Intro to Coding with Python– Lists

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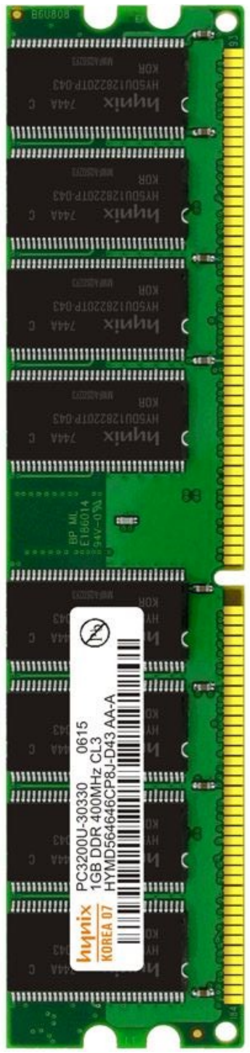
Slides based off slides courtesy of Jordan Crouser (https://jcrouser.github.io/)

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 = “Computer Science”
s[3:6] = “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

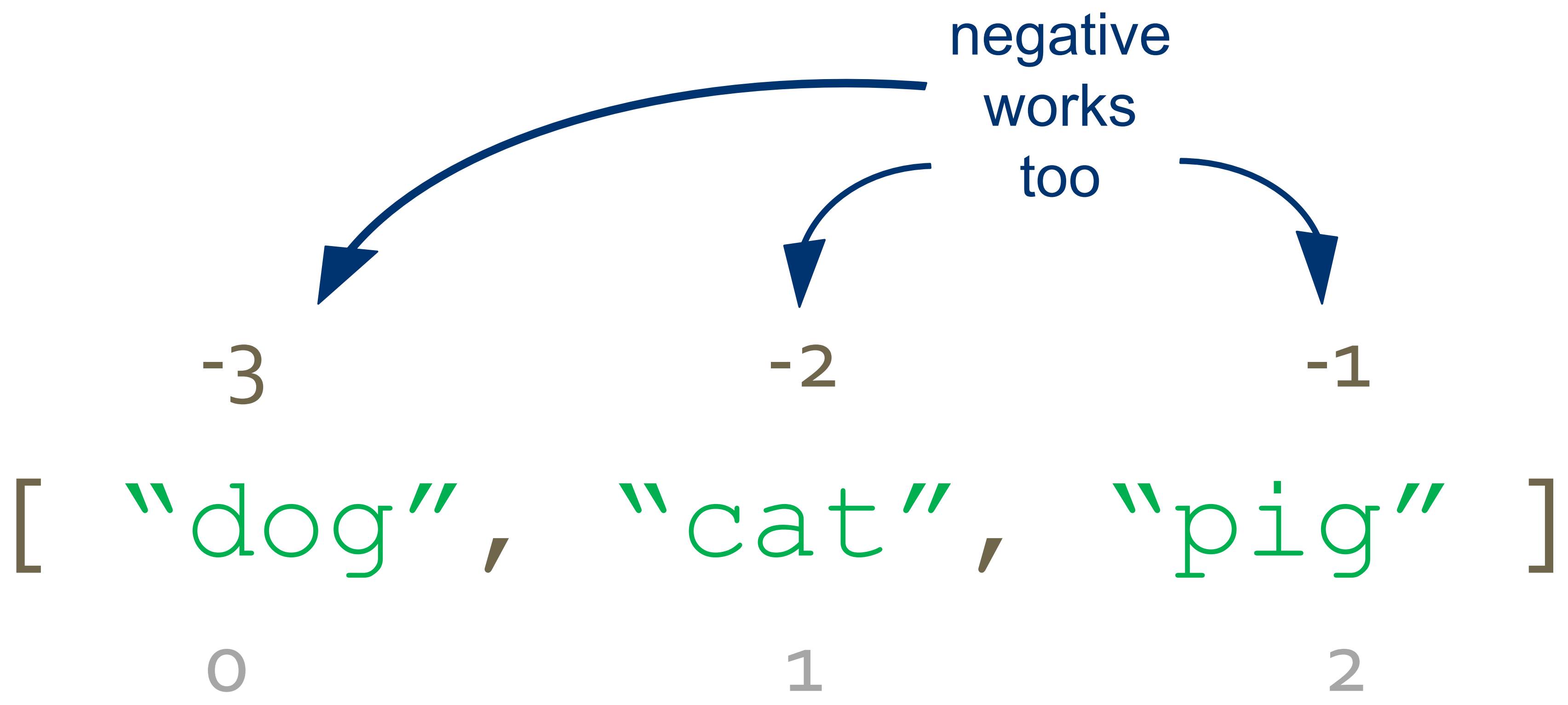
```
[ "dog", "cat", "pig" ]
```

Indexing a `list`

```
[ “dog”, “cat”, “pig” ]
    0      1      2
```

just like with strings

Indexing a `list`



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

Weird **python** thing

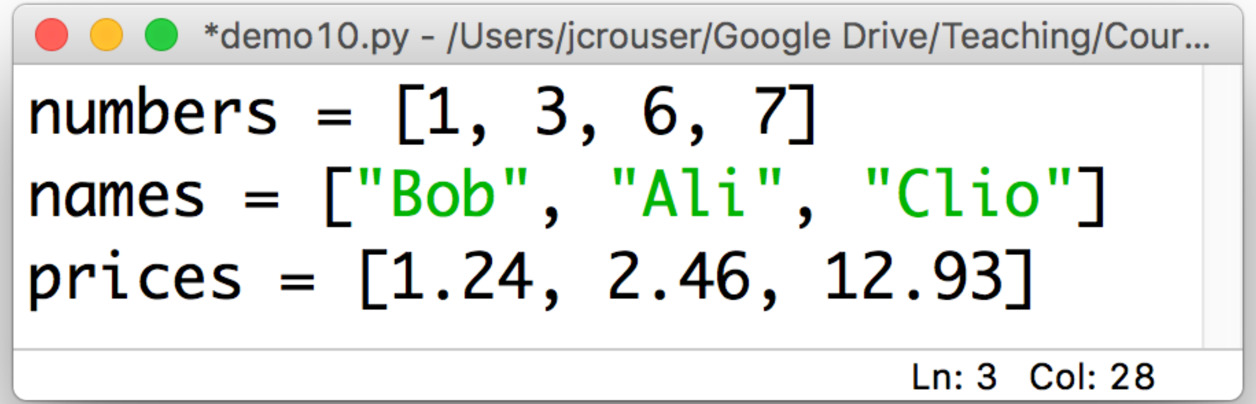
in **python**, lists can contain **mixed types:**

