Why Does My Computer Do That? Intro to Coding with Python– Loops

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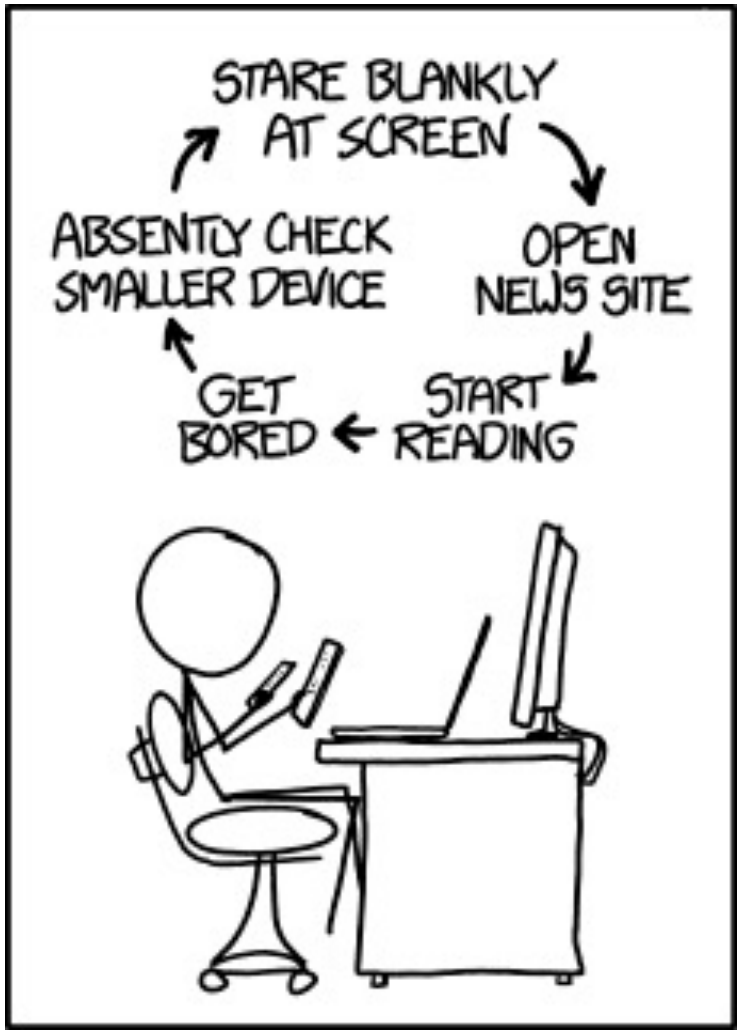
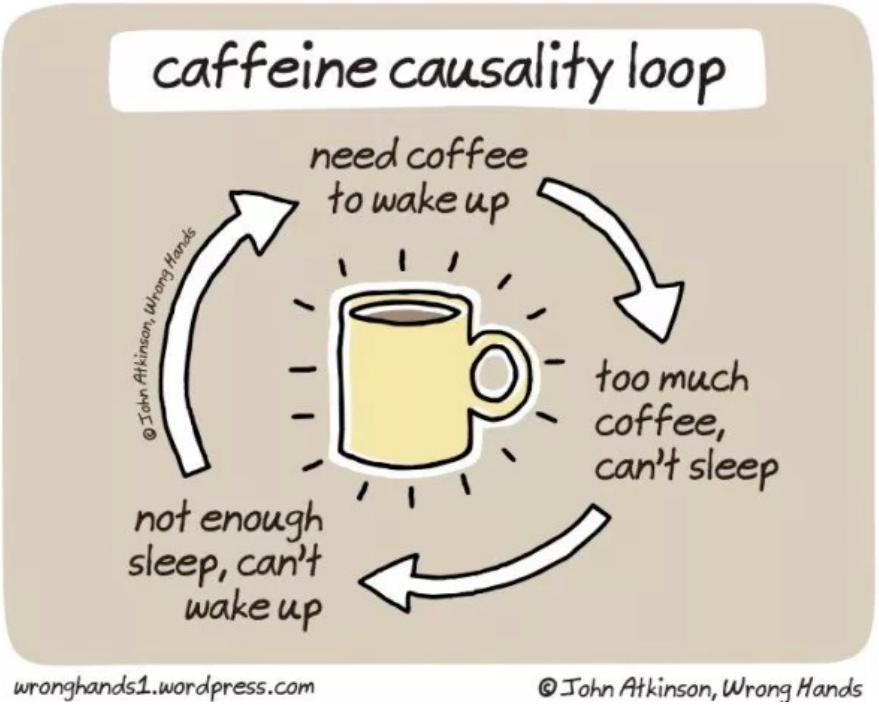
Slides based off slides courtesy of Jordan Crouser (https://jcrouser.github.io/)

