Introduction to Programming Python

Peter Newhook

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http://sdrv.ms/12uSLo9

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Agenda

- Programs
- Basic math with Python
- Types
- Functions
- Variables
- Printing
- Conditions
- Loops
- Data structures
- Building a game

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Introduction

A bit of house keeping

- Ask questions at any point
- Bathroom keys are on the fridge
- Files located at http://sdrv.ms/12uSLo9

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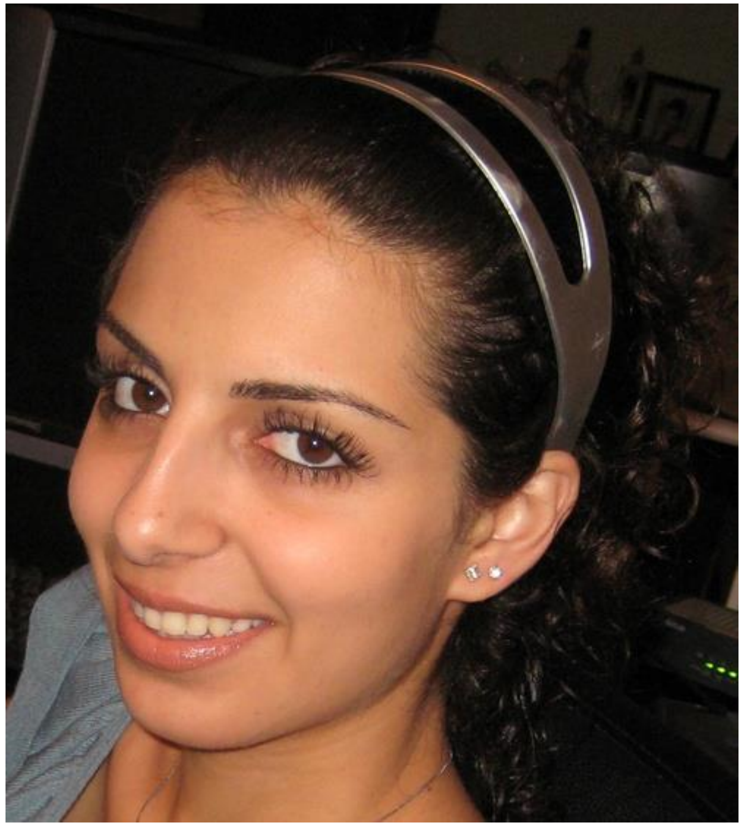
Acknowledgements

- Juan Musleh - @juanmusleh



Quick Prerequisites Check

- Python installed
  - Open the command line/terminal and type ‘python’
  - We’re going to refer to this as the ‘python shell’
- Text editor
  - Notepad++ on Windows
  - TextWrangler on Mac
- A burning desire to learn programming

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You’re already a python programmer

```
x = 5
if x > 2:
    print "I’m greater than two!"
```

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Running Python

- We’re going to being in the Python interpreter
- Windows
  - Start > Programs > IDLE
- Mac
  - Applications > Terminal > Utilities > python

Your First Program

```
print "Hello, world!"
```

What Is Python

- Python is a programming language
- What is a programming language?
- Why do we need one?

Your computer speaks another language

```
'  ' 000b 0000             NOP
'PH' 000c 5048             AND $0048
'XR' 000d 5952             DSZ $0152
'EC' 000e 4543             JSM Lbl_0052
'  ' 000f 2020             ADA $0020
'RE' 0010 5245             AND $fe45
'V ' 0011 5620             AND $fe31
'B.' 0012 422e             JSM $fe2e
'  ' 0013 8000 Lbl_0001:   LDA A,I
'  ' 0014 ffff             SES *-1,S [Lbl_00
' $' 0015 1624 Lbl_0002:   CPA $fe39
'  ' 0016 10f9             CPA $00f9
```

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Why python is great

- Easy to use: It is closer to human language than to machine language.
- Powerful: It's used in academic research, Google and NASA.
- Runs Everywhere: It's platform independent. You can write your program on a Mac and run it on Windows.
- Free and Open Source.
- Great Community.

Learning to Code is as Simple as ABC

Always

Be

Coding

Python is good at math

```
>>> 1 + 1
2
>>> 2 - 3
-1
>>> (345 + 3) * 9
3132
```

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Math Operators

- + Addition
- – Subtraction
- * Multiplication
- / Division

Exercise: Try some math

- Does Python follow order of operation rules?
- Did division return the whole result?

