CSCI 132: Basic Data Structures and Algorithms

Final Study Guide

Logistics

- Monday, May 8th @ **2:00 PM – 3:50 PM** in Norm Asbjornson Hall 165
- Time length: 110 minutes. This exam is designed to be completed in 60-75 minutes.
- Open notes. You are allowed to use your laptop, your IDE, any notes, slides, lecture examples. This exam can be completed without a laptop.
- You are NOT allowed to use the internet to access external resources (Google, Stack Overflow, W3 Schools, etc)
- The midterm exam will consist of different types of question, such as:
    - Multiple choice questions
    - True/False
    - Short answer
    - Illustrate the steps of ____ sort
    - What does the stack/queue look like after X operations?
    - Complete the line of code so that X happens.
    - What does this (recursive) method do?

Content

The following topics are all fair game for the midterm exam.

- Basic Java Classes, Class Structure, Methods, Operations, if statements, loops, OOP
- Basic Linked Lists
- Big-O Notation, How to determine running time of an algorithm
- Stacks
- Queues
- Bubble Sort
- Selection Sort
- Merge Sort
- Quick Sort
- Linear Search/Binary Search
- Recursion

Sample Exam Questions

1. What is the running time of adding a new element to a stack?
    a. O(1)
    b. O(N)
    c. $O(N^2)$
    d. O(logn)

2. How does Merge Sort achieve O(nlogn) running time?

3. True/False: The Binary Search algorithm only works on a sorted dataset.

4. Consider the following code:

```
Queue<String> queue = new LinkedList<String>();
queue.add("Blue");
queue.add("Red");
queue.add("Yellow");
System.out.println(queue.remove());
queue.add("Green");
queue.add("Purple");
System.out.println(queue.peek());
queue.remove();
queue.add("Orange");
System.out.println(queue.remove());
```

I. What is the output of the code above?

II. What is the running time of the code above?

III. Illustrate the current contents of the Queue after the code finishes.

Front of queue Back of Queue

5. Given the following unsorted array:

10	6	21	14	1	3	5

Suppose you are running **selection sort** to sort this array of integers. Selection sort consists of several iterations across the array. Illustrate the steps of selection sort for each iteration until the array is sorted

Iteration 1

Iteration 2

Iteration 3

Iteration 4

Iteration 5

Iteration 6

Iteration 7

6. The table below lists the big-O running times of certain operations. Fill in the missing spots of the table with the correct running time.

Linear Search	
Quick Sort	$O(n^2)$
Binary Search	
Popping an element from the Stack	
Printing out a linked list using recursion	O(n)

7. Suppose you want to create your own Stack data structure class, but you need to decide if you should use an Array or a Linked List. In general, when should you use an array vs a LinkedList as an underlying data structure for a stack?

8. What is a stack overflow?

9. True/False: It doesn't matter what sorting algorithm I use; they all do the same thing in the end.