Example: Summing the Elements of a List

def sum(thelist):
    """Returns: the sum of all elements in thelist
    Precondition: thelist is a list of all numbers
    (either floats or ints)"
    result = 0
    result = result + thelist[0]
    result = result + thelist[1]
    ...  
    return result

There is a problem here

Working with Sequences

- Sequences are potentially unbounded
  - Number of elements inside them is not fixed
  - Functions must handle sequences of different lengths
    - Example: sum([1,2,3]) vs. sum([4,5,6,7,8,9,10])
- Cannot process with fixed number of lines
  - Each line of code can handle at most one element
  - What if # of elements > # of lines of code?
- We need a new control structure

For Loops: Processing Sequences

# Print contents of seq
x = seq[0]
print x
x = seq[1]
print x
...
x = seq[len(seq)-1]
print x

- Remember:
  - We cannot program
  ...

The for-loop:
    for x in seq:
        print x

- Key Concepts
  - loop sequence: seq
  - loop variable: x
  - body: print x
  - Also called repetend

To execute the for-loop:
1. Check if there is a “next” element of loop sequence
2. If not, terminate execution
3. Otherwise, put the element in the loop variable
4. Execute all of the body
5. Repeat as long as 1 is true

Example: Summing the Elements of a List

def sum(thelist):
    """Returns: the sum of all elements in thelist
    Precondition: thelist is a list of all numbers
    (either floats or ints)"
    result = 0
    for x in thelist:
        result = result + x
    return result

For Loops and Conditionals

def num_ints(thelist):
    """Returns: the number of ints in thelist
    Precondition: thelist is a list of any mix of types"
    result = 0
    for x in thelist:
        if type(x) == int:
            result = result + 1
    return result

Body
Modifying the Contents of a List

```python
def add_one(thelist):
    """(Procedure) Adds 1 to every element in the list
    Precondition: thelist is a list of all numbers
    (either floats or ints)"
    for x in thelist:
        x = x + 1
    # procedure; no return
```

**DOES NOT WORK!**

On The Other Hand

```python
def copy_add_one(thelist):
    """Returns: copy with 1 added to every element
    Precondition: thelist is a list of all numbers
    (either floats or ints)"
    mycopy = []  # accumulator
    for x in thelist:
        x = x + 1
        mycopy.append(x)  # add to end of accumulator
    return mycopy
```

Accumulator keeps result from being lost

For Loops: Processing Ranges of Integers

```python
for x in range(2, 201):
    total = total + x * x
```

The for-loop:

```python
for x in range(2, 201):
    total = total + x * x
```

The range function:

- `range(x)`: List of ints 0 to x-1
- `range(a, b)`: List of ints a to b-1

**Important Concept in CS:**

**Doing Things Repeatedly**

1. Process each item in a sequence
   - Compute aggregate statistics for a dataset, such as the mean, median, standard deviation, etc.
   - Send everyone in a Facebook group an appointment time
2. Perform \( n \) trials or get \( n \) samples.
   - A4: draw a triangle six times to make a hexagon
   - Run a protein-folding simulation for \( 10^6 \) time steps
3. Do something an unknown number of times
   - CUAUV team, vehicle keeps moving until reached its goal