We can use more than just numbers

```
>>> "Buenos" + " dias"
'Buenos dias'
>>> 'or I can use single quotes'
'or I can use single quotes'
>>> 'but I cannot use both"
SyntaxError: EOL while scanning string literal
```

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But what if we combine text and numbers?

```
>>> "I'll see you at " + 2
Traceback (most recent call last):
 File "<stdin>", line 1, in <module>
TypeError: cannot concatenate 'str'
and 'int' objects
```

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Types

- Python is extremely picky and needs to classify everything before it knows what to do with it
- “I’ll see you at “ is a **String**
- 2 is an **Integer**
- Use the `type()` function to tell what type an object is

Types

```
>>> type("Ladies Learning Code")
<type 'str'>
>>> type(6)
<type 'int'>
>>> type(6.1)
<type 'float'>
>>> type(6.0)
<type 'float'>
```

Why do we need types?

- Python has rules for what to do with different types of objects.
- When you ask Python what **1 + 2** is:
  - It knows that 1 is an INTEGER
  - It knows that 2 is an INTEGER
  - It finds the instruction sheet for INTEGER
  - Scans the instruction sheet for **+**
  - Understands that when you ask for an INTEGER + INTEGER, you want it to add the two together
- The rules for combining “hello” and “world” are different

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Sometimes we can change types

```
>>> "I'll see you at " + str(2)
"I'll see you at 2"
>>> 1 + int("2")
3
```

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But casting won’t always work

```
>>> 1 + int("two")
Traceback (most recent call last):
   File "<stdin>", line 1, in <module>
ValueError: invalid literal for int() with base 10: 
'two'
```

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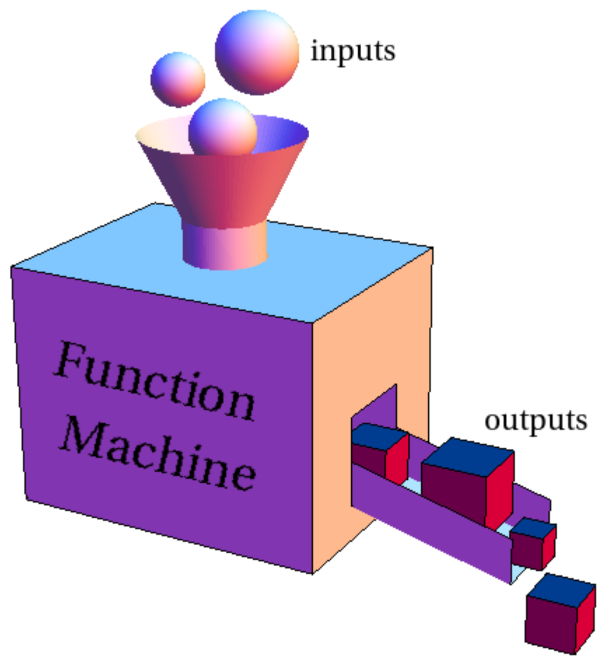
Beyond math symbols

- What if you want to do something more complex than addition, subtraction, etc?
- Python gives us *functions* to do more complex operations
- Functions act on specific types



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Number Functions

- abs
- pow

Hint: to figure out what a function does use the help function

```
>>> help(abs)
```

String Methods

```
>>> "toronto".capitalize()
'Toronto'
>>> "Ladies Learning Code".replace("Ladies","Girls")
'Girls Learning Code'
>>> "MOAR PYTHON!!!".lower()
'moar python!!!'
```

Try the Following String Methods

- title
- strip
- index
- split

Hint: if to find out what a method does use the help function

```
>>> help("f".strip)
```

But functions only work on certain types

```
>>> pow("elephant", "brain")
Traceback (most recent call last):
 File "<stdin>", line 1, in <module>
TypeError: unsupported operand type(
s) for ** or pow(): 'str' and 'str'
```

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Quick Recap

- Programming languages are intermediates between computer and human language
- Programs are sets of instructions
- Languages have ‘types’
  - string
  - integer
  - float
  - and lots more
- Functions add behaviour
- Most functions work on only one type

Keeping your code DRY

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DRY

- **D**on’t **R**epeat **Y**ourself
- You should only have to type anything once

Variables

```
>>> password = "SuperSecure"
>>> password
'SuperSecure'
>>> num1 = 4
>>> num1
4
>>> num2 = 1234.5
>>> num2
1234.5
```

Why variables are useful

- Variable means “liable to change”
- Variables change throughout the lifetime of our program
- Without variables our programs wouldn’t be able to change
- Setting a fixed value in a program is called ‘hard coding’

Let’s throw a party

```
>>> party_budget = 1000
>>> angel_round = 100000
>>> party_budget + angel_round
101000
```

What is your party budget now?

