Exam.Code:0921
Sub. Code: 6474

2122

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 Part. Direct answer to a question will not be entertained for the award of marks. Start answer of fresh question from the 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. 10x1

(i) Prove that: $2n + 1 \leq 2^n$ for all $n \geq 3$

(ii) Write a function to delete a node from a circular queue.

(iii) Differentiate between AVL Tree and m-way Search Tree.

(iv) Generate a B+ -tree of order 3 by inserting 89, 77, 66, 44, 33, 22 and 11.

(v) If we apply Depth First Search Algorithm to traverse graph shown in Figure 1 then what will be final output. Assume a as initial vertex.

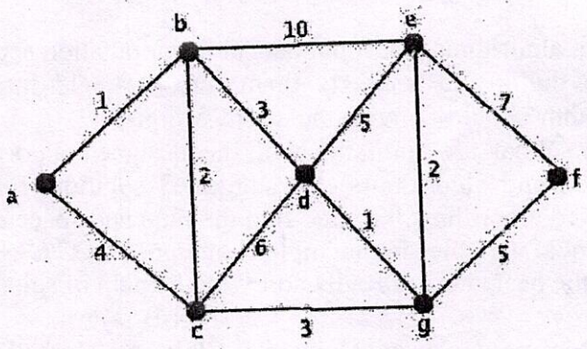

Figure 1. Network Graph

(vi) Consider the binary tree shown in Figure 2. What is output of Post order traversal algorithm this tree.

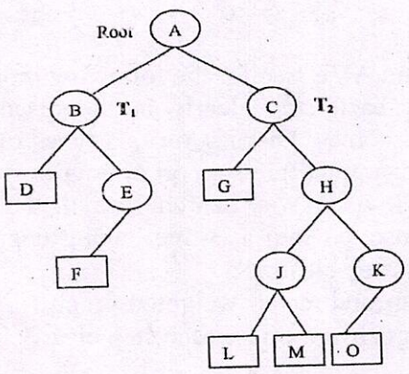

Figure 2. Binary tree

(vii) Find Euler Circuit for network graph shown in Figure 1.

(viii) Build AVL Tree for the data set: 14, 15, 16, 13, 12, 11, 10.

(ix) If we conduct a depth-first search of the graph starting with node a then what will be order of nodes in which they are visited?

(x) Find S(n) for the following algorithm. Consider 1 word memory for each declaration/storage.

```
Algorithm (A)
For i =1 to n
{
        For j=1 to n{
            R[i][j]=A[i][j]+B[i][j]
        }
}
```

P.T.O.

Part-A

2. (a) Write algorithm for deleting a desired node from the doubly linked list using abstract data type concept. Write a method to implement the designed algorithm. 2x5

(b) We want to update an item/record which is lying into a queue Q. Now question is whether it is possible to reconstruct the queue Q or not. Discuss. Write an algorithm for the said operation and find its time and space complexity. Write a method for implementing the developed algorithm using linked list data structure.

3. (a) Explain how to implement two stacks in one array A[1...n] in such a way that neither stack overflows unless the total number of elements in both stacks together is n. The PUSH and POP operations should run in O(1) time. 2x5

(b) What is simple linked list? Discuss all possible operations by giving appropriate algorithm of each. Wherever possible use appropriate example in support of your answer.

4. (a) Design algorithms (for input data and computation separately) which read 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. What are limitations of the designed algorithms? Suggest suitable solution and algorithm(s) for suggested solution. Finally implement all the designed algorithms. Further, find the time and space complexity. Note: do not use global variables in the implementation. Use C/C++. 2x5

(b) State the basic idea of Radix sort with the help of suitable example.

Part-B

5. (a) What is principle of Universal Class of Hash Functions? Use suitable example(s) in support of your answer. Also list advantages and disadvantages. 2x5

(b) What is heap? Construct Binary Heap tree for the following data set. Show each step clearly.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
97	88	95	66	55	95	48	60	45	48	55	62	77	25	38	18	40	38

6. (a) What is an AVL tree? Find AVL tree for the following input data- 3, 2, 1, 4, 5, 6, 7, 16, 15, 14. Show each step clearly in the discus. Why rotation is important factor for AVL-Trees. Discuss various types of rotation(s) used in AVL Tree. Use suitable example(s) in support of your answer. 6+2x2

(b) What is the basic principle of m-Way Search Tree? If the data keys- 1, 3, 12, 4, 25, 6, 18, 20, 8 are inserted into a B-tree having degree 5. What will be resulting tree? Show each step clearly.

(c) Consider the following an undirected weighted graph (Figure 3) and find its MST using Kruskal's algorithm. Show each step clearly in the discus.

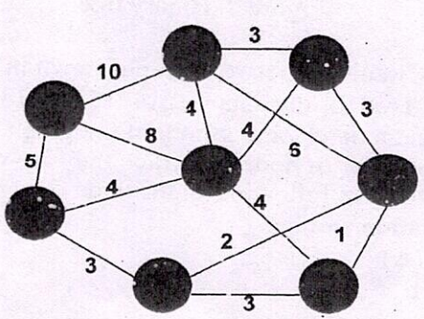

Figure 3. Network Graph

7. (a) What is Prim's Algorithm? Discuss. Given a connected graph with non-negative weights on the edges as shown in Figure 4. Find a spanning tree T for which the sum of the weights on the edges in T is as small as possible. Use discussed algorithm. 4+3x2

(b) A tree has 2n vertices of degree 1, 3n vertices of degree 2, and n vertices of degree 3. Determine the number of vertices and edges in the tree.

(c) Construct a b-Tree of degree for the data list shown in Question b(b). Show how much performance improved in comparison to Binary Heap Tree if data size is n.

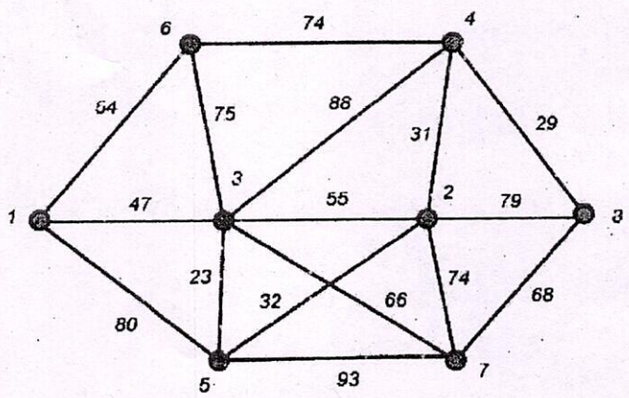

Figure 4. Graph

x-x-x