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

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

Naming convention

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

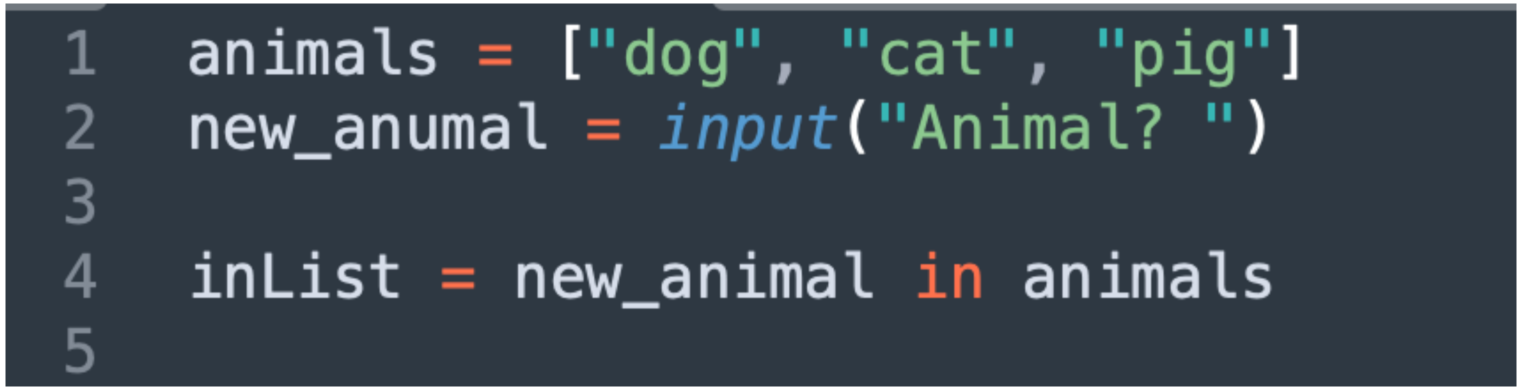


*demo10.py - /Users/jcrouser/Google Drive/Teaching/Cour...

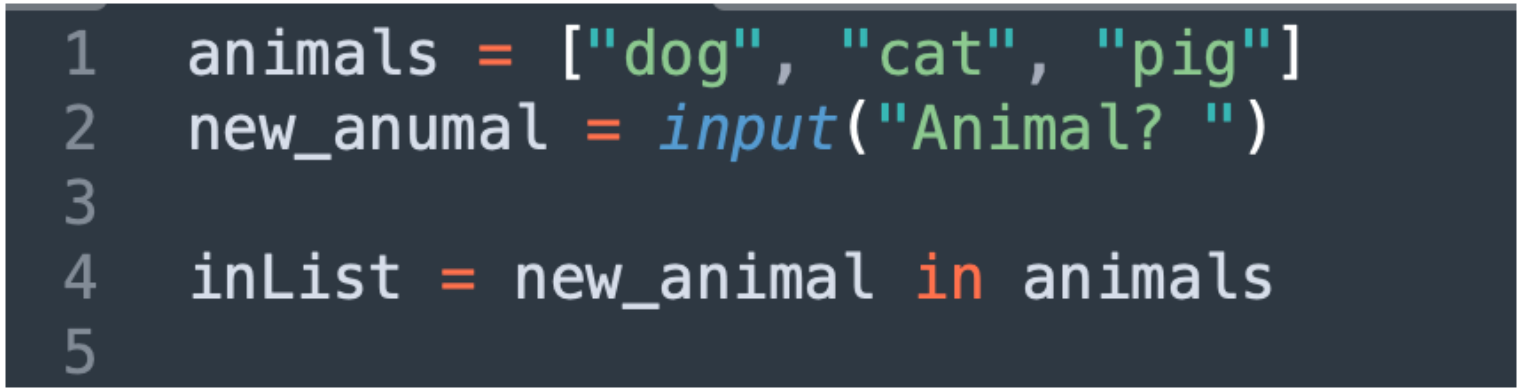
```
numbers = [1, 3, 6, 7]
names = ["Bob", "Ali", "Clio"]
prices = [1.24, 2.46, 12.93]
```

Ln: 3 Col: 28

Checking membership `in` a `list`


```python
animals = ["dog", "cat", "pig"]
new_anumal = input("Animal? ")

inList = new_animal in animals

```

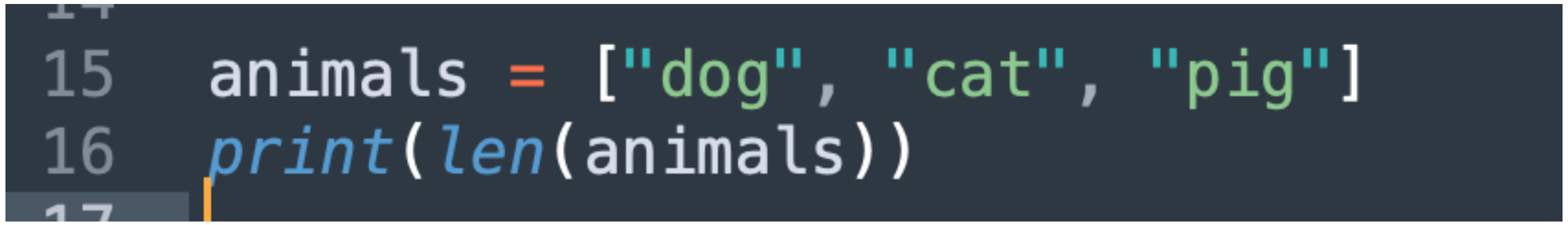
Checking membership `in` a `list`



```
animals = ["dog", "cat", "pig"]
new_anumal = input("Animal? ")

inList = new_animal in animals

```

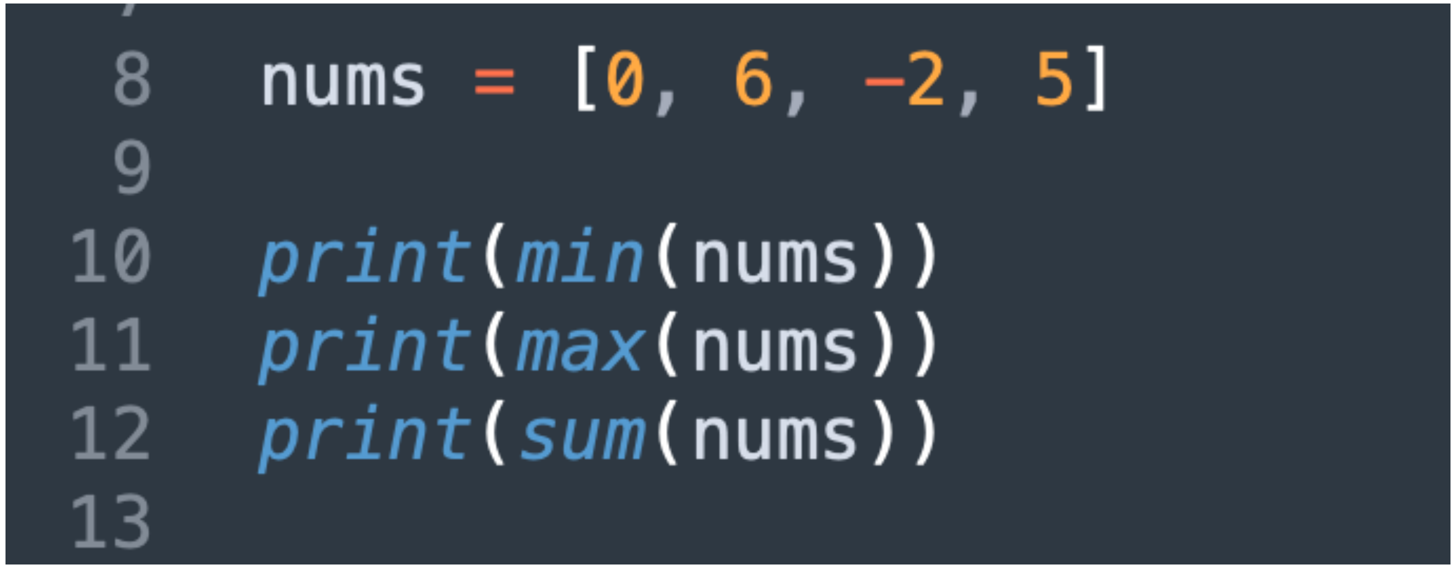
- Returns `True` if new_animal is in animals
- Returns `False` otherwise