New Budget

```
>>> party_budget
1000
```

We have to tell the party_budget it has a new value

```
>>> party_budget = party_budget + angel_round
>>> party_budget
101000
```

The guestlist

```
>>> guestlist = "Peter June Shreek"
>>> guestlist_copy = guestlist
>>> guestlist_copy
'Peter June Shreek'
>>> guestlist = guestlist + " Roberto"
>>> guestlist
'Peter June Shreek Roberto'
>>> guestlist_copy
'Peter June Shreek'
```

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Anything you can do to a ‘literal’ you can do to a variable

```
>>> startup = "my elephant brain"
>>> startup.title()
'My Elephant Brain'
>>> revenue = -429376
>>> abs(revenue)
429376
>>> revenue + 1000000
570624
```

But did the variable change?

```
>>> startup
'my elephant brain'
```

The function returned a new value, it did not change the original value.

Exercise

- Try using the math operators we saw earlier on variables

Some more strings

```
>>> combined = "combined"
>>> "Strings can be "+ combined + " with variables."
'Strings can be combined with variables.'
>>> fun = "not fun"
>>> "But it is " + fun
'But it is not fun'
```

String Format method

```
>>> utensil = "spoon"
>>> "My {} is too big".format(utensil)
'My spoon is too big'
>>> "The {0} came before the {1}".format('chicken', 'egg')
'The chicken came before the egg'
>>> "The {1} came before the {0}".format('chicken', 'egg')
'The egg came before the chicken'
>>> template = "The Jaguar F-Type has {}hp"
>>> template.format(488)
'The Jaguar F-Type has 488hp'
```

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Exercises (for later)

- Use multiple placeholders but only one argument
- Round Pi to 3 decimals
- Print centered text
  - '   centered   ‘
- Print centered text and pad with plus signs
  - `'+++++++++++centered+++++++++++'`
- Look at http://docs.python.org/2/library/string.html#formatstrings for help

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Recap

- Variables save us from repeating ourselves
- Anything you can do to a literal you can do to a variable
- Variables don’t change until you tell them to
- Formatting strings with the plus sign (+) is error prone
- Use str.format()

Honest to Goodness Programs

Files

- So far we’ve been typing out our entire program
- But when you run real programs (like Chrome or Outlook) you don’t write all the lines
- We need to put repeatable code in a file

Programs in a File

- Create a folder named exercises somewhere on your computer
- Open your text editor
- Create a new file called party.py
- Add the following code

```
party_budget = 1500
party_budget
```

A quick lesson about the command line

- To run Python on the command line you'll have to move around
- To change the directory(folder) we type cd <directory name>
- To move one directory up we type cd ..
- That's all the command line wizardry you need to know today

Running your program

- On the command line, go to the exercises folder
- Type `python party.py`
- Wait, where’s my party budget?

In programs, you have to tell Python to print

```
party_budget = 1500
print party_budget
```

Shouldn’t print be a function?

- Oh boy, now you’ve stepped in it.
- It should
- And in Python 3 it is
- But there’s still a lot of code that uses Python 2.x
- So for now, just use print like a statement

Getting fancy with special characters

```
print "215 Spadina"
print "Toronto"
print "Ontario"
```

```
print  "215 Spadina \nToronto \nOntario"
```

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Other Special Characters

- \n
- \'
- \"
- \\
- \t

Comments

- Python ignores anything after the # character

```
# This is a comment
print 'Hello World' # so is this
# print("this won't be printed")
```

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Asking for Input

```
#raw input prompts the user
raw_input("Please enter your name:\n")
#store the result in a variable
my_name = raw_input("Please enter your name:\n")
#store the result in a variable
my_age = int(raw_input("How old are you?\n"))
```

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A Ticket App

- We’re going to write a ticket app for Peter’s Python Prognostications
- Here’s how it’s work
    1. We start with 8 tickets
    2. We ask the user how many they want
    3. We print out that number
    4. We show the user how many tickets are left
- Check tickets1_begin.py if you’re stuck

Issues you may have had

- raw_input always returns a string
  - You’ll need to cast it to an int
- Did you forget to close a quotation mark?
  - It happens to the best of us
- num_tickets wasn’t updated
  - You have to explicitly update the number
  - This is called tracking ‘state’

