

# Programming Fundamentals

## Lab #6

### Topics

- Algorithm analysis
- Searching and sorting

### Concepts

Asymptotic complexity

Big-Oh notation

Binary Search

Insertion sort

Selection sort

### **Exercise 1**

Write the simplest Java method that would have  $O(N^3)$  time complexity, where  $N$  is the single input parameter to the method.

### **Exercise 2**

Find the time complexity of the following Java method:

```
int foo(int N) {
    int result = 0;
    for (int i=0; i<N; i++)
        result++;

    for (int j=0; j<1000000; j++)
        result+=j;

    return result;
}
```

### **Exercise 3**

Find the time complexity of the following Java method:

```
int bar(int N) {
    int result = 1;
    for (int i=1; i<N; i*=2)
        result+=2;

    return result;
}
```

### **Exercise 4**

Assume a binary search is performed on the following array of integers:

{1, 14, 15, 24, 55, 59, 73, 90, 94, 99}

Trace through each iteration of the algorithm, writing the number that will be the middle element and the left and right bounds (indexes), when searching for the number 73.

### **Exercise 5**

Trace the execution of the insertion and selection sort algorithms when executed on the following array of integers:

{1, 29, 14, 15, 94}

Show how the array will look like after each iteration of the outer loop.