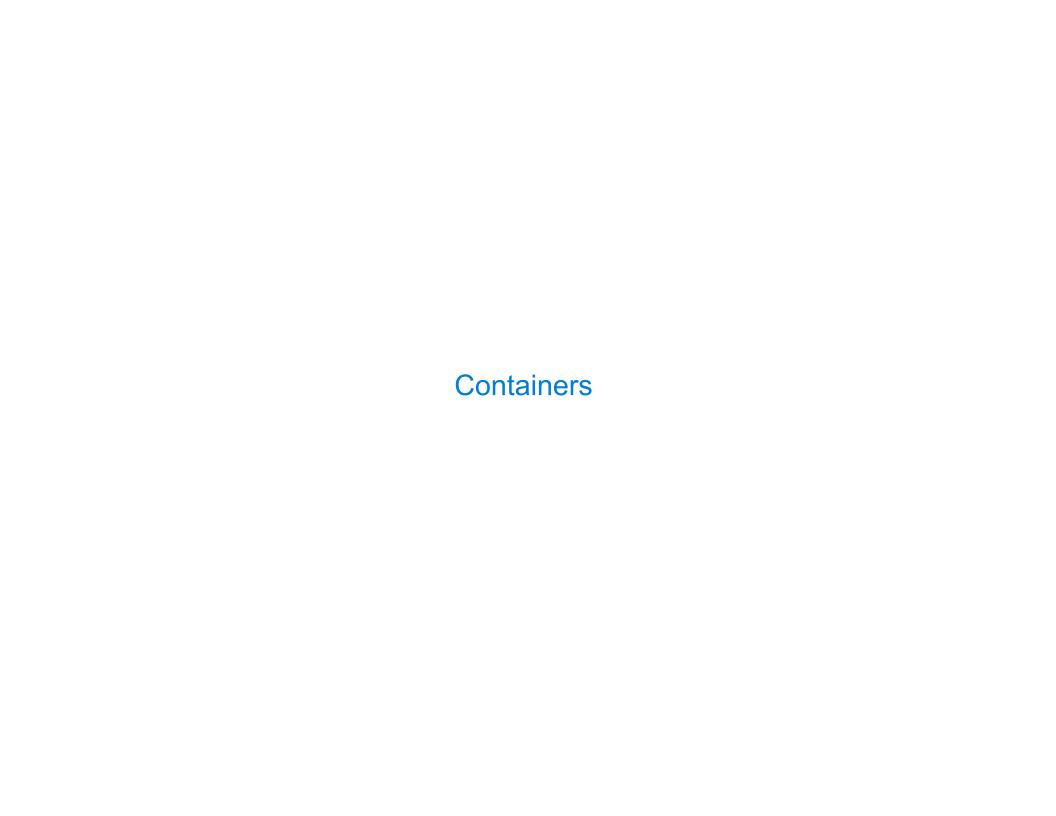


Lists

['Demo']

Working with Lists

```
>>> digits = [1, 8, 2, 8]
                                         >>> digits = [2//2, 2+2+2+2, 2, 2*2*2]
The number of elements
   >>> len(digits)
An element selected by its index
   >>> digits[3]
                                         >>> getitem(digits, 3)
Concatenation and repetition
   >>> [2, 7] + digits * 2
                           >>> add([2, 7], mul(digits, 2))
    [2, 7, 1, 8, 2, 8, 1, 8, 2, 8]
                                         [2, 7, 1, 8, 2, 8, 1, 8, 2, 8]
Nested lists
   >>> pairs = [[10, 20], [30, 40]]
   >>> pairs[1]
   [30, 40]
   >>> pairs[1][0]
   30
```



Containers

Built-in operators for testing whether an element appears in a compound value

```
>>> digits = [1, 8, 2, 8]
>>> 1 in digits
True
>>> 8 in digits
True
>>> 5 not in digits
True
>>> not(5 in digits)
True
```

(Demo)

For Statements

(Demo)

Sequence Iteration

```
def count(s, value):
    total = 0
    for element in s:

        Name bound in the first frame
        of the current environment
            (not a new frame)

        if element == value:
            total = total + 1
        return total
```

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For Statement Execution Procedure

- 1. Evaluate the header <expression>, which must yield an iterable value (a sequence)
- 2. For each element in that sequence, in order:
 - A. Bind <name> to that element in the current frame
 - B. Execute the <suite>

