M.TECH/IT/1ST SEM /INFO 5103/2015
2015

Design Analysis of Algorithm
(INFO 5103) 16

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: **10 x 1=10**

(i) The solution to the recurrence relation T(n)=2T(n/2) + n is
(a) O (log n) (b) O (n log n)
(c) O (n) (d) O (n^2).

(ii) The minimum number of colors needed to color a graph having n > 3 vertices and 2 edges is
(a) 2 (b) 3 (c) 4 (d) 1.

(iii) Which sorting algorithm is also known as tournament sort ?
(a) Selection (b) Insertion
(c) Bubble (d) Heap.

(iv) The Big O notation of the expression f(n)=n log n + n^2 + $e^{\log n}$
(a) O(n) (b) O (n log n)
(c) O (n^2) (d) O ($e^{\log n}$).

(v) Which one is true of the following
(a) All NP Hard problems are NP complete
(b) All NP complete problems are NP Hard
(c) Some NP complete problems are NP Hard
(d) None of these.

(vi) Which one is asymptotically smallest
(a) 2^n (b) $n^{\log n}$ (c) $n^{\sqrt{n}}$ (d) n (log n).

(vii) 'Small o' of g(n) is
(a) Asymtotically loose (b) Asymtotically tight
(c) same as Big O (d) None of these.

(viii) The fractional Knapsack problem can be solved using
(a) Greedy Approach (b)Divide and Conquer
(c) Dynamic Programming (d) None of these.

(ix) An edge that has identical end-points is called a
(a) Multi-path (b) Loop
(c) Cycle (d) Multi-edge.

(x) Time complexity for Floyd's algorithm to find all pairs of shortest paths of a graph G with vertices V and edges E using dynamic programming method is
(a) $O(V^2)$ (b) $O(E^2)$
(c) $O(V^3)$ (d) $O(E^3)$.

Group – B

2.(a) State master theorem.

(b) Solve the following in the best possible way
i) $T(n)= 4T(n/2)+ n^2$
ii) $T(n)= 2T(n^{1/2}) + \log n$
iii) $T(n)=2^nT(n/2) + n^n$
iv) $T(n)=T(n/2) + 2^n$

(c) Show that the lower bound for comparison sort is O(n lgn).

3 + 6 +3= 12

3.(a) State divide and conquer principle. Write quick sort algorithm. Analyze quick sort for average case.

(b) Determine the number of comparisons required to find the maximum and minimum elements from a given array simultaneously by dividing the array recursively into two halves until each half contains one or two elements.

(1 + 4 + 3) + 4 = 12

Group – C

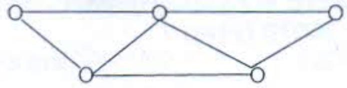
4.(a) An instance of the problem of scheduling unit time Task/Jobs with deadlines and profits for a single processor is given. Only one job can be processed at a time. Find all possible feasible solutions. Among these find the optimal solution. Show the order in which the jobs have to be scheduled and the total profit for each feasible solution.

Jobs	J1	J2	J3	J4	J5	J6	J7
Deadlines	6	4	4	3	1	2	4
Profits	10	20	50	40	30	60	70

(b) Solve the following instance of 0/1 Knapsack problem using dynamic programming.
No. Of objects = 5; Sack Capacity = 7; W : < 2,4,2,3,1 > B : <8,9,16,15,4>.

6 + 6 = 12

5.(a) Apply the backtracking technique to solve the 3 coloring problem for the following graph also draw the corresponding search space tree.



b) What do you mean by branch and bound and how is it different from other methods? Explain with suitable example.

6 + 6 = 12

Group – D

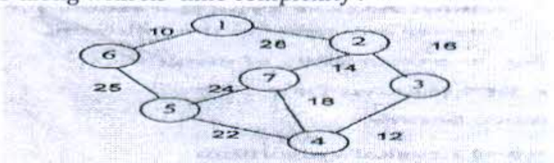
6.(a) Write an algorithm for N-queens problem. Find its complexity

(b) Find the minimum number of operations required for the following matrix chain multiplication using dynamic programming

A(10 x 20) * B(20 x 50) * C(50 x 1) * D(1 x 100).

(5+2) + 5 = 12

7.(a) Find out the minimum cost spanning tree using prims algorithm. Also write down the algorithm along with its time complexity.



(b) Given a set of points Q, prove that the pair of points farthest from each other must be vertices of CH(Q). Show how to implement the incremental method for computing the convex hull of n points so that it runs in O(n log n) time.

4 + (5 + 3) = 12

Group – E

8.(a) Define class P, NP, NP-complete and NP-hard. Explain how these classes are related to each other?

(b) Prove that CDP (clique decision problem) is NP-complete.

(4 + 2) + 6 = 12

9. Write short notes on any three of the following:
   (i) Nearest neighbor search
   (ii) Triangulation
   (iii) Approximation algorithm
   (iv) Floyd Warshall all pair shortest path algorithm
   (v) 15 puzzle problem

(3 x 4) = 12