Checking length of a `list`



```
animals = ["dog", "cat", "pig"]
print(len(animals))
```

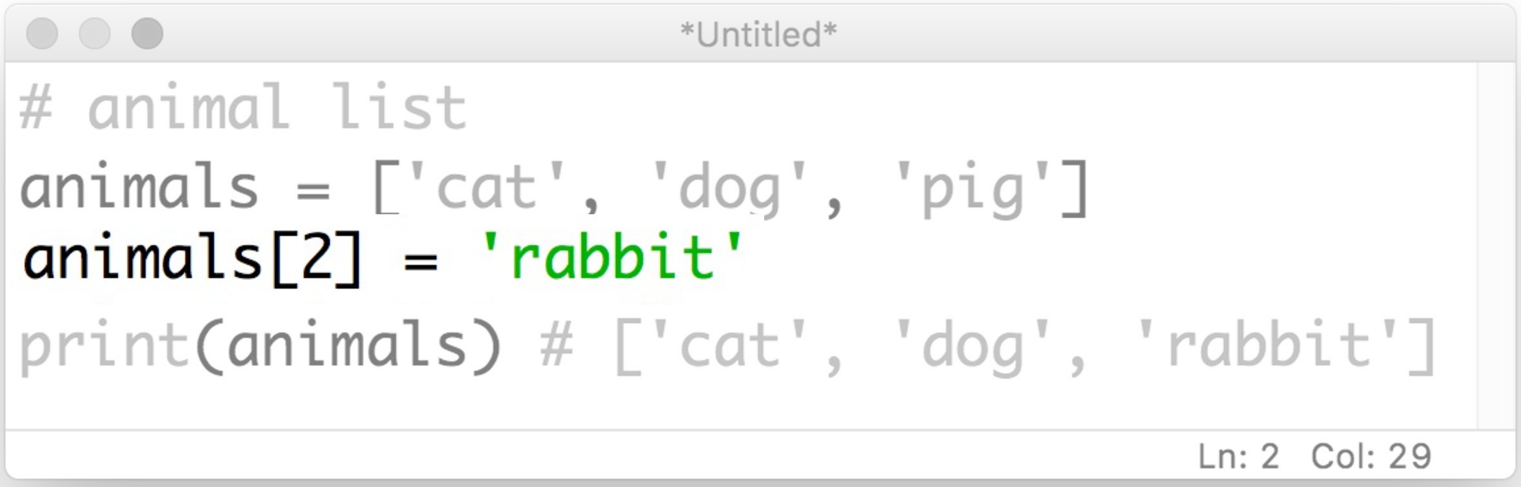
Functions on **`lists`** of numbers



```
nums = [0, 6, -2, 5]

print(min(nums))
print(max(nums))
print(sum(nums))

```

Overwriting an item in a `list`

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

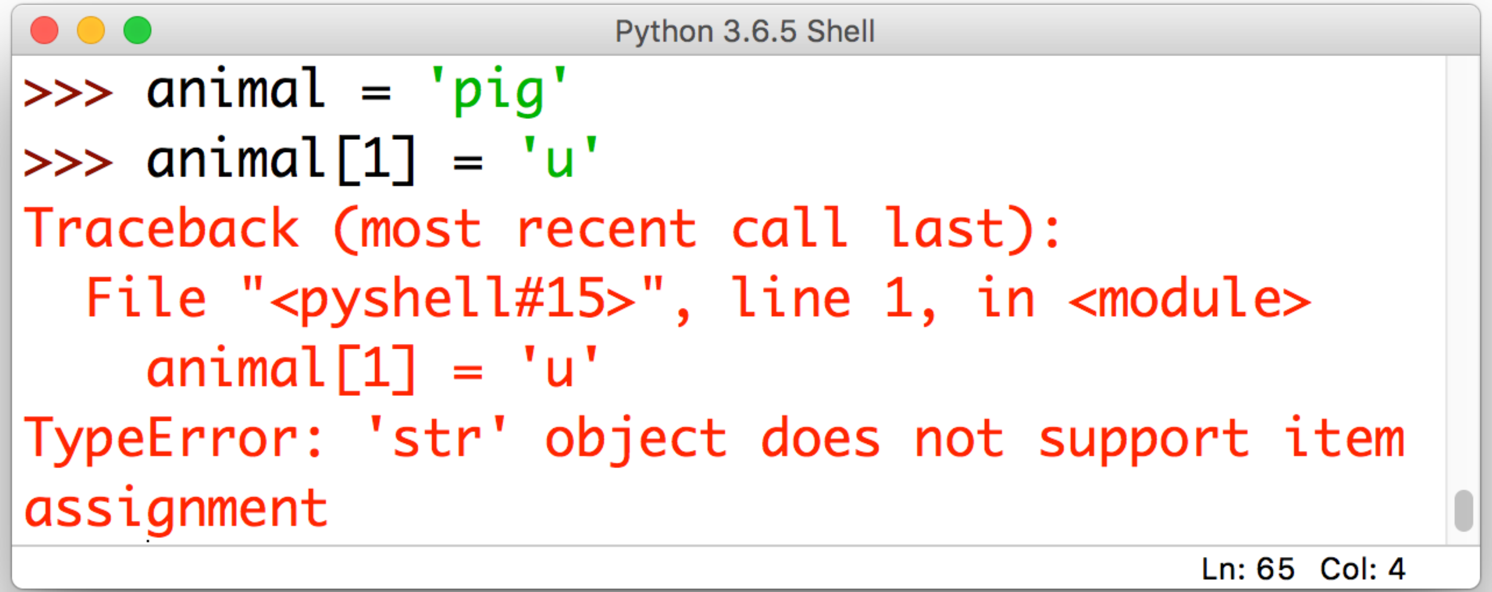


```
# animal list
animals = ['cat', 'dog', 'pig']
animals[2] = 'rabbit'
print(animals) # ['cat', 'dog', 'rabbit']
```

