1. 1D Arrays

You have an array of length $N$ with the numbers $0$ to $N-1$ in a random order. Let's say $N = 6$ and the array looks like this:

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Where the indices are written above and the values of those indices in the array are in the table.

You want to trace your way around the array by going to the index of the value at each index until you get back to the start.

For example, let's say you start at index 0.

At index 0. Value at $arr[0]$ is 5. Go to index 5.
At index 5. Value at $arr[5]$ is 2. Go to index 2.
At index 3. Value at $arr[3]$ is 0. Go to index 0.

As we can see it took 4 steps to get back to index 0.

Write a method:

```java
private int cycleLength(int[] arr, int startIndex)
```

which given an array of integers 0 to $N-1$, and a starting index, computes the number of steps until you return back to the start.

2. String Processing

Query parameters are a way of putting information in your URLs. I Googled 'query parameters' to find more information about them. Here was the URL the Google generated.

http://www.google.com/search?sourceid=chrome&ie=UTF-8&q=query+parameters
As you can see, Google is storing some information here. What it is saying is that I made the search from a chrome browser, my text input encoding was UTF-8, and my search was 'query parameters.'

More generally, query parameters in urls have the form

\[http://website.com/?KEY1=VALUE1&KEY2=VALUE2…\]

Write a method

`HashMap<String, String> getQueryParameters(String url)`

which puts all of the query parameters into a Map. And then another method

`void PrintQueryParameters(HashMap<String,String> map)`

that prints this information. For the example above the output should be

sourceid: chrome
ie: UTF-8
q: query parameters

Or an example from Facebook

\[http://graph.facebook.com/search?q=watermelon&type=post\]

q: watermelon
type: post

So you work at Facebook/Google and you need to write these functions ASAP!

Note: The + sign usually indicates spaces.

3. 2D Arrays

Breaking news: The CS106A test is now an all multiple choice scantron test. However, the one issue is, we don't have the program that grades them. It's your job to write it.

Given a 2D array of scantron answers, where the first row is the solutions, and the proceeding rows are the answers for each student write a method

`private int[] grade(char[][] grid)`

which returns an int array of the scores for each student.
4. Graphics Programs and Mouse Events

(Problem Idea from section leader Zach Galant)

We are going to make the best circle clicking game ever. So here is the game: You draw a circle initialized at a random spot fully on the canvas. Then when you receive a click, you animate the circle toward the spot of the click. However, if the player clicks again, you change the direction of the circle to move towards the new click. The end result is a game where you get the circle chasing your mouse.

Extension: If the circle reaches the next spot, the game is over, and the circle should stop.

Assume you have constants given for the circle diameter (DIAMETER), a pause time (PAUSE_TIME), and the number of time steps (NUM_STEPS) it should take for the circle to reach the next point. There is also an error (ERROR) range, that if the circle center is within that distance of the next point, you should stop.
5. Data Structures and Large Program Design

We will write Microsoft Office 1995. In this example we will build up a simple email-like application that allows you to send messages, and view messages in your inbox.

Challenges in this problem:
- Choosing the data structures
- Setting up the necessary interactors
- Linking the interactors with methods
- Writing classes to manage all of the information

This problem encompasses aspects from all parts of the class
- Classes
- Data Structures
- Design
- Interactors
- Event handling
- String manipulation
- File reading

(Note: These are not real emails between Mehran and Mark Zuckerberg)