B. Tech.

(SEM. V) EXAMINATION, 2008-09
DESIGN & ANALYSIS OF ALGORITHMS

Time : 3 Hours]   *[Total Marks : 100*

Note :   (i)   *Attempt all questions.*

         (ii)   *All parts of a question should be attempted at one contigous place.*

1   Attempt any **four** parts of the following :   5×4=20

    (a)   Solve the recurrence relation by iteration :

$$T(n) = T(n-1) + n^4.$$

    (b)   What is the smallest value of n such that an algorithm whose running time is $100\, n^2$ runs faster than an algorithm whose running time is 2^n on the same machine ?

    (c)   Prove that any comparison sort algorithm require $\Omega(n \log n)$ comparisons in worst case.

    (d)   Illustrate the operation of counting sort on the following array :

$$A = \langle 6, 0, 2, 0, 1, 3, 4, 6, 1, 3, 2 \rangle.$$

(e) How, both the minimum and the maximum of a set of *n* elements can be computed in atmost $3\lfloor n/2 \rfloor$ comparisons ?

(f) Solve the recurrence relation for binary search algorithm using tree method.

2 Attempt any **four** of the following : 5×4=20

(a) Prove that a red-black tree with *n* internal nodes has height at most $2 \log(n+1)$.

(b) Construct binary expression tree from the following traversals :

Inorder : $4+3+2*1$

Preorder : $+4*+3\,2\,1$

(c) Write an algorithm **HEAP-DELETE(A, i)**, which deletes the item in node *i* from heap *A*.

(d) Write three operations and their implementation on dynamic sets.

(e) Give an algorithm to count the number of leaf nodes in a binary tree *t*. What is it's computing time ?

(f) Explain the process of augmenting a data structure with an example.

3 Attempt any **two** of the following : 10×2=20

(a) What steps are used in Dynamic Programming Approach ? Discuss the **0/1** Knapsack problem with respect to Dynamic Programming. Is Greedy method equally applicable for the above problem ?

(b) Apply greedy approach to an activity-selection problem of scheduling several competing activities that require exclusive use of common resources, with a goal of selecting a maximum size set of mutually compatible activities.

(c) What do you understand by amortized analysis ? What are different methods for it ? Explain with an example.

4   Attempt any **two** of the following :   10×2=20

(a) Prove that if the weights on the edge of the connected undirected graph are distinct then there is a unique Minimum Spanning Tree. Give an example in this context. Also, discuss Kruskal's minimum spanning tree in detail.

(b) Explain Floyd Warshall algorithm with suitable example.

(c) For the graph (Weighted, directed)
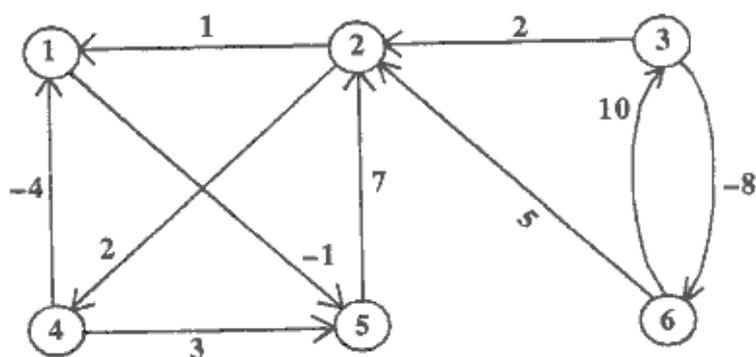
apply Floyd-Warshall algorithm for constructing shortest path. Show the matrix $D^{(K)}$ that results each iteration.

5   Attempt any **two** of the following :   10×2=20

(a) (i)   Discuss the decision problems of class **P** and **NP**.

(ii) Discuss **NP** complete problems.

(b) Explain Boyer-Moore algorithm for string matching for text :

"*a b c a a b c c a a b b a b c a*"

Pattern *a b c*.

Compute worst time complexity of this algorithm.

(c) What are approximation algorithms ? What is meant by a $P(n)$ - approximation algorithm ? Give an approximation algorithm for travelling salesman problem.