

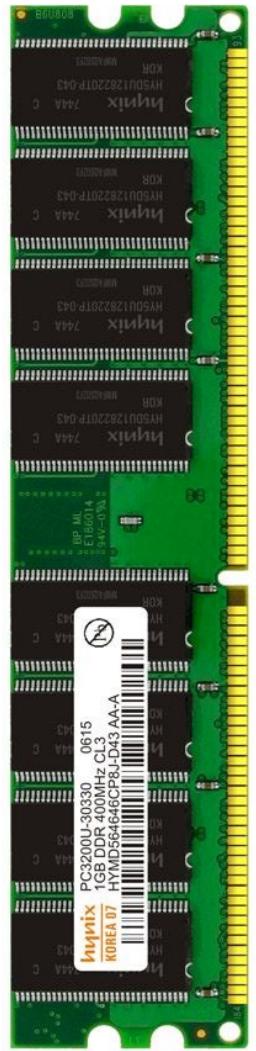
# Intro to Coding with Python– Lists

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# Plan for Today

- String recap
- Lists
  - the basics
  - methods

# Recap: storing stuff in memory



**collections of things in  
“numbered boxes”**

# Recap: strings

- Collections of **characters**:

```
name = "Jordan"  
≈ [ 'J', 'o', 'r', 'd', 'a', 'n' ]  
     0   1   2   3   4   5
```

- To access the letter at position 2:

```
name[2] = "r"
```

- Can also use **negative** indexing (i.e. start at the end):

```
≈ [ 'J', 'o', 'r', 'd', 'a', 'n' ]  
   -6   -5   -4   -3   -2   -1
```

- To access the letter at position -2:

```
name[-2] = "a"
```

Check in

There are two ways to access the **last letter** in a string: what are they?

## Recap: slicing strings

- Sometimes we want to access a specific part of the string (more than a single letter, but less than the whole thing)
- e.g. to access the letters in positions **3 through 5**:  
 $s = \text{“Computer Science”}$   
 $s[3:6] = \text{“put”}$ 

remember:  
**not inclusive**
- This is called **slicing**

# Recap: slicing strings

- Special slices:

`s = "Computer Science"`

`s[:9] = "Computer"`

  
“start at the beginning”

`s[10:] = "Science"`

  
“continue until the end”

Okay, so...

**strings** are collections of **characters**

defined using  
“ quotes ”



Okay, so...

**lists** are collections of **objects**

defined using  
[ square brackets ]

Okay, so...

i.e. just about  
anything



**lists** are collections of **objects**

defined using  
[ square brackets ]

list of  
integers

[ 1 , 2 , 3 , 4 , 5 , 6 ]

list of  
floats

[ 1 . 2 , 3 . 5 , 0 . 7 , 7 . 8 ]

