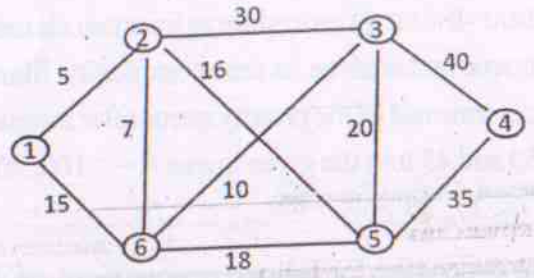
(b) Write the procedure for finding minimum cost spanning tree using Kruskal's method and find its time complexity. Generate the MST from the following graph. [4



8. (a) Write the pseudo code for solving the n-queen problem using Backtracking method. [4

(b) Prove that Ham-Cycle is NPC. [4

XXXXX

SUPPLEMENTARY EXAMINATION-2012

5th Semester B.Tech / B.Tech Dual(M.Tech/MBA)

DESIGN & ANALYSIS OF ALGORITHMS CS-502

Full Marks: 60 Time: 3 Hours

Answer any SIX questions including Q.No.1 which is compulsory.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. (a) $f(n)=3n^{\sqrt{n}}$, $g(n)=2^{\sqrt{n}\log n}$, $h(n)=n!$, [2 × 10

Which of the following is true?

(i) h(n) is O(f(n)) (ii) h(n) is not O(g(n)) (iii) g(n) is O(f(n))

(iv) f(n) is O(g(n))

(b) Give the correct matching for the following match

(A) O (logn)	(a) Finding max-min in an array
(B) O (n)	(b) Heap-sort
(C) O (nlogn)	(c) Binary search
(D) O (n^2)	(d) Insertion sort

(c) Solve the recurrence, $T(n) = 4T(n/2) + n$

(d) Arrange the following functions in non-decreasing order of their growth.

$n^{2\log 2}$, $2^{0.5\log n}$, $2^{n\log n}$, $2^{\log n}$, $2^{\sqrt{n}\log n}$, $n!$, $3n^{\sqrt{n}}$

(e) How many times MAX-HEAPIFY will be called if BUILD-MAX-HEAP is run on the given array elements (22, 17, 15, 12, 10, 9, 6, 4, 3, 1).

(f) Place 5 nonattacking queens on a 5×5 chess-board using backtracking procedure.

(g) Consider a Quick-sort algorithim that always selects $(n/5)^{th}$ smallest as the pivot element using O(n) time algorithim. What is the worst-case time comlexity of the given Quick-sort algorithm?

(h) State and explain Dynamic-Programming method of solving the problem.

(i) Find the optimal solution to the knapsack instance where fractional amount of any item can also be taken n=7, m=15, $\{p_1,p_2,\ldots,p_7\} = \{10,5,15,7,6,18,3\}$ and $\{w_1,w_2,\ldots,w_7\} = \{2,3,5,7,1,4,1\}$.

(j) Define different classes of problem.

2. (a) Define O (Big-oh), θ (Theta), and Ω (Omega) notations with example. [4

(b) Solve the recurrence relation $T(n) = 2T(\sqrt{n})+\log n$ when $n > 5$ and $T(n)=1$ when $n=5$. [4

3. (a) Write the Insertion-Sort Algorithim and derive its best and worst case time complexities. [4

(b) Consider a set 'S' of size n integers and given another integer 'x', Use Divide-And-Conquer strategy to describe a θ (nlogn) time algorithm, which determines whether or not there exists two elements in S whose sum is exactly 'x'. [4

4. (a) Write a Merge-Sort algorithm which always divides the array into two parts of size n/4 and 3n/4. Write the recurrence of the above Merge-Sort algorithm and derive its time complexity. [4

(b) Write the algorithm for Quick-Sort Derive its Best, Average and Worst case time complexities. [4

5. (a) Write HEAP-INSERT() procedure to insert an element into a prority queue and analyze its time complexity. Illustrate the level order traversal of the priority queue after inserting in the order 150 and 45 into the given queue A = < 100, 90, 82, 50, 80, 20, 78, 17, 25 >. [4

(b) Write the procedure for following operations on disjoint-dynamic sets. [4

I. Find-set()

II. Weighted_union()

6. (a) Explain how knapsack problem is solved using Dynamic Programming approach? Consider items n=5, Weights $(w_1, w_2, w_3, w_4, w_5)=(2,3,4,5,5)$, Profit $(v_1, v_2, v_3, v_4, v_5)=(12,10,15,8,10)$ and Knapsack capacity W=7. Find optimal solution to fill the knapsack. [4

(b) Find the optimal parenthesization of a Matrix-Chain product whose sequence of diomensions is <7, 10, 5, 4, 6 > and write the procedure of it. [4

7. (a) What is the minimum penalty generated by the function job scheduling where n=7, penalty for those that are not completed by its deadline are $(P_1,P_2,\ldots,P_7)=(3,5,20,18,1,6,30)$ and deadline for completion are $(d_1,d_2,\ldots,d_7)=(1,3,4,3,2,1,2)$? [4