Discussion

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

Discussion



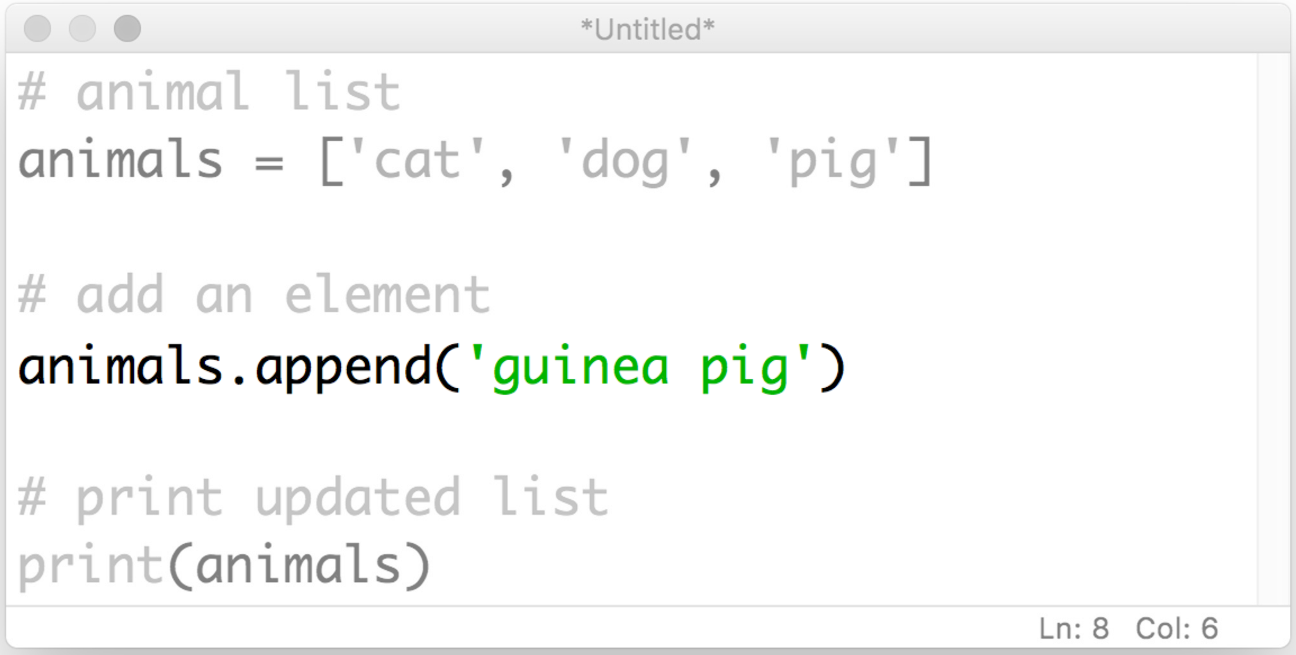
```
>>> animal = 'pig'
>>> animal[1] = 'u'
Traceback (most recent call last):
  File "<pyshell#15>", line 1, in <module>
    animal[1] = 'u'
TypeError: 'str' object does not support item
assignment
```

`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()`

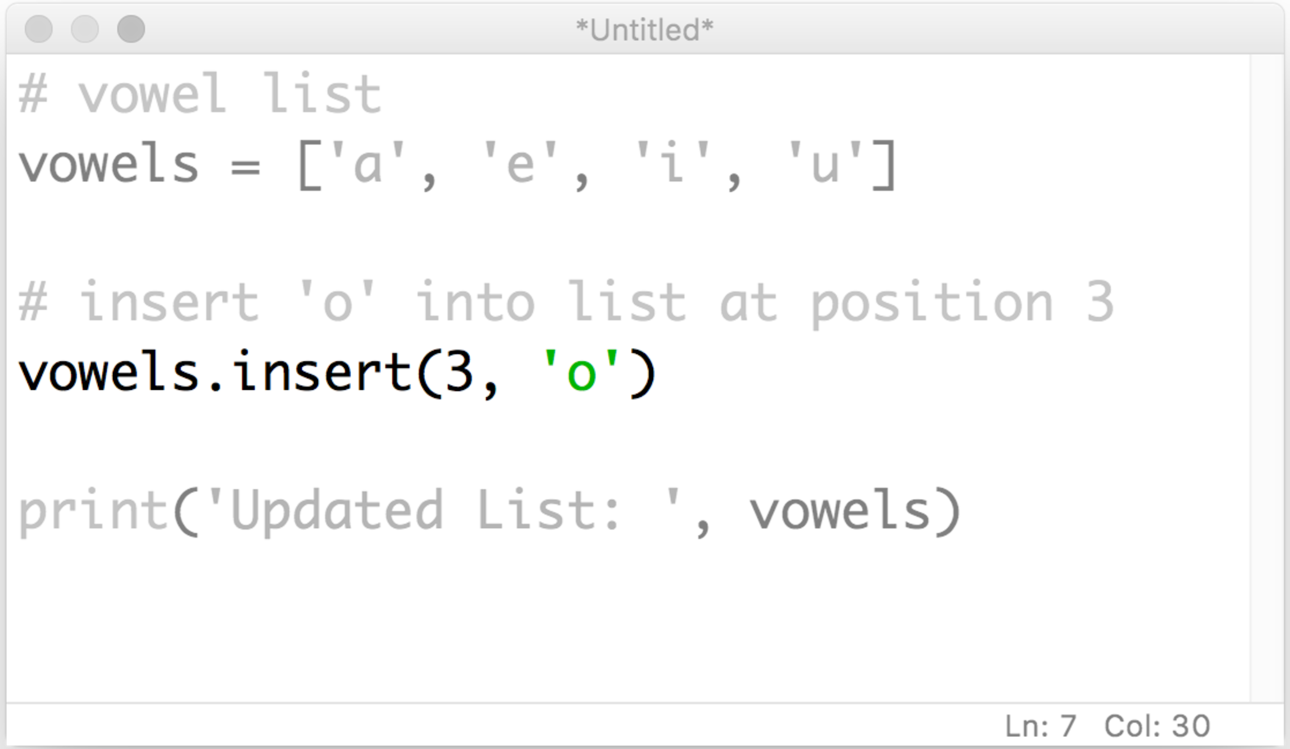
- If you want to **add a new item** to the end of a `list`:



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

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

# print updated list
print(animals)
```

`list` methods: `.insert()`

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



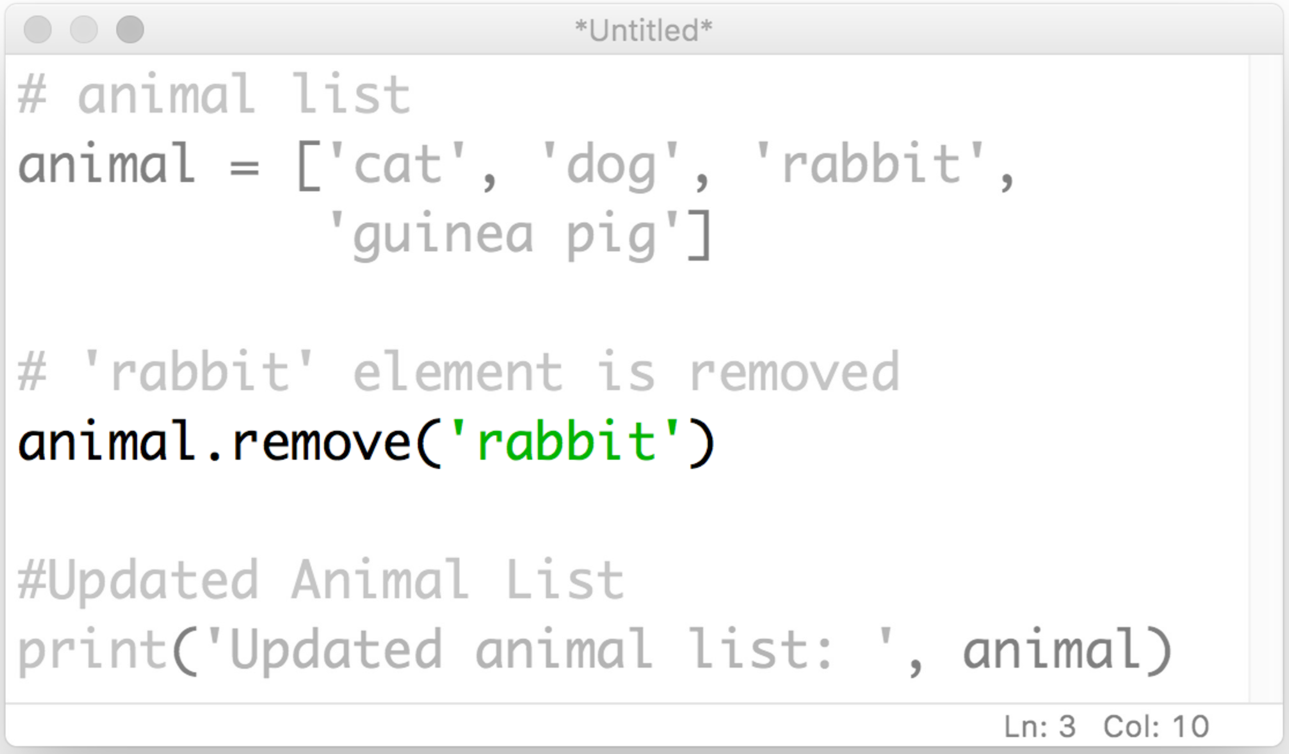
Untitled

```
# 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`**:



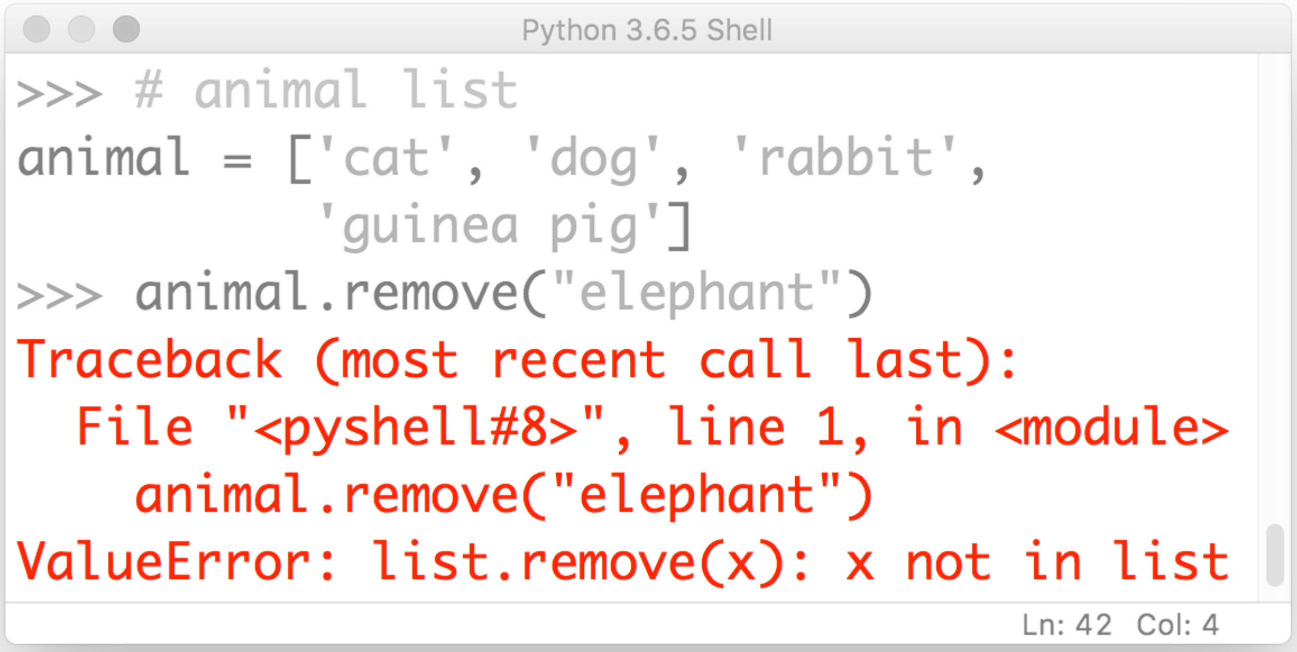
Untitled

```
# 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`**:



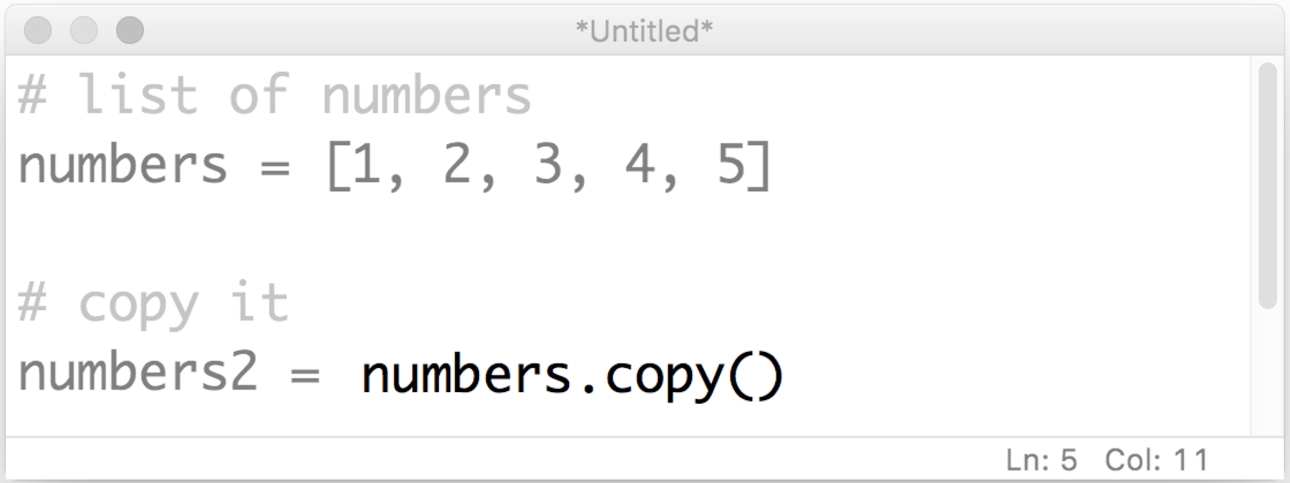
Python 3.6.5 Shell

