CS 106A
Summer 2013

Handout 14
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# Simple Java Problems

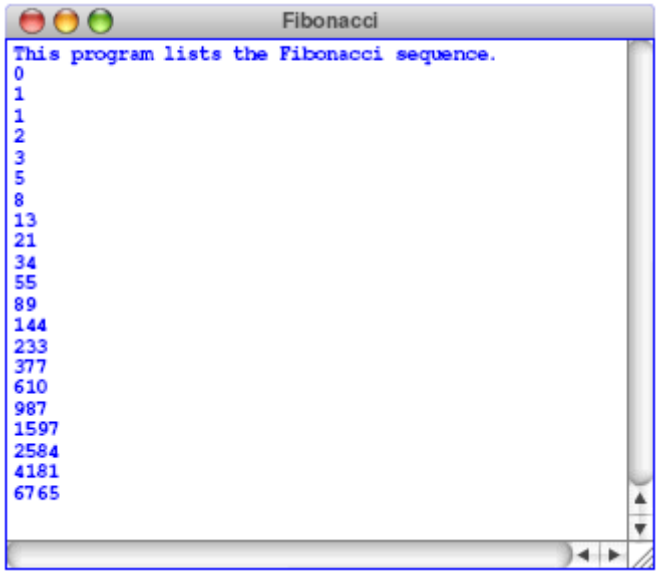
Portions of this handout by Eric Roberts

## 1. The Fibonacci sequence

In the 13th century, the Italian mathematician Leonardo Fibonacci—as a way to explain the geometic growth of a population of rabbits—devised a mathematical sequence that now bears his name. The first two terms in this sequence, **Fib**(0) and **Fib**(1), are 0 and 1, and every subsequent term is the sum of the preceding two. Thus, the first several terms in the Fibonacci sequence look like this:

| | | | |
|---|---|---|---|
| **Fib**(0) | = | 0 | |
| **Fib**(1) | = | 1 | |
| **Fib**(2) | = | 1 | (0 + 1) |
| **Fib**(3) | = | 2 | (1 + 1) |
| **Fib**(4) | = | 3 | (1 + 2) |
| **Fib**(5) | = | 5 | (2 + 3) |

Write a program that displays the terms in the Fibonacci sequence, starting with **Fib**(0) and continuing as long as the terms are less than 10,000. Thus, your program should produce the following sample run:




This program continues as long as the value of the term is less than the maximum value, so that the loop construct you need is a **while**, presumably with a header line that looks like this:

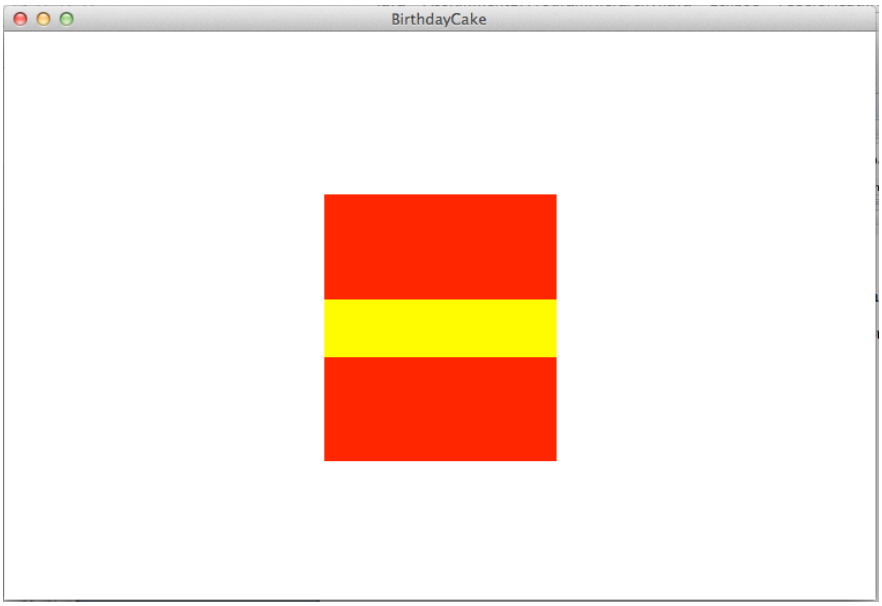
```
while (term < MAX_TERM_VALUE)
```

Note that the maximum term value should be specified using a named constant.

**2. Birthday Cake**

It's your friend's birthday, and you promised that you'd make her a cake. Unfortunately for your friend, you are a better programmer than baker, so you decide to program a digital greeting card instead of busting out the flour.

You decide to make a three-layer cake that looks something like this:



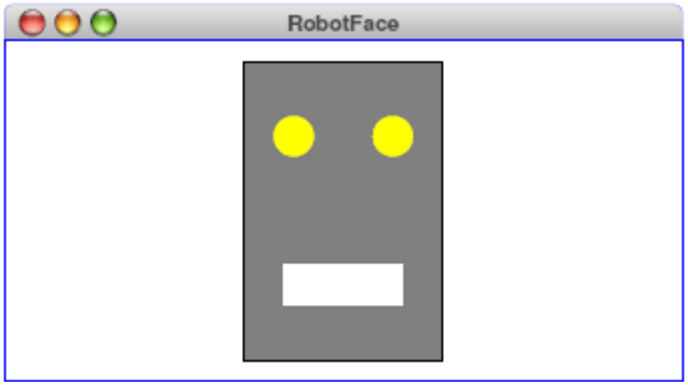

The entire cake must be centered both horizontally and vertically in the window. Recall that **`getHeight()`** and **`get getWidth()`** return the height and width (respectively) of the graphics window.

Use the following named constants for the measurements – **`INNER_LAYER_HEIGHT`**, **`OUTER_LAYER_HEIGHT`**, and **`CAKE_WIDTH`**. (The above image uses 50, 100, and 200, respectively, as the measurement values.)

Hint: Think about how you center one object in a window. How can you adapt that to center a group of three objects?

### 3. Drawing a face

Your job is to draw a robot-looking face like the one shown in the following sample run:




This simple face consists of four parts—a head, two eyes, and a mouth—which are arranged as follows:

- *The head*. The head is a big rectangle whose dimensions should be given by the named constants **`HEAD_WIDTH`** and **`HEAD_HEIGHT`**. The interior of the head is gray, although it should be framed in black.
- *The eyes*. The eyes are circles whose radii in pixels should be given by the single named constant **`EYE_RADIUS`**. The centers of the eyes should be set horizontally a quarter of the width of the head in from either edge, and one quarter of the distance down from the top of the head. The eyes are yellow.
- *The mouth*. The mouth should be centered with respect to the head in the *x*-dimension and one quarter of the distance up from the bottom of the head in the *y*-dimension. The dimensions of the mouth should be given by the named constants **`MOUTH_WIDTH`** and **`MOUTH_HEIGHT`**. The mouth is white.

Finally, the robot face should be centered in the graphics window.

The image above uses the following measurement values:

- **`HEAD_WIDTH = 100`**
- **`HEAD_HEIGHT = 150`**
- **`EYE_RADIUS = 10`**
- **`MOUTH_WIDTH = 60`**
- **`MOUTH_HEIGHT = 20`**