

MCA (Revised)
Term-End Examination
December, 2007

MCS-021 : DATA AND FILE STRUCTURES

Time : 3 hours

Maximum Marks : 100
(Weightage 75%)

Note : Question number 1 is **compulsory**. Attempt any **three** questions from the rest. All algorithms should be written nearer to 'C language.

1. (a) Differentiate between the big O notation and big Ω notation. Find time complexity of the following functions in Θ -notation : 10
- (i) $f(n) = n^3 + 2^{1000}$
- (ii) $f(n) = n^4 + \lfloor n \rfloor + 100$
- (iii) $f(n) = n^3 + n^2 \log n + \log^4 n + 20$
- (iv) $f(n) = 2^n + \lfloor n \rfloor \log n + \log(\log(\log(n))) + 100$
- (b) Write algorithm to insert elements in a B-Tree. Make B-Tree using your algorithm for the following list of elements : 10
- 2, 4, 9, 8, 7, 6, 3, 1, 5, 10
- (c) Two Binary trees are similar if they are both empty or if they are both non-empty and left and right subtrees are similar. Write an algorithm to determine if two Binary trees are similar. 10

- (d) Sometimes, a stack data structure uses an operation top, where top (S) returns the top of element of stack S, which must be checked non-empty before doing the operation. Write C program/function that can be used with
- (i) array data structure
 - (ii) linked list data structure 10
2. (a) Explain the factors involved in the selection of a particular file organization for user. What is sequential file ? Why are sequential files stored in disk cylinder by cylinder ? 10
- (b) (i) What are the limitations of a Binary Search Tree (BST) ? How does AVL tree help in this regard ? 5
- (ii) Give an AVL tree for which the deletion of a node requires two double rotations. Draw the tree and explain why two rotations are needed. 5
3. (a) Write a function in 'C' to insert a node in a linked list at the following position : 10
- (i) at the beginning
 - (ii) at the end
- (b) Write an algorithm to convert infix expression into postfix expression. Show execution of your algorithm manually on following expression :
- $$((a + b)/c) * (d + (e - f)/g) \quad \text{10}$$

4. (a) (i) What are the different types of hash functions ?
 How can *clustering* involved in *linear probing*
 be avoided ? Explain any two methods. 5

(ii) Consider a hash table with 50 slots i.e.
 $m = 50$, and key value $k = 1632, 1739, 3123$.
 Calculate k^2 and $h(k)$. 5

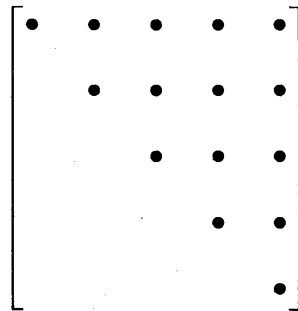
(b) (i) A binary tree T has 9 nodes. The inorder and
 preorder traversals yield the following sequences
 of nodes : 5

Inorder : E A C K F H D B G

Preorder : F A E K C D H G B

Draw the tree.

(ii) Find formula for finding $A[i, j]$ th element in
 upper triangular matrix. Find formula for both if
 the matrix is stored in row major order as well
 as in column major order. 5



5. (a) Write an algorithm to sort an array
 25, 15, 30, 9, 99, 20, 26
 using *insertion sort*. Also write the steps involved in
 it. 10

(b) Write an algorithm to discuss the implementation of
 breadth first traversal method of a graph. 10