Plan for Today

- For loops
- While loops

Loops: a familiar idea





https://xkcd.com/1411/

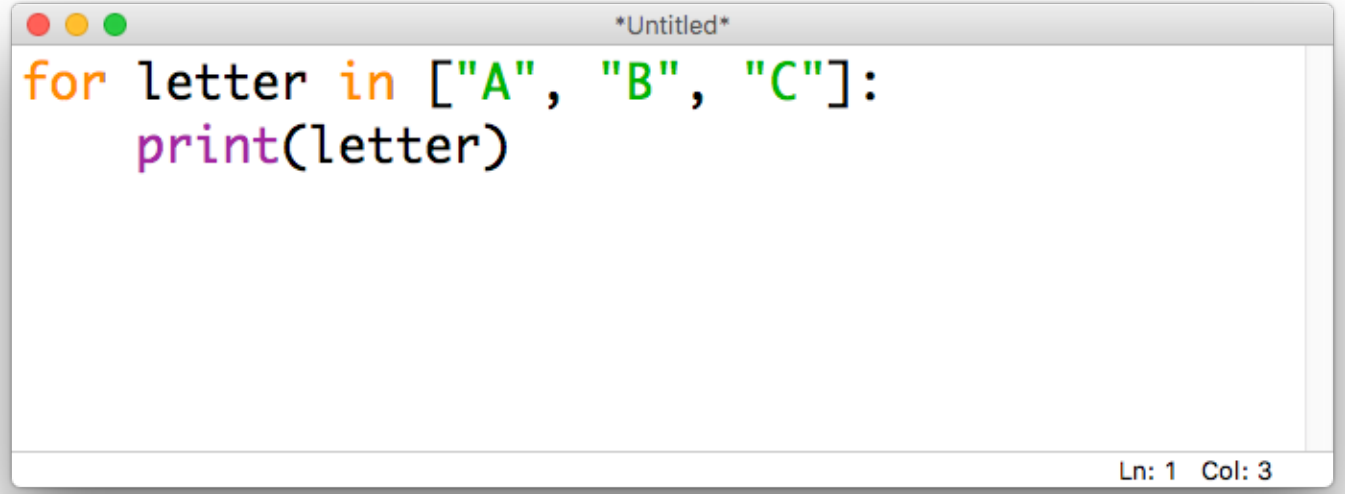
Loops in computer programming

- **Goal**: simplify the description of repeated blocks of code (i.e. make it shorter/easier to understand by highlighting **what's being repeated** and **for how long**)

- **Three approaches:**
  - run for **each item** in a list
  - run a specific **number of times**
  - run **until** some condition is met

