

C343 Practice Midterm @ IUB

Note: real midterm will have more questions

1. Short answers.

- a) In github, a project database that stores the history and configuration of the project is called a _____. A _____ is a single point in the Git history (this word is often used by Git in the same places other revision control systems use the words “revision” or “version”). The command git _____ is used to upload a version to the github hosted remote repository.
- b) An abstract data type (ADT) can be implemented as _____ in Java, and a _____ is an implementation for ADT.

2. Determine the time complexity (in big-Theta) for the following code fragments. Assume doIt() and swap() takes an constant time. **Explain your answer briefly.**

```
a) for (i=1; i<=n; i++)
    doIt();

b) for (i=1; i<=n; i++) //n
    for (j=1; j<=m; j++) //m
        doIt();
```

...

3. Working with BST

- a) Draw the BST for a list of numbers given in this order: 30, 100, 40, 5, 10, 8, 4, 2, 3.
- b) Is this a balanced tree? Explain your answer.
- c) To search if 400 is in this BST or not, how many nodes in the tree will be visited? Explain your answer.
- d) Draw the BST after deleting the node with key value 5 from the above tree. Explain your deletion algorithm.

4. Given an alphabet {A, T, C, G} and the frequency of the letters [5, 10, 40, 45], show the following:

- a. Huffman tree.
- b. Huffman codes for this alphabet.
- c. The expected length in bits of a sequence containing n letters for this frequency distribution. Explain your answer briefly.

5. Coding and time complexity analysis [15 points]

- a. Complement a **method for finding the minimum number in a BST and a main function in the class to test your implementation**. The binary node class (BinNode), and parts of the BST class (BST) are given. You **ONLY** need to complete the function **findMinHelp** (6 points) and the **main function** (6 points).

```
public class BinNode {
    private int value;
    private BinNode left, right;
    public BinNode(int e) {
        value = e; left = right = null;
    }
    public int getValue() { return value; }
    public BinNode getLeft() { return left; }
    public BinNode getRight() { return right; }
}
public class BST {
    private BinNode root; //the root node of the BST
    public BST(int[] nums) {
        //build a BST from an input array of integers
    }
    public int findMin() {
        return findMinHelp(root);
    }
    public int findMinHelp(BinNode anode) {

    }

    //implement your main function here

}
}
```

- b) Show the time complexity of **findMin** in terms of the total number of nodes (n), in the average case and the worst case. **Explain your answer.**

6. Problem solving.

You are given a collection of records of 1 million twitter users. For each user, you have the name of the user, the total number of his/her followers, and all her/his messages. You are asked to analyze the records and output the top 100 users who are most followed. Please describe an algorithm for solving the problem. Show what data structure you will use, and the time complexity of your algorithm.