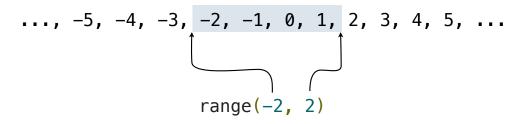
Sequence Unpacking in For Statements

```
A sequence of
                  fixed-length sequences
>>> pairs = [[1, 2], [2, 2], [3, 2], [4, 4]]
>>> same count = 0
     A name for each element in a
                                       Each name is bound to a value, as in
         fixed-length sequence
                                       multiple assignment
>>> for (x, y) in pairs:
        if x == y:
            same_count = same_count + 1
>>> same_count
```



The Range Type

A range is a sequence of consecutive integers.*

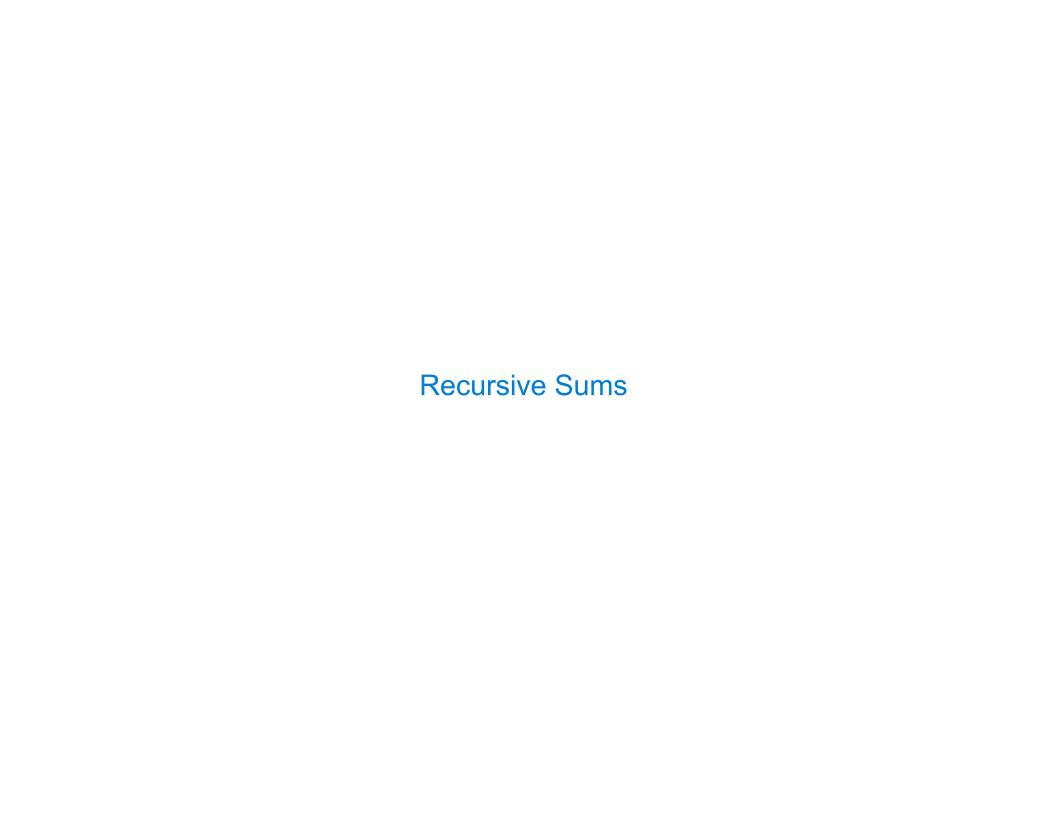


Length: ending value - starting value

(Demo)

