(Please write your Exam Roll no) **Exam Roll No.....**

END TERM EXAMINATION

FOURTH SEMESTER [MCA] MAY-JUNE 2012

Paper Code: MCA 202	**Subject: Design and Analysis of Algorithms**
Time : 3 Hours	**Maximum Marks : 60**

Note: Attempt any five questions including Q.no.-1 which is compulsory. Select one question from each unit.

Q1 (a) Distinguish between big oh (O) and little oh (o).

(b)What is loop invariant?

(c) Create max heap for the list of elements : 23, 12, 67, 34, 25, 11, 65, 42.

(d) Give two sorting algorithms that are based on divide and conquer.

(e) Show that time complexity of linear search is of O(n).

(f) Give two examples each for greedy algorithm and dynamic programming paradigm.

(g) Kruskal's algorithm is faster than Prim's algorithm. Justify the statement.

(h) Draw a finite automata for searching string "aabbc" in a string over Σ={a,b,c}.

(i) What is complexity of naïve string matching algorithm.

(j) State cook's theorem. **(2x10=20)**

Unit –I

Q2. (a) Define an algorithm. What are the different criteria that are used to ascertain the efficiency of an algorithm? **(5)**

(b) Prove that $a_n = 2a_{n/2}+1$; $a_1=0$ is of order $n*\log_2 n$. **(5)**

Q3. (a) Input comprises a sorted list of n integers with many duplicates such that the number of distinct integers in the sequence is O(log n). Find the time complexity to search an element in the list. **(5)**

(b) Prove that the following Pseudo codes always finds maximum of the three elements: a, b and c. **(5)**

```
{
  If(a<b)

      If(b<c) then maximum is c
      Else maximum is b
Else
      If (a<c) then maximum is c
      Else maximum is a
}
```

Unit II

Q4 (a) Construct a Red-Black tree for the following integers in sequence: 34, 23, 12, 25, 38, 45 and 21. Show all the steps involved in inserting a new node in the tree and then balancing the tree. **(5)**

(b) State and prove master theorem of algorithm. **(5)**

Q5. (a) Prove that the time complexity of merge sort is $O(n*\log_2 n)$. **(5)**

(b) Write the recursive implementation of binary search algorithm. If x is median value of the list of n items then how many searches were required to find x in the list using this algorithm. **(5)**

Unit III

Q6. (a) Write Floyd Warshall algorithm for computing all path shortest past and compute its time and space complexity. **(5)**

(b) Find the number of spurious hits that the Rabin-Karp matcher encounter in the text T=31415926 when looking for the pattern P=26 with working modulo q=11. **(5)**

Q7. (a) Prove that Kruskal's algorithm for computing always finds minimum spanning tree in a weighted undirected graph. **(5)**

(b) Draw an optimal Huffman tree for the following set of frequencies, based on the first 8 fibonacci numbers :- a:1 b:1 c:2 d:3 e:5 f:8 g:13 h:21 **(5)**

Unit –IV

Q8. (a) For any three integers a, b and q where q is a prime number $a \neq b \bmod q$ implies that $a \neq b$ but $a = b \bmod q$ does not necessarily implies that a=b. Justify it. **(5)**

(b) What is the effect of backtracking on the time complexity of an algorithm? Do you think that backtracking is never required in a polynomial time algorithm. **(3+2)**

Q9. a) Define terms: Pclass, Polynomial time verification, Reducibility. **(1+2+2)**

(b) Explain the subset-sum problem with a suitable example. Give a naïve algorithm to solve the problem. **(5)**

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