Week 2: Functions

FINALLY!

- Remember when I bragged that Python has lots of built in tools and libraries? Some built in functions:
- print()
- type()
- help() * *doesn't need a print, take that consistency! More on this later!
- min() / max()
- bin() / hex() / oct()
- id()
- input()
- int() / float()
- pow() round()

More examples of built-in functions

Just to name a few…

abs()	bytearray()	enumerate()
dict() help()	filter()	input()
min()	issubclass()	oct()
setattr()	pow()	bin()
all()	super()	eval()
dir()	bytes()	int()
hex()	float()	open()
next()	iter()	str()
slice()	print()	bool()
any()	tuple()	exec()
divmod()	callable()	isinstance()
id()	format()	ord()
object()	len()	sum()
sorted()	property()	
ascii()		

Arguments

- Not that kind of argument

- An argument is something passed to a function, it’s what you want the function to work on. Functions can be thought of as black boxes
- Aka a parameter.

Why Use functions?

- "Off the top of my head, I'd say you're looking at a Bowski, a Jim Brown, a Miss Daisy, two Jethros and a Leon Spinks, not to mention the biggest Ella Fitzgerald ever!"
- Or for those of us who are normal: Reusability.
- And unlike the previous example : Clarity.

Some useful built-in functions:

1. help()

min() / max()

- Running from Math? Python can help!

int/float/str

- Casting as we discussed earlier

print()/input()

- The basic input and output functions in python

Quick Question:

- If we had to accept 2 numbers from a user, and check which one of the two was greater, how would we do that?

- …and one last one. Take two numbers from a user and add them.

BUT WAIT,
THERE'S MORE!
made on imgur

Since we will not be having class on Friday, We will have the test on Thursday during class.

There is a Project this week, I will assign it on Friday. Please check blackboard for it.

WELCOME BACK!

Where we are:

Types	Functions	Flow Control	Keywords
Int	print()		
Float	input()		
String	pow()		
Boolean	int()		
	float()		
	str()		
	min()/max()		
	help()		

Built-In Functions

- Most of us like just the regular chocolate-chip or peanut butter or snickerdoodle cookie varieties.
- But what if I (or the Dalai Lama) wanted one with everything?

- Similarly, If we have a whole lot of built in "flavors" (read: functions) in python. But what if we wanted our own flavor?

User Defined Functions

User Defined Functions: Syntax

```
def times_two(num):
return num * 2
```

- **def** is a key word that tells python you are starting the definition of a function
- **times_two** is the name of my function
- **num** is a parameter (or argument), it is an input passed to the function, not all functions require arguments
- **return** is what the function is going to give back when finished

Lets try this code, do you think it will work?

User Defined Functions: Indent

- Why didn't that code work?
  - Because we forgot a crucial part of function writing! The indent
  - Try the one given below.

```
def times_two(num):
        return num * 2
```

- Luckily for us, IDLE does this automatically when it sees the keyword def and the ":".
- For the most part, python is flexible with whitespaces, the biggest exception to this is the indent.

Indent continued:

- So why did it work?

```
def times_two(num):
        return num * 2
```

- Python uses indents to tell what code goes together
- when the code stops being indented then python knows the function is complete
- so

```
def times_two(num):
return num * 2
```

- won't work because the function times_two *has no code*

The “other” argument

```
def times_two(num):
        return num * 2
```

- **num** is a parameter (or argument), it is an input passed to the function, not all functions require arguments
- What exactly is “num”?
- It’s essentially a variable, but one that only lives inside the function.
- if we call times_two(4) then the first thing this code does is
- num = 4
- *Arguments are what let us call functions on a variety of inputs*

A Special kind of User-Defined Function: The Hard Coded Function

```
def three_times_two():
        return 3 * 2
```

- We’ve written a version of times_two that doesn’t take an argument and instead is hardcoded for a specific value (i.e. fixed, not variable).
- this works the same way as times_two(3) would but is obviously **much** less useful.

Side-Effects

```
def times_two(num):
        return num * 2

def times_two(num):
        print(num * 2)
```

- Do these do the same thing? Hint: **NO**.
- Note the color differences,

  orange is a keyword,

  purple is a built in function
- What does the second function *return*?

So what does it all mean?

