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

Dr. Ab Mosca (they/them)

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

Plan for Tuesday

- Next Tuesday, 10/10, is a Monday schedule
- **I will have office hours in this room during class time** (9:20 – 11:15) for anyone who has hw or general questions, or wants to touch base

Plan for Today

- What is random?
- The `random` module

Discussion

What does it mean
for something to be **random**?

Expectation #1: even distribution

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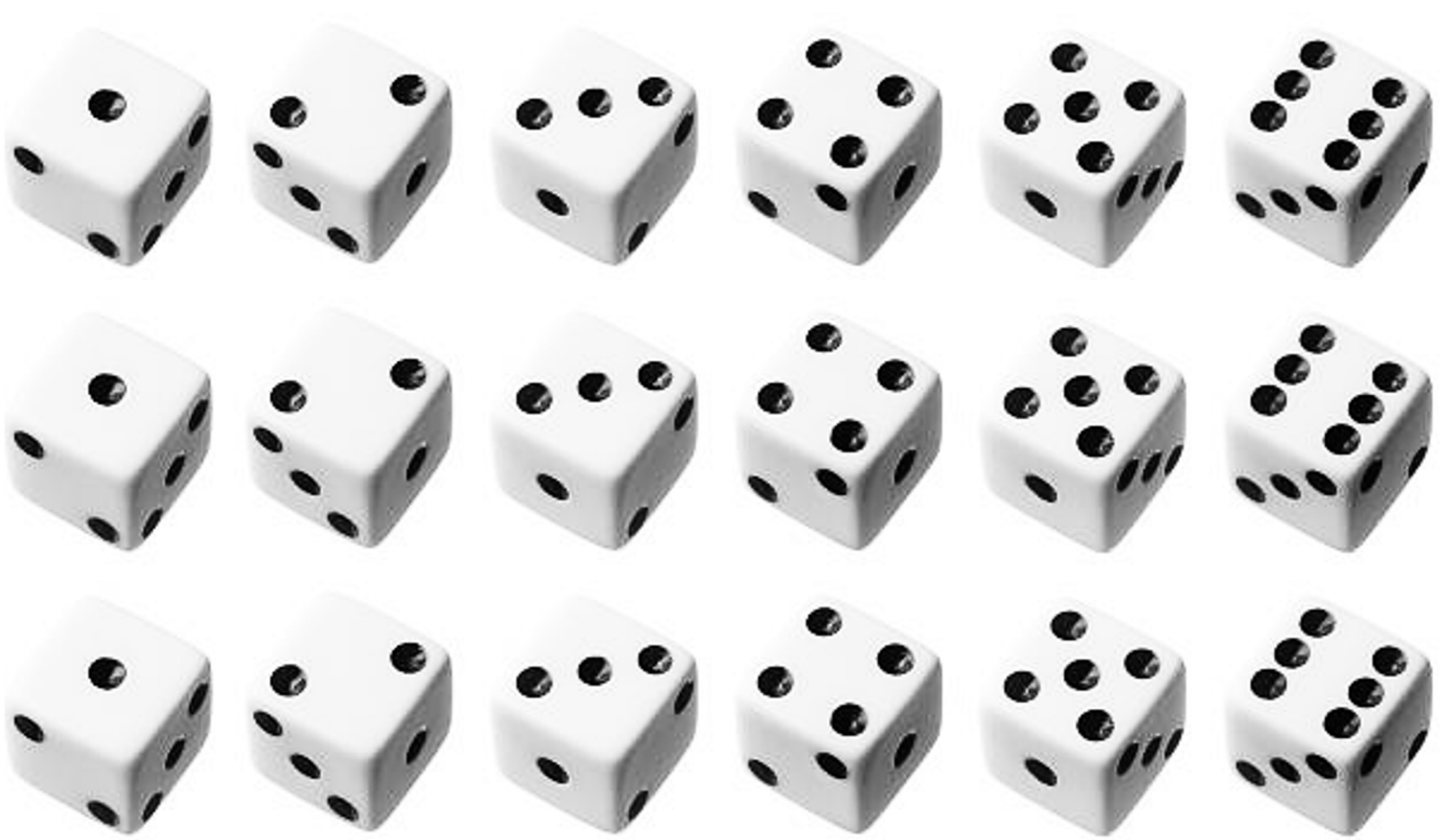
- Every value has an **equal chance** of being chosen
- **Example**: if we roll a die several times, we expect to see:
  - 1 roughly 1/6 of the time
  - 2 roughly 1/6 of the time
  - 3 roughly 1/6 of the time, etc.
- **On average** (over a large number of samples) the distribution is roughly uniform

Discussion

Is an even distribution **enough**?