Is it working

- Good
- Now break it

It depends

Introduction to conditions

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Control Flow

- Programs don’t run line by line from start to end
- They jump around according to rules
- One way to specify those rules is to use conditions

Conditional Logic

- We frequently want to test if two values are equal
    - For equality we use the double equal sign
    - 1==1
- We can test if two things aren't equal with !=
    - 1!=2
- There are also many of the math operators we know
    - Greater than: >
    - Greater than or equal to: >=
    - Less than: <
    - Less than or equal to: <=

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Exercise

- In the Python shell use all the operators on the previous slide

Boolean types

- Either true or false
- Useful when making a decision

If statement

```
if 1==1:
     print "I am the walrus!"
```

Beautiful is better than ugly (indentation)

```
# so beautiful
if True:
    print "I am the egg man!"
# my eyes!
if True:
print "coo coo ca choo!"
```

else Statement

```
if 0:
        print "0 is always false"
else:
        print "So the else clause is executed"
```

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elif statement

```
today = "Saturday"

if today == "Friday":
     print "Everybody’s working for the weekend!"
elif today ==  "Saturday":
     print "S-A-T-U-R-D-A-Y Night!"
elif today == "Sunday":
     print  "Pancakes."
else:
     print "Early to bed and early to rise."
```

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Exercise

- Stop the user from buying tickets if they ask for more than are available

What we’ve covered

- Programs
- Basic math with Python
- Types
- Functions
- Variables
- Printing
- Conditional logic

Morning Recap

- Write a program that asks you what your favourite colour is and tells you something else that is the same colour
  - What is your favourite colour?
    Green
    I like turtles

- Write a program that prints a string if the input is less than 10 **or** greater than 20
  - Do the same thing for greater than 10 **and** less than 20

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Colour

```
fav = raw_input('What is your favourite colour?\n')
fav_lower = fav.lower()
if fav_lower == 'green':
    print 'I like turtles'
elif fav_lower == 'blue':
    print 'Like the sky'
elif fav_lower == 'purple':
    print 'My favourite ice cream when I was young was called Purple People Eater'
else:
     print "{} is my favourite too.".format(fav)
```

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and/or

```
input = raw_input("Give me a number: ")
input = int(input)
if input < 10 or input > 20:
    print 'That\'s a good number'
if input > 10 and input < 20:
    print "You've found the sweet spot"
```

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Getting loopy

Loops

- So far our code has run from top to bottom
- Programs usually need to do something over and over agin
- Computers don’t mind doing repetitive tasks

While Loop

```
#"while" something is true
#perform an action
while True:
    print 'Are we there yet?'

#use Ctrl + c to cancel the program
```

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Apple Campus
One Infinite Loop
CAUTION

We need a way to stop the loop

```
#code within the loop my invalidate the condition
loop = True
while loop:
    print 'Are we there yet?'
    loop = False
print 'Done the loop'
```

Or we could ask the user for input

```
loop = True
while loop:
     answer = raw_input('Are we there yet?')
     loop = answer == 'no'
print 'Done the loop'
```

break dancing

```
#or we can use the break keyword
loop = True
while loop:
    print 'Are we there yet?‘
    break
print 'Done the loop'
```

To run a certain number of times we test a variable and increment within the loop

```
x = 1
while x < 10:
    print x
    x += 1
```

Exercise: Print from 10 to 1

```
x = 10
while x > 0:
    print x
    x -= 1
```

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Guided Exercise

- We’re going to write a game for the computer
- The computer will pick a number and we have to guess it
  - `from random`
  - `import randint x = randint(1,10)`
- The user should know if they are too high or too low
- We know how to ask for input
- We know how to compare guesses
- We want to give the user multiple chances

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Data structures

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Lists

- Lists are lists
- That was useless
- But seriously, they’re just a set of objects
- Lists can hold strings, integers, floats, booleans, and anything else you can create

Creating Lists

```
mylist = [1,2,3,4]
print mylist #[1, 2, 3, 4]
companies = ['My Elephant Brain', 're:3D', 'Hacker You']
print companies
#['My Elephant Brain', 're:3D', 'Hacker You']
kitchen_sink = [1 , 'a', True]
print kitchen_sink
#[1, 'a', True]
```

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Accessing Items in a List

```
>>> companies[1]
're:3D'
>>> companies[-1]
'Hacker You'
>>> companies[10]
Traceback (most recent call last):   File "<stdin>",
 line 1, in <module>
IndexError: list index out of range
```

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Exercise

- Using a list and a while loop, print the days of the week
- ‘break’ the loop on Wednesday

