Topics

- Exam I stuff, plus...

- Loops
  - Understand the difference between a counter-controlled condition and a sentinel condition, and which loop is usually appropriate.
  - Be able to trace a given while-loop, for-loop, or do-while loop, and determine the outcome.
  - Be able to write a loop (possibly nesting other loops) to solve a given problem.
  - (Good practice to review the code to determine if a number is prime.)

- Collections
  - Without being prompted, understand when to model problems using 1D arrays, 2D arrays, ArrayLists, or HashMaps.
  - Be familiar with the methods provided for manipulating ArrayLists and HashMaps.
  - Be ready to write methods using loops to work with 1D and 2D arrays.
  - Be able to read and write code involving the use of ArrayLists and HashMaps.

- User Input and Strings
  - Given the API, know how to manipulate Strings for various purposes.
  - Know how to parse (or tokenize) Strings using the split(…) method, and understand when you would need to tokenize Strings.
  - Know how to obtain user input from the terminal using the Scanner class.

- Defensive Programming
  - Given a piece of code, be able to identify “edge cases” that could present a runtime error (e.g., negative inputs when you don’t expect them, a null being input for an object, or an illegal index given for an array).
  - Unless instructed to ignore edge cases, you are expected to program defensively on the exam.

- Miscellanea
  - Wrapper classes and auto-boxing
  - It is important that you’re able to read code and be able to quickly summarize and/or apply it where necessary.
  - Be familiar with classes you worked on in your homework and lab assignments, including GuessingGame, ComboGuesser, etc. For instance, you may be asked to add a new functionality to an old assignment (provided the code to the old assignment).
  - Understand how use other classes to solve problems-at-hand when given only the API (e.g., what you had to do for TweetProcessor)
Practice Problems

1. While loops have the same expressive power as for loops (i.e., can be used interchangeably).
   
   TRUE / FALSE
   Explain:

2. Private methods can only be called by methods within the same class, which is why they are not very useful in practice.
   
   TRUE / FALSE
   Explain:

3. **Explain why the following code prints 0.

   ```java
   ArrayList<Integer> A = new ArrayList<Integer>(100); // create 100 elements?
   System.out.println(A.size());
   ```

4. What is a “wrapper class?” What is its purpose?
5. Define a class called `Point` that represents an \((x, y)\) pair of integers. For full credit, your class must have a two-argument constructor, getters for retrieving \(x\) and \(y\) values, a `toString()` method, and an `equals()` method for comparing instances of `Point` as shown below. (Two instances are equal if their \(x\) coordinates are equal, as are their \(y\) coordinates.)

```java
> Point p = new Point(5, -3);
> p.toString()
"(5, -3)" (String)

> p.getX()
5 (int)

> p.getY()
-3 (int)

> Point z = new Point(5, -3);
> p.equals(z)
true (boolean)
```

6. Next, define a class called `PointCollection`, which stores an `ArrayList` of `Point` objects. Implement the following methods:

- public void `insertInPlace(Point p)` — inserts the given `Point` into the collection. It must be inserted in such a way that the collection of points is sorted in ascending order of the \(x\) value.
- public boolean `notExists(Point p)` — returns true if the given point is not found in the collection, and false otherwise.
- public String `toString()` — returns a String representing the collection of points.

```java
> PointCollection list = new PointCollection();
> list.insertInPlace(new Point(0, 0));
> list.insertInPlace(new Point(-5, 2));
> list.insertInPlace(new Point(2, 3));
> list.insertInPlace(new Point(-2, -9));

> list.toString()
"(-5,2), (-2,-9), (0,0), (2,3)" (String)

> list.notExists(new Point(0, 0))
false (boolean)
```
7. Consider the method below:

```java
public void mystery(int x) {
    Circle c;
    for(int i=x; i > 0; i -= 1) {
        c = new Circle();
        c.changeSize(i*20);
        if (i % 2 == 0) {
            c.changeColor("red");
        } else {
            c.changeColor("blue");
        }
        c.makeVisible();
    }
}
```

(a) What does this method do if passed a zero when invoked?

(b) What does this method do if passed a three when invoked?