```
>>> # 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`**:



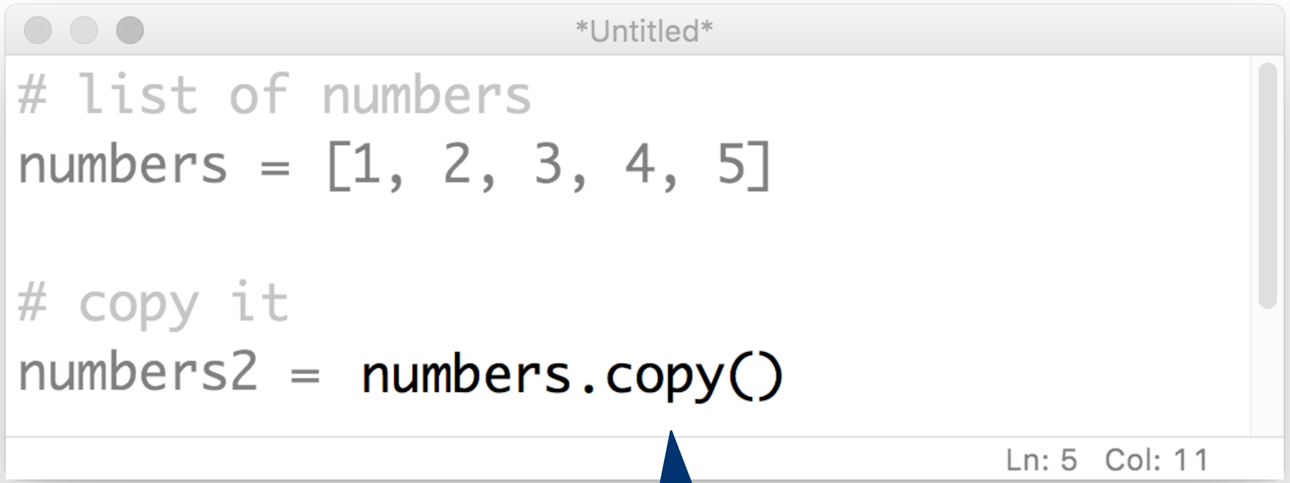
Untitled

```
# 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`**:



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

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

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:

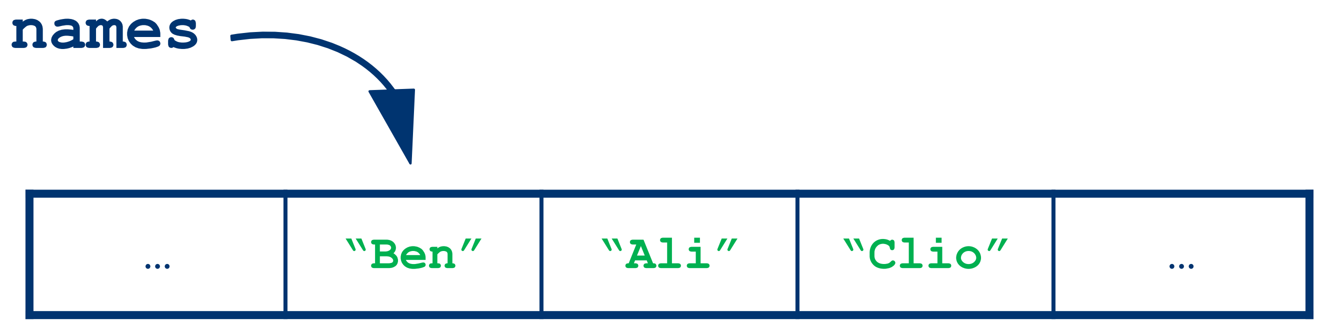
```
x2 = x1
```

- 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`

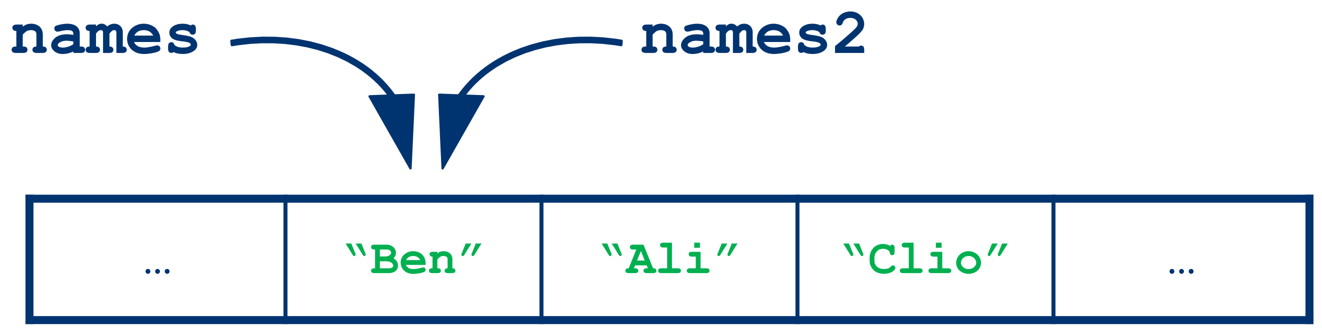
- Let's say we have a **`list`** stored in memory:

```
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”]`

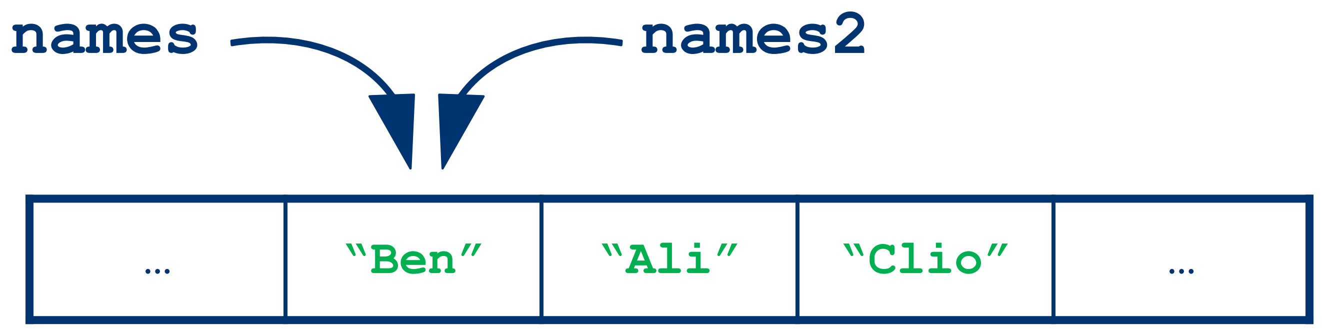


- And then we say **`names2 = names`**

An important note about copying a `list`

- Let's say we have a **`list`** stored in memory:

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

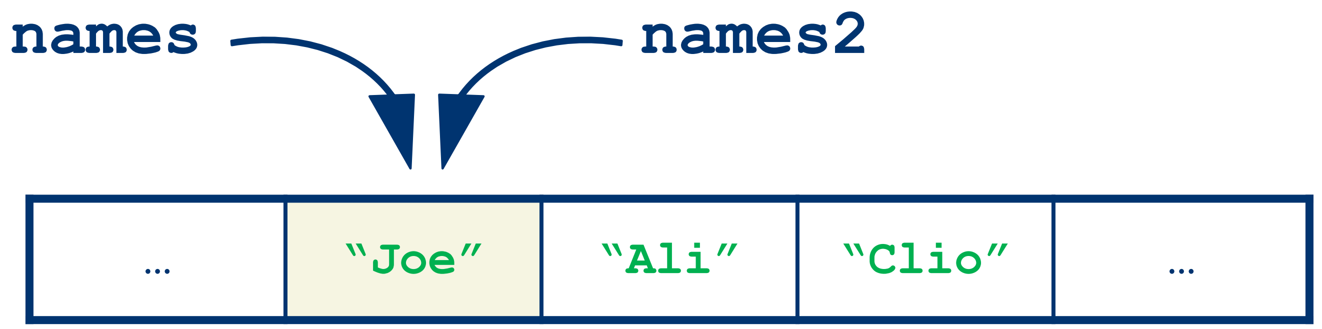


- And then we say **`names2 = names`**
- If we then say:

```
    names2[0] = "Joe"
```

An important note about copying a `list`

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



- And then we say **`names2 = names`**
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    names2[0] = "Joe"
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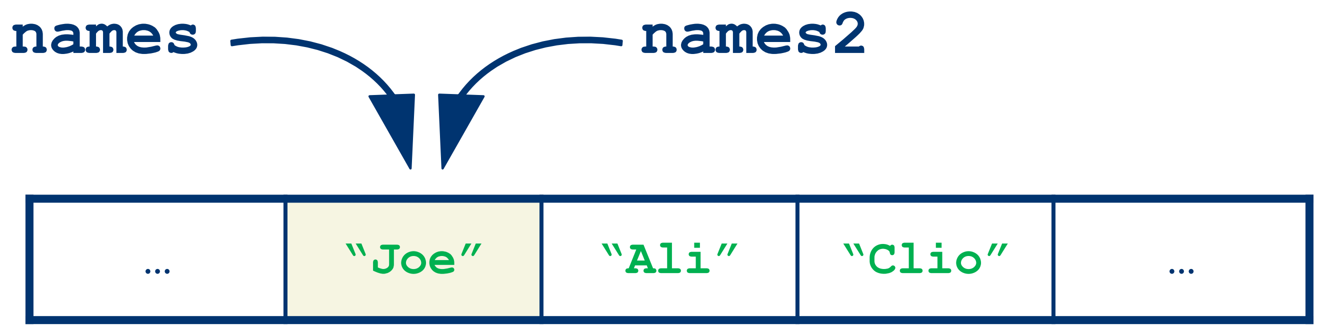
An important note about copying a `list`

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

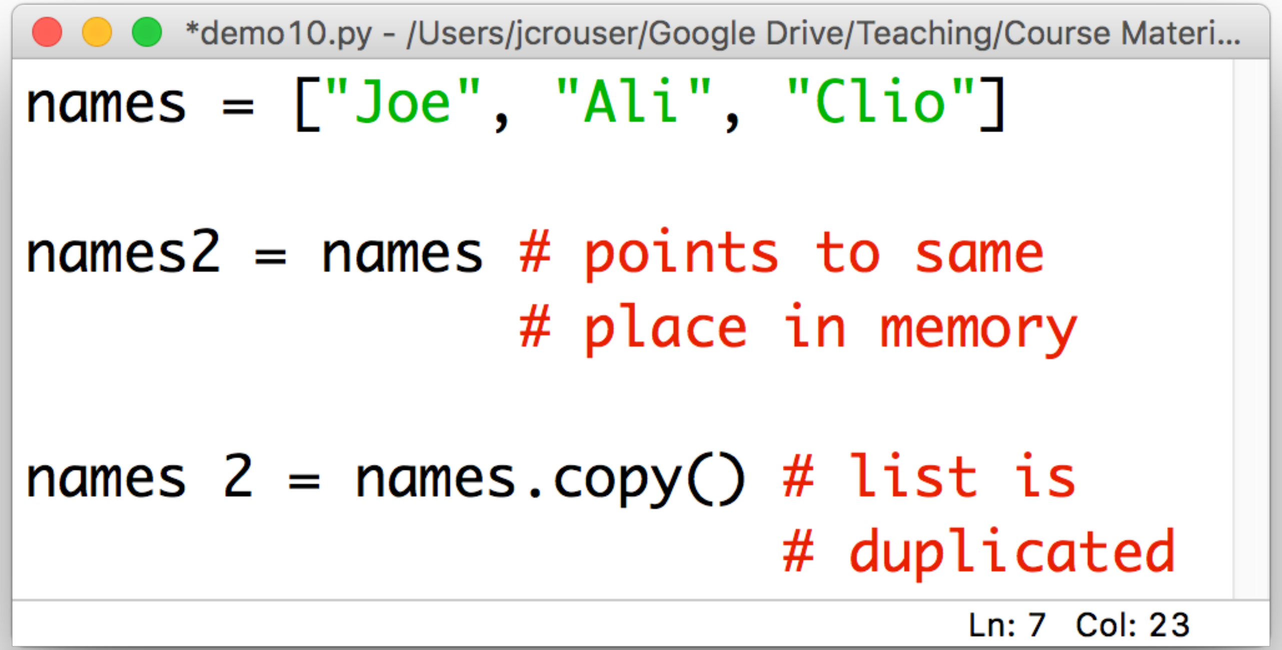


- And then we say `names2 = names`
- If we then say:

```
    names2[0] = “Joe”
```

