2.7 Lab Two: Programming Mathematical Algorithms

In Lesson 2, we examined two mathematical programs: one to compute Fibonacci numbers and a second to implement the division algorithm. In this lab we will examine three additional mathematical algorithms.

Number of Divisors

If $a$ and $b$ are two integers, we say that $a$ is a divisor of $b$ if there is no remainder when $b$ is divided by $a$. In other words, $b$ is an integral multiple of $a$. Thus, for example, the integer 10 has exactly 4 (positive) divisors, namely 1, 2, 5, and 10.

In this program we will count the number of divisors of an integer. The class will have two methods, one two count the number of divisors of an input number, and a main method to get the ball rolling.

```java
/**
 * Today's Date Your Name Divisors Count the number of divisors of a given integer.
 */
public class Divisors {
    public static int numdiv(int n) {
        int total = 0;
        for (int i = 0; i <= n; i++) {
            if (n % i == 0) {
                total++;
            }
        }
        return (total);
    }
    public static void main(String[] args) {
        int n = Integer.parseInt(args[0]);
        System.out.print("The number of divisors of "+n+" is "+numdiv(n));
    }
}
```

Try the following experiments.

1. Enter and run the program. Does it work? Run it giving as input each integer from 1 to 10. What is the smallest and largest number of divisors?
2. Change the `main` method to compute the number of divisors of each number from 1 to 200, printing out for each the number followed by the number of divisors. Print out the table produced by your program. Which integer has the greatest number of divisors? Which has the least? Which have exactly two divisors? Which have exactly three divisors? Do you see a pattern?

3. Change the `main` method again to compute the number of divisors of each number from 1 to 1000, but only print out the number if it has exactly two divisors. Do you see a pattern?

4. Repeat the last experiment, but print out only the numbers with exactly three divisors. Do you see a pattern?