What if the die always rolled like this?



Expectation #2: unpredictable

Expectation #2: unpredictable

- Randomness is more than ensuring that every value has an equal chance of being chosen
- We also want each value to be **hard to predict**
- **Specifically**: seeing several values in the series ("rolls") shouldn't help us **guess the next one**

Pseudorandom numbers

pseu·do·ran·dom

/ˌso͞odō'randəm/

adjective

(of a number, a sequence of numbers, or any digital data) satisfying one or more statistical tests for randomness but produced by a definite mathematical procedure.

Translations, word origin, and more definitions

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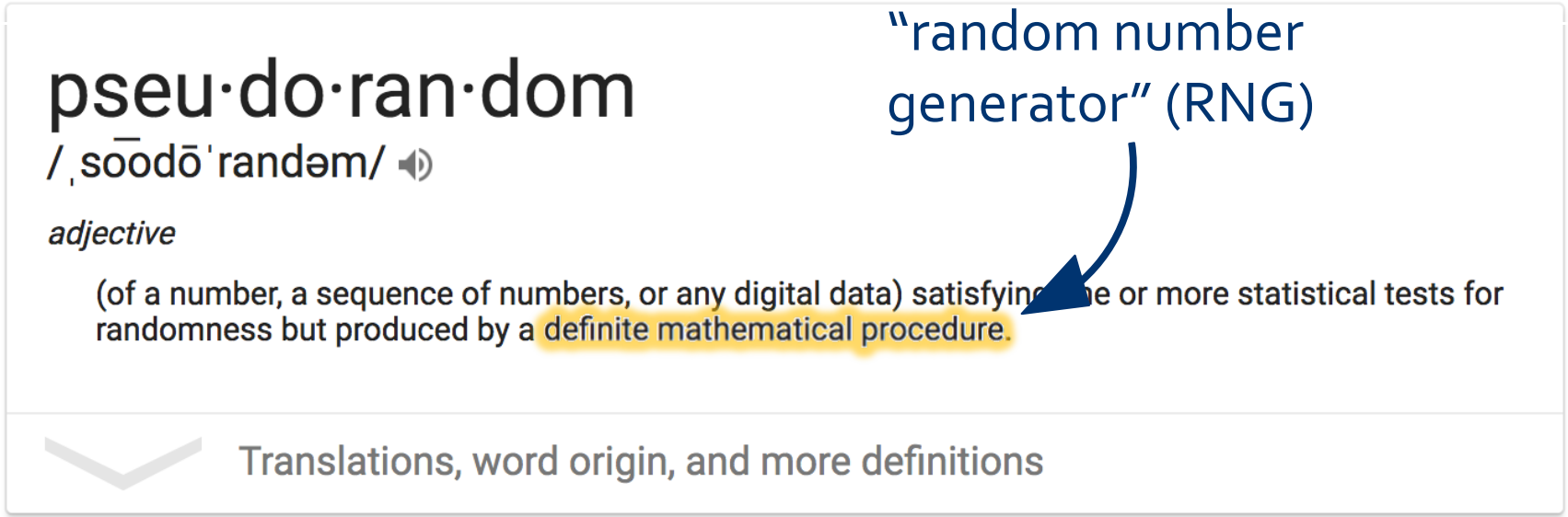
"random number generator" (RNG)

Pseudorandom numbers



"random number generator" (RNG)

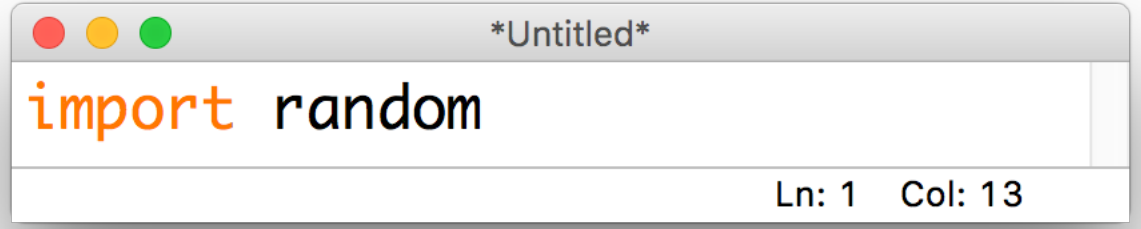
"random enough"

Discussion

How could a deterministic machine generate a (seemingly) random value?

