

CSCI 132: Basic Data Structures and Algorithms

Midterm Study Guide

Logistics

- Wednesday, March 6th @ 3:10 PM in Norm Asbjornson Hall 165
- Time length: 50 minutes. We will try to start the exam at 3:05 .This exam is designed to be completed in 40 minutes (hopefully).
- Open notes. You are allowed to use your laptop, your IDE, any notes, slides, lecture examples, lecture recordings. 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
 - What is wrong with this code?
 - What is the difference between X and Y
 - Write some code so that X happens.

Content

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

- Basic Java Classes, OOP
- Operations and variables
- Methods
- If statements
- Loops
- Arrays
- Inheritance
- References
- Static Methods
- Abstract Classes, Interfaces
- Polymorphism
- ArrayLists
- LinkedLists (Singly, Doubly, Circular)
- Growth Rates
- Big-O Notation, How to determine theoretical running time of an algorithm

Sample Exam Questions

1. Consider the following Java Class

```
public class Duck {  
    private String name;  
    public Duck() {  
        this.name = n;  
    }  
}
```

- What does the **private** keyword mean?
- Consider the following line of code in a demo class:

```
Duck don = new Duck("Donald");
```

This line of code results in an error. Why is this error occurring?

- Rewrite the constructor below so that the line of code from part B work correctly

2. What is an **interface** in Java?

3. What will the following code print out?

```
int myArray[] = {1, 2, 3, 4, 5};  
for(int i = 0; i < myArray.length - 1; i++) {  
    System.out.println(myArray[i+1] * 2 );  
}
```

4. True/False. To add a node to the very end of a doubly linked list, we must traverse the entire linked list first.
5. The code below prints out an N x N multiplication table.

```
public void print_table(int n) {  
    for (int i =1; i <= n; i++){  
        for (int b=1; b <= n; b++){  
            System.out.print(i*b + " ");  
        }  
        System.out.println();  
    }  
}
```

- a. For each instruction in the function, clearly mark/label the running time of that operation.
 - b. What is the total running time (in Big-O) of this function?
6. What is the running time of printing out a Circular Linked List?
 - a. $O(1)$
 - b. $O(N)$
 - c. $O(N^2)$
 - d. $O(X^N)$
7. What is the difference between an Array, and an ArrayList?

8. Consider this basic Node class that is used in a circular linked list.

```
public class Node {  
    private String name;  
    private Node next;  
    private Node prev;  
    public Node(String c) {  
        this.name = c;  
        this.next = null;  
        this.prev = null;  
    }  
    public Node getNext() {  
        return this.next;  
    }  
    public Node getPrev() {  
        return this.prev;  
    }  
    public void setNext(Node newNode) {  
        this.next = newNode;  
    }  
    public void setPrev(Node newNode) {  
        this.prev = newNode;  
    }  
}
```

- a. A new node needs to be inserted into the circular linked list before the head. Supply the code below so that a new node (`newNode`) will get added. You can assume that the circular linked list has at least 1 node already in it. The linked list class does keep track of the `head` node, and `tail` node.

```
public void addBeforeHead(Node newNode){
```

```
}
```

- b. What is the running time of your algorithm from part A (You must state your answer in Big-O notation)