list of  
strings

```
[ "dog", "cat", "pig" ]
```

# Indexing a list

```
[ "dog", "cat", "pig" ]
```

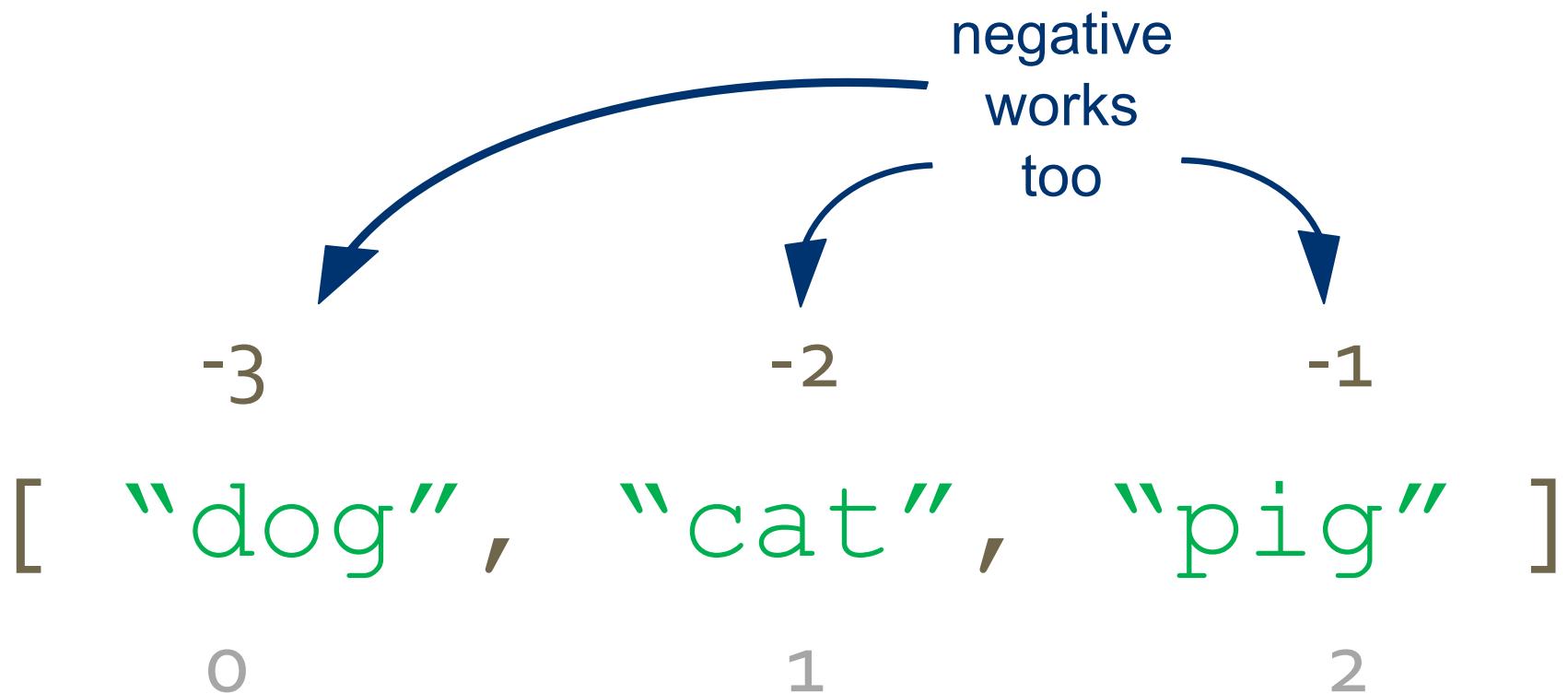
0

1

2

just  
like with  
strings

## Indexing a list



# Weird python thing

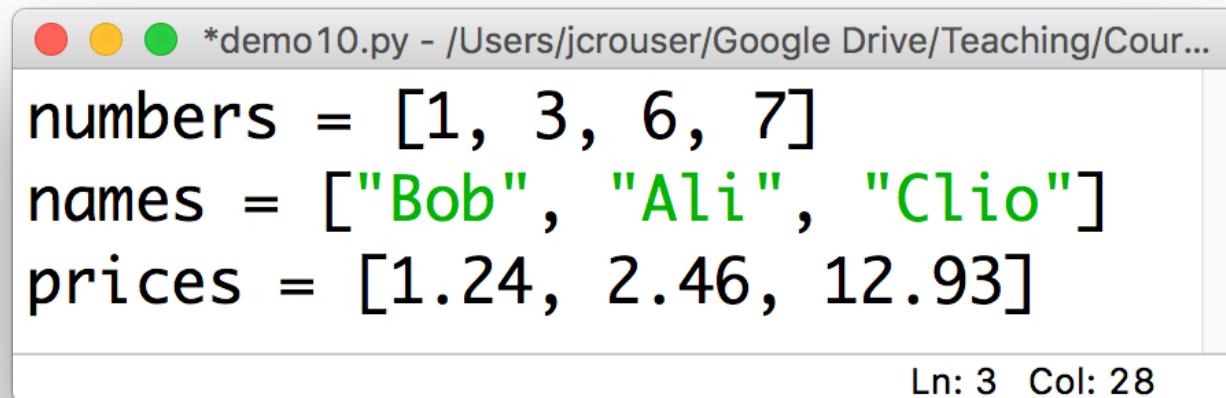
in **python**, lists can contain **mixed types**:

```
[ 1, "cat", 7.8 ]
```

this is  
**not allowed**  
in many other languages  
(so be careful!)

# Naming convention

- Remember: it's always a good idea for variable names to be **descriptive**
- Because lists contain collections of things, we'll generally label them with a **plural noun**, e.g.



```
*demo10.py - /Users/jcrouser/Google Drive/Teaching/Cour...
numbers = [1, 3, 6, 7]
names = ["Bob", "Ali", "Clio"]
prices = [1.24, 2.46, 12.93]
```

Ln: 3 Col: 28

# Checking membership **in** a list

```
1 animals = ["dog", "cat", "pig"]
2 new_animal = input("Animal? ")
3
4 inList = new_animal in animals
5
```

# Checking membership **in** a list

```
1 animals = ["dog", "cat", "pig"]
2 new_animal = input("Animal? ")
3
4 inList = new_animal in animals
5
```

- Returns True if new\_animal is in animals
- Returns False otherwise

# Checking length of a list

```
1+  
15 animals = ["dog", "cat", "pig"]  
16 print(len(animals))  
17 |
```

# Functions on lists of numbers

```
8     nums = [0, 6, -2, 5]
9
10    print(min(nums))
11    print(max(nums))
12    print(sum(nums))
13
```

# Overwriting an item in a *list*

- If we want to overwrite an item in a **list**, we can use indexing combined with the **=** operator:

```
*Untitled*
```