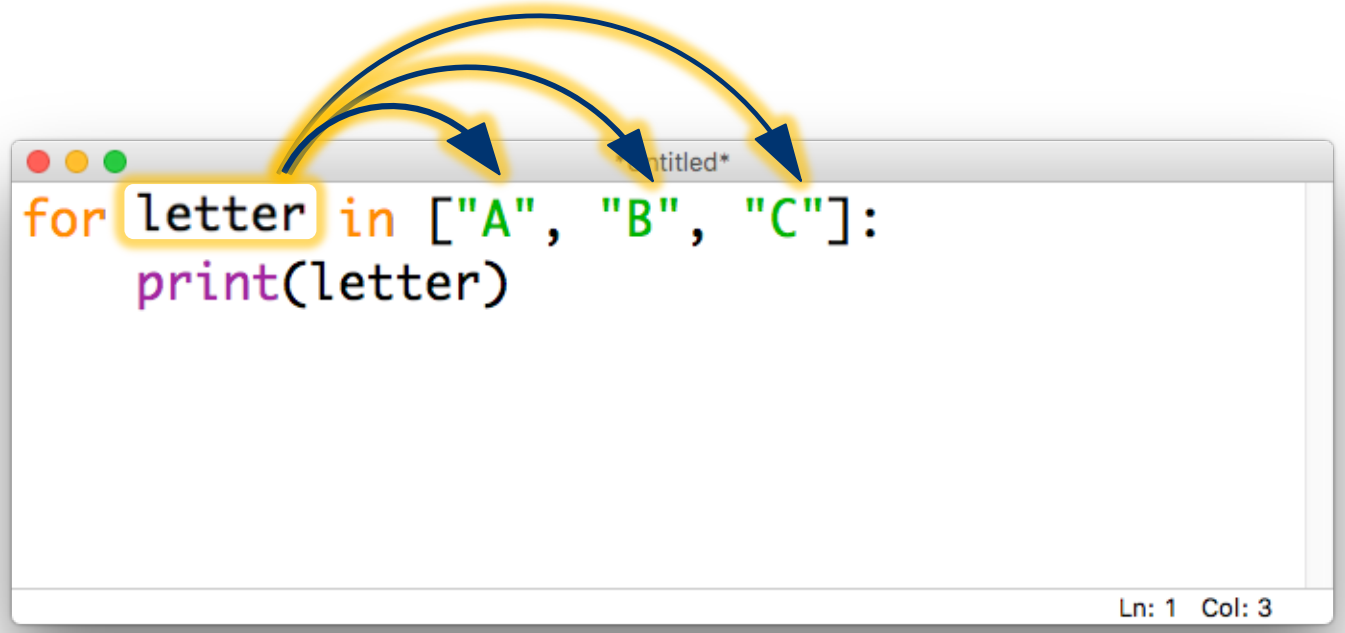
`for...in` loops

- In Python, we use the keywords **`for`** and **`in`** to loop through a list



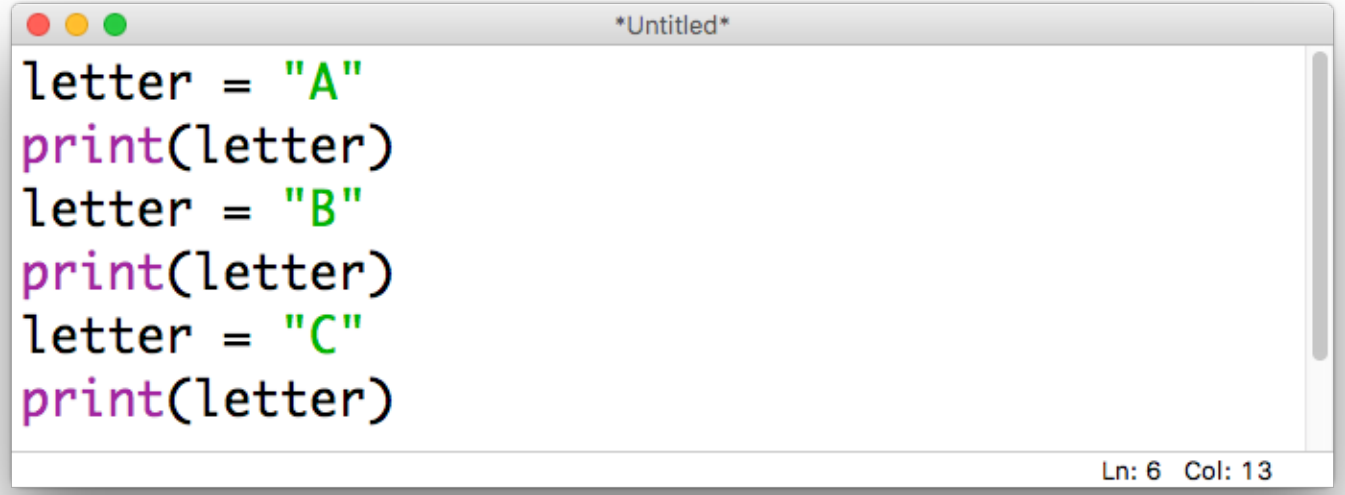
`for...in` loops

- We can think of this in terms of where the variable **`letter`** is pointing:



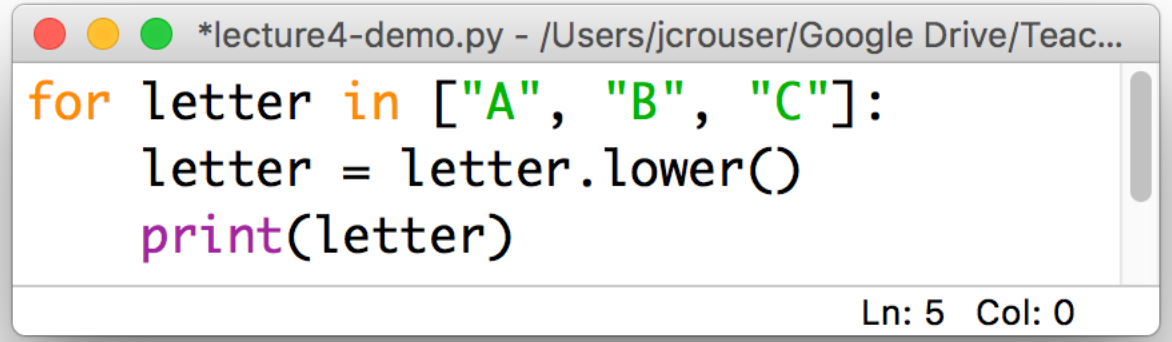
`for...in` loops: unpacked

- We could accomplish the same thing by writing it out as **three separate assignments**:



`for...in` loops: a common "gotcha"

- Python will allow you to **modify a list** while you're looping through it:



- This is generally a **bad idea** (more on why later)
  - it's fine to format the **values**, etc.
  - just don't **overwrite** the originals!