The `random` module

- Python's built-in RNG can be accessed through the **`random`** module

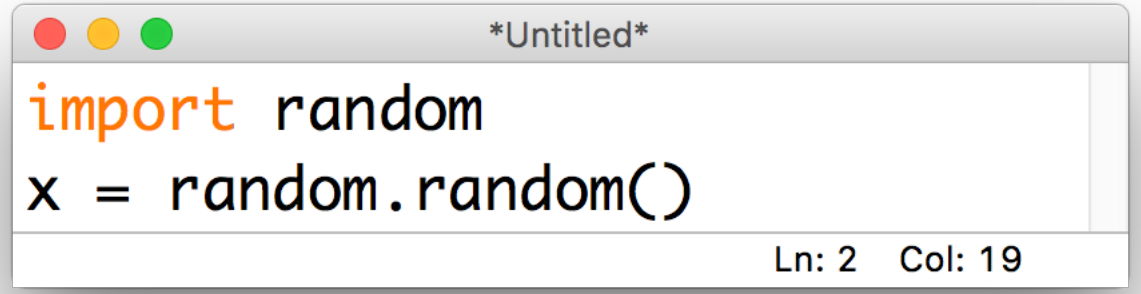


- This module contains several useful functions, all of which are documented here:

https://docs.python.org/3/library/random.html

Generating a `random` float

- The simplest way to get a random number is by calling the **`.random()`** function:



- This always returns a float with **a value in [0.0, 1)**
- Particularly useful for setting probabilities:

```
if random.random() == 0.7:
    #70% chance of being True
```

10-minute exercise: coin flip

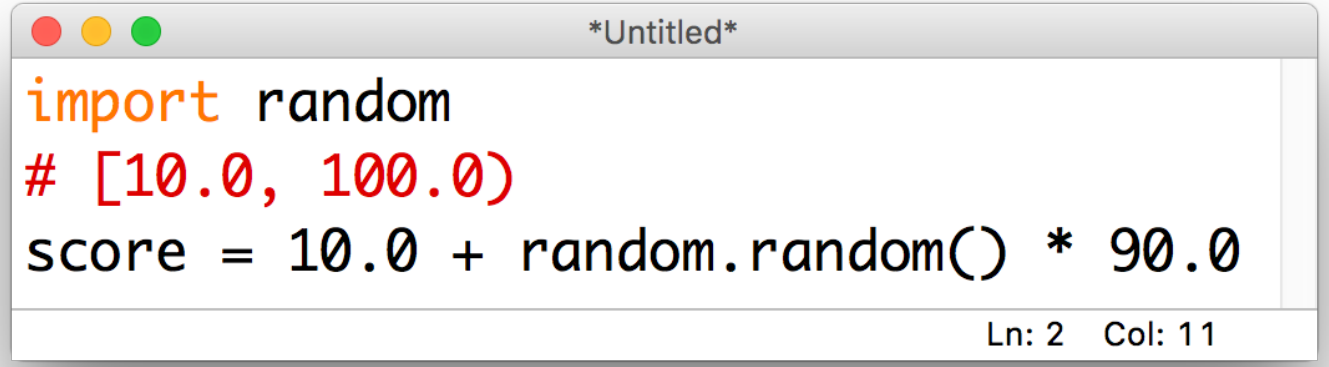
Use the `.random()` function from the **`random`** module to write a program that prints **`HEADS`** 50% of the time and **`TAILS`** the remaining 50% of the time

Discussion

What if we wanted a random float **in a different range**?

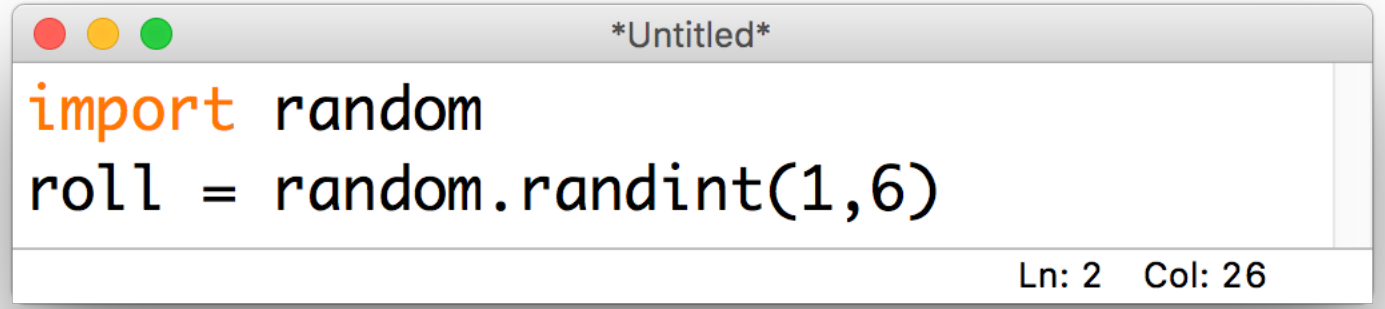
`random` floats in other ranges

- Just use math!
- **Example**: imagine a homework assignment is scored out of 100 points (partial points allowed, and you get 10 points for writing your name)



