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

1

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**

2

The For-Loop

```
# Create local var x
x = seqn[0]
print(x)
x = seqn[1]
print(x)
...
x = seqn[len(seqn)-1]
print(x)
```

Not valid Python

```
# Write as a for-loop
for x in seqn:
    print(x)
```

Key Concepts

- **iterable**: seqn
- **loop variable**: x
- **body**: print(x)

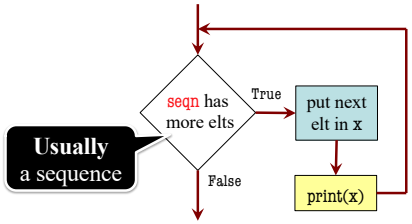
3

Executing a For-Loop

The for-loop:

```
for x in seqn:
    print(x)
```

- **iterable:** seqn
- **loop variable**: x
- **body**: print(x)



4

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
```

Accumulator variable

- **iterable:** thelist
- **loop variable**: x
- **body**: result=result+x

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Example: String-Based Accumulator

```
def despace(s):
    """Returns: s but with its spaces removed
    Precondition: s is a string"""
    result = ''
    for x in s:
        if x != ' ':
            result = result+x
    return result
```

Body

6

Modifying the Contents of a List

```
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!

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On The Other Hand

```
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

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How Can We Modify A List?

- **Never** modify loop var!
- This is an infinite loop:

```
for x in thelist:
    thelist.append(1)
```

Try in Python Tutor to see what happens

- Need a second sequence
- How about the *positions*?

```
thelist = [5, 2, 7, 1]
thepos = [0, 1, 2, 3]

for x in thepos:
    thelist[x] = x+1
```

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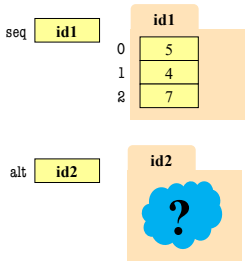
This is the Motivation for Iterables

- **Iterables** are objects
  - Contain data like a list
  - **But cannot slice them**
- Have list-like properties
  - Can use then in a for-loop
  - Can convert them to lists
  - mylist = list(myiterable)
- **Example**: Files
  - Use open() to create object
  - Makes iterable for reading



10

The Range Iterator

- range(x)
  - Creates an iterator
  - Stores [0,1,…,x-1]
  - **But not a list!**
  - But try list(range(x))
- range(a,b)
  - Stores [a,…,b-1]
- range(a,b,n)
  - Stores [a,a+n,…,b-1]

- Very versatile tool
- Great for processing ints

```
total = 0

# add the squares of ints
# in range 2..200 to total

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

Accumulator

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Modifying the Contents of a List

```
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)"""
    size = len(thelist)
    for k in range(size):
        thelist[k] = thelist[k]+1
    # procedure; no return
```

Iterator of list **positions** (safe)

WORKS!

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