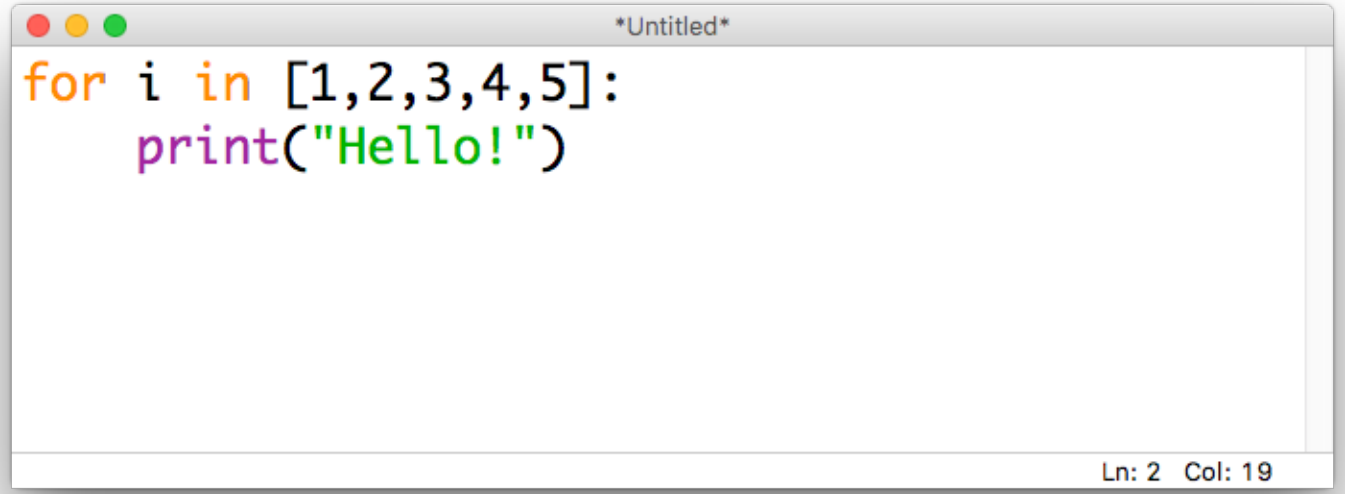
Demo: compute a sum

Use a `for` **loop** to compute the **sum** of a list of numbers

- **Step 1**: pseudocode
- **Step 2**: python

Looping `n` times

- **Bad news**: there isn't a way to say "run this loop `n` times" in Python – we'll have to find a way around that
- If we want a **`for...in`** loop to run a specific # of times, can "trick" it using a list of numbers that's the right size



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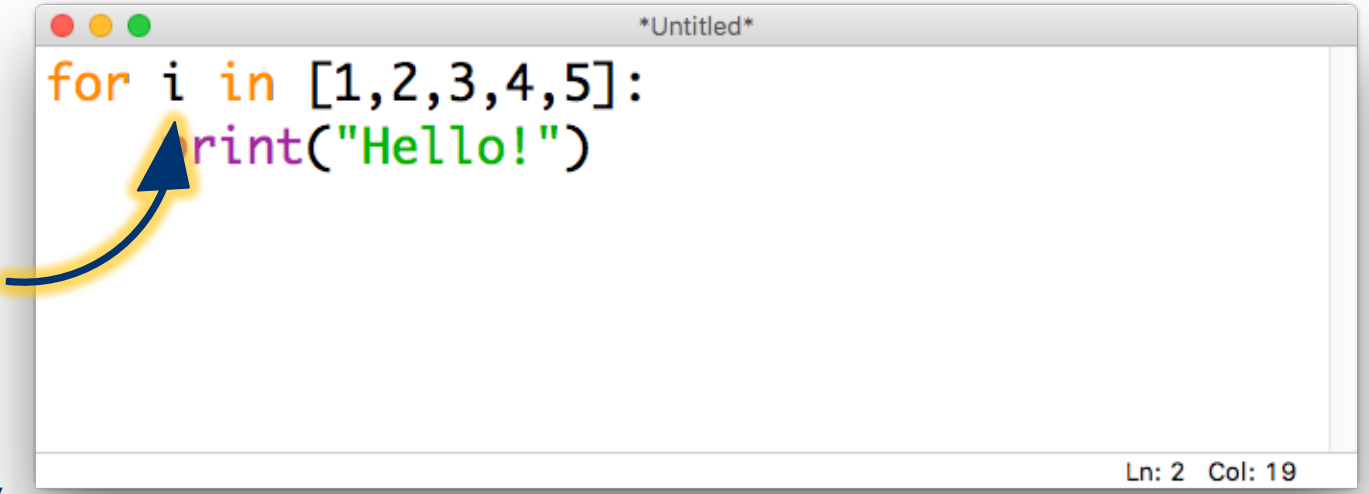
common practice: use the letter **`i`** to denote the "index"



