Unit - V

5. a) What do you understand about Graph? How the graphs are represented in the memory?

   b) Write a C function to create the adjacency list representation of a graph, given its adjacency matrix representation.

   c) Define the following with the help of example :

      i) Adjacency Matrix of a graph

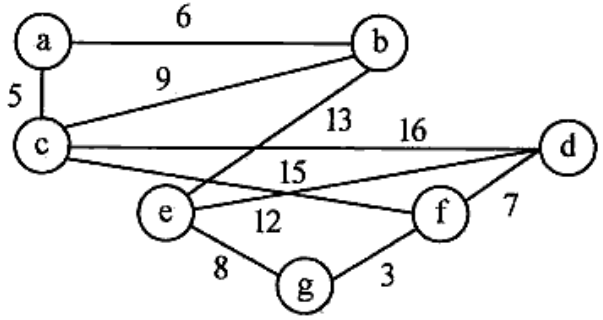
      ii) In-degree and out-degree of a graph

      iii) Directed Acyclic Graph (DAG)

   d) Write an algorithm to implement depth-first search. How is depth-first search different from Breadth-first search? Also write any two application of complete graph.

OR

What is a minimum spanning tree? Using Dijkstra's methods find a spanning tree of the following graph.



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Roll No .....

CS/IT-305

B.E. III Semester

Examination, June 2016

CS - 305 : Data Structure

IT - 305 : Data Structure and Algorithm

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each questions are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a) Explain how to derived complexity of algorithm with the help of all three notations.

   b) What are the limitations of array data structures? How can it be avoided using linked lists?

   c) Define a sparse metrics. Explain the representation of a 2×2 matrix using array.

   d) Write a recursive code to compute the sum of squares as shown in the series.

   $m^2 + (m+1)^2 + ... + n^2$

   for m, n integers $1 \le m \le n$

OR

Write a recurrence relationship that describes the number of ring moves as a function of n made by the following algorithm that solves the Towers of Hanoi problem using four spikes.

Unit - II

2. a) What is Stack and how it is implemented using Array? List few application of stack.

   b) What are the limitations of array data structures? How can it be avoided using linked lists?

   c) Convert the following Infix expression to Postfix form using a stack. A + BC*C + (P * Q + R) * S, follow usual precedence rule and assume that the expression is legal.

   d) What is Two-way Header List? Explain the operation of inserting an element at the front, middle and at the rear in a doubly linked list.

   OR

   Show how to implement a queue using two stacks. Analyze the running time of the queue operations :

   i) Show that for a sequence of n queue operations, the implementation takes a worst case running time of $O(n)$.

   ii) If there are a maximum of k elements in the queue at a given time, what is the worst case running time to perform one queue operation?

Unit - III

3. a) What Huffman Coding? List out few applications of it.

   b) Explain Traversing Binary Tree and Threaded Binary Tree.

   c) Prove that a binary tree with n nodes has at most $[n/2]$ leaves.

   d) i) Define B-tree of order m? When is it preferred to use B-trees.

   ii) Write an algorithm to search a key in a B-tree. What is the worst case of searching in a B-tree? List the possible situations that can occur while inserting a key in a B-tree.

   iii) What is the complexity of the following code?

```
int counter = 0;
    for (i=0; i<n; i++)
    for (j=0; j<n*n; j++)
counter++;
```

   OR

   What are AVL trees? Explain various types of rotations required in balancing a AVL tree. Illustrate how insertions and deletions are performed in AVL trees by inserting the elements 8, 7, 3, 2, 1, 9, 6, 4 one after the other starting from an initially empty tree and construct AVL tree.

Unit - IV

4. a) What do you understand by Sequential Search and Binary Search? Explain keys and records.

   b) Explain Symbol Table and Dynamic Tree Table.

   c) What is meant by hashing? Can a perfect hash function be made? Justify your answer. Explain briefly the various methods used to resolve collision.

   d) Here is an array of 6 integers (unsorted) :

   3, 10, 5, 9, 13, 8, 12. Sort the list in ascending order using Bubble sort and Radix sort. Draw the array diagram for each iteration.

   OR

   i) Show under what order of input, the insertion sort will have worst-case and best-case situations for sorting the set {142, 543, 123, 65, 453, 879, 572, 434}.

   ii) Explain how Merge Sort sorts the following sequence of numbers using a diagram {142, 543, 123, 65, 453, 879, 572, 434}