Element selection: starting value + index

^{*} Ranges can actually represent more general integer sequences.



```
Sum (recursively)

def mysum(L):
    if (L == []):
        return 0
    else:
        return L[0] + mysum( L[1:] )

mysum( [2, 4, 1, 5] )

2 + mysum( [4, 1, 5] )

4 + mysum( [1, 5] )

1 + mysum( [5] )

5 + mysum( [] )
```

```
# --- DRILL ---
# Write an iterative function that takes as input
# integer "n" and returns the sum of the first "n"
# integers: sum(5) returns 1+2+3+4+5
```

```
# --- DRILL ---
# Write an iterative function that takes as input
# integer "n" and returns the sum of the first "n"
# integers: sum(5) returns 1+2+3+4+5

def sum_iter(n):
    sum = 0
    for i in range(0,n+1):
        sum = sum + i

    return( sum )
```

```
# --- DRILL ---
# Write a recursive function that takes as input
# integer "n" and returns the sum of the first "n"
# integers: sum(5) returns 1+2+3+4+5
```

```
# --- DRILL ---
# Write a recursive function that takes as input
# integer "n" and returns the sum of the first "n"
# integers: sum(5) returns 1+2+3+4+5

def sum_rec(n):
    if( n == 0 ):
        return(0)
    else:
        return n + sum_rec(n-1)
```

List Comprehensions

```
>>> letters = ['a', 'b', 'c', 'd', 'e', 'f', 'm', 'n', 'o', 'p']
>>> [letters[i] for i in [3, 4, 6, 8]]

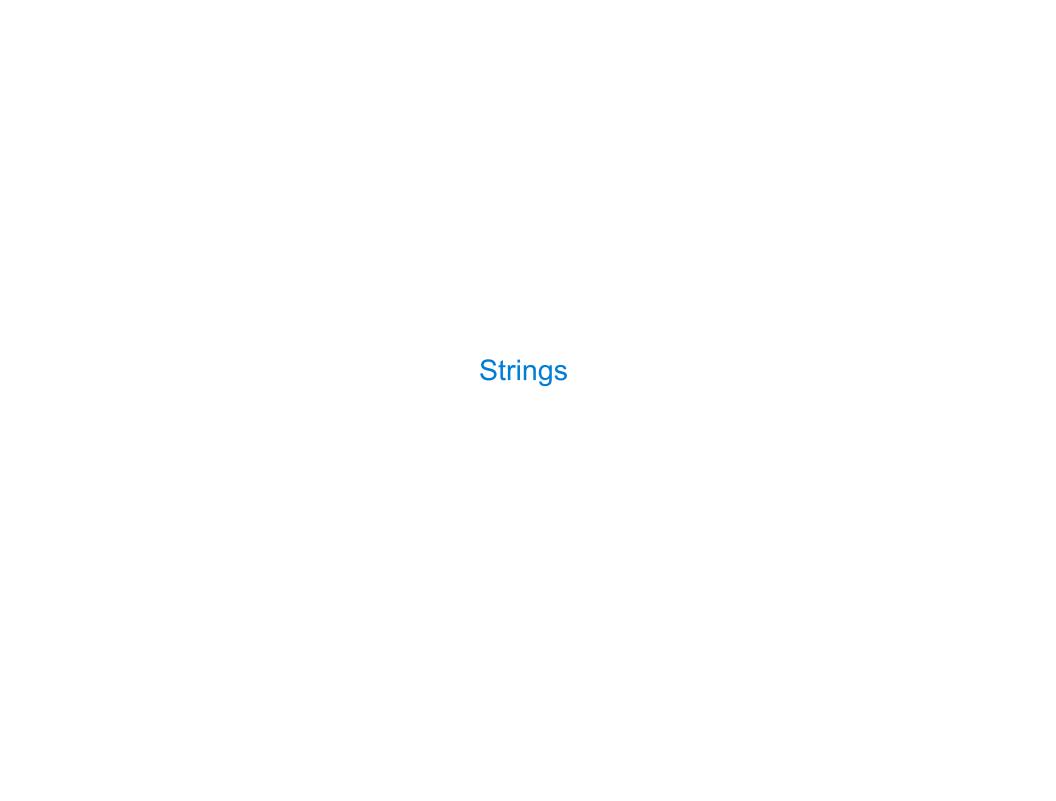
['d', 'e', 'm', 'o']
```

List Comprehensions

```
[<map exp> for <name> in <iter exp> if <filter exp>]
Short version: [<map exp> for <name> in <iter exp>]
```

A combined expression that evaluates to a list using this evaluation procedure:

- 1. Add a new frame with the current frame as its parent
- 2. Create an empty result list that is the value of the expression
- 3. For each element in the iterable value of <iter exp>:
 - A. Bind <name> to that element in the new frame from step 1
 - B. If <filter exp> evaluates to a true value, then add the value of <map exp> to the result list



