DATA STRUCTURES

Time: *Three Hours*

Maximum Marks: *100*

Answer five questions, taking ANY TWO from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Define Big O notation and what is its utility in analysis of algorithms?   10

   (b) Order the following function by growth rate: N, $\sqrt{N}$, $N^{1.5}$, N^2, $NlogN$,   10
   $NloglogN$, $Nlog(N^2)$, $2/N$, 2^N, 37

2. (a) Suppose multidimensional arrays A and B are declared using A (-2:2, 2:22)   10
   and 5(1:8,-5:5, - 10:5), (i) find the length of each dimension and the number
   of elements in A and B; and (ii) consider the element, B[3,3,3] in B. Find
   the effective indices E_1, E_2, E_3 and the address of the element, assuming
   Base (B) = 400 and there are w = 4 words per memory location.

   (b) What is sparse matrix? Write an algorithm to add to sparse matrix and   10
   explain the assumed data structure in support of your algorithm.

3. (a) What is a circular list? Write an algorithm for inserting a node at the front.   8

   (b) What are the advantages of circular link list over linear list? What are the   6
   problems of a circular link list?

   (c) Write an algorithm to merge two circular lists A and B to produce a   6
   resultant list C.

4. (a) How can you differentiate stack from an array? Implement the push and pop   8

operation of stack with testing for exceptional conditions.

(b) Write C functions to perform push and pop operations in a stack. Using these functions, write a program converting a positive integer (in decimal) to its equivalent binary form.   6

(c) Write a function using a stack that converts an expression from infix to postfix.   6

Group B

5. (a) Define a binary tree. What do you mean by tree traversal? Write one traversal algorithm.   8

(b) Form the binary tree for which the following are given: 6

In-order traversal   :

f	h	i	g	b	a	d	e	c

Pre-order traversal

a	b	f	g	h	i	c	d	e

(c) How is a B tree different from B^+ tree?   6

6. (a) How are graphs represented in memory of a computer? Give relative merits and demerits of these representation schemes.   8

(b) What do you mean by graph traversal? Define depth first traversal (DFS) of a graph. Write an algorithm of non recursive depth first traversal.   6

(c) Compare and contrast between DFS and BFS (breadth first search).   6

7. (a) What is hashing? Give the characteristics of hash function.   8

(b) Name different hash functions with a brief description and analysis.   6

(c) Explain various collision resolving techniques encountered in hashing function.   6

8. (a) What are indexed files? How is a B+ tree used to implement indexes? Explain with an example.   10

(b) Compare sequential, relative and indexed file organizations. Also, give their applications with examples.   10

Group C

9. Answer the following in brief: 20

   (i) Explain the following terms with respect to binary tree :

   (a) Strictly binary tree

   (b) Complete binary tree.

   (ii) Which is the operation performed more efficiently by doubly-linked list than by singly-linked list?

   (iii) What is dangling pointer and how to avoid it?

   (iv) What is a priority queue?

   (v) What is an inverted file ?

   (vi) The following sequence of operation is performed on a stack:

   push(1), push(2), pop, push(1), push(2), pop, pop, pop, push(2),pop.

   Determine the sequences of popped out values.

   (vii) What is the average and best case time complexity of insertion sort algorithm?

   (viii) What is garbage collection?

   (ix) What is divide and conquer methodology? Name one sorting algorithm where the divide and conquer methodology is used.

   (x) Parenthesis are never needed in prefix or postfix expression. Why?

   (Refer our course material for answers)