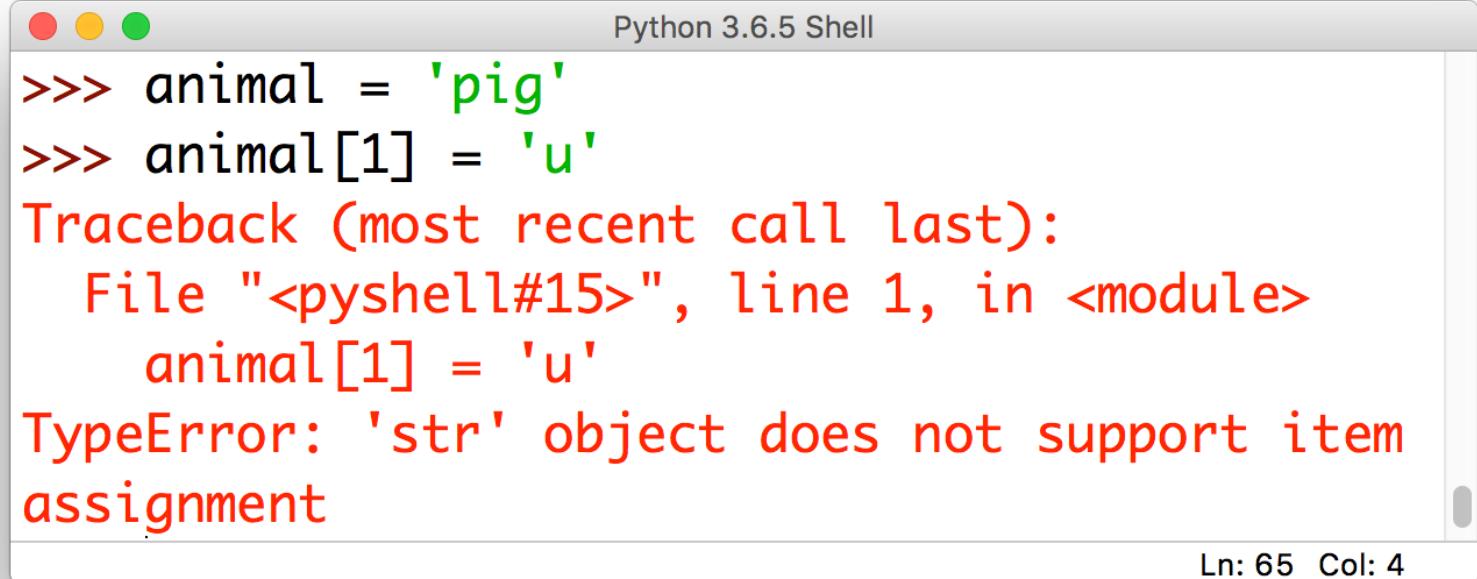
```
# animal list
animals = ['cat', 'dog', 'pig']
animals[2] = 'rabbit'
print(animals) # ['cat', 'dog', 'rabbit']
```

Ln: 2 Col: 29

# Discussion

What happens when we try to do this  
with a **string**?

# Discussion



The screenshot shows a Python 3.6.5 Shell window. The user has typed two commands:

```
>>> animal = 'pig'  
>>> animal[1] = 'u'
```

When the second command is run, a traceback is printed:

```
Traceback (most recent call last):  
  File "<pyshell#15>", line 1, in <module>  
    animal[1] = 'u'  
TypeError: 'str' object does not support item assignment
```

In the bottom right corner of the shell window, the text "Ln: 65 Col: 4" is visible.

# **mutable** vs. **immutable**

- **strings** are **immutable** (which means we cannot change them in memory, we have to overwrite them completely)
- **lists** defined with [...] are **mutable** (which means we can change them in memory)
- if we want an **immutable list**, we can define it with (...) instead

list  
methods:  
.append()

- If you want to **add a new item** to the end of a **list**:



```
*Untitled*
```

```
# animal list
animals = ['cat', 'dog', 'pig']

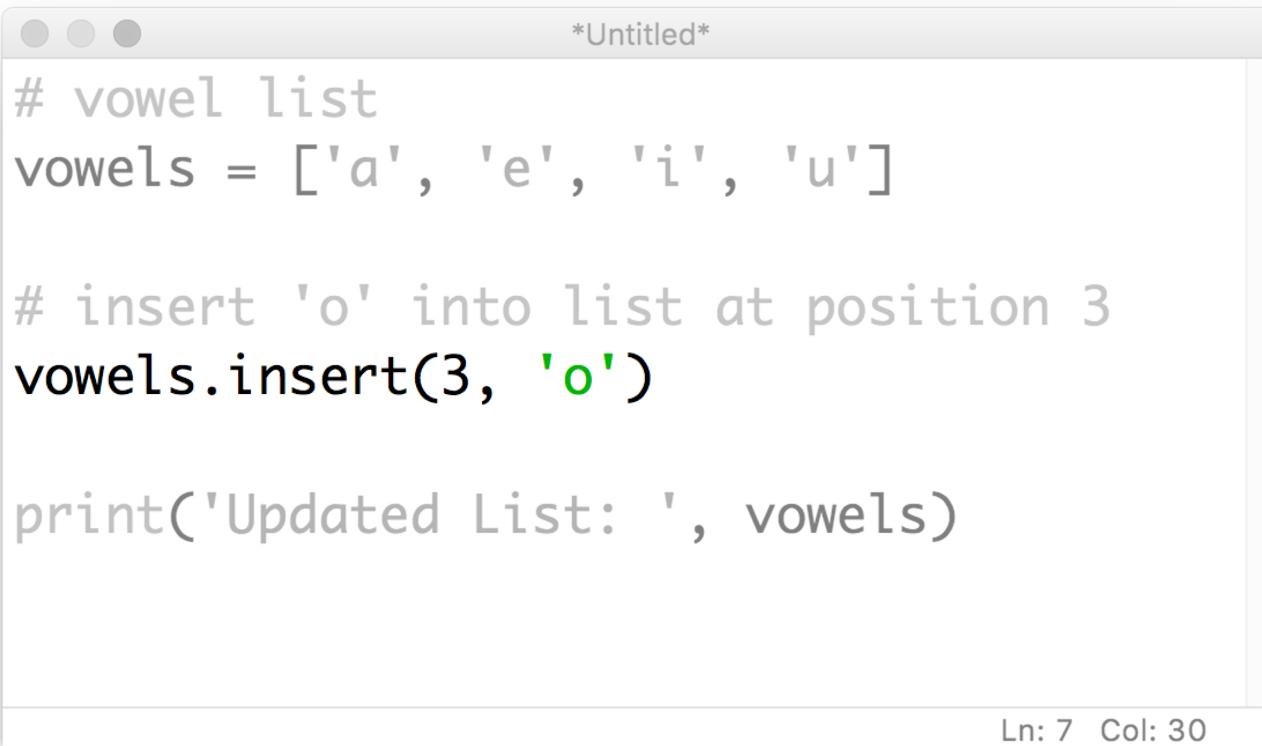
# add an element
animals.append('guinea pig')

# print updated list
print(animals)
```

