# ICS 211 Spring 2015 Exam 2, April 13th, 2014

Clearly write your name on both the **back** and **front** of this exam.

This exam is closed-book. No calculators are allowed. There are a total of 100 points.

Be sure to answer all parts of each question.

**Question 1** (10 points): Write a **recursive** method **even** that takes as a parameter a **LinkedNode<E>** and returns a **boolean**. If the parameter is null or refers to a linked list of even length, the method should return **true**. Otherwise the method should return **false**.

**Question 2** (10 points): Write the **Stack<E>** interface.

**Question 3** (10 points): Implement the following method.

**public class ArrayStack<E> implements StackInterface<E> {**

**private int top;**

**private E[] array;**

**public E pop() throws EmptyStackException {**

**Question 4** (20 points): Implement this method to perform a binary search. If the value is found, the method returns the index of the value, otherwise the method returns -1. The array **data** is sorted in ascending order.

**static int binarySearch(java.lang.Comparable value, Object[] data) {**

**Question 5** (10 points): Write the **Queue<E>** interface.

**Question 6** (10 points): Implement the following method:

**public class LinkedQueue<E> implements Queue211<E> {**

**private LinkedNode<E> front;**

**private LinkedNode<E> rear;**

**public boolean offer(E e) {**

**Question 7** (5 points): Which of the following is a preorder traversal of a binary tree?

1. Visit root node, traverse TR, traverse TL
2. Traverse TL, traverse TR, visit root node
3. Visit root node, traverse TL, traverse TR
4. Traverse TL, visit root node, traverse TR

**Question 8** (5 points): What is the worst-case runtime of binary search on a sorted array of *n* items.

**Question 9** (5 points): Fill in the blank for both of these sentences.

The node at the top of a tree is called its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Nodes that have the same parent are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Question 10** (5 points): A double-linked list requires the same amount of storage as that of a single-linked list.

True or False (circle one)

**Question 11** (10 points): Implement an in-order traversal of the following binary tree. Print the node values to System.out. You may use a helper method.

**public class BinaryTree<E> {**

**private E[] treeData;**

**…**

**public void printInOrder() {**

**// your code**

**}**