AMIETE – CS/IT (OLD SCHEME)

Code: AC06 / AT06 **Subject: DATA STRUCTURES & ALGORITHM DESIGN**
Time: 3 Hours **Max. Marks: 100**

JUNE 2011

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. f(n) is O(g(n)) if there exists positive numbers *c* and *N* such that --------- for all n >= N

(A) f(n) <= cg(n) **(B)** f(n) = cg(n)
(C) f(n) >= cg(n) **(D)** f(n) < > cg(n)

b. Evaluate the following arithmetic expression written in postfix form 12 7 3 - / 2 1 5 + * + is

(A) 12 **(B)** 14
(C) 16 **(D)** 15

c. The maximum level (l_{max}) and minimum level (l_{min}) that is possible for a binary tree with *n* nodes are

(A) $l_{max} = n+1 \text{ and } l_{min} = [\log_2(n+1)+1]$

(B) $l_{max} = n-1 \text{ and } l_{min} = [\log_2(n+1)-1]$

(C) $l_{max} = n+1 \text{ and } l_{min} = [\log_2(n+1)-1]$

(D) $l_{max} = n-1 \text{ and } l_{min} = [\log_2(n+1)+1]$

d. Instead of searching the locations with address like h, h+1, h+2, …, h + n, search is done on locations with address like h, h+1, h+4, h+9, …. $h+i^2$. This technique is termed as:

(A) Double hashing **(B)** Quadratic hashing
(C) Clustered hashing **(D)** None of the above

e. Average case and worst case complexity of selection sort is :

(A) O(n^2), O(nlogn) **(B)** O(nlogn), O(n^2)
(C) O(n^2), O(n^2) **(D)** O(nlogn), O(nlogn)

f. Depth First Search algorithm uses the following data structure

(A) Linked List **(B)** Queue
(C) Tree **(D)** Stack

g. Activation records are maintained during the following :

(A) Iteration **(B)** Recursion
(C) Sorting **(D)** Searching

h. Maximum number of pointers to be changed in doubly linked list are :

(A) 3 **(B)**2
(C) 4 **(D)** NULL

i. First visit root node T, then traverse left sub-tree of T and finally traverse right sub-tree of T is defined as

(A) Reverse order traversal **(B)** Post order traversal
(C) Inorder traversal **(D)** Preorder traversal

j. --------- is an in-place sort that requires O(n log n) operations regardless of the order of input.

(A) Heap sort **(B)** Quick sort
(C) Binary sort **(D)** Selection sort

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Define abstract data type and give an example for illustration. **(4)**

b. Write an algorithm to implement polynomial representation using arrays. **(5)**

c. Explain Big-O notation. Give the rate of growth of common computing functions and give its graphical plot. **(5)**

d. Explain the working of recursion. **(2)**

Q.3 a. Consider a doubly linked list with the following elements: **(6)**
20, 30, 40, 12, 50 60, 140, 80, 130, 100
Write an algorithm to delete maximum and minimum values from doubly linked list.

b. Define sparse matrix. Give the address calculation in upper-triangulation matrix for the following:
(i) Row-major order (ii) Column-major order **(6)**

c. Compare linked list and array representation of stack and queue. **(4)**

Q.4 a. Consider the algebraic expression E= (2x + y) (5a – b)^3 **(6)**
(i) Draw a tree T for the expression E
(ii) Find the preorder traversal of the tree T drawn in (i).

b. Write an algorithm to display all the nodes at level *i* in a binary tree. **(6)**

c. Draw the structure of threaded binary tree. Give its advantages over binary trees. **(4)**

Q.5 a. Give an example of the following AVL operations:
(i) LL Rotation
(ii) LR Rotation
(iii) RL Rotation
(iv) RR Rotation **(8)**

b. Define heaps and priority queues. Give their applications. **(4)**

c. Give the time complexity of the following tree search algorithms
(i) Binary search tree (ii) Heaps
(iii) AVL tree (iv) B- tree **(4)**

Q.6 a. Write algorithm for quick sort and give its complexity analysis. **(6)**

b. Explain various types of hashing and give an example for each. **(7)**

c. Compare the performance of selection sort and insertion sort. **(3)**

Q.7 a. Give the complexity analysis of Dijkstra's shortest path algorithm. **(3)**

b. For the directed graph given in Fig.1, find Dijkstra's shortest path between node *A* and node *D.* **(5)**

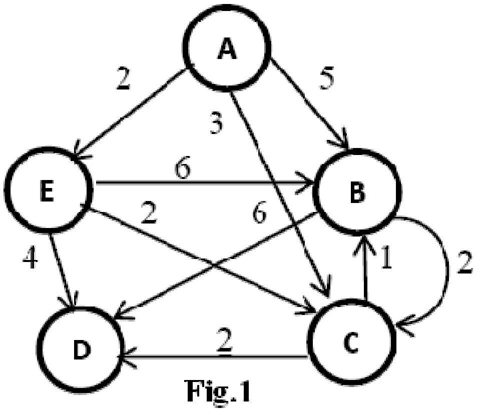

Fig.1

Give sequence of steps to find shortest path.

c. Write the Kruskal's algorithm for MST. Give its complexity. **(5)**

d. Explain various ways to represent graphs. **(3)**

Q.8 a. Write an algorithm to merge two singly linked lists. The final list should contain one element from list L1 and second element from list L2 and so on. **(8)**

b. Give the representation of polynomial addition using linked list. **(4)**

c. Give the application of circular linked list and its representation. **(4)**

Q.9 a. Draw internal memory representation for the following tree (Fig.2). **(9)**

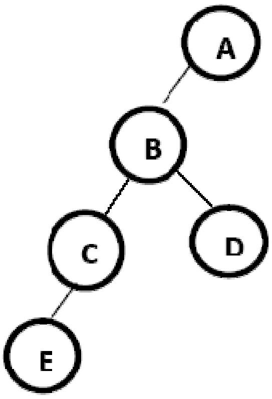

Fig.2

Give representation for the following:
(i) Sequential
(ii) Linked
(iii) Threaded linked representation

b. Write an algorithm to search an element in B-Tree. Give its complexity. **(7)**