Ln: 8 Col: 6

# list methods: .insert()

- If you want to **add a new item** into a **list** at a specific position:



```
*Untitled*
# vowel list
vowels = ['a', 'e', 'i', 'u']

# insert 'o' into list at position 3
vowels.insert(3, 'o')

print('Updated List: ', vowels)

Ln: 7 Col: 30
```

# list methods: .remove ()

- If you want to **remove an item from a list**:

```
*Untitled*
```

```
# animal list
animal = ['cat', 'dog', 'rabbit',
          'guinea pig']

# 'rabbit' element is removed
animal.remove('rabbit')

#Updated Animal List
print('Updated animal list: ', animal)
```

Ln: 3 Col: 10

# list methods: .remove()

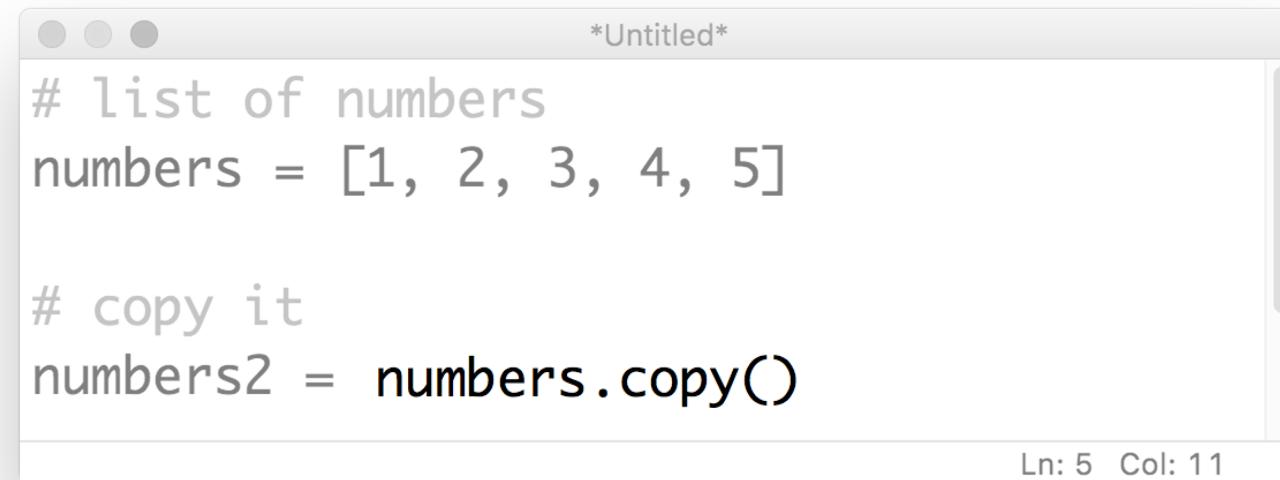
- If you try to **remove** an item that isn't in the **list**, the interpreter will throw a **ValueError**:



```
Python 3.6.5 Shell
>>> # animal list
animal = ['cat', 'dog', 'rabbit',
          'guinea pig']
>>> animal.remove("elephant")
Traceback (most recent call last):
  File "<pyshell#8>", line 1, in <module>
    animal.remove("elephant")
ValueError: list.remove(x): x not in list
Ln: 42 Col: 4
```

list  
methods:  
.copy()

