ROLL NO. _____

DipIETE – CS (NEW SCHEME) – Code: DC54

Subject: DATA STRUCTURES

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. When a variable is declared as _____, memory is allocated to the variable when function is called and deallocated once the function completes its execution.

   (A) Static   **(B)** Register
   (C) Automatic   **(D)** Both **(A)** and **(B)**

   b. The time complexity of heap sort of an array having n elements is

   (A) $O(\log_2(n))$ **(B)** $O(2n\log_2(n))$
   (C) $O(n*n\log_2(n))$ **(D)** $O(n\log_2(n))$

   c. Priority _____ is maintained by the scheduler of an operating system.

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

   d. Minimum number of pointers used by a node in a doubly linked list is:

   (A) 4   **(B)** 3
   (C) 1   **(D)** 2

   e. The data type used in file pointer is _____.

   (A) File   **(B)** FILE
   (C) PTRFILE   **(D)** FILEPTR

   f. Adjacency matrix and adjacency lists are used to represent _____ data structure.

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

g. _____ sort requires an additional list of size *n*.

    (A) Bubble   **(B)** Merge
    (C) Heap   **(D)** Quick

h. The link field of a node in a singly linked list contains the address of _____ node

    (A) Next   **(B)** Start
    (C) Last   **(D)** NULL

i. The maximum number of nodes in a binary search tree at level *i* where $i \geq 1$ is given as

    (A) 2^{i*1} **(B)** 2^{i}
    (C) 2^{i-1} **(D)** 2^{i+1}

j. The maximum number of edges in an undirected simple graph with *n* vertices is given as

    (A) *n*(*n*-2)/2   **(B)** *n*(*n*-1)/2
    (C) *n*(*n*+2)/2   **(D)** *n*(*n*+1)/2

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

Q.2 a. Explain the scope of following variables. Also explain how storage allocation is done for these
(i) External variables
(ii) Register variable
(iii) Static variables   **(6)**

    b. Explain the working of recursive functions. Write a program to implement a recursive function.   **(6)**

    c. Compare static memory allocation and dynamic memory allocation. Give their respective applications.   **(4)**

Q.3 a. Create a structure named Employee with fields as name, designation and salary. Declare structure variable, structure array and structure pointer. Write a program to input values and display values for each of the above declarations.   **(7)**

    b. Write a program to read the contents of a data file, a.dat. Sort the data values and write the modified values to a new file, b.dat.   **(7)**

    c. Define Unions and compare it with structures.   **(2)**

Q.4 a. Write a program to implement quick sort technique. Discuss best and worst case of quick sort.   **(7)**

    b. Compare the performance of bubble sort and heap sort.   **(4)**

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c. Discuss briefly binary search algorithm .Give an example to illustrate the algorithm. **(5)**

Q.5 a. Give various technical applications of stacks and queues. **(4)**

b. Write a program to implement the following data structures with necessary basic functions:
(i) Stacks   (ii) Queues **(8)**

c. How can queue structure be modified to work as stack? Give its representation and an illustration. **(4)**

Q.6 a. Consider a linked list having integer elements. Write a program to split the linked list into two linked list, where the first linked list has even numbers and the second linked list has odd numbers. **(6)**

b. Explain how a polynomial can be represented using linked list. **(5)**

c. If a linked list is very long, then the time complexity increases. Suggest a solution to minimize the complexity of linear linked list. (Note: The structure of linked list should not be changed). **(5)**

Q.7 a. Compare the performance of Breadth First Search and Depth First Search traversal algorithms. **(6)**

b. Define in-degree and out-degree for a directed graph. Give an illustration to find out in-degree and out-degree of each node **(4)**

c. Find the minimum cost spanning tree for the following graph (Fig.1). Show sequence of steps involved. **(6)**
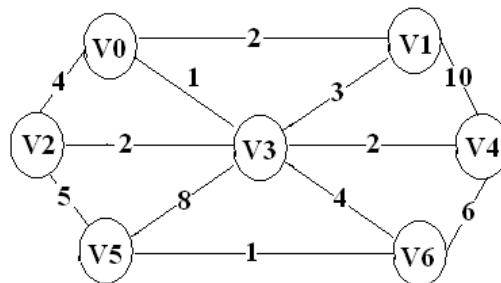

Fig. 1

Q.8 a. Write a program to insert an element into a doubly linked list at the following positions:
(i) Start
(ii) End
(iii) After a specified node position **(9)**

b. What are limitations of linear linked list over circular linked list? **(2)**

c. Compare the performance of singly and doubly linked lists. Give various applications of doubly linked list. **(5)**

Q.9   a.   Find the preorder, inorder and postorder traversals of the following binary tree
(Fig.2)   **(6)**
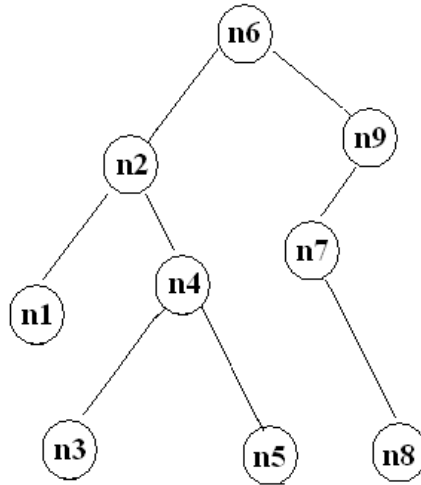
Fig.2

b.   Write a program to search an element *k* in a binary search tree.   **(6)**

c.   Compare the performance of non-linear and linear data structures. Illustrate by
using suitable example.   **(4)**