Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech EE(N)/SEM-5/EE-504 A/2012-13

2012

DATA STRUCTURE AND ALGORITHM

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives of the following : $10 \times 1 = 10$

   i) Which of the following case does not exist in complexity theory ?

   a) Best case b) Worst case

   c) Average case d) Null case.

   ii) Which of the following data structure is not linear data structure ?

   a) Arrays b) Linked lists

   c) Both of these d) None of these.

   iii) Binary search algorithm cannot be applied to

   a) sorted linked list b) sorted binary trees

   c) sorted linear array d) pointer array.

   iv) To represent hierarchical relationship between elements, which data structure is suitable ?

   a) Deque b) Priority

   c) Tree d) All of these.

v) The data structure which allows deletions at both ends of the list but insertion at only one end is
   a) Input-restricted deque
   b) Output-restricted deque
   c) Priority queues
   d) None of these.

vi) The situation when in a linked list Start=NULL is,
   a) underflow b) overflow
   c) housefull d) saturated.

vii) The complexity of merge sort algorithm is
   a) $O(n)$ b) $O(\log n)$
   c) $O(n^2)$ d) $O(n \log n)$.

viii) The worst case occur in linear search algorithm when
   a) Item is somewhere in the middle of the array
   b) Item is not in the array at all
   c) Item is the last element in the array
   d) Item is the last element in the array or is not there at all.

ix) The elements of an array are stored successively in memory cells because
   a) by this way computer can keep track only the address of the first element and the addresses of other elements can be calculated
   b) the architecture of computer memory does not allow arrays to store other than serially
   c) both of these
   d) none of these.

x) When converting binary tree into extended binary tree, all the original nodes in binary tree are
   a) internal nodes on extended tree
   b) external nodes on extended tree
   c) vanished on extended tree
   d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Polynomials can be represented either by an array or by linked list. Compare & contrast these two types of representations. Represent the following polynomials by a linked data structure (show only the diagram) $-5x^5 + 4x^4 - 25x^3 + 10$.
3. Consider the following queue of characters, where queue Q is a circular array which is allocated 5 memory cells : Front = 2, Rear = 3, Q : _, P, Q, _, _. Describe the following operations on queue :
   (a) R is added to the queue. (b) Two letters are from the queue. (c) S, T, U are added to queue.
4. Explain DFS Algorithm with example.
5. Compare between insertion sort and selection sort. Write the insertion sort alogorithm. 2 + 3
6. Insert the following keys into a B-Tree of given order mentioned below :
   a,f,b,k,h,m,e,s,r,c. (Order 3)
   a,g,f,b,k,d,h,m,j,e,s,I,r,x,c,l,n,t,u,p. (Order 5) 2 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

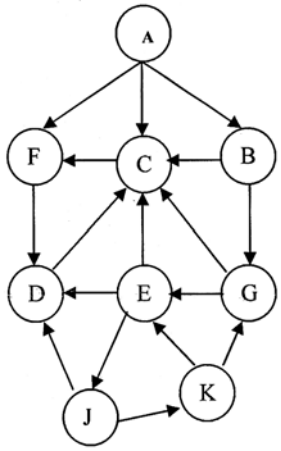
7. What are sparse matrices ? How is it represented in memory ? What are the types of sparse matrices ? Show that the function $f(n)$ defined by :
   $f(1) = 1$
   $f(n) = f(n\text{-}1) + 1/n$ for $n > 1$, has the complexity $O(\log n)$
   Let the size of the elements stored in an 8×3 matrix be 4 bytes each. If the base address of the matrix is 3500, then find the address of A [5, 2] for both row major & column major cases. 2 + 2 + 2 + 4 + 5

8. What is recursion tree ? Draw the recursion tree for computing nth Fibonacci numbers, where n may be any number & Tower of Hanoi having 4/3 disks. Write short notes on Tail Recursion & Tower of Hanoi Problem.

1 + 2 + 2 + 5 + 5

9. Show that the running time for Merge Sort algorithm is O ($n\log_2^n$). Explain with suitable example, the principle operation of Selection Sort. Find out the complexity values of Quick Sort Algorithm. 5 + 5 + 5

10. What is expression tree ? Draw the expression tree and write the In, Pre & Post-Order traversals for the given expression tree : $E = (2x + y)\ (5a - b)^3$. Prove that the number of odd degree vertices in a graph is always even. Apply BSF/DFS Algorithm find out the path of the given graph :



2 + 2 + 1 + 1 + 1 + 3 + 5

11. Write short notes on any *three* of the following : 3 × 5

a) AVL Tree

b) Heap sort

c) B-tree

d) Radix sort

e) Threaded binary tree.