- If you want to **copy** the **list**:



```
*Untitled*
```

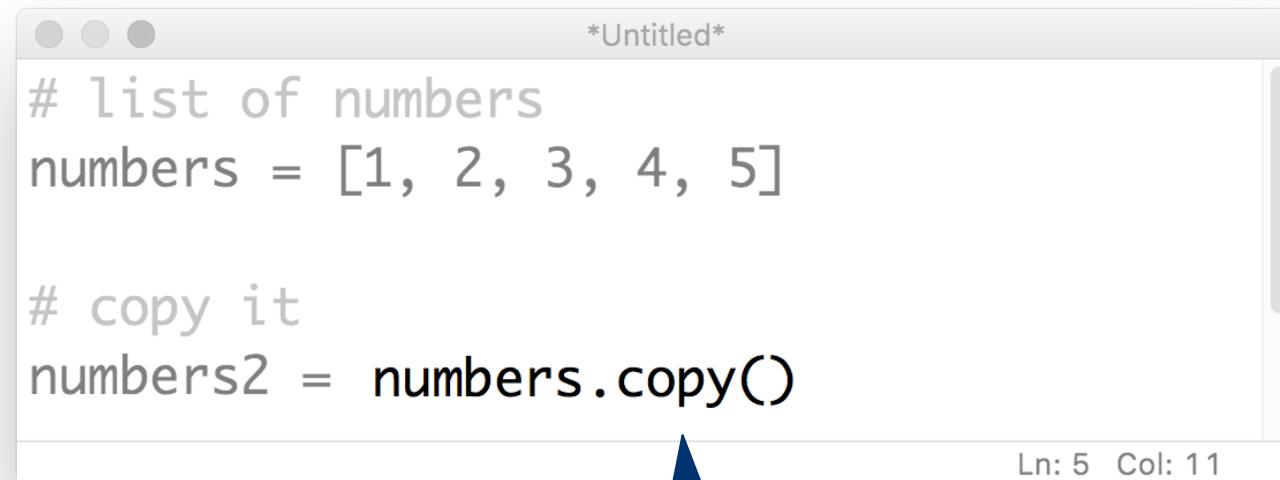
```
# list of numbers
numbers = [1, 2, 3, 4, 5]

# copy it
numbers2 = numbers.copy()

Ln: 5 Col: 11
```

list  
methods:  
.copy()

- If you want to **copy** the **list**:



The image shows a screenshot of a code editor window titled '\*Untitled\*'. The code is written in Python:

```
# list of numbers
numbers = [1, 2, 3, 4, 5]

# copy it
numbers2 = numbers.copy()
```

The status bar at the bottom right indicates 'Ln: 5 Col: 11'. A blue arrow points from the word 'copy' in the second line of code upwards towards the text 'wait... why?'.

wait... why?

# An important note about copying a list

- Usually when we want to copy a string or a number, we just say something like:  
 $x2 = x1$
- Copying a list this way, both the original and the copy point to the **same spot** in memory
- This can cause some unexpected behavior... remember when we said lists were **mutable**?

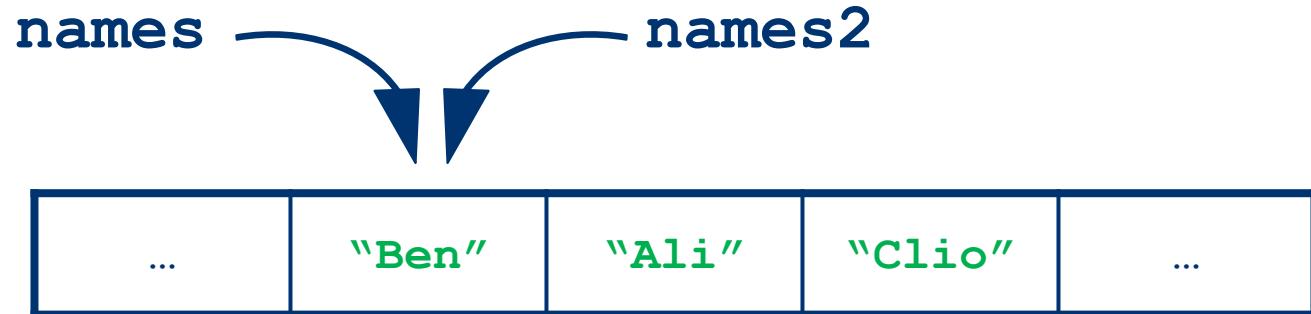
# An important note about copying a list

- Let's say we have a `list` stored in memory:  
`names = ["Ben", "Ali", "Clio"]`



# An important note about copying a list

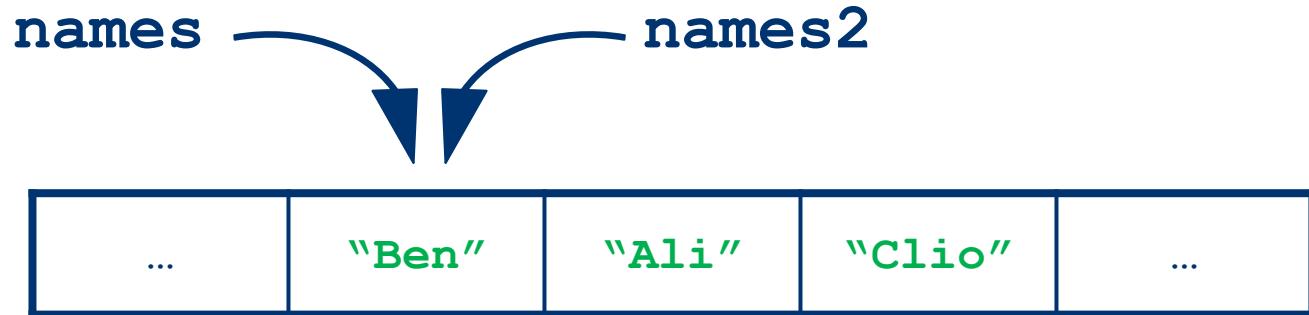
- Let's say we have a `list` stored in memory:  
`names = ["Ben", "Ali", "Clio"]`



