# CS Teaching Academy Activity 5A: Recursion

# Why?

Recursion is an essential element of many programming languages. Recursion is often the better design choice for algorithms. It's important, therefore, for programmers to understand how to implement recursion correctly.

## Vocabulary:

recursion, base case, recursive case

### Key Questions (answer individually, then check answers with your teammates):

1. Which is more powerful as a programming tool, recursion or iteration?

2. True or False? Every recursive procedure must have a base case.

### Exercises (answer as a team, then check with the instructor):

1. What part of a recursive procedure must guarantee that it will terminate in a finite time?

2. Which do you think is more expensive to implement, recursion or iteration? Why?

### Problems (answer as a team, then write your answers on the board:

1. Correct the following procedure so that it will always terminate correctly.

```
int sumSquares(int last) {
   if (last == 1) {
      return 1;
   }
   return last * last + sumSquares(last-1);
}
```

2. Interpret the following procedure. What will be output by each call (a, b, c)?

```
int[] x = {1, 5, 3, 7, 8, 2, 6, 4};
int p1(int[] x, int start) {
    if (start < 0 || start >= x.length) {
       return -1;
    }
    if (start == x.length-1) {
       return x[x.length-1];
    }
    int n = p1(x, start+1);
    if (n < x[start]) {
       return n;
    }
    return x[start];
}
a) p1(x, 0)
b) p1(x, 3)
c) p1(x, 8)
```

3. Rewrite the procedure p1 so that is uses iteration instead of recursion.