UBIT: ____________@buffalo.edu CSE116 - Fall 2019

Name: ___________________________ Level 4 Quiz

Q1. First-Order Functions [15 points]

```
def selectionSort[T](inputData: List[T], comparator: (T, T) => Boolean): List[T] = {
  var data: List[T] = inputData
  for (i <- data.indices) {
    var minFound = data.apply(i)
    var minIndex = i
    for (j <- i until data.size) {
      val currentValue = data.apply(j)
      if (comparator(currentValue, minFound)) {
        minFound = currentValue
        minIndex = j
      }
    }
    data = data.updated(minIndex, data.apply(i))
    data = data.updated(i, minFound)
  }
  data
}


def q1(): Unit = {
  var data = List(7, 1, -9, -4, 6, -3)
  val comparator = (a: Int, b: Int) => Math.abs(a) < Math.abs(b)
  data = selectionSort(data, comparator)

  println(data)
}
```

What is printed to the screen when the method q1() is called?

Continue on back

Q2. Linked-Lists [15 points]

```
class LinkedListNode[A](var value: A, var next: LinkedListNode[A]) {

  def append(a: A): Unit = {
    if (this.next != null) {
      this.next.append(a)
    } else {
      this.next = new LinkedListNode[A](a, null)
    }
  }

  def q2method(f: A => Boolean): Int = {
    var value = 0
    if (f(this.value)) {
      value = 2
    }
    if (this.next == null) {
      value
    } else {
      value + this.next.q2method(f)
    }
  }
}


def q2(): Unit = {
  val x = new LinkedListNode[Int](1, null)
  x.append(3)
  x.append(5)
  x.append(6)
  x.append(9)

  val f: Int => Boolean = (a: Int) => a < 8 && a > 2
  val result = x.q2method(f)

  println(result)
}
```

Draw the linked-list that is created when the method q2() is called.

What is printed to the screen when the method q2() method is called?

Q3. Trees and Traversals [10 points]

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

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

def q3(): 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)
}
```

Draw the tree that is created when the method q3() is called.

What is printed to the screen when the method q3() method is called?

Continue on back

Q4. Binary Search Tree [10 points]

```
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 q4(): Unit = {
  val comp = (a: Int, b: Int) => a < b
  val bst = new BinarySearchTree[Int](comp)
  bst.insert(-8)
  bst.insert(-7)
  bst.insert(-6)
  bst.insert(1)
  bst.insert(12)
  bst.insert(-10)
  inOrderTraversal(bst.root, println)
}
```

Draw the tree that is created when the method q4() is called.

What is printed to the screen when the method q4() method is called?