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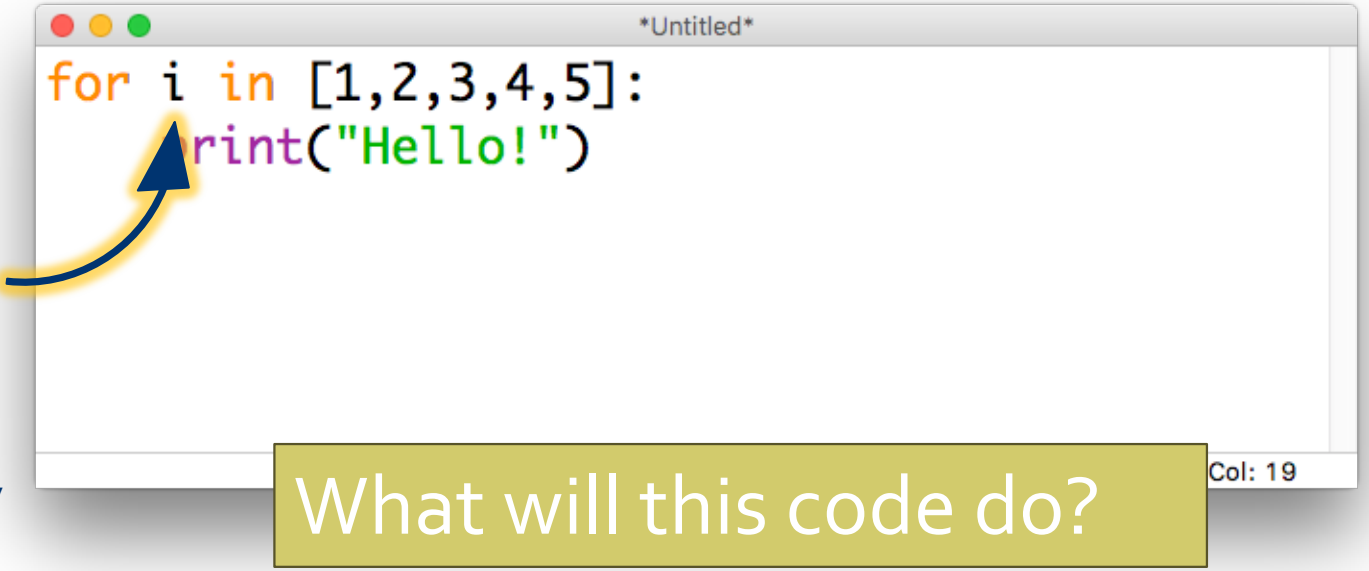
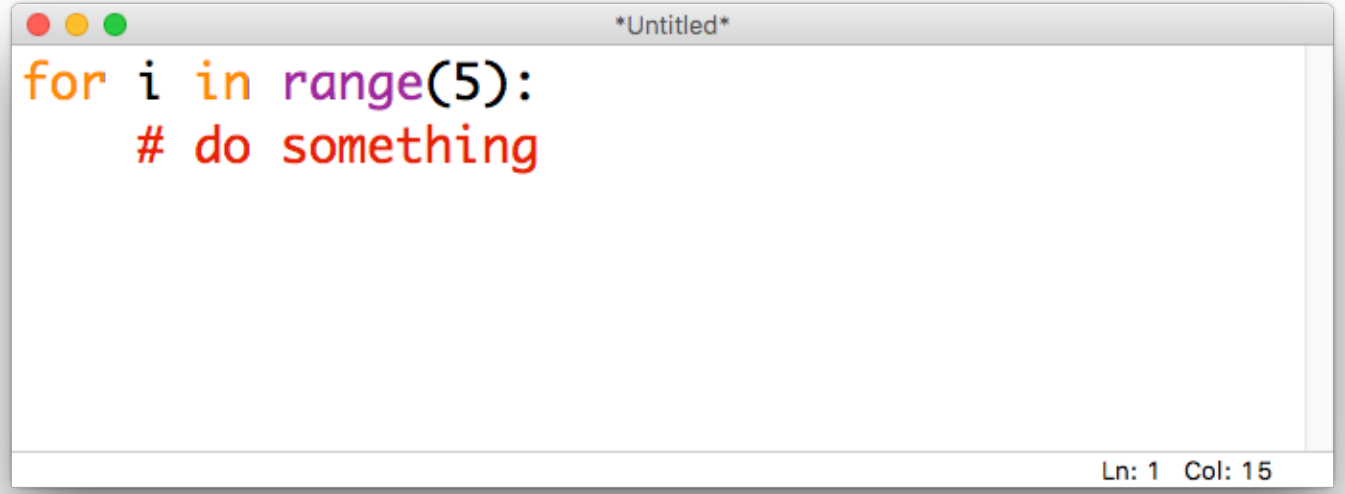


