9-19-2011
Opening Discussion

- Minute essay comments
  - Bitwise operators
  - When reading is going over your head.
    - Unclear sections.
    - Potential modifications.
  - When to read. Most like after class, but some before.
  - Arrays in 2 weeks.
  - Scientific notation in Scala.
  - Letters and words in binary.
  - Skating for the novice.
Functions in Math

- Let's review the concept of functions from math.
- In algebra a function would take one or more values and give you back a value. The values were generally numbers.
- In higher level math this is generalized with things like sets.
- In math functions the same input always leads to the same result.
The concept of a function is critically important to programming.

Functions can take one or more arguments and give us back values. (Most languages allow only one return value.)

Let's think of some examples of functions that we could write.
We declare functions in Scala using `def`. Here is the general form.

```
def name(arg1: Type1, arg2: Type2, ...): Type = expression
```

- The argument list can have zero or more elements. If there are zero even the parentheses can be left off.
- Function arguments must have types.
- The return type is optional, but it is recommended.
Why Functions?

- Functions are used in programs for a number of reasons.
  - Reduce code duplication. You can call the same function multiple times and only write it once.
  - Improve readability and maintainability. Good function names make it easier to read. Small functions are easier to test and debug.
  - Break problems down/problem decomposition.
Never solve a hard problem. If a problem is hard, break it into smaller problems that are easier. Repeat until you are only solving trivial problems.

- **Top-down**
  - This is the “normal” approach where you start with the full problem and break it into pieces.

- **Bottom-up**
  - Sometimes you realize that different trivial pieces will be useful and build up from those.
Function Literals

- Just like 5 is a literal for an Int and “hi” is a literal for a string, you can write literals of functions.
- The full syntax is an argument list followed by an equals equals arrow followed by the function expression.
  - (a:Int,b:Int) => 3*a+2*b
- Types don't have to be specified in many situations, only if Scala can't figure it out.
Higher-Order Functions

- These are functions that take functions as arguments or return functions.
- These are the main things we use function literals for. We will see them a lot in two weeks.
Minute Essay

- What questions do you have about functions?
- Do you feel that end of section exercises would be helpful for the book?
- IcP #2 is next class.