(c) Describe what the method does. (To get in the right frame of mind, think about what you’d write as a comment for this method.)
8. ** Write a method that inputs two int values \(a\) and \(b\). The method should return \(a^b = a \times a \times a \times \ldots\) \((b\ \text{times})\). You may assume \(a \geq 0\) and \(b \geq 0\).

9. ** Write a method that accepts an integer, then print out all positive odd numbers less than or equal to that integer. For instance, if 6 was input, then print 1, 3, 5.

10. ** The Fibonacci Sequence starts off with 0, followed by 1. The next number is always the sum of the two previous numbers. Therefore, the first 6 Fibonacci numbers in the sequence is: 0, 1, 1, 2, 3, 5. Write a method called void fib(int \(n\)) that prints the first \(n\) Fibonacci numbers.
11. Consider the method defined below. Explain what it does using a few brief sentences.

```java
public int mystery(int[] A, int B) {
    int x = 0;
    for (int i = 0; i < A.length; i++)
        if (A[i] < B) { 
            x++;
        }
    return x;
}
```

12. **Consider the method defined below. Explain what it does using a few brief sentences.

```java
public boolean mystery(int[] A) {
    for (int i = 0; i < A.length; i++)
        for (int j = i+1; j < A.length; j++)
            if (A[i] == A[j]) {
                return true;
            }
    return false;
}
```
13. **Consider the method defined below. Explain what it does using a few brief sentences.**

```java
public boolean mystery(int[][] A)
{
    for (int i = 0; i < A.length; i++)
    {
        for (int j = 0; j < A[i].length; j++)
        {
            if (A[i][j] < 0)
            {
                return false;
            }
        }
    }
    return true;
}
```

14. **Consider the method defined below. What is the output when mystery("john doe") is called?**

```java
public String mystery(String name)
{
    String[] name_tokens = name.split(" ");

    String ret = name_tokens[1].substring(0, 1).toUpperCase() + name_tokens[1].substring(1, name_tokens[1].length()).toLowerCase() + ", " + name_tokens[0].substring(0, 1).toUpperCase();

    return ret;
}
```
15. Write a method public int findLargest(int[][] A) that returns the largest number found in the given 2D array. You may assume that A is not null and is of a square shape. Consider the following usage:

```java
int[][] table = {
    {32,10,3},
    {56,54,69},
    {32,83,49},
};
System.out.println(findLargest(table));
> 83
```

16. Write a method public int maxRow(int[][] A) that returns the row number that has the maximum sum. You may assume that A is not null and is of a square shape. Consider the following usage:

```java
int[][] table = {
    {32,10,3},
    {56,54,69},
    {32,83,49},
};
System.out.println(maxRow(table));
> 1

int[][] table2 = {
    {32,10,3},
    {-56,-54,-69},
    {-32,-83,-49},
};
System.out.println(maxRow(table2));
> 0
```
17. **Consider the Notebook class below. The constructor has not been provided.**

(a) Write the default constructor, which creates an empty collection of notes.

(b) Write a new Notebook method called countNotesContaining(..) that takes a String as argument, and returns the number of notes in the notebook that contain the specified string.

(c) Write a new Notebook method called getNotesContaining(..) that takes a String as argument, and returns an array list of notes in the notebook that contain the specified string.

(d) Write a new method called countWords(..) that counts the total number of words in all the stored notes.

```java
public class Notebook {
    // Storage for an arbitrary number of notes.
    private ArrayList<String> notes;

    public void storeNote(String n) {
        this.notes.add(n);
    }

    // other methods not shown
}
```

Here is the expected result in codepad:

```java
Notebook nb = new Notebook();
b. storeNote("Java is lots of fun");
b. storeNote("Exams are fun too");
b. storeNote("I like donuts");
b. countNotesContaining("fun") > 2  (int)
b. countNotesContaining("o") > 3  (int)
b. countWords() > 12  (int)
ArrayList<String> results = nb.getNotesContaining("fun");
for (int i = 0; i < results.size(); i++) {
    System.out.println(results.get(i));
}
> Java is lots of fun
> Exams are fun too
```