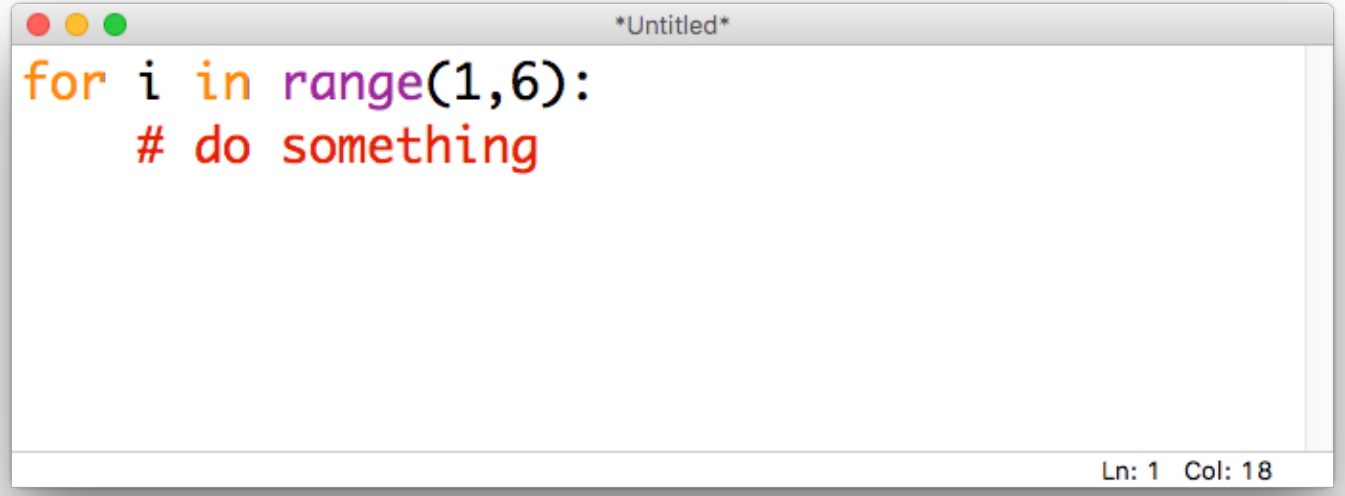
The `range()` function

- The **`range()`** function lets us generate lists of integers
- Given **one** integer **`a`**, **`range(a)`** will generate a list starting at 0 and going up to (but not including) **`a`**
- For example, if we want a loop to run **5** times:



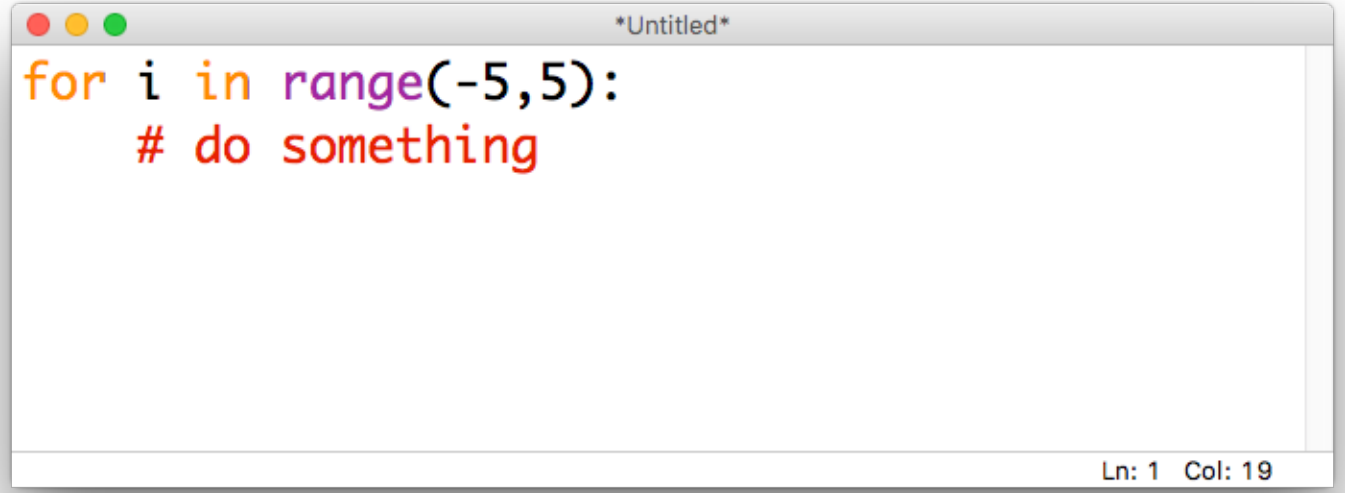
The `range()` function

- Given **two** integers **`a`**,**`b`**, **`range(a,b)`** will generate a list starting at **`a`** and going up to (but not including) **`b`**
- E.g., if we want to loop over the integers from 1 to 5:



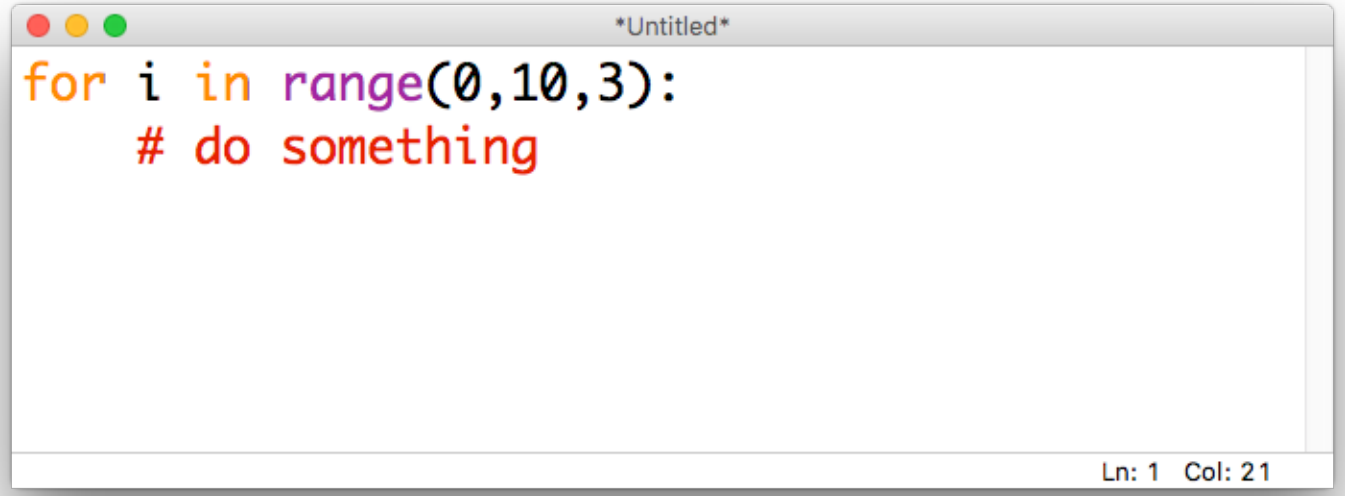
The `range()` function

- These values can be **positive** or **negative** (but for now, the second integer should be **larger** than the first)
- E.g., if we want to loop over the integers from -5 to 5:



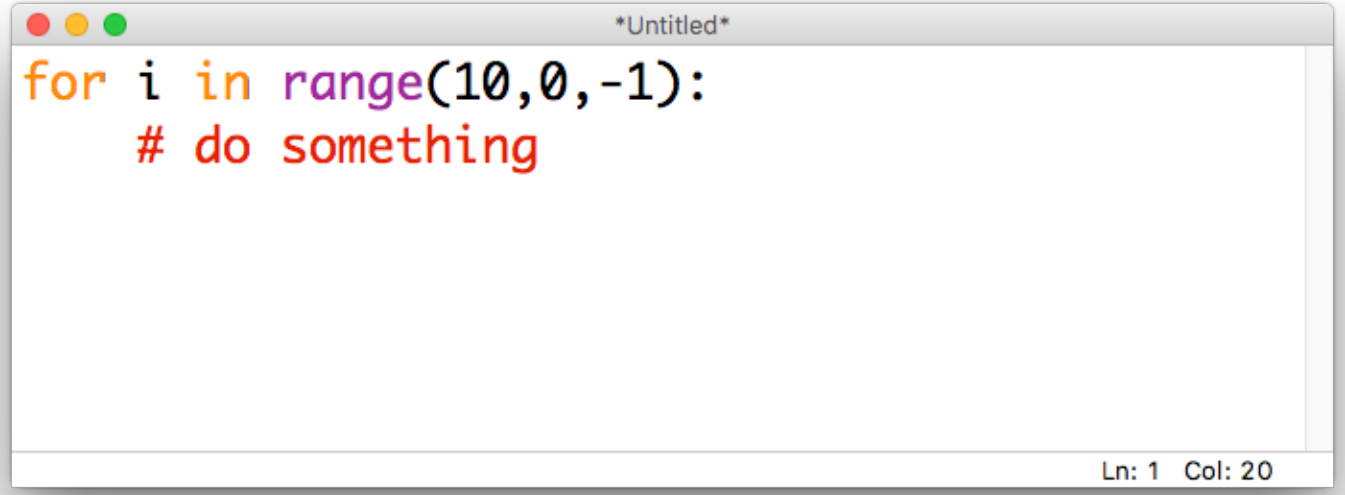
The `range()` function

- Given **three** integers **`a`**, **`b`**, **`c`**, calling **`range(a,b,c)`** will generate a list starting at **`a`** and going up to (but not including) **`b`** with step size **`c`**
- E.g., if we want the integers from 0 to 9, counting by 3s:



The `range()` function

- If we want to count down instead of up, we can set `b < a` and use a negative step size
- E.g., if we want to count down from 10 to 1:



15-Minute Exercise: convert $°F$ to $°C$

Use a **`for` loop** and the **`range()`** function to generate a **conversion table** of temperatures from $°F$ to $°C$ ranging from $100°F$ to $-30°F$ in increments of $10°F$

Tips:

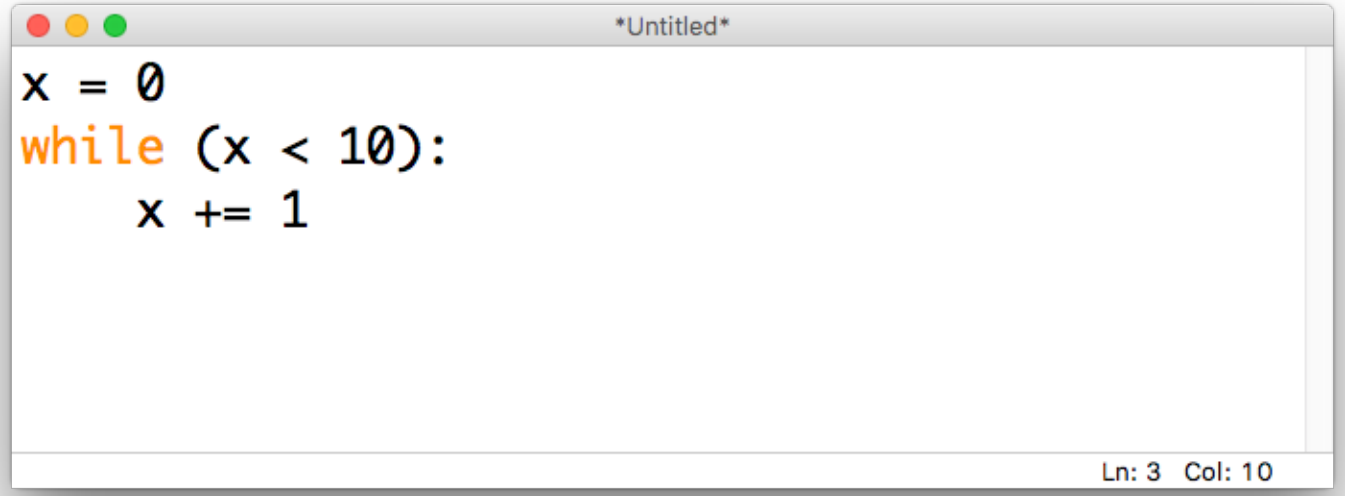
- use the formula $°C = (°F - 32) * 5 / 9$

Discussion

What did you come up with?

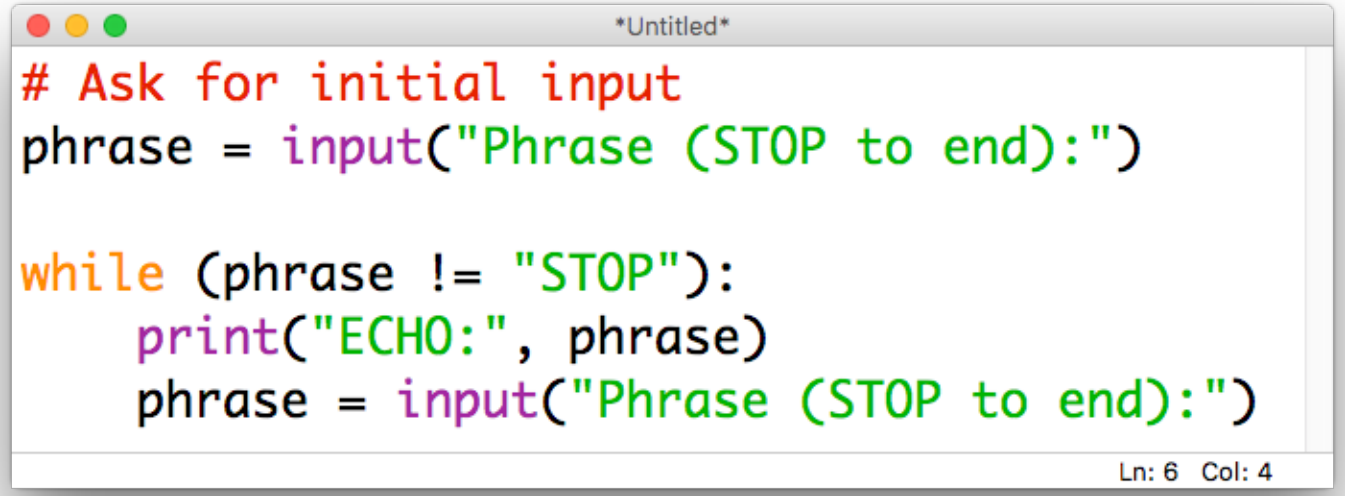
`while` loops

- We may sometimes want a program to continue doing the same thing **until something happens**
- In Python we can do this with a **`while`** loop, which is paired with a conditional (`True/False`) statement



`while` loops

- **`while`** loops can be especially useful when combined with the **`input()`** function
- For example, we may want to continue asking for input until the user tells us they are done:



Demo: compute a sum pt.2

Modify our previous demo program to use a **`while` loop** to compute the **sum** of a series of numbers entered by the user

(continue until the user enters a blank)

Discussion

What did you come up with?

Checking in

What's **one thing** you learned in today's class?