- And then we say `names2 = names`

# An important note about copying a list

- Let's say we have a `list` stored in memory:  
`names = ["Ben", "Ali", "Clio"]`

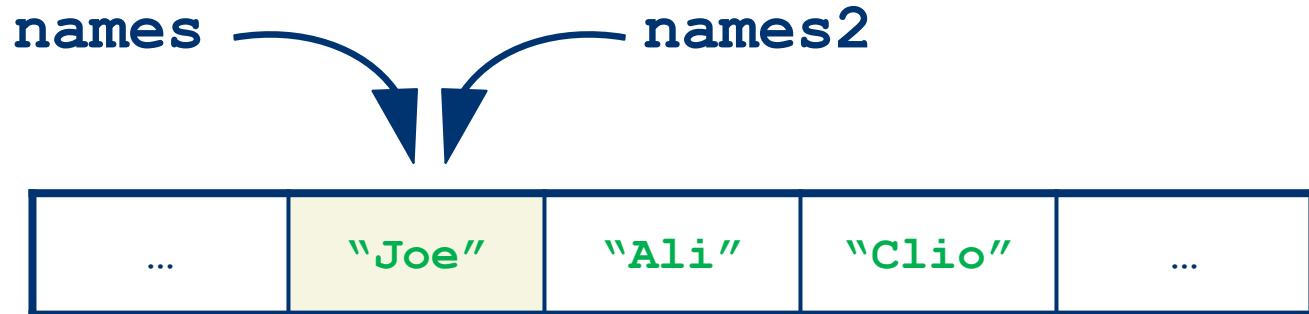


- And then we say `names2 = names`
- If we then say:

`names2[0] = "Joe"`

# An important note about copying a list

- Let's say we have a `list` stored in memory:  
`names = ["Ben", "Ali", "Clio"]`

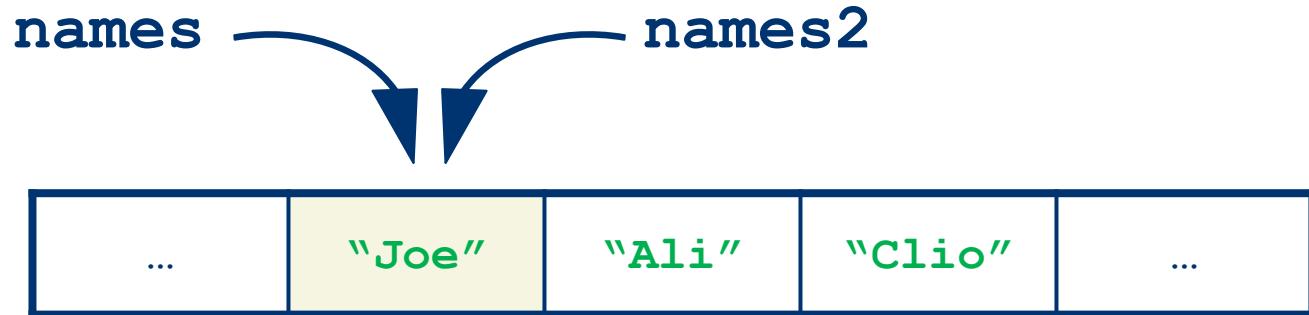


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# An important note about copying a list

- Let's say we have a `list` stored in memory:  
`names = ["Ben", "Ali", "Clio"]`

