

Cumulative Algorithms

CSCI 161 – Introduction to Programming I

Professor Thomas Rogers

Overview

- Reading: Chapter 4 - Conditional Execution
- Topics:
 - Cumulative Algorithms

Cumulative Algorithms

- **Cumulative Algorithm** - An operation in which an overall value is computed incrementally, often using a loop.
- **Cumulative Sum** - The sum of a series of numbers.
 - Pseudocode of cumulative sum algorithm:

```
sum = 0.  
for (all numbers to sum) {  
    obtain "next".  
    sum += next.  
}
```

- Sample from book: [ExamineNumbers1](#).

Cumulative Algorithms (continued)

- Pseudocode of the variant cumulative product algorithm:

```
product = 1.  
for (all numbers to multiply) {  
    obtain "next".  
    product = product * next.  
}
```

Cumulative Algorithms (continued)

- **Min/Max Loops** - These loops are used to find the minimum or maximum (or both) numbers in a series.

- Pseudocode for max algorithm:

```
initialize max.  
for (all numbers to examine) {  
    obtain "next".  
    if (next > max) {  
        max = next.  
    }  
}
```

- What to initialize Max to? 0? - No!
First number in sequence? - No!

Cumulative Algorithms (continued)

- **Cumulative Sum with if** - A variation on cumulative sum in which a conditional is used (divide by zero, special handling of certain numbers, etc.)

Often used when you want need to perform special handling, counting or other such operations on specific values found in the sequence.

- Sample from book: [ExamineNumbers2](#).

Cumulative Algorithms (continued)

- **Roundoff Error** - A numerical error that occurs because floating-point numbers are stored as approximations rather than as exact values.
 - Sample from book: [Roundoff](#).
 - Computer stores numbers in base-2 and 0.1 is not evenly described in base-2 (it is approximated).
 - Order of values in an expression can lead to rounding as well:

```
double dollars1 = 0.01 + 0.05 + 0.10 + 0.25;  
double dollars2 = 0.25 + 0.10 + 0.05 + 0.01;  
System.out.println("Output is:\n");  
System.out.println(dollars1);  
System.out.println(dollars2);
```

Output is:

```
0.410000000000000003  
0.41
```