Generating a **`random`** integer

- We could multiply, add and call **`int(...)`** to get a random integer using **`.random()`**, but there's no need!
- The **`.randint(...)`** function takes two arguments **`min`** and **`max`**, returns an integer in **`[min, max]`** (inclusive):

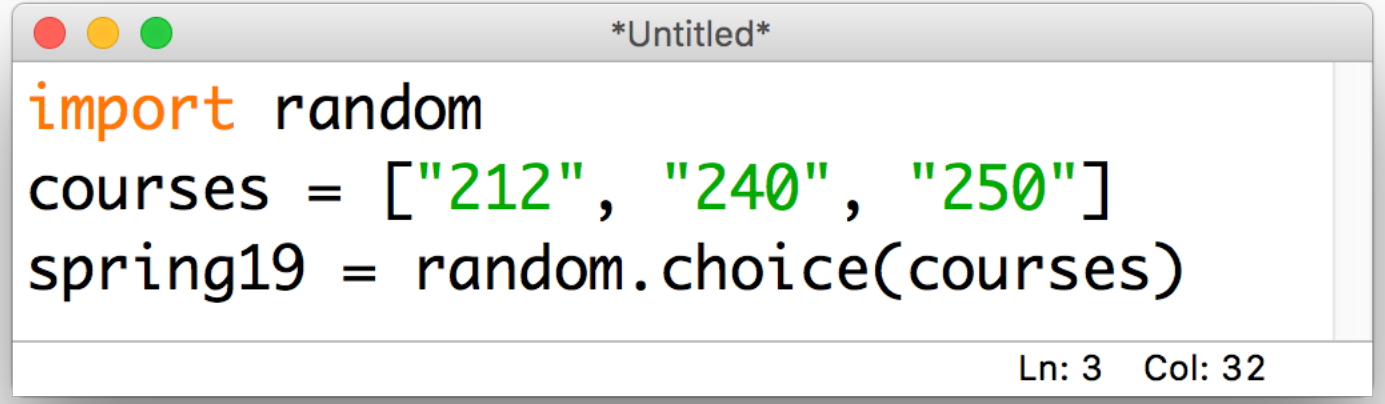


Discussion

How could we use this to choose a **random item from a list**?

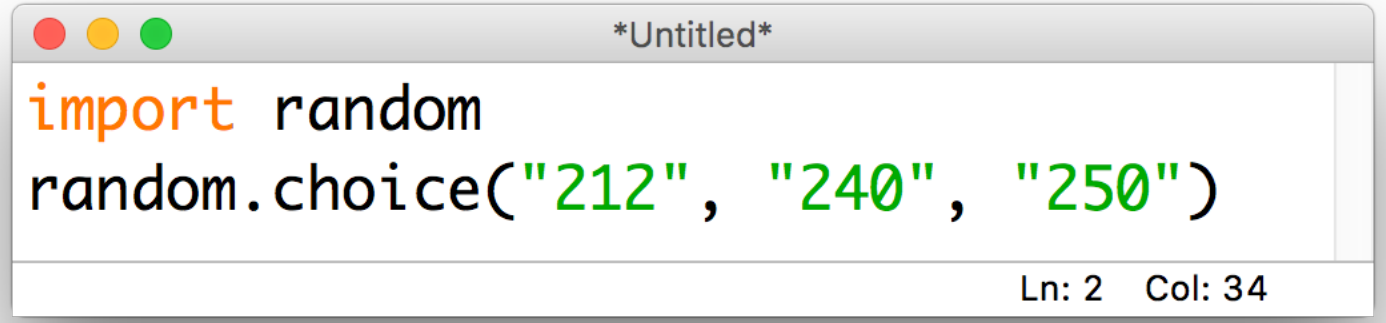
Choosing a `random` item

- Unsurprisingly, other people have also noticed that this would be a useful feature… so there's a function for that!
- The **`.choice(...)`** function takes in a **`list`**, and returns a randomly selected element:



A common gotcha

- The `.choice(...)` function only works when given a `list-like` object:
- Don't forget the brackets!




```
TypeError: choice() takes 2 positional
arguments but 4 were given
```

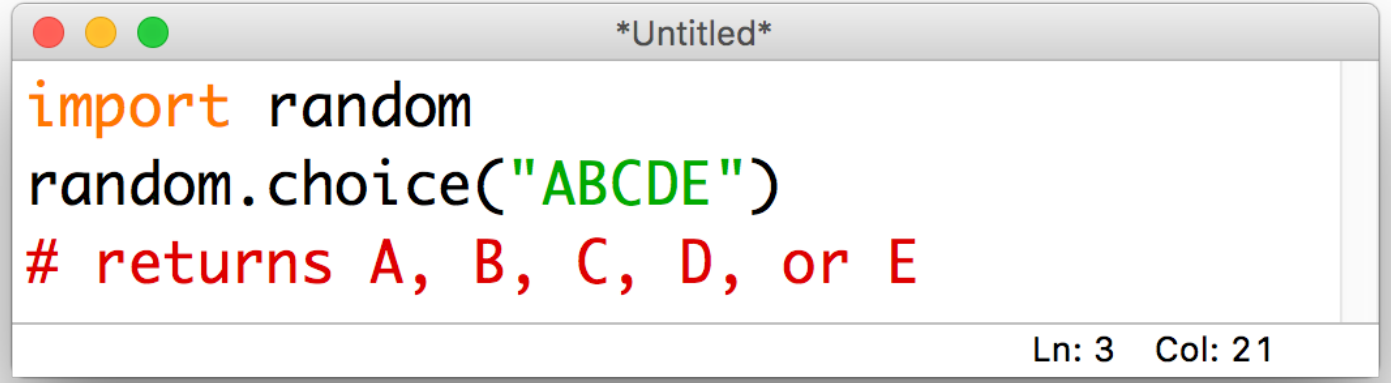
Discussion

What happens if we

call `.choice(...)` on a string?

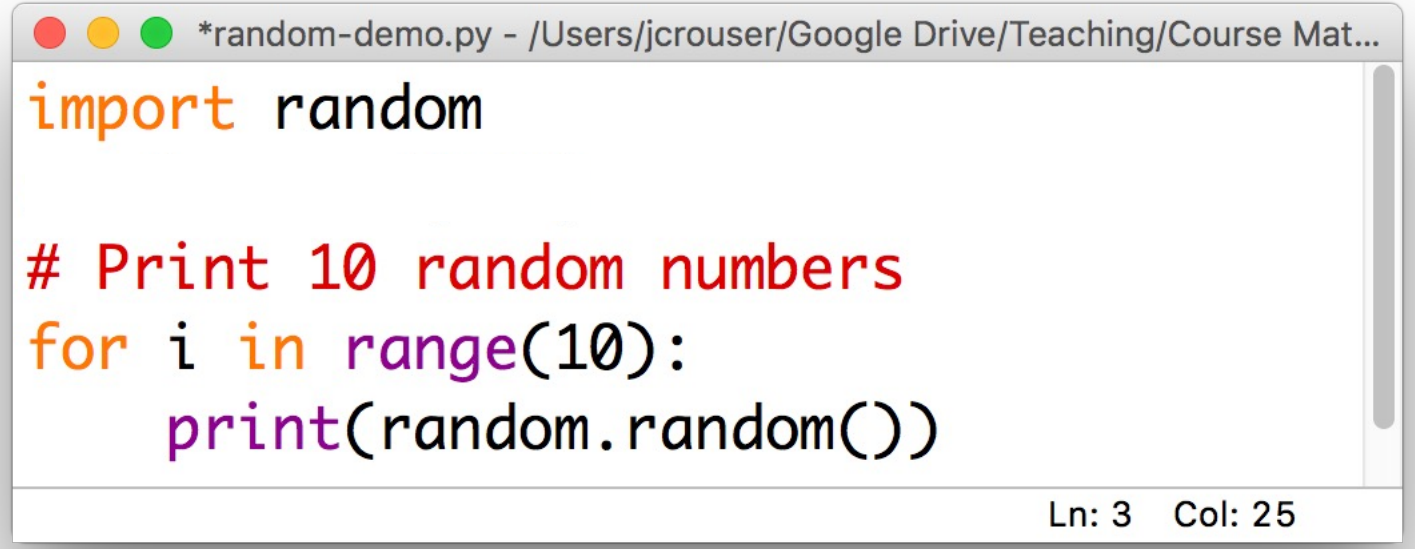
`.choice(...)` on strings

- Strings are **`list-like!`**
- The "items" in a string are the individual characters, so this is what **`.choice(...)`** chooses between:



A note on testing `random` programs

- It can be really challenging to **test** a program that **behaves differently** every time you run it
- In order to solve this, we can tell python precisely how to generate its (not-so-random-anymore) random numbers using a parameter called a **seed**



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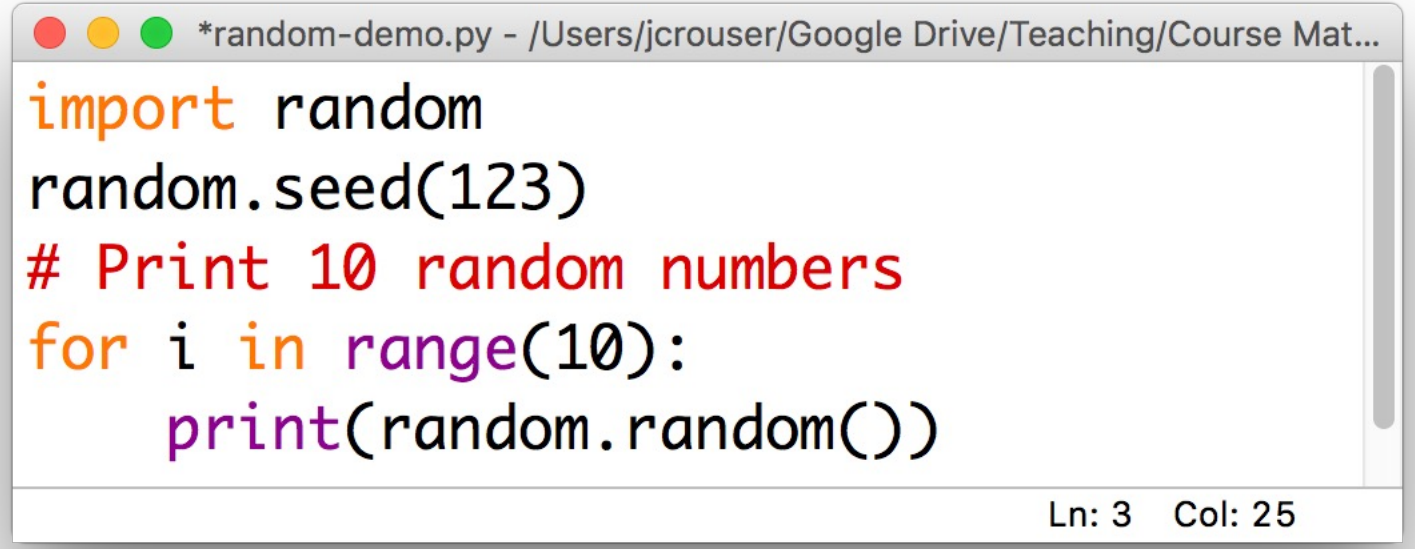
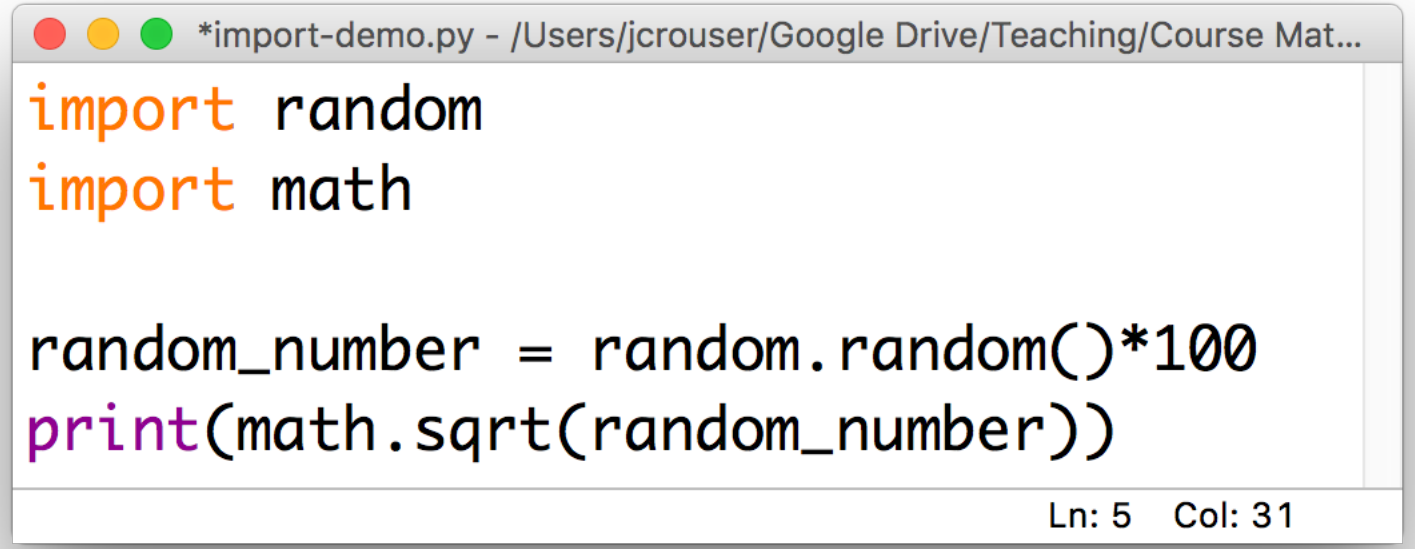


