(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0110 Roll No. | | | | | | | | | | |

B. Tech.

(SEMESTER-III) THEORY EXAMINATION, 2012-13

DATA STRUCTURES USING C

Time : 3 Hours] *[Total Marks : 100*

Note : This question paper contains three sections. Attempt all the sections as per instructions.

Section – A

1. This question contains **ten** parts. Attempt **all** parts of this question. **2 × 10 = 20**
   (a) What is the need of different types of data structures ?
   (b) What is the advantage of linked list over array ? Explain in brief.
   (c) Differentiate between time complexity and space complexity of an algorithm.
   (d) Discuss some applications of asymptotic analysis of algorithms.
   (e) Explain a circular queue. What is the condition if a circular queue is full ?
   (f) What are the different orders to traverse a binary tree ? Explain with an example.
   (g) Differentiate between a binary tree and a complete binary tree.
   (h) What is the condition to produce correct result by Dijikstra algorithm ?
   (i) How a garbage collector works ?
   (j) What is the precondition on a list of elements to apply binary search ?

Section – B

2. This question contains **five** parts. Attempt **all** parts. **All** parts carry equal marks. **6 × 5 = 30**
   (a) Consider the below given values of the elements as priorities to build the heap tree and sort them using heap sort. Show all the steps clearly.
   15, 19, 10, 7, 17, 16
   (b) For a perfect binary tree of height h containing $N = 2^{h+1} - 1$ nodes, the sum S of the heights of the nodes is $S = 2^{h+1} - 1 - (h + 1) = O(N)$. Prove it.
   (c) With a suitable example demonstrate CREATE, ADD, DELETE, EMPTY and FULL FUNCTIONS on a queue data structure.
   (d) Define AVL tree. Take an example and show INSERTION and DELETION in an AVL tree.
   (e) Write the procedure for postfix expression evaluation.

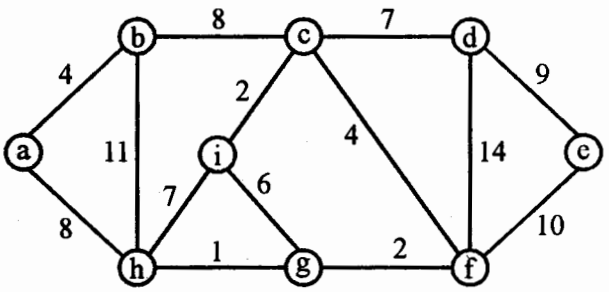
Section – C

Attempt any **two** parts from each question. **All** questions are compulsory. **10 × 5 = 50**

3. (a) Select a data structure and then write a procedure to convert *infix* expression into *postfix* expression.

   (b) Design an algorithm to search an element in a sorted list of which size is not known and its time complexity is equal to binary search algorithm.

   (c) Find the minimum spanning tree of the following graph by Prim's Algorithm and compute the value of MST.

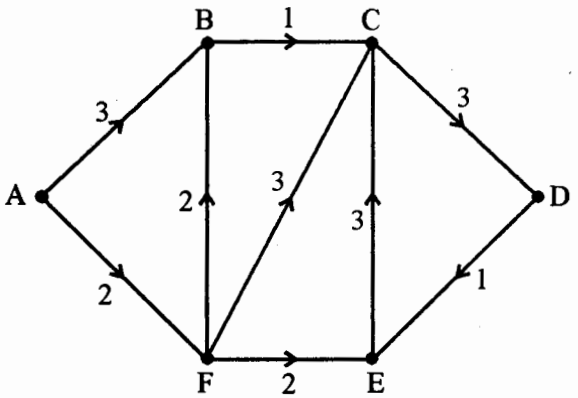


4. (a) Differentiate between internal sorting and external sorting.

   (b) Define connected component in a graph and write pseudo code to find the connected components of a graph with example.

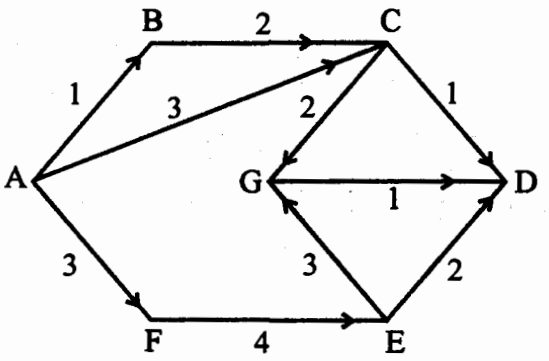
   (c) How a graph can be represented to store in Memory ? Show with examples.

5. (a) Apply Dijkastra's algorithm to find shortest part between node A & D.



   (b) What is hashing ? Explain all probing techniques to resolve collision in open addressing.

(c) Show all steps to traverse the following graph by Breath First Search. Start from node A.



6. (a) Suppose you have integers between 1 to 1000 in an array sorted in non-descending order. You have to search a number 363 from this array by applying binary search. Which of the following sequences could not be the sequence of values examined.

2, 252, 401, 398, 344, 397, 363

924, 220, 911, 244, 898, 258, 362, 363

925, 202, 911, 244, 912, 245, 363

2, 399, 387, 219, 266, 382, 381, 278, 363

935, 278, 347, 621, 299, 392, 358, 363

(b) Prove that any comparison-based algorithm for finding both the maximum and the minimum of an unordered list A[1...n] of n elements must perform at least $(3n/2 - 2)$ comparisons.

(c) The following pseudo-code computes the k^{th} power of x

(1) power (x, k)

(2) if k = 0 then

Return 1

(3) else if k is even then

(4) return sqr (power (x, k/2)

(5) else

(6) return x x sqr (power (x, $\lfloor k / 2 \rfloor$))

Write down the running time recurrence.

7. (a) Solve the following recurrences :

$T(n) = T(n-1) + cn$

(b) To determine whether two binary search trees on the same set of elements have identical tree structures, one could perform an in-order three traversal on both and compare the output lists. Justify your answer.

(c) Explain the types of edges which occur during depth first search of graph.