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

Recap: copying `lists`

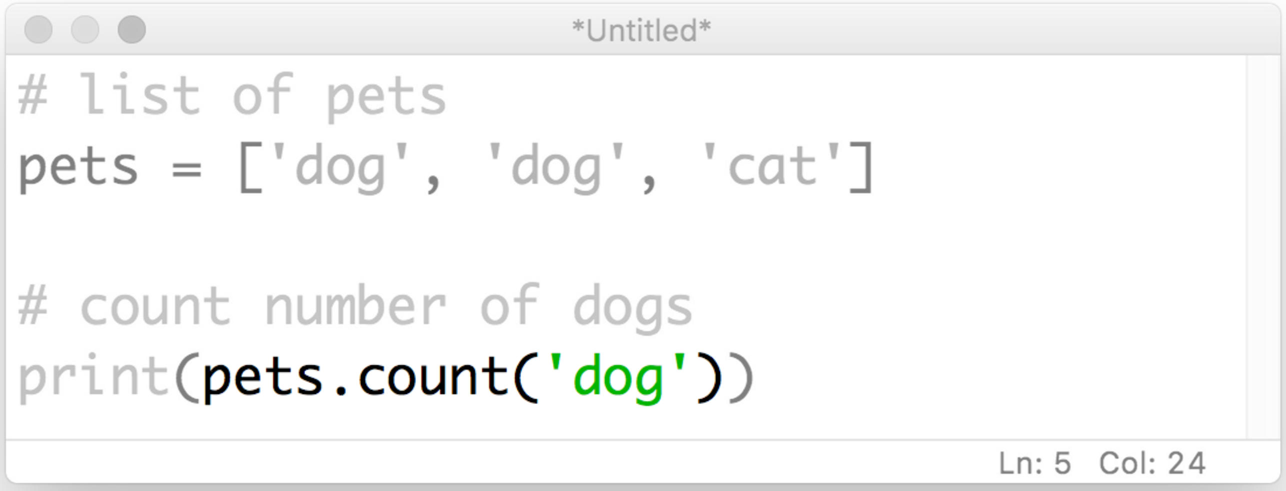

*demo10.py - /Users/jcrouser/Google Drive/Teaching/Course Materi...

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

names2 = names # points to same
               # place in memory

names 2 = names.copy() # list is
                       # duplicated
```

Ln: 7 Col: 23

`list` methods: `.count()`

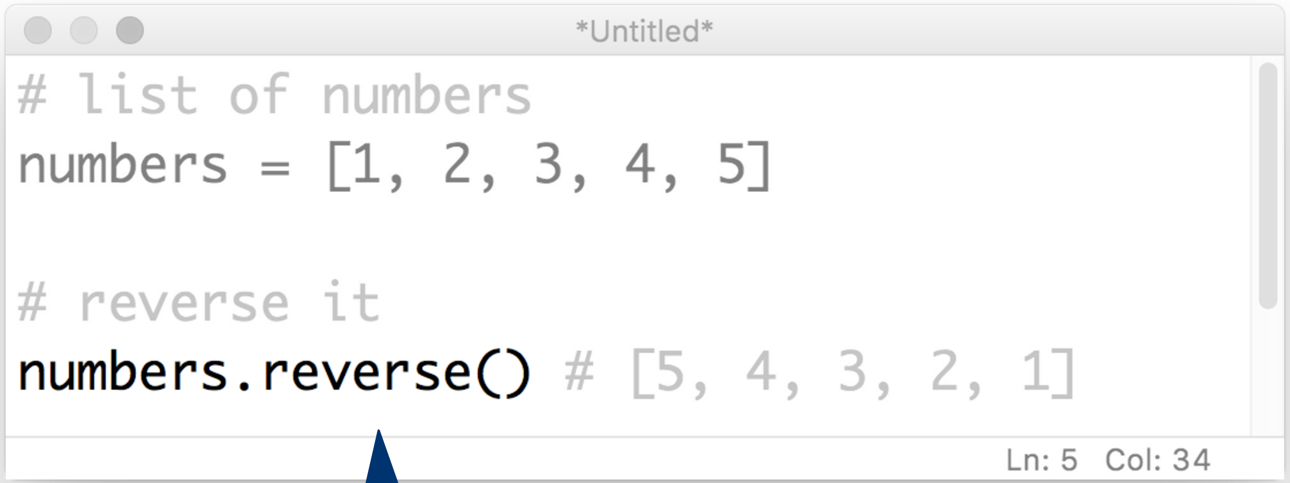
- If you want to **count how many times an item appears** in the **`list`**:



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

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

`list` methods: `.reverse()`

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

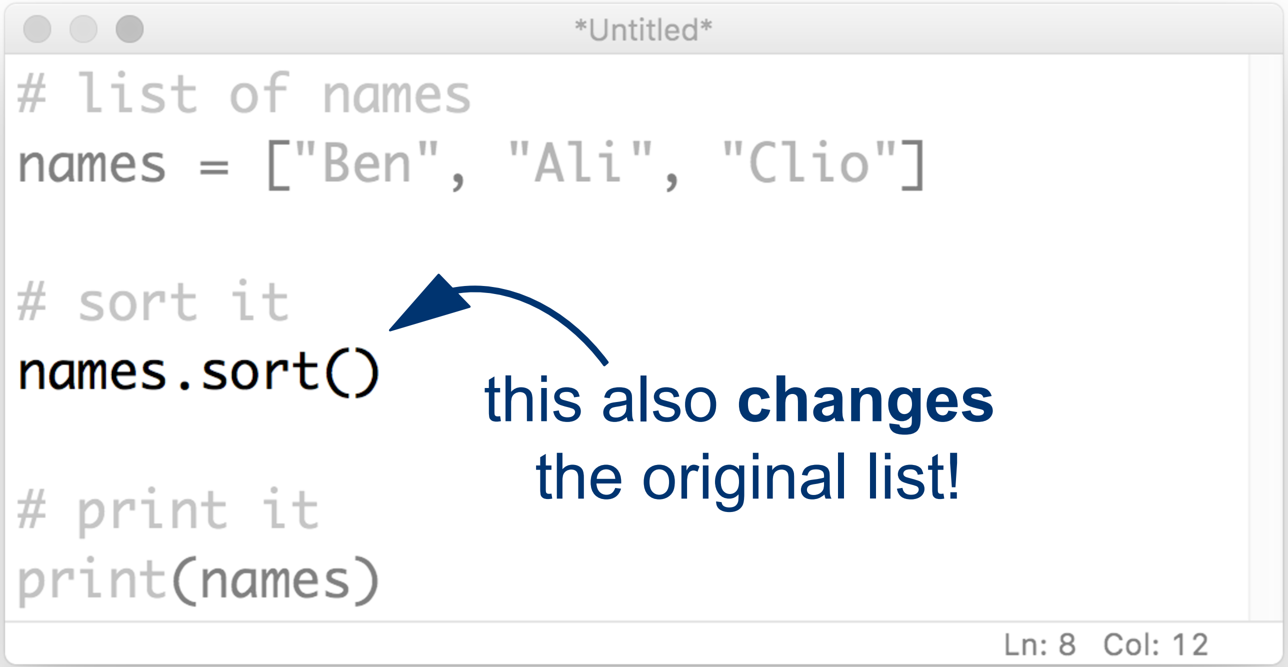


```
# list of numbers
numbers = [1, 2, 3, 4, 5]

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

this **changes** the original list!

`list` methods: `.sort()`

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



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

# sort it
names.sort()

# print it
print(names)
```

this also **changes** the original list!

15-minute exercise:

Write a program that:

- asks the user to input names separated by commas
- creates a list with the input names
- prints the length of the list
- prints list with the names in alphabetical order
- prints the list with the names in reverse alphabetical order