

## Section Handout #2—Simple Java

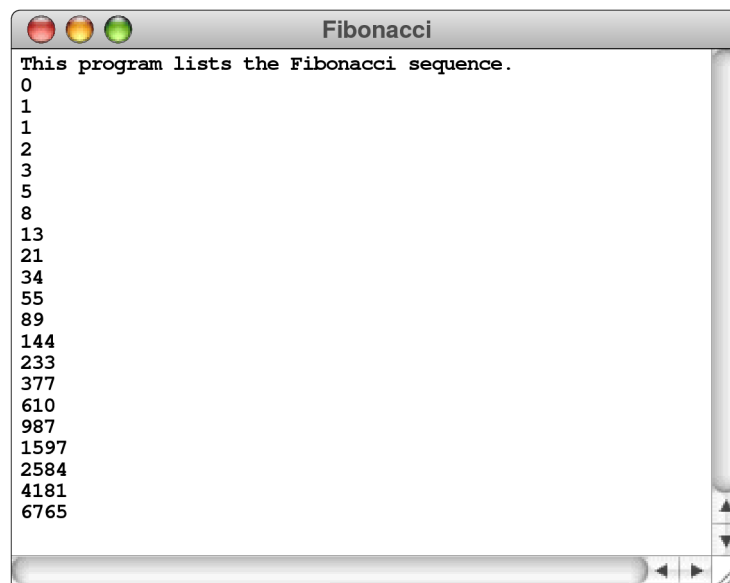
*Problem 2 was contributed by Mehran Sahami.*

### 1. The Fibonacci sequence

In the 13th century, the Italian mathematician Leonardo Fibonacci—as a way to explain the geometric 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:



```
Fibonacci
This program lists the Fibonacci sequence.
0
1
1
2
3
5
8
13
21
34
55
89
144
233
377
610
987
1597
2584
4181
6765
```

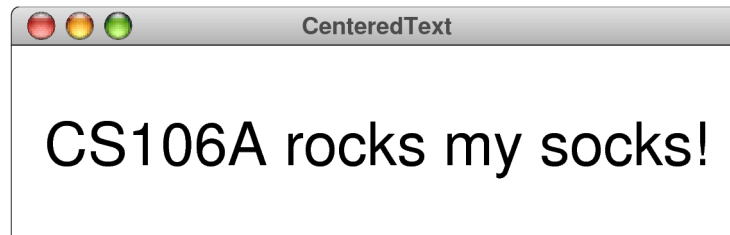
You should make sure that the maximum term size (10,000 in this example) is specified as a named constant so that the program is easy to change.

### 2. Centering text on the screen

Your job is to write a `GraphicsProgram` that displays the message

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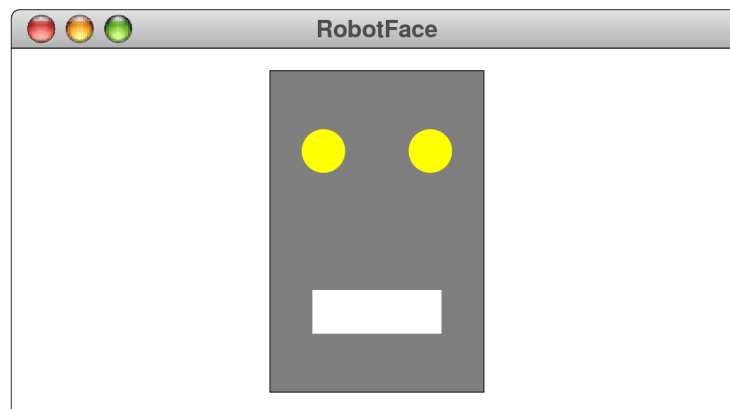
so that the label appears in SansSerif 28-point font, centered horizontally and vertically in the middle of the graphics window. The screen should therefore look something like this:



You can find the width of a label by calling `label.getWidth()` and the height it extends above the baseline by calling `label.getAscent()`. If you want to center a label, you need to shift its origin by half of these distances in each direction.

### 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 are 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 should be circles whose radius in pixels is given by the 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 are given by the named constants `MOUTH_WIDTH` and `MOUTH_HEIGHT`. The mouth is white.

If you were drawing a face, how would you make it more interesting?