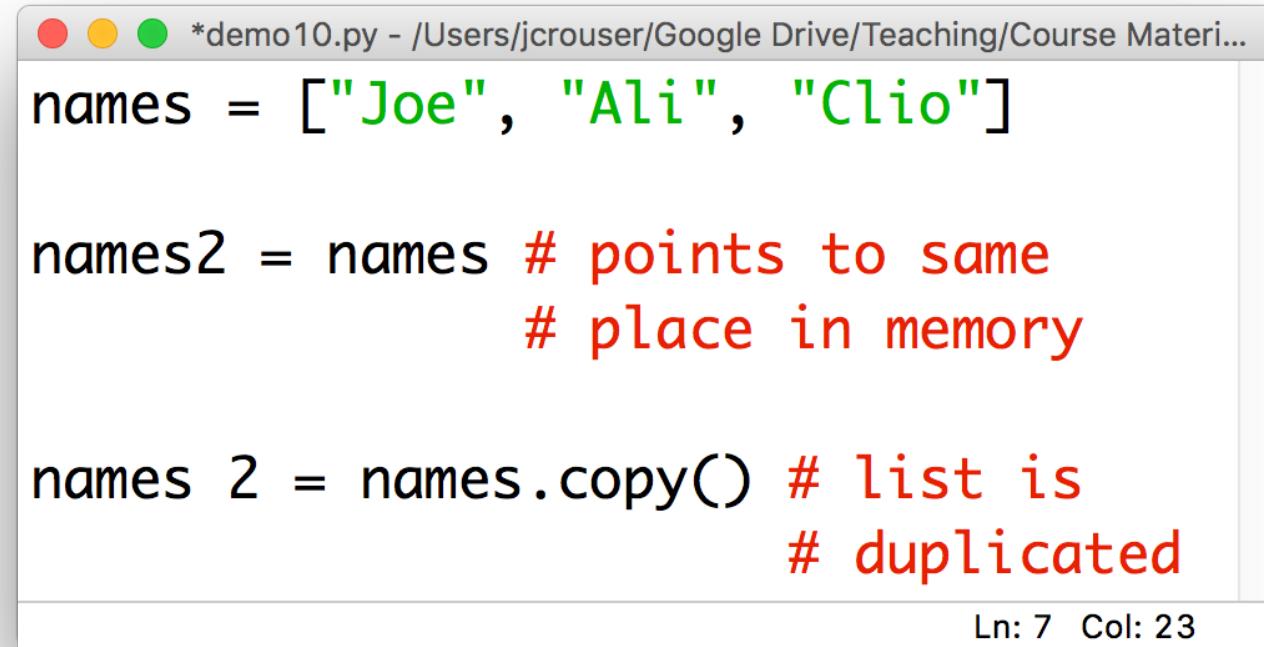


- And then we say `names2 = names`
- If we then say:

`names2[0] = "Joe"`

What happens if we then ask for `names[0]`?

# Recap: copying lists



The image shows a screenshot of a Python code editor window titled '\*demo10.py - /Users/jcrouser/Google Drive/Teaching/Course Mater...'. The code demonstrates two ways to copy lists:

```
names = ["Joe", "Ali", "Clio"]

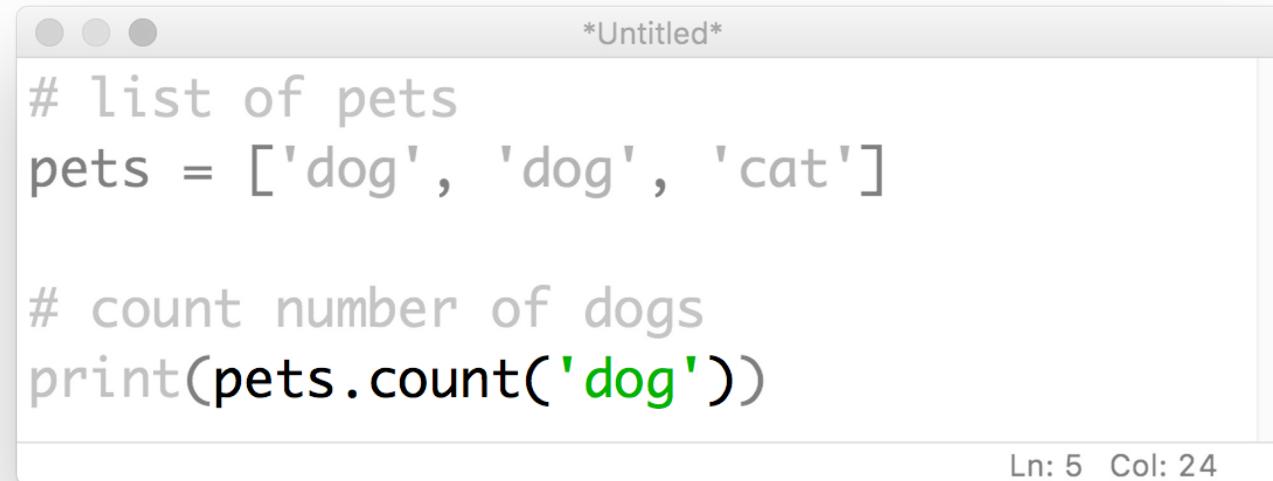
names2 = names # points to same
               # place in memory

names2 = names.copy() # list is
                      # duplicated
```

The status bar at the bottom right indicates 'Ln: 7 Col: 23'.

# list methods: .count()

- If you want to **count how many times an item appears** in the **list**:



```
*Untitled*
```

