Exam.Code:0921
Sub. Code: 33524

2125

B. E. (Information Technology), Third Semester

PC-IT-301: Data Structures

Time allowed: 3 Hours Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit. Show each step in the derivations. Direct solution to the problem will not be considered for awarding the marks. Start a fresh question from a fresh page only.

x-x-x

1. Write answer in brief? Show each step of derivation. Wherever possible use suitable example in support of your answer.

(a) Consider a hash table that uses the linear probing technique with the following hash function f(x) = (5x+4)%11. (The hash table is of size 11.) If we insert the values 3, 9, 2, 1, 14, 6 and 25 into the table, in that order, show where these values would end up in the table?

(b) Differentiate between the following data structures- Array, Queue, Stack, Linked List, binary Tree and B-tree using attributes: Access, Insertion, Deletion, and Search Time.

(c) Draw the complete undirected graph for the five vertices. Prove the number of edges in an n vertex graph is n (n – 1)/2.

(d) List at least 10 real life problems which can be solved using graphs.

(e) Differentiate between the following data structures- Array, Queue, Stack, Linked List, binary Tree and B-tree using attributes: Access, Insertion, Deletion, and Search Time.

(f) Find growth function for the following algorithm

```
Algorithm Sum(a[][],n,m)
{
  for i=1 to n do;
    for j=1 to m do
      s = s+a[i][j];
  return s;
}
```

(g) Write an algorithm which reverses the contents of a Linked list. You are also required to find/compute Time and Space complexity of defined algorithm.

(h) Let L**A** and L**B** are two single linked and their size are 20 and 30, respectively. Suppose one wants to keep 40 data in these lists. But in accessing the data problems are that when one makes a search for particular data if he/she does not find the data in list L**A** then goes into list L**B** in this fashion accessing of data being very slow. Suggest remedies for this problem.

(i) The value of 15 5 / 13 21 *+ is _____.

(j) What are two problems with arrays data structures? Discuss with the help of suitable example. **(10x1)**

P.T.O.

UNIT - I

2. (a) Suppose the following **Stack** of names is in memory, where **Stack** is allocated **n = 10** rooms:

TOP = 7

Stack: DON, RACHITA, MISTHI, TOM ALTER, NAFIZ, JEF, DONO MANN, _____, _____, _____.

Find output of the following codes:

(i) pop(Stack, Name1)
pop(Stack, Name2)
push(Stack, Name3)

(ii) Do while (TOP ≠ 0)
pop (Stack, Name)
[End of loop]

(b) What are two criteria usually used to measure algorithm's efficiency? Discuss. Design an algorithm that reads in **n** single digits and converts them into a single integer. For example, the algorithm should convert the set of 5 digits {2, 7, 4, 9 and 3} to the integer 27493. Finally implement the designed algorithm. **(2x5)**

3. (a) Suppose we have following list of months: January, February, March, April, May, June, July, August, September, October, November, and December. Create a linked structure to sort months in their alphabetical order.

(b) What is header linked list? Write methods to create and traverse a header linked list. **(2x5)**

4. Write a program that implements the list of employees of UIET Company. Write recursive methods that a method searches an employee record using binary search and another method to Sort the list of employees' record in alphabetical order. The attributes for a record may be

(i) Employee code (primary key)
(ii) Name
(iii) Father Name
(iv) Date of joining
(v) Date of retirement
(vi) Department

(10)

UNIT - II

5. (a) What is basic principle of Insertion sort? Discuss Insertion Sort algorithm. Verify the functionality of algorithm using dummy data set. You are also required to give its limitations?

(b) What is Binary Search tree? What are its limitations? Consider the following data set and draw the Binary Search Tree. Data Set: {34, 35, 37, 38, 39, 4, 32, 7, 8, 9, 26, 27, 28 10, 17, 20, 21, 22, 24, 25, 29, 31, 32, 33, 11, 12, 14, 15}. **(2x5)**

6. (a) A binary tree **T** has 9 nodes. The inorder and preorder traversals of **T** yield the following sequences of the nodes. Find the binary tree. Show each step clearly.

Inorder: 5, 1, 3, 11, 6, 8, 4, 2, 7

Preorder: 6, 1, 5, 11, 3, 4, 8, 7, 2

(b) What is binary heap? Build the max binary heap for the following data set by showing all the steps of derivation. Data Set:{ 332, 333, 33, 412, 13, 14, 17, 337, 338, 18, 19, 110, 111, 112, 114, 115, 117, 20, 221, 22, 224, 225, 26, 227, 228, 29, 331, 35, 339, 4 43}. **(2x5)**

7. **(a)** Discuss bread first search (BFS) algorithm. Traverse the network graph shown in Figure 1 using BFS algorithm. Start from node a.

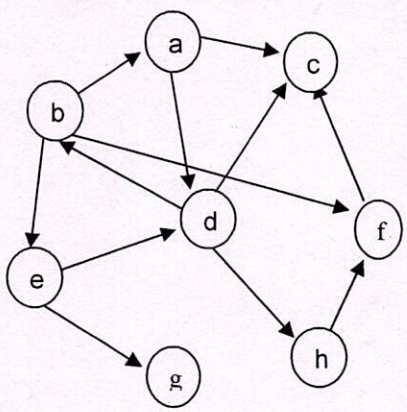

Figure 1. Network Graph

(b) What is spanning tree? Discuss Prim's algorithm and Find the Minimum Spanning tree for the graph show in Figure 2.

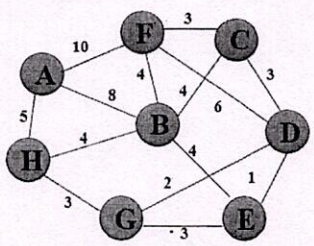

Figure 2. Network Graph

(2x5)

x-x-x