Strings are an Abstraction

Representing data:

```
'200' '1.2e-5' 'False' '[1, 2]'
```

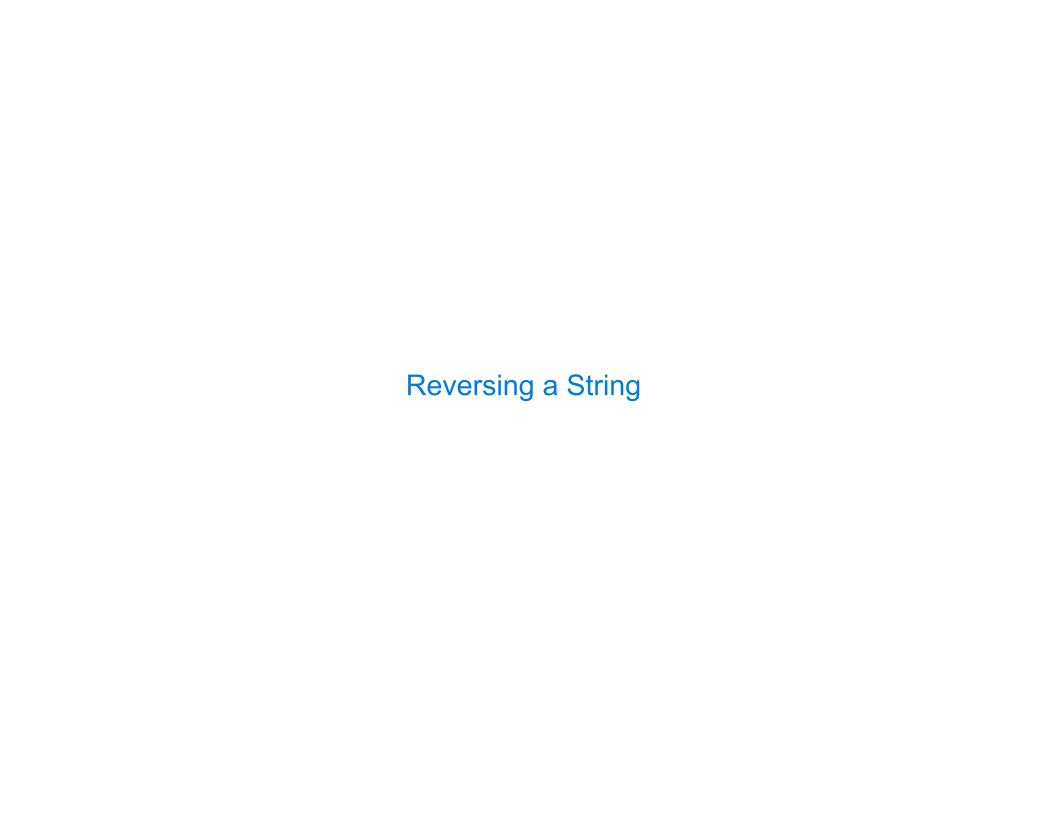
Representing language:

"""And, as imagination bodies forth
The forms of things unknown, the poet's pen
Turns them to shapes, and gives to airy nothing
A local habitation and a name.

Representing programs:

String Literals Have Three Forms

```
>>> 'I am string!'
'I am string!'
>>> "I've got an apostrophe"
                                Single-quoted and double-quoted
"I've got an apostrophe"
                                     strings are equivalent
>>> '您好'
'您好'
>>> """The Zen of Python
claims, Readability counts.
Read more: import this."""
'The Zen of Python\nclaims, Readability counts.\nRead more: import this.'
      A backslash "escapes" the
                                          "Line feed" character
         following character
                                          represents a new line
```



```
Reversing a List (recursively)

reverse("ward") = "draw"

reverse("ward") = reverse("ard") + "w"

reverse("ard") = reverse("rd") + "a"

reverse("rd") = reverse("d") + "r"

reverse("d") = "d"
```

```
Reversing a List (recursively)

reverse("ward") = "draw"

reverse("ward") = reverse("ard") + "w"

reverse("ard") = "d" + "r" + "a"
```

```
Reversing a List (recursively)

def reverse(s):
    if len(s) == 1:
        return s
    else:
        return reverse(s[1:]) + s[0]
```