

## CS 61A Lecture 10

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## Announcements

# Lists

`['Demo']`

## Working with Lists

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```
>>> digits = [1, 8, 2, 8]
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>>> digits = [1, 8, 2, 8]
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```
>>> digits = [2//2, 2+2+2+2, 2, 2*2*2]
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The number of elements

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>>> len(digits)
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## Working with Lists

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An element selected by its index

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>>> getitem(digits, 3)
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Concatenation and repetition

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>>> digits = [2//2, 2+2+2+2, 2, 2*2*2]
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An element selected by its index

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```

Concatenation and repetition

```
>>> [2, 7] + digits * 2
[2, 7, 1, 8, 2, 8, 1, 8, 2, 8]
```

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

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>>> getitem(digits, 3)
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[2, 7, 1, 8, 2, 8, 1, 8, 2, 8]
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>>> 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]
```

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```
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[2, 7, 1, 8, 2, 8, 1, 8, 2, 8]
```

Nested lists

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

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```

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

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```

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

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

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

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

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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
```



## 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

---

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

## Sequence Iteration

---

```
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

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```
for <name> in <expression>:  
    <suite>
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2. For each element in that sequence, in order:

## For Statement Execution Procedure

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```
for <name> in <expression>:  
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2. For each element in that sequence, in order:
  - A. Bind <name> to that element in the current 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

---

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```
>>> pairs = [[1, 2], [2, 2], [3, 2], [4, 4]]
```

```
>>> same_count = 0
```

## Sequence Unpacking in For Statements

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A sequence of  
fixed-length sequences

```
>>> pairs = [[1, 2], [2, 2], [3, 2], [4, 4]]
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## Sequence Unpacking in For Statements

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```
>>> pairs = [[1, 2], [2, 2], [3, 2], [4, 4]]
```

```
>>> same_count = 0
```

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

```
>>> same_count  
2
```

## Sequence Unpacking in For Statements

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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

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

```
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2
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## Sequence Unpacking in For Statements

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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

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A range is a sequence of consecutive integers.\*

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

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A range is a sequence of consecutive integers.\*

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

```
range(-2, 2)
```

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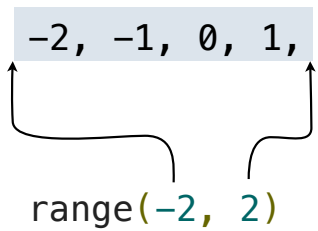


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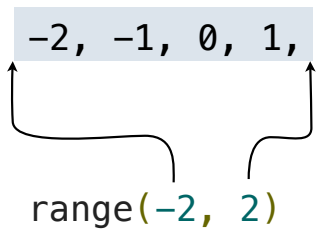
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range(-2, 2)

**Length:** ending value - starting value

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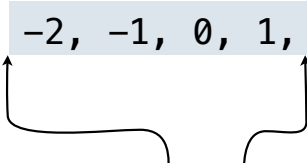
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range(-2, 2)

**Length:** ending value - starting value

**Element selection:** starting value + index

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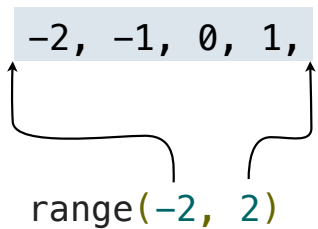
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range(-2, 2)

**Length:** ending value - starting value

**Element selection:** starting value + index

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

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

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range(-2, 2)

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List constructor

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>>> list(range(-2, 2))  
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List constructor

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Range with a 0 starting value

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(Demo)

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List constructor

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# List Comprehensions



## List Comprehensions

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

## List Comprehensions

```
>>> letters = ['a', 'b', 'c', 'd', 'e', 'f', 'm', 'n', 'o', 'p']  
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```

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

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[<map exp> for <name> in <iter exp> if <filter exp>]
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A combined expression that evaluates to a list using this evaluation procedure:

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  - A. Bind `<name>` to that element in the new frame from step 1

## List Comprehensions

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[<map exp> for <name> in <iter exp> if <filter exp>]
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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]'

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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.  
"""
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### Representing programs:

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

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

```
>>> '您好'
'您好'
```

## String Literals Have Three Forms

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Single-quoted and double-quoted strings are equivalent

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Single-quoted and double-quoted strings are equivalent

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>>> '您好'
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```

```
>>> """The Zen of Python
claims, Readability counts.
Read more: import this."""
'The Zen of Python\nclaims, Readability counts.\nRead more: import this.'
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A backslash "escapes" the following character

"Line feed" character represents a new line

## Dictionaries

```
{'Dem': 0}
```

## Limitations on Dictionaries

---



## Limitations on Dictionaries

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Dictionaries are **unordered** collections of key-value pairs

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The second restriction is part of the dictionary abstraction

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This first restriction is tied to Python's underlying implementation of dictionaries

The second restriction is part of the dictionary abstraction

If you want to associate multiple values with a key, store them all in a sequence value