**CSCI 132**: Basic Data Structures and Algorithms

Final Exam Study Guide

**Logistics (10% of your final grade)**

* Monday, May 5th @ **2:00 PM – 3:50 PM** in Norm Asbjornson Hall 166
* 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, and java documentation.
* Final Exam will be in the form of a D2L/Brightspace Quiz.
* 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

**Content**

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

* Arrays
* Linked Lists
* Big-O Notation, How to determine running time of an algorithm
* Stacks
* Queues
* Priority Queues
* Bubble Sort
* Selection Sort
* Merge Sort
* Quick Sort
* Other Sorting Algorithms
* Linear Search/Binary Search
* Recursion
* Java Generics
* Software Testing
* OOP Principles

Sample Exam Questions

1. What is the running time of adding a new element to a stack?
   1. O(1)
   2. O(N)
   3. O(N2)
   4. O(logn)
2. How does Merge Sort achieve O(nlogn) running time?
   1. By using recursion.
   2. By splitting our array in half in each recursive call, which requires half the amount of work
   3. By checking each element only once
   4. By only having no for loops
3. True/False: The Binary Search algorithm only works on a sorted dataset.
4. Consider the following code that uses a FIFIO queue:

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());

1. What is the output of the code above?
   1. Yellow Purple Orange
   2. Blue Red Green
   3. Blue Red Yellow
   4. Green Purple Orange
2. What is the running time of the code above?
   1. O(1)
   2. O(n)
   3. O(n^2)
   4. O(nlogn)
3. 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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |

1. For each algorithm, provide the running time.

|  |  |
| --- | --- |
| Linear Search |  |
| Quick Sort |  |
| Binary Search |  |
| Popping an element from the Stack |  |
| Printing out a linked list using recursion |  |

1. 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?
   1. You should use an array when you need fast insert time
   2. If the amount of data is known ahead of time, one should use an array
   3. An array cannot be used for a stack
   4. If the Stack is holding objects, a Linked list is better
2. What is a stack overflow?
3. True/False: It doesn’t matter what sorting algorithm I use; they all do the same thing in the end.
4. What is a unit test?