Modifying a List

```
#add and item
l.append(5)
print l
#remove and item
l.remove(3)
print l
# remove throws an error if the item doesn't exist
l.remove(9)
```

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A Quick jump Back to Loops

```
# for loops make it easy to loop over a list
for company in companies:
    print company
# they're also useful for looping
# a konwn number of times
for i in range(1,10):
    print i
```

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Exercise

- Use a for loop to print the days of the week
- Use a for loop to count from 10 to 1
  - Hint: by default range() increases by 1 each time, but you can give it a third argument to tell it the number to increment by each time
  - E.g range(0, 10, 2)

The Grand Finale

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Hangman

- Let's make a hangman game using what we learnt today.
- But before you start coding away, it helps to think about what you're trying to do.
- Remember, computers need specific instructions, so you need to break it down.
- You can start by playing hangman on paper with each other.
- Start with hangman_draft.py

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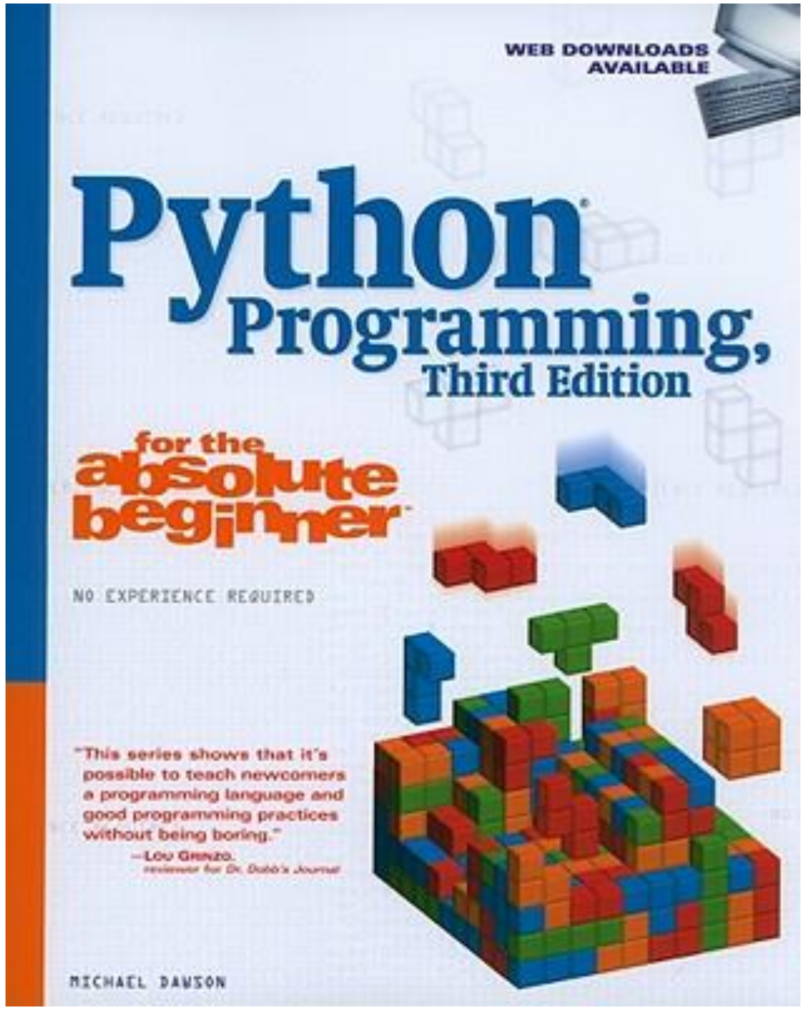
Hangman credit to Python Programming for the Absolute Beginner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MICHAEL DAWSON

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You’re programmers now!

- Sure there’s more to know
- There’s always more to know
- The trick is using what you know
- http://www.pyschools.com/
- http://www.djangobook.com/en/2.0/index.html
- http://learnpythonthehardway.org/

Congratulations!

- Thank-you Ladies Learning Code
- Thank-you mentors
- And thank-you participants

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Putting the ‘fun’ in functions!

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Functions

```
# we put reusable code inside 'functions'
def add_two(a, b):
    return a + b
ans = add_two(1, 2)
print ans
```

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Exercise

- Write functions to do the following
  - Multiply two numbers
  - Combine an int and a string
  - Print the sequence of a given number, down to zero
    - 5, 4, 3, 2, 1, 0

Modules

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Python code is reusable by other code

```
# start python in the same folder as functions.py
from functions import add_two
print add_two(1,2)

# from math import factorial
```