

## CMSC 10200: Homework 2

assigned: June 22, 2005; due: June 24, 2005 (before 5 PM)

The following homework assignment should afford some more practice writing functions along the lines of the first lab.

First, create a folder called `hw2` in your computer science home directory (the same directory that contains `lab1`, `lab2`, etc.). Then create a file in that directory called `MorePractice.java`.

You will write a batch of functions, all of which will be declared `static` as in the lab, for reasons which will be discussed later in the course.

Write the following five functions, and write tests for them as well. Use the first lab exercise, `Practice.java`, for guidance as to how to structure the file.

- `max3`, which should take three integers and return the largest one. (Note there is a clever way to accomplish this with the help of `max2` from the lab.) Example: `max3(10,-4,22) -> 22`. Note that “logical and” is `&&` in Java, and can be used like the double-bar “logical or” symbol `||`.
- `min3`, like `max3`. Example: `min3(10,-4,22) -> -4`.
- `med3`, which should return the median integer among three integers. Example: `med3(10,-4,22) -> 10`.
- `fact`

The factorial function is recursively defined as follows:

- (assumption:  $n \geq 0$ )
- `fact(0) = 1`
- `fact(n) = n * fact(n-1)`, for  $n > 0$

Note that factorial is a partial function. Therefore there will be cause to throw an `IllegalArgumentException`.

- `fib`

The Fibonacci numbers are the sequence 1, 1, 2, 3, 5, 8, ... where the first two numbers are 1 and all numbers thereafter are the sum of the two previous Fibonacci numbers. We can define a function to give the  $n$ th Fibonacci number as follows:

- (assumption:  $n > 0$ )
- `fib(1) = 1`
- `fib(2) = 1`

$$- \text{fib}(n) = \text{fib}(n-2) + \text{fib}(n-1), \text{ for } n > 2$$

Write the function `fib` following this definition.

If you decide to work in the CS lab, here are a few reminders as to how to go about it:

- Choose a Linux machine (as opposed to a Mac). Before logging on, click the question mark that says “Session”, and choose item 5: KDE.
- Once logged on, start two programs: “emacs” under “Editors”, and “terminal session” under “System”.
- Edit the file in emacs, then click over to the “terminal session” window. In the terminal session window, type `cd hw2` to “change to” the directory `hw2`, which should contain your `MorePractice` program. Type `javac MorePractice.java` to make your program ready to run, then `java MorePractice` to run it.

A last word: if you try running your program with `java MorePractice` and it doesn’t finish running, it may be caught in an infinite loop. If your program doesn’t finish running in a second or so, you can use `ctrl-c` to interrupt it.

Submit your homework by typing `cd`, which will put you in your home directory, and then `hwsubmit cs102 hw2`.

## Extra Credit Problem

There is a non-recursive definition of the Fibonacci numbers which is as follows. To find the  $n$ th Fibonacci number, where  $n > 0$ , use the formula

$$\frac{(1 + \sqrt{5})^n - (1 - \sqrt{5})^n}{2^n \sqrt{5}}$$

This is known as Binet’s Fibonacci Number Formula. Write a function `binet` which consumes an integer and produces an integer according to the given formula.

Use `Math.sqrt(double)` for square root, and `Math.pow(double, double)` for raising one number to another.

(Example: `Math.pow(9.0, 2.0)` -> 81.0.)