Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/M.Tech(SE)/SEM-1/PGSE-104/2012-13

2012

ADVANCED ALGORITHMS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

1. Answer any *seven* of the following : 7 × 2 = 14

   a) Write two heuristic functions for 8-puzzle problem.

   b) Write a non-deterministic algorithm for search operation.

   c) Write two basic characteristics of Dynamic programming.

   d) Write a general algorithm for greedy strategy.

   e) Differentiate between Prim's algorithm and Kruskal's algorithm for minimum spanning tree.

   f) What is approximation algorithm ?

g) What is the best time complexity for the calculation of x^n ? Give an example.

h) Derive the time complexity for Tower of Hanoi problem.

i) Define speed up and efficiency of parallel algorithm.

j) Draw the commonly believed relationship among P, NP, NP complete and NP-hard problems.

GROUP – B

Answer any *four* of the following. $4 \times 14 = 56$

2. a) Write an algorithm to multiply two n-bits numbers in an efficient way and derive its time complexity.

   b) Rod cutting problem is stated as follows : Given a rod of length n inches and a table of prices P_i for $i = 1, 2, \ldots, n$, determine the maximum revenue R_n obtained by cutting up the rod and selling the pieces.

      i) Write a dynamic programming algorithm for the above problem.

      ii) Solve the following example using that algorithm for the piece of length 5. Show all the steps.

Length i :	1	2	3	4	5	6	7	8	9	10
Price Pi :	1	5	8	9	10	17	17	20	24	30

5 + (5 + 4)

3. a) What is the greedy choice for activity selection problem ? Write a gready algorithm for the above problem. What is the time complexity of the above algorithm ?

b) Obtain a set of optimal Huffman codes for the messages $\left(M_1 , M_2 , \dots , M_8 \right)$ with relative frequencies $\left(q_1 , q_2 , \dots , q_8 \right)$ = (5, 10 2, 6, 3, 7, 12, 14). Draw the decode tree for this set of codes. (2 + 4 + 1) + 7

4. a) Write the properties of a Red Black tree.

b) Show the Red Black trees that result after successively inserting the keys 41, 38, 31, 12, 19, 8, 6 into an initially empty red black tree. Show each step of insertion.

c) Prove that a red black tree with n-internal nodes has height at most 2log(n + 1). 3 + 6 + 5

5. a) Solve the following 8-puzzle problem using A* heuristic algorithm :

2	8	3		1	2	3
1	—	4		8	—	4
7	6	5		7	6	5
Initial state				Goal state		

b) Write an approximation algorithm for travelling salesman problem and determine its approximation ratio ? 6 + (4 + 4)

6. a) What do you mean by parallel algorithm ?

   b) Briefly explain different computational models of parallel algorithm.

   c) Explain with an example how two sorted sequences of numbers, stored in a Mesh computational model can be merged using odd-even merge algorithm.

   d) What is the time complexity of the algorithm ?

   2 + 4 + 7 + 1

7. a) Define the classes *P* and *NP*.

   b) Discuss what you mean by polynomial reduction.

   c) Prove that circuit satisfiability problem is in *NP*.

   d) Prve that Clique decision problem is *NP* complete.

   2 + 2 + 4 + 6