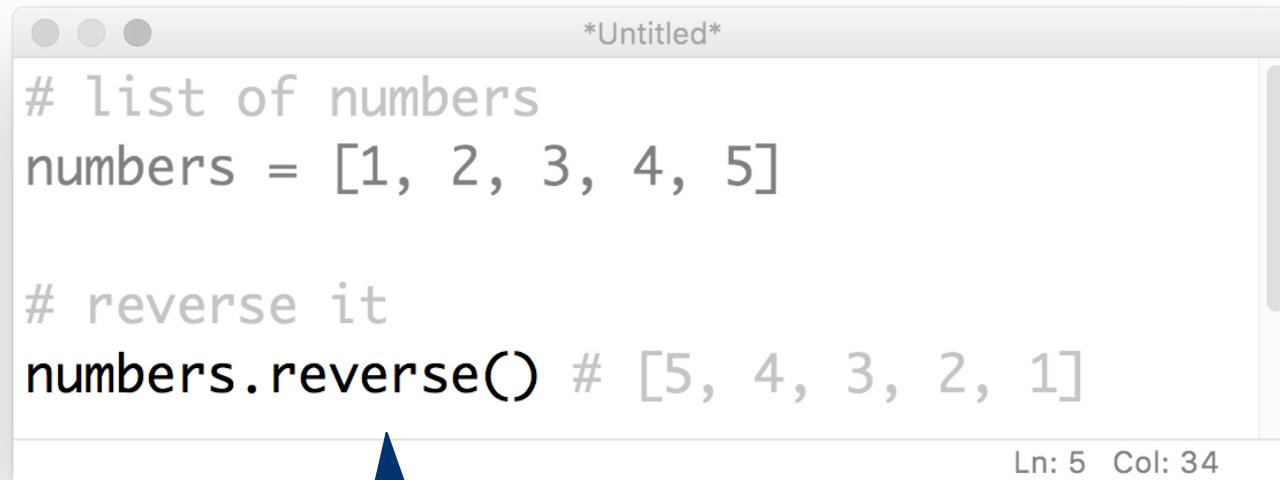
```
# list of pets
pets = ['dog', 'dog', 'cat']

# count number of dogs
print(pets.count('dog'))
```

Ln: 5 Col: 24

# list methods: .reverse()

- If you want to **reverse** the list:



A screenshot of a code editor window titled '\*Untitled\*'. The code is as follows:

```
# list of numbers
numbers = [1, 2, 3, 4, 5]

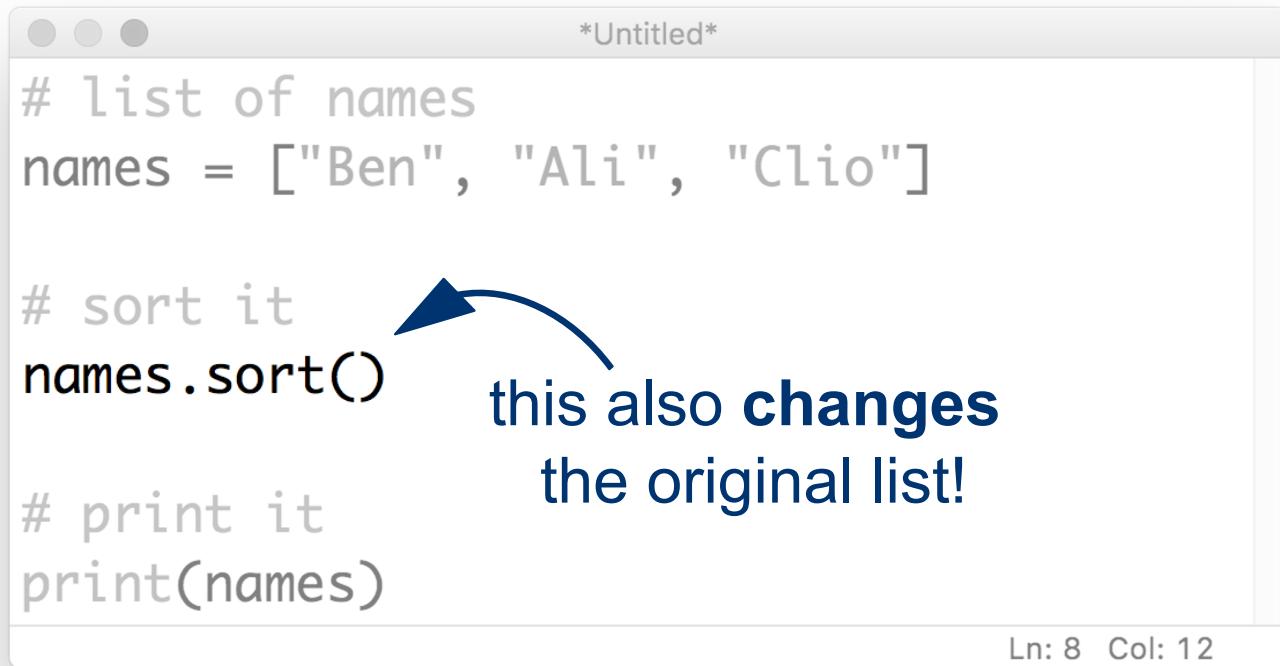
# reverse it
numbers.reverse() # [5, 4, 3, 2, 1]
```

The line `numbers.reverse()` is highlighted in black. In the bottom right corner of the editor, it says "Ln: 5 Col: 34".

this **changes**  
the original list!

# list methods: .sort()

- If you want to **sort** the **list**:



The image shows a screenshot of a code editor window titled "\*Untitled\*". The code is written in Python:

```
# list of names
names = ["Ben", "Ali", "Clio"]

# sort it
names.sort()

# print it
print(names)
```

A blue arrow points from the text "this also changes" to the `sort()` method call in the code.

**this also changes  
the original list!**

Ln: 8 Col: 12

## 15-minute exercise:

Write a program that:

- asks the user to `input()` 5 names
- adds each new name to a list called `friends`
- after each name is added prints the list in alphabetical order