Introduction to Algorithms

- What is this course about?
- Writing Algorithms using pseudocode
- Basics of counting & algorithm analysis
- Bubble Sort Algorithm

Reading Assignment: Sections 1.2, 1.3, 1.4, and 2.3

Bring laptops to lab next Tuesday!

What Is Covered in Algorithms

- Introduction to a set of well-loved & useful algorithms and problems
- Algorithm design techniques
- Algorithm efficiency
- Exact and approximate solutions to problems
- Proving an algorithm's correctness
- Proving that some things are impossible

Pseudocode

- Pseudocode –a mixture of natural language and programming language-like constructs used to specify algorithms.
- More precise than natural language
- No standard "dialect" of pseudocode
- This book's "dialect":
  - omits variable declarations
  - indentation shows scope of for, if, and while statements (no curly braces!)
  - arrow ← used for assignment
  - single '=' for equality comparison
  - // used for comments
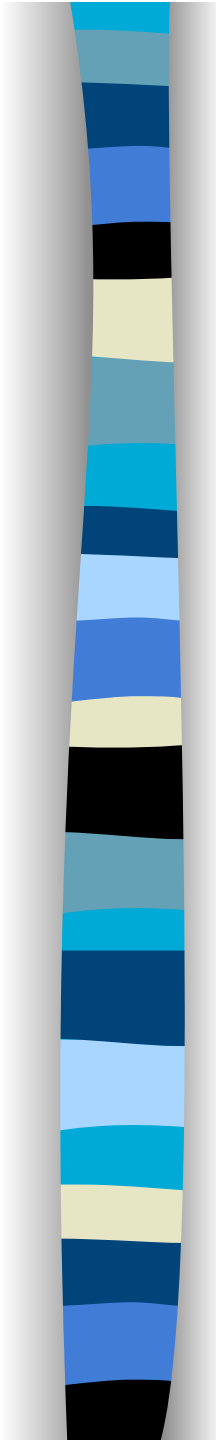 - no semicolons!

Counting Basic Operations Bubble Sort

```
// sorts elements in A[0…N-1]
BubbleSort( A[0…N-1] )
    For i ← 0 to N-2 do
        For j ← 0 to N-2 do
            If A[ j ] > A[ j+1 ] then
                swap A[ j ] and A[ j+1 ]
```
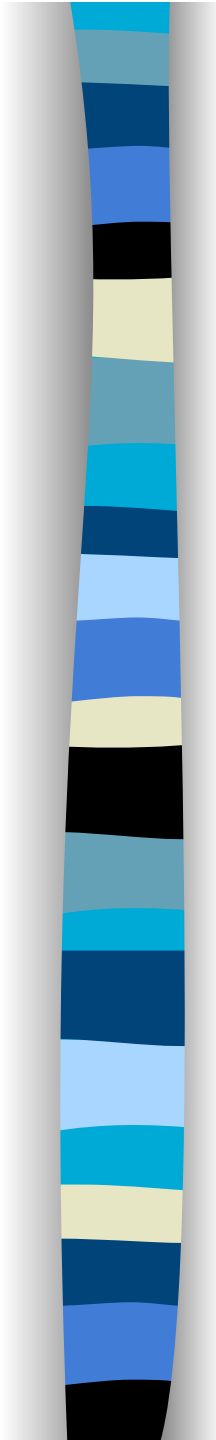
Class Simulation of algorithm

Obama Takes a Stand on Bubble Sort

www.youtube.com/watch?v=k4RRi_ntQc8

Analysis of Bubble Sort

Is Bubble Sort Practical?

Counting Basics

■ Some old friends☺

$$\sum_{i=5}^{8} 1 =$$

$$\sum_{i=\ell}^{u} 1 =$$

$$\sum_{i=5}^{8} N =$$

$$\sum_{i=\ell}^{u} N =$$

$$\sum_{i=\ell}^{u} (a + b) = \sum_{i=\ell}^{u} a + \sum_{i=\ell}^{u} b$$

Counting Basics

■ More friends☺

$$\sum_{i=1}^{N} i = 1 + 2 + 3 + ... + N =$$

$$\sum_{i=\ell}^{u} i =$$
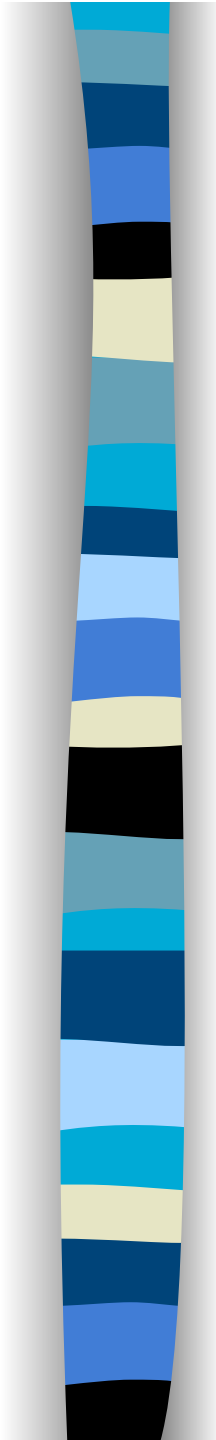
Counting Basic Operations
Improved Bubble Sort

```
// sorts elements in A[0…N-1]
ImprovedBubbleSort( A[0…N-1] )
    For i ← 0 to N-2 do
        For j ← 0 to [          ] do
            If A[ j+1 ] < A[ j ] then
                swap A[ j ] and A[ j+1 ]
```

Using Summations to Count Operations

Is Improved Bubble Sort Practical?