Lab Quiz 4

Q1

Q1 (40 points; 10 points per part): Study the following code to answer the question below

```
class BinaryTreeNode[A](var value: A, var left: BinaryTreeNode[A], var right:
BinaryTreeNode[A]) {}

def preOrderTraversal[A](node: BinaryTreeNode[A], f: A => Unit): Unit = {
 if (node != null) {
   f(node.value)
   preOrderTraversal(node.left, f)
   preOrderTraversal(node.right, f)
 }
}

def inOrderTraversal[A](node: BinaryTreeNode[A], f: A => Unit): Unit = {
 if (node != null) {
   inOrderTraversal(node.left, f)
   f(node.value)
   inOrderTraversal(node.right, f)
 }
}

def postOrderTraversal[A](node: BinaryTreeNode[A], f: A => Unit): Unit = {
 if (node != null) {
   postOrderTraversal(node.left, f)
   postOrderTraversal(node.right, f)
   f(node.value)
 }
}

def q1(): Unit = {
 val root = new BinaryTreeNode[Int](19, null, null)
 root.left = new BinaryTreeNode[Int](-32, null, null)
 root.right = new BinaryTreeNode[Int](6, null, null)
 root.left.right = new BinaryTreeNode[Int](8, null, null)
 root.right.left = new BinaryTreeNode[Int](83, null, null)
 root.right.right = new BinaryTreeNode[Int](-2, null, null)
 root.right.right.right = new BinaryTreeNode[Int](5, null, null)

 preOrderTraversal(root, println)
 inOrderTraversal(root, println)
 postOrderTraversal(root, println)
}
```

a) Draw the tree created by running q1()

b) Write the pre-order traversal of the tree (`preOrderTraversal(root, println)`)

c) Write the in-order traversal of the tree (`inOrderTraversal(root, println)`)

d) Write the post-order traversal of the tree (`postOrderTraversal(root, println)`)

Q2

Q2 (20 points): Study the following code to answer the question below

```
class BinarySearchTree[A](comparator: (A, A) => Boolean) {

 var root: BinaryTreeNode[A] = null

 def insert(a: A): Unit = {
   if(this.root == null){
     this.root = new BinaryTreeNode(a, null, null)
   }else{
     insertHelper(a, this.root)
   }
 }

 def insertHelper(a: A, node: BinaryTreeNode[A]): Unit = {
   if(comparator(node.value, a)){
     if(node.right == null){
       node.right = new BinaryTreeNode[A](a, null, null)
     }else{
       insertHelper(a, node.right)
     }
   }else{
     if(node.left == null){
       node.left = new BinaryTreeNode[A](a, null, null)
     }else{
       insertHelper(a, node.left)
     }
   }
 }

}

def q2(): Unit = {

 val comp = (a: Int, b: Int) => a < b

 val bst = new BinarySearchTree[Int](comp)

 bst.insert(-8)
 bst.insert(11)
 bst.insert(-7)
 bst.insert(8)
 bst.insert(-6)
 bst.insert(1)
 bst.insert(12)
 bst.insert(-10)
}
```

Draw the Binary Search Tree created when q2() is called

Q3

Q3 (20 points):

Write the following infix expression using postfix notation

```
4 + 5 * (3 + 1 - 2) - 20 / 2
```

Q4

Q4 (20 points): Study the following code to answer the question below

```
class BinaryTreeNode[A](var value: A, var left: BinaryTreeNode[A], var right:
BinaryTreeNode[A]) {

 def compute(func: (Int, A, Int) => Int): Int = {
   val leftResult = if (this.left != null) this.left.compute(func) else 1
   val rightResult = if (this.right != null) this.right.compute(func) else 1
   func(leftResult, this.value, rightResult)
 }

}

def q4(): Unit = {
 val root = new BinaryTreeNode[Int](8, null, null)
 root.left = new BinaryTreeNode[Int](3, null, null)
 root.right = new BinaryTreeNode[Int](15, null, null)
 root.left.right = new BinaryTreeNode[Int](-5, null, null)
 root.right.left = new BinaryTreeNode[Int](11, null, null)
 root.right.right = new BinaryTreeNode[Int](7, null, null)

 val customFunction = (a:Int, b:Int, c:Int) => a + 3 * b - c

 println(root.compute(customFunction))
}
```

What is printed by the last line of q4()?