Paper Code: MCA-312	**Roll No.**									

MCA
THIRD SEMESTER EXAMINATION, 2016-17
DESIGN & ANALYSIS OF ALGORITHMS

[Time: 3 hrs.] [Max. Marks: 100]

Note: – Attempt All questions. All questions carry equal marks.

1. Attempt any *four* part of the following: - **(5x4=20)**

(a) Differentiate Time complexity from Space complexity. How do you calculate running time of an algorithm? Elaborate on Asymptotic Notations with example.

(b) Solve T(n)= T(n/2)+ T(n/4)+ T(n/8)+n by recursion tree method.

(c) State the best case and worst case analysis for binary search.

(d) Apply insertion sort algorithm to sort the list I,N,*S,E,R,T,I,O,N* in alphabetical order.

(e) Using Master method give tight asymptotic bounds for the following recurrence
$T(n)= 16\ T(n/4) + n^2$

(f) Define Max-Heap and Min-Heap property. Write an algorithm for re-heaping a max-Heap .

2. Attempt any *two* part of the following: - **(10x2=20)**

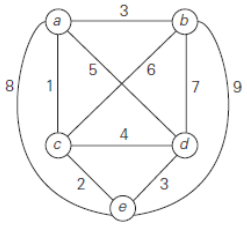
(a) What do you mean by hashing? Explain any five popular hash functions. Draw the 11-item hash table resulting from hashing the keys 37, 48, 70, 87, 76, 97 using linear probing. Consider the hash function h(k) = k mod 11

(b) Discuss all cases of insertion in Red Black tree. Show the red black tree that result after successively inserting the keys 4,7, 12,15,3,5,14,18,16 into an initially empty red black tree.

(c) (i)Write algorithm for preorder traversing of binary tree.
(ii) Draw binary search trees of height 2,3,4,5 and 6 on the set of keys {1,4,5,10,16,17,21}

3. Attempt any *two* part of the following: - **(10x2=20)**

(a) Find the shortest Hamiltonian circuit for the given graph using backtracking algorithm.



(b) Write an algorithm to matrix chain multiply & find an optimal parenthesization of a matrix chain product whose sequence of dimension is (5, 10, 3, 12)

(c) (i) what is backtracking approach? Explain State Space Tree to solve 4-Queens problem with backtracking.

(ii) Prove that fractional knapsack problem has the greedy choice property.

solve the following instance of the Knap Sack problem. Capacity of the Knap Sack is 6.

Item	Weight	Value
1	3	Rs.15
2	2	Rs.25
3	5	Rs.20
4	4	Rs.10

4. Attempt any *two* part of the following: - **(10x2=20)**

(a) (i) Explain BFS and show the result of running BFS on directed graph of fig 1, using vertex A as the source.

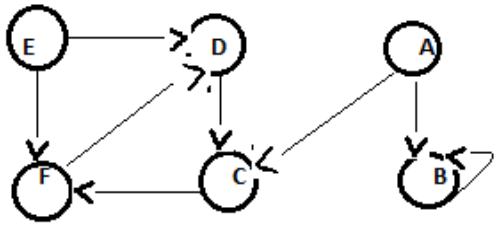


fig 1

(ii) Show that for each minimum spanning tree T of G, there is a way to sort the edges of G in Kruskal's algorithm so that the algorithm returns T.

(b) Write an efficient algorithm to decompose a directed graph into its strongly connected components

(c) What is correctness of Dijkstra's algorithm for single source shortest path. Analyse the time complexity of Floyd-Warshell algorithm for shortest path.

5. Attempt any two part of the following:- **(10x2=20)**

(a) Show the comparisons the Robin matcher makes for the pattern P=589 in the Text T=41592653589793,where working module is q=11.

(b) Write down Strassen's algorithm for multiplying two matrices. Use the algorithm to compute the product of the following two matrices.

$$\begin{vmatrix} 3 & 9 \\ 11 & 8 \end{vmatrix} \text{ and } \begin{vmatrix} 2 & -5 \\ -6 & 7 \end{vmatrix}$$

(c) (i) Show that the Hamiltonian path problem can be solved in polynomial time on directed acyclic graph. Give an efficient algorithm for the problem.

(ii) What is Reduction? What can we do with polynomial time reduction f: L1-> L2.