- 42
- Just Kidding. Simply put:
  - print() exists to give information to a human being
  - returns exist to pass data around between parts of the program
- Lets take the examples of

```
        x= max(2,3)
```

And,

```
        print(max(2,3))
```

50 shades of IDLE

Ok there aren't so many but here are the ones that are there

Python default syntax colors:

Keywords	orange
Builtins	royal purple
Strings	green
Comments	red
Definitions	blue

Shell default colors:

Console output	brown
stdout	blue
stderr	red
stdin	black

This is also viewable on IDLE Help on the taskbar

Programming as Data

- a function is essentially a variable whose "value" is a series of steps on some input. This was a HUGE conceptual breakthrough.

WELCOME BACK!

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	str()		
	min()/max()		
	help()		

Verbosity!

This code

```
def foo (a):
        return a * a
```

is a lot less easy to understand than this

```
def square(num):
        return num * num
```

Just like with variables giving functions and arguments good names is a very good idea (which makes sense since arguments and functions really are sorts of variables)

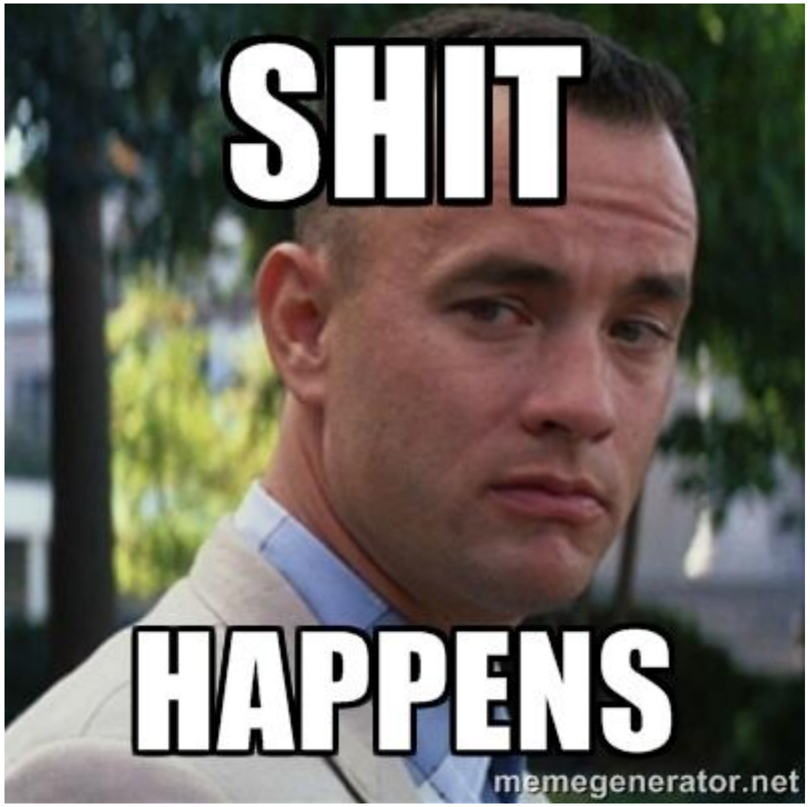
Introduction to Scope

```
def foo (A):
        doubleA = 2* A

print( doubleA )
```

Does this code work?

BUGS!!



A Quick Introduction to Entymology

- Syntax Errors
- Logic Errors
- Runtime Errors

This list is in ascending order of suck.

This list is non-exhaustive, there are many more types of errors and all come under the category of exceptions

Syntax Error

```
def times_two(num:
        return num * 2
max(2 3)

def two()
return 2
```

Syntax error = your code sucks (or a typo)

Good news- easy to catch, easy to fix

Logical Errors

```
def times_two(num):
        return num * 3
```

- Logic error = your *computational thinking* sucks (or a typo)
- May be easy or hard to spot, often frustrating to fix

Runtime Errors

“good” runtime error :

```
def times_two(nam):
        return num * 2
```

bad runtime error

```
def divide_ten(num):
        return 10 / num
```

- Runtime error = you didn’t think of an important case, or you referenced non existing variables
- Can be nearly impossible to find without very good test cases. Often not that hard to fix.

For more on errors and exceptions

- https://docs.python.org/3.4/library/exceptions.html

Question Time!

Group Question:

Given the information that simple interest is calculated with the formula

S.I = Principle Amount x (Rate/100) x Time (in years)

Write a function to calculate Simple interest