

CS104: Data Structures

Time: 3:00 Hours

Max. Marks: 40

Note: Answer any five questions. Write pseudo codes/C code for explaining algorithms. Assume suitable missing data, if any.

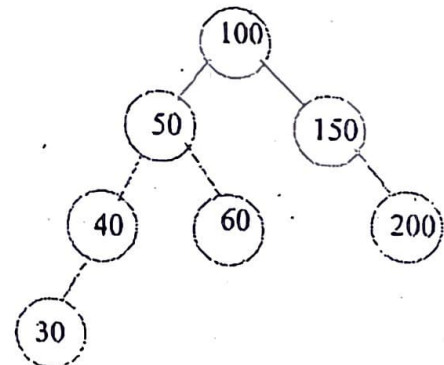
1. A program is to read a long text input having only lowercase alphabets. We need to count frequency of each alphabet and store it in a data structure so that at any point of time we can tell the character with highest frequency.
 - (a) Suggest a suitable data structure for this task and write following functions:
 - (b) UpdateFrequency(..., chr) to update increase frequency of character chr. This function can take other parameters also if needed.
 - (c) PrintHighestFrequency(...) to print character with highest frequency and its frequency count.

[2+3+3=8 marks]

2. Implement a stack using doubly linked list and write algorithms for following operations: CreateEmptyStack(), Push(), Pop(). Assume suitable return type and passed parameters.

[2+3+3=8 marks]

3. Consider following AVL tree:
 - (a) Show the AVL tree after inserting 10
 - (b) Show the AVL tree after inserting 180
 Consider given AVL tree as beginning point in both questions and show all intermediate trees (if any).

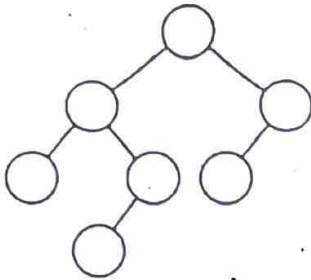


[4+4=8 marks]

4. Given an undirected connected graph $G(V,E)$, write an algorithm to display one path between vertex x to vertex y taking help of DFS graph traversal technique and print the path as $x \rightarrow p \rightarrow q \rightarrow \dots \rightarrow y$.

[8 marks]

5. (a) Label each node in the following binary tree with numbers from the set {2, 26, 10, 27, 20, 15, 42} so that it is legal Binary Search Tree.



- (b) Construct the binary tree that generated following In-order and Pre-order traversal results:
 In-order: A Q V N B R M S P
 Pre-order: B Q A V N R S M P

[4+4=8 marks]

6. Consider a hash table consisting of $M = 11$ slots, and suppose nonnegative integer key values are hashed into the table using the hash function $h1()$ written in C language:

```

int h1 (int key)
{
    int x = (key + 7) * (key + 7);
    x = x / 16;
    x = x + key;
    x = x % 11;
    return x;
}
  
```

Suppose that collisions are resolved by using linear probing. The integer key values [43, 23, 1, 0, 15, 31, 4, 7, 11, 3] are to be inserted, in the order given. Show the final hash table.

[8 marks]

7. (a) Describe the structure of a node in B-tree.
 (b) Describe how minimum and maximum number of keys/children in a B-tree node are decided in B-tree structure.

[4+4=8 marks]