Tuesday, April 17

Warmup
Draw three simple images that you will be able to draw quickly for an exercise. You will need to be drawing them several times. For example, a cat, a tree, a cloud, a flower, or a letter. Label them as 1, 2, and 3. These are for your notes.

examples
drawings
  TiledPictures
  Lines
  Sierpinski triangle
  Towers of Hanoi

Exponentiation
Write a method powerIt that takes two parameters: a double base and an integer expo.
It returns as its double return value base to the expo power, that is:
expo = base * base * base * .. * base  (expo times)

// return base to the expo power   --- C++ and Java are the same here
double powerIt(double base, int expo) {
    double answer = 1.0;
    for (int i = 1; i <= expo; i++) {
        answer = answer * base;
    }
    return answer;
}

Part of computer science is finding better ways of doing things
  various data structures and their implementation
  better representations of a problem
  more efficient algorithms
To do that, you need to be aware of tools
One such tool is recursion

Keep applying solution to smaller and smaller versions of the problem until the problem is small enough to solve directly

A recursive function is one that calls itself with a smaller version of the problem.

\[
\begin{align*}
1 & \quad \text{if } n = 0 \\
\ a^n &= \ a \cdot a^{(n-1)} & \text{otherwise}
\end{align*}
\]

we could write this as a recursive function that calls itself with increasingly simpler versions of the problem until it reaches a base case which is solved without any further recursion

in this case base case of n of 0 gives a result of 1

```
// return base to the expo power --- C++ and Java are the same
double powerRec1(double base, int expo) {
    if (0 == expo) { // base case we can solve directly
        return 1.0;
    } else {
        return base * powerRec1(base, expo-1);
    }
}
```

Activation stack
be aware of its existence
each call to a method gets its own copy of parameters and local variables

postfix assignment
due Wednesday April 18
use resources
not a class with instance variables
use the built-in stack
look at notes for April 10

recursion assignment
3 programs: pattern, hourglass, commas
due Monday April 23 and Wednesday, April 25
be careful with error messages
do not talk with anyone other than instructor about them