

### Administrivia

- Midterm *next Monday*. Review sheet on the Web. Topics everything up through loops. In-class review Friday?
- Reminder: Homework 4 due Wednesday. "Accepted without penalty" through Friday. (Should we just make the deadline Friday?)
- Sample solutions for homeworks coming soon.

Slide 1

### Repetition — Recap/Review

- Ability to repeat an operation, either a fixed number of times or until some condition is true is critical to many if not most interesting(?) uses of computers.
- How to express repetition? all sufficiently powerful programming languages provide at least one way, and many provide several, many based on recursion and/or loops. Often more than one type of loop.

Slide 2

### Loops — Another Example

- As you might have learned in a calculus course, the area under the curve

$$4/(1 + x^2)$$

in the interval  $0 \leq x \leq 1$  turns out to be  $\pi$ . (If you don't remember/understand this, okay to take it on faith — key point for us is what we do with this mathematical fact.)

- So one way of approximating  $\pi$  is to approximate this area, which can be done with “numerical integration” — split the area into many small slices, all the same width, approximate the area of each slice by its width times the function value at the midpoint of the slice, and sum these areas.

Slide 3

### Example Continued

- Turning the basic calculation into code is straightforward with a `for` loop, no? We could write a program to do that, with its input being the number of slices (“steps”).
- Or, as an example of using `while` to calculate until convergence, we could repeat the calculation with increasing numbers of slices until the values “converge”, with input being the threshold for convergence. (Next time.)

Slide 4

## Minute Essay

- None — quiz.

Slide 5