## **COMP 258: Assignment 2 Weight: 10% Due Date: January 29**

Name:

**Instructions:** Provide all answers to questions in this document. Submit the document in the provided drop box on Brightspace. The test is marked out of 40.

**Question 1**

In your own words describe the advantages of generic data structures over non-generic data structures. (5 Marks)

Generic data structures are more flexible and generally easier to understand than non-generic data structures.

**Question 2**

**a)**

Given the following list of numbers: 50, 25, 75, 13, 33, 60, 88, 7, 19, 80, 101.

Create a graphic displaying the tree these numbers were inserted into a binary search tree in the order above. Insert the graphic into this document. (5 Marks)

**Diagram

Description automatically generated**

**b)**

Do you consider the tree to be an efficiently structured tree? If yes, provide a sequence that would create an inefficiently structured tree. If no, provide a sequence that would create an efficiently structured tree. (5 Marks)

A sequence that would create an inefficiently structured tree: 1, 2, 3, 4, 5, 6, 55, 43, 45, 13, 11.

**Question 3**

**a)**

Describe the two features required for a recursive method. When does a recursive method behave like an infinite loop? (5 Marks)

1. Base case: A base case is the stopping condition for the recursion. It defines when the recursion should end and prevent it from continuing indefinitely.
2. Recursive case: A recursive case is the logic for breaking down the problem into smaller sub-problems. The method calls itself with smaller input until the base case is reached.

When there is no well-defined base case or a base case is not been reached.

**b)**

The Fibonacci numbers are the numbers in the following integer sequence.  
0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, ……..

In mathematical terms, the sequence Fn of Fibonacci numbers is defined by the recurrence relation

Fn = Fn-1 + Fn-2

with starting values always being

F0 = 0 and F1 = 1.

Write a recursive method: int fib(int n), that prints the numbers in the sequence and returns Fn.

For example fib(12) would return 144. (10 Marks)

Graphical user interface, text, application

Description automatically generated

**Question 4**

Write a recursive method in your Tree class called findMax. It will return the largest object in your tree. (10 Marks)

public int findMax() {

return findMax(root);

}

private int findMax(TreeNode node) {

if (node == null) {

return Integer.MIN\_VALUE;

}

int max = (Integer)node.data;

max = Math.max(max, findMax(node.left));

max = Math.max(max, findMax(node.right));

return max;

}