

# SENIOR RESEARCH

## CSC 450-01

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# Example #1: factorial method

// precondition: a non-negative integer (n) is ready to be specified

// postcondition: returns  $n! = n \cdot (n-1) \cdot (n-2) \cdot \dots \cdot 1$ , with  $0! = 1$ .

```
public static int factorial(int n) {  
    int prod = 1;  
    for (int i = n; i > 1; i--) {  
        prod *= i;  
    }  
    return prod;  
}
```

- Can we *prove* that this method is *correct*?
- What if the method is called with a negative number?
- What if the method is called with a very large number? How *reliable* is the method?

## Example #2: factorial method (recursive)

// precondition: a non-negative integer (n) is ready to be specified

// postcondition: returns  $n! = n \cdot (n-1) \cdot (n-2) \cdot \dots \cdot 1$ , with  $0! = 1$ .

```
public static int factorial(int n) {  
    if (n == 0) return 1;  
    int prod = n * factorial(n-1);  
    return prod;  
}
```

- Is this method *better* or *worse* than the *factorial* function on the previous page?
- How could we compare the two methods?

# Paradigms in Computer Science

- **Rationalist paradigm** – programs are mathematical objects
  - Ex: we can theoretically *prove* a program is correct, will not crash, etc.
- **Technocratic paradigm** - we can empirically determine reliability through testing
  - Ex: program crashes 0.00001% of the time
- **Scientific paradigm** – programs are like natural processes and are amenable to experiment and study
  - Ex: Evaluate different ways of slowing a flu epidemic in a computer model of influenza infection
  - Ex, Bing vs. Google (<http://www.bingiton.com>)

# What is scientific research?

- Scientific research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

# Course Objectives

1. Demonstrate the ability to engage in independent inquiry
2. Apply current and critical thinking in a focused area of study
3. Reflect on the context of their independent inquiry or artistic creation
4. Reflect on this work as an outcome of a liberal arts education
5. Learn to write, communicate, and present research ideas and results in computer science.