ROLL NO. _____

Code: AC06/AT06 Subject: DATA STRUCTURES & ALGORITHM

AMIETE – CS/IT (OLD SCHEME)

Time: 3 Hours **DECEMBER 2011** Max. Marks: 100

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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. Let $f(n) = 4n^2 + 3\log n$. Which of the following is wrong?

(A) $f(n) = O(\log n)$ **(B)** $f(n) = O(n^3)$
(C) $f(n) = O(n^2)$ **(D)** both **(A)** and **(B)**

b. Which of the following operation on a singly linked list can be carried out in O(1) time?

(A) Deleting a node given the element stored in it
(B) Inserting a node to the head of the list
(C) Inserting a node in a sorted list
(D) Counting the number of nodes in a list

c. Which of the following type of binary tree has a height of n, where n is the number of nodes?

(A) Complete Binary tree **(B)** Strictly Binary tree
(C) Skew tree **(D)** The height of a binary tree cannot be n

d. Which of the following array is valid representation of a binary tree? – denotes NULL entry.

(A) [A - B C - - D] **(B)** [A B C - D - E]
(C) [A B - C D E -] **(D)** both **(A)** and **(C)**

e. What is the worst case complexity of searching in Binary Search tree?

(A) O(n) **(B)** O(log n)
(C) O(1) **(D)** O(n log n)

f. What does the following algorithm compute?
Algorithm f(n)
return (n * f (n-1))
end

(A) factorial of n **(B)** n times factorial of n
(C) n times n **(D)** error

g. What is the average case complexity of quick sort?

(A) O(N) **(B)** $O(N^2)$
(C) O(log N) **(D)** O(N log N)

h. Which of the following describes collision in hashing?

(A) The hash value of all keys is unique
(B) The hash value of identical keys is same
(C) The hash value of non-identical keys is same
(D) Mapping of keys to address

i. Consider representing the railway routes using graphs. Frequent queries include checking whether a route exists between pair of cities, cost of a route between pair of cities. Which of the following representation would you suggest?

(A) A directed graph using adjacency matrix
(B) A directed graph using adjacency list
(C) A undirected graph using adjacency matrix
(D) A undirected graph using adjacency list

j. Which of the following are linear data structures? (i) Stack (ii) Queue (iii) Tree (iv) Graph

(A) (i), (ii), (iii) and (iv) **(B)** (iii) and (iv)
(C) (i) and (ii) **(D)** (i)

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

Q.2 a. Define Big O notation. Explain the type of algorithms that belong to each of the following classes of complexity. Give an example for each.(i) O(1) (ii) O(log n) (iii) O(n) (iv) O(n log n) (v) $O(n^2)$) (vi) $O(2^n)$. **(11)**

b. What are recursive algorithms? What are the points to be considered while writing a recursive algorithm? Write a recursive algorithm to find the factorial of a number. **(5)**

Q.3 a. Write algorithms for the following operations on singly linked list: (i) Copy a l into another (ii) Append one list with another. **(8)**

b. Describe how polynomials can be represented using linked list. Write an algorithm to add two such polynomials. **(8)**

Q.4 a. Describe the inorder, preorder and postorder traversal of binary trees. Draw the binary tree whose inorder traversal is B, C, A, G, E, D, F, preorder traversal sequence is A, B, C, D, E, G, F and the post order traversal sequence is C, B, G, E, F, D, A. **(10)**

b. What are threaded binary trees? Give its applications. Explain with an example. **(6)**

Q.5 a. What is a binary search tree? Construct a binary search tree by inserting 40, 25, 60, 36, 27,70 one at a time in the given order. **(6)**

b. What is an AVL tree? Under what situations insertions in AVL would imbalance an AVL tree? What are the different forms of rotation required to balance AVL trees? Create an AVL tree, starting with an initially empty tree with elements 30, 20, 10, 40, 50, 60 and 25 in order. Show the tree after each insertion. Indicate what type of rotation is performed, if any. **(10)**

Q.6 a. Write algorithms for push and pop operations on a stack implemented using linked list. **(10)**

b. What is a doubly linked list? Write algorithms to delete the node pointed by the given pointer. **(6)**

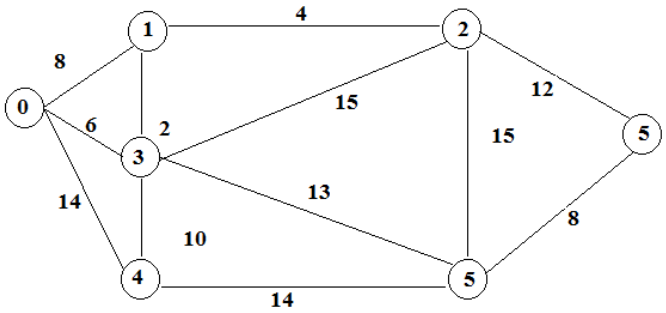
Q.7 a. Write an algorithm for binary search. Indicate its best and worst case complexity.**(8)**

b. Illustrate how heap sort works on the following list of numbers: 10, 15, 12, 25, 31, 45, 24, 56, 26 and 35 **(8)**

Q.8 a. Write an algorithm for quick sort. Explain its working for sorting 35, 26, 10, 13, 45, 92, 30, 60. **(8)**

b. What is meant by hashing? What is collision? Explain with example. Describe any two methods for handling collision? **(8)**

Q.9 a. Explain the steps in Kruskal's algorithm to determine the minimum spanning tree. Using Kruskal's algorithm determine the minimum spanning tree of the following tree. **(10)**



b. With an example, illustrate representation of graphs using
(i) Adjacency matrix and (ii) Adjacency list. **(6)**