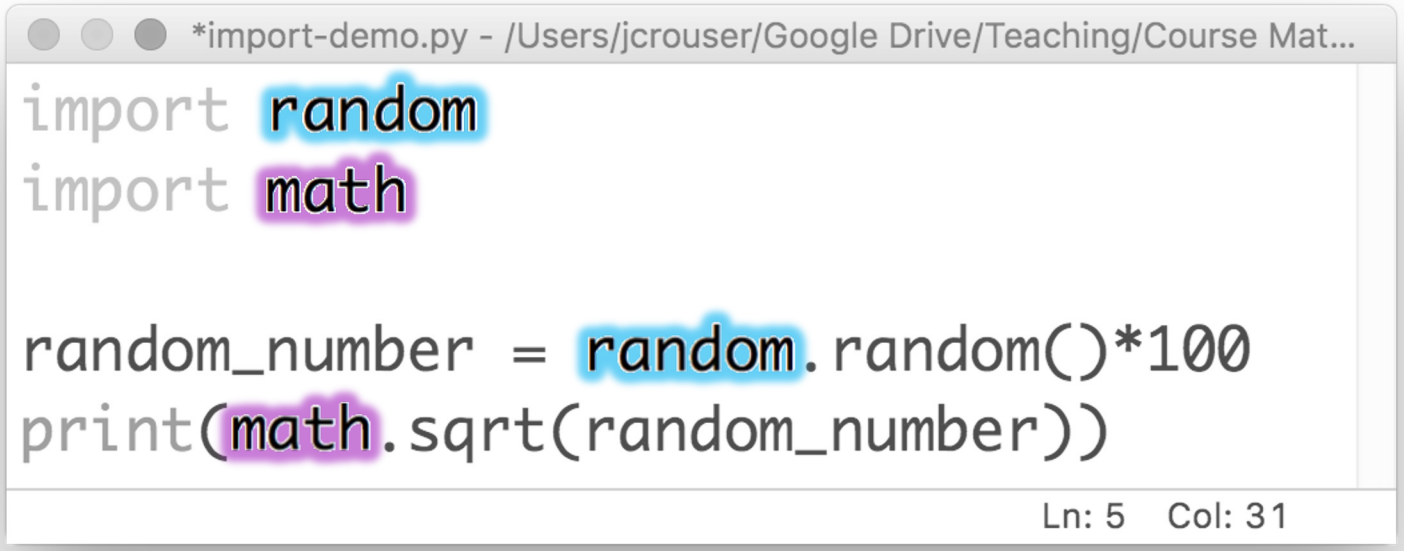
A note on importing modules

- So far, we've always imported modules like this:



A note on importing modules

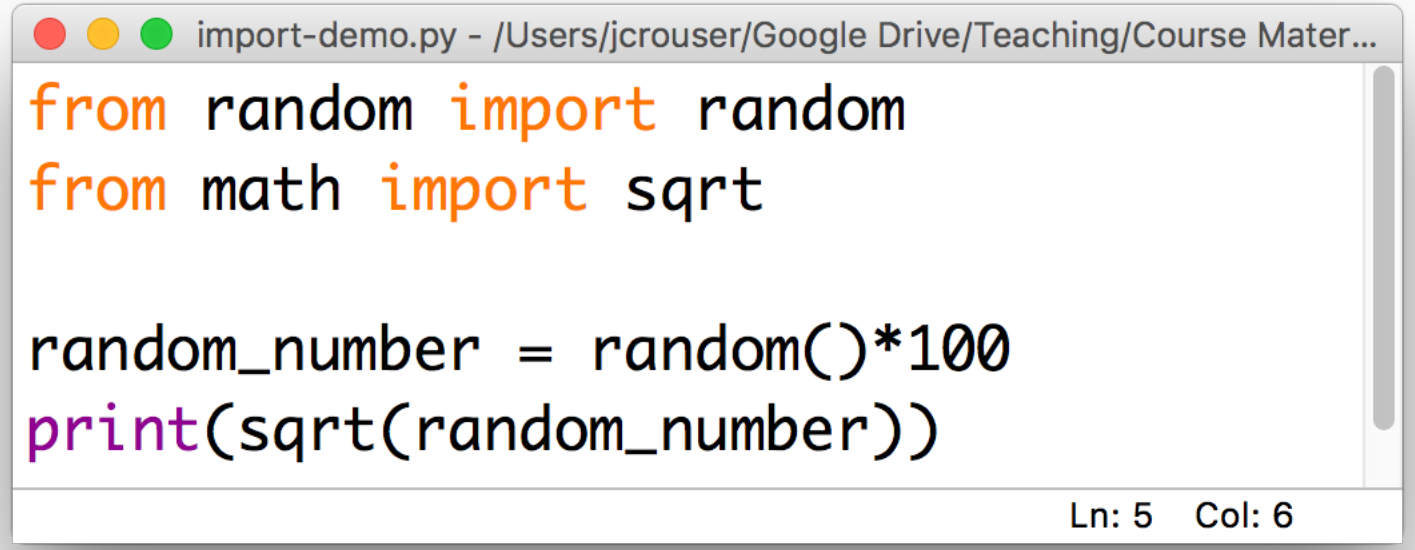
- To use a function, we need to specify the **module**:



- This prevents "name clashes" (i.e. if two functions have the same name, the second one overwrites the first)

A note on importing modules

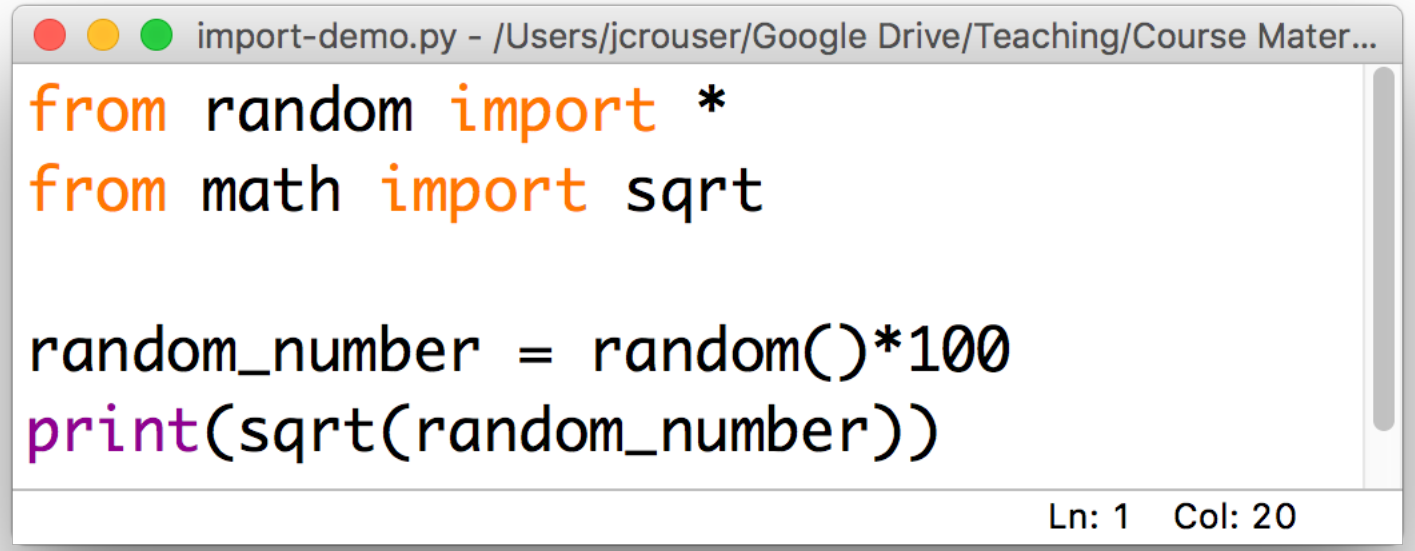
- However, there's also **another way**:



- This is useful if we only need specific functions and we want to save ourselves some typing

A note on importing modules

- We can use * to import **everything** from a module :



- Again, just be cautious of name clashes…