

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1406

Roll No.

--	--	--	--	--	--	--	--	--	--

MCA

THIRD SEMESTER EXAMINATION, 2004-2005

DESIGN AND ANALYSIS OF ALGORITHM

Time : 3 Hours

Total Marks : 100

- Note :**
- Attempt **ALL** questions.
 - All questions carry equal marks.
 - Write clearly the base which you have assumed for algorithm.
 - Assume suitable data if required.

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

- (a) Horner's rule is a means for evaluating a polynomial at a point x_0 using a minimum number of multiplications. If the polynomial is $A(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$,

Horner's rule is

$$A(x_0) = (\dots((a_n x_0 + a_{n-1})x_0 + \dots + a_1)x_0 + a_0$$

Write an algorithm to evaluate a polynomial using Horner's rule.

- What is time complexity ? Analyze time complexity of Fibonacci number algorithm.
- Describe a programming situation in which a digraph would be preferred to a binary search tree as data structure.

- (d) What is the probability that the sum of two faces of a six faced dice is 10 ?
- (e) Solve the recurrence relation shown below :

$$T(n) = 1 \quad \text{for } n = 1$$

$$= 2 * T(n - 1) \quad \text{for } n > 1$$

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

- (a) Explain Heap Sort algorithm through diagrams.
- (b) For example, consider an array of elements. Now explain the working of partition function in Quick Sort algorithm.
- (c) What are Hash tables ? How do we make a good choice of Hash function ?
- (d) Construct Binary Expression tree from the traversals shown below :

$$\text{Inorder} \quad 4 + 3 + 2 * 1$$

$$\text{Preorder} \quad = 4 * + 3 2 1$$

- (e) Write algorithm for add Q or delete Q, assuming the queue is represented as a linked list.
- (f) Define Red Black tree. Prove that a Red Black tree with n internal nodes has height at most $2 \log(n + 1)$.

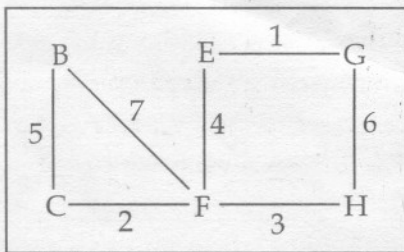
3. Attempt *any two* of the following :- (10x2=20)

- (a) What are amortization schemes ? Also discuss their time complexities.
- (b) What is a B-tree of order m ? Explain the insertion algorithm for a B-tree with the help of diagrams.

- (c) Prove that the maximum degree of any node in an n node binomial tree is $\log n$.

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

- (a) What are spanning trees. Illustrate with examples. Also write down their various applications.
- (b) Indicate the order in which Kruskal's algorithm would include edges in constructing a minimum spanning tree for the following graph :



- (c) Use the digraph adjacency matrix below and topologically sort vertices 1 to 5.

	1	2	3	4	5
1	0	0	1	0	0
2	0	0	1	1	0
3	0	0	0	0	1
4	0	0	0	0	1
5	0	0	0	0	0

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

- (a) What is principal of divide and conquer as applied to parallel algorithm design ?
- (b) How would you show that an NP hard decision problem is NP complete ? Explain details.
- (c) Discuss relationship between P, NP, NP complete and NP hard problems with examples.

*** **