

# Containers

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## Announcements

# Lists

```
[ 'Demo ' ]
```

## Working with Lists

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```
>>> digits = [1, 8, 2, 8]
```

The number of elements

```
>>> len(digits)
4
```

An element selected by its index

```
>>> digits[3]
8
```

Concatenation and repetition

```
>>> [2, 7] + digits * 2
[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
```

```
>>> digits = [2//2, 2+2+2+2, 2, 2*2*2]
```

```
>>> getitem(digits, 3)
8
```

```
>>> add([2, 7], mul(digits, 2))
[2, 7, 1, 8, 2, 8, 1, 8, 2, 8]
```

# Containers

## Containers

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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

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```
def count(s, value):  
    total = 0  
    for element in s:  
        if element == value:  
            total = total + 1  
    return total
```

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



## For Statement Execution Procedure

---

```
for <name> in <expression>:  
    <suite>
```

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  
fixed-length sequence

Each name is bound to a value, as in  
multiple assignment

```
>>> for x, y in pairs:
...     if x == y:
...         same_count = same_count + 1
```


```
>>> same_count
2
```

Ranges

## The Range Type

A range is a sequence of consecutive integers.\*

..., -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, ...



range(-2, 2)

**Length:** ending value - starting value

(Demo)

**Element selection:** starting value + index

```
>>> list(range(-2, 2))  
[-2, -1, 0, 1]
```

List constructor

```
>>> list(range(4))  
[0, 1, 2, 3]
```

Range with a 0 starting value

\* Ranges can actually represent more general integer sequences.

## Recursive Sums

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( [] )  
0

```
# --- 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

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[<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

## Strings are an Abstraction

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### 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:

```
'curry = lambda f: lambda x: lambda y: f(x, y)'
```

(Demo)

## String Literals Have Three Forms

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```
>>> 'I am string!'
'I am string!'
```

```
>>> "I've got an apostrophe"
"I've got an apostrophe"
```

Single-quoted and double-quoted 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 following character

"Line feed" character represents a new line

## Reversing a String



## 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]
```