

# CSCI 132: Basic Data Structures and Algorithms

## Final Exam Study Guide

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

- Monday, May 5<sup>th</sup> @ **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?
  - a.  $O(1)$
  - b.  $O(N)$
  - c.  $O(N^2)$
  - d.  $O(\log n)$
2. How does Merge Sort achieve  $O(n \log n)$  running time?
  - a. By using recursion.
  - b. By splitting our array in half in each recursive call, which requires half the amount of work
  - c. By checking each element only once
  - d. 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 FIFO 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());
```

5. What is the output of the code above?
- a. Yellow Purple Orange
  - b. Blue Red Green
  - c. Blue Red Yellow
  - d. Green Purple Orange
6. What is the running time of the code above?
- a.  $O(1)$
  - b.  $O(n)$
  - c.  $O(n^2)$
  - d.  $O(n \log n)$

7. Given the following unsorted array:

10	6	21	14	1	3	5
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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

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Iteration 2

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Iteration 3

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Iteration 4

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Iteration 5

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Iteration 6

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Iteration 7

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8. 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	

9. 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?

- a. You should use an array when you need fast insert time
- b. If the amount of data is known ahead of time, one should use an array
- c. An array cannot be used for a stack
- d. If the Stack is holding objects, a Linked list is better

10. What is a stack overflow?

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

12. What is a unit test?