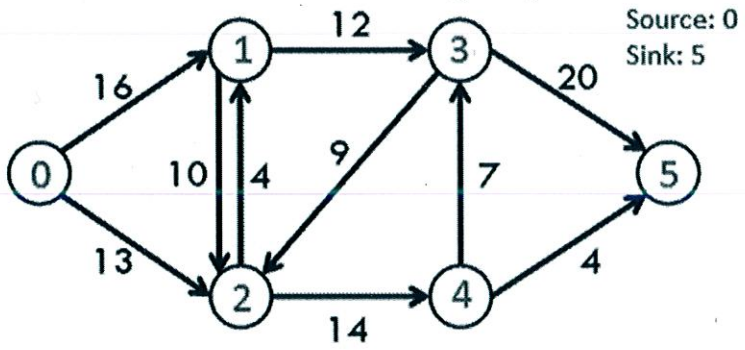

Figure Q.3B

3C. A file contains the symbols listed below with the frequency mentioned in the bracket.
A(9), B(2), C(2), D(2), E(4), F(6). Construct the Huffman code. [5+3+2]

4A. Define All-Pairs-Shortest path problem. Find the shortest path from node 1 to node 4 in the graph shown in Fig. Q.4A. Also write the recurrence equation and determine the time complexity.

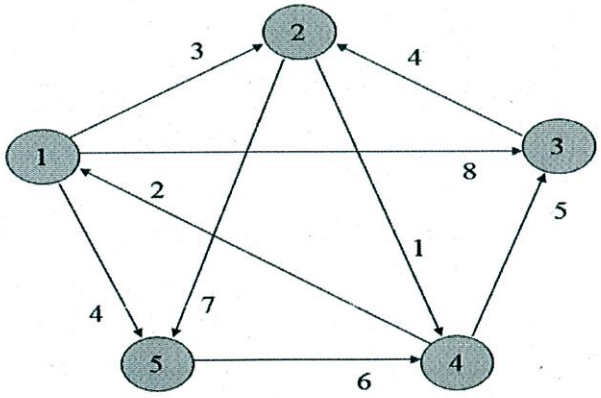

Figure Q. 4A

4B. Prove that a leftist tree with r nodes on the right path must have at least $2^r - 1$ nodes.

4C. Define principle of optimality? How does it hold good for matrix multiplication chain problem. Write the recurrence equations to solve the same. [5+3+2]

5A. Explain with a proper example, the status of different processing elements of a Shuffle-Exchange SIMD model for summing up of elements. Also write the algorithm and determine the time complexity.

5B. Show the result of the following sequence of instructions on disjoint sets: Union(1, 2), Union(3, 4), Union(3, 5), Union(1, 7), Union(3, 6), Union(8, 9), Union(1, 8), Union(3, 10), Union(3, 11), Union(3, 12), Union(3, 13), Union(14, 15), Union(16, 17), Union(14, 16), Union(1, 3), Union(1, 14), when the unions are performed

a) By height

b) By size

5C. Discuss an algorithm to find the shortest path from a node to all the other nodes when there are negative edges and cycles in a graph. [5+3+2]

6A. Consider the following 0/1 knapsack instance:
n=4, W=[18, 24, 12, 40], P=[38, 39, 30, 57] and c=60.

i. Draw the solution space tree

ii. Trace the working of a backtracking algorithm on the above tree using bounding function.

6B. Construct an expression tree for the expression: (6+5*(3-2))^2/(3-2)

6C. How can you apply randomization to test whether a given number is prime? Explain. [5+3+2]

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