Introduction to programming

Day 1

Programming is problem solving

- Problem solving means the ability to formulate problems, think creatively about solutions, and express a solution clearly and accurately.
- How you solve the problem is called the algorithm.
- An algorithm is a step by step list of instructions, or a program, that if followed exactly will solve the problem under consideration.
- These programs are written in **programming languages**.

Python

- Python is an example of a **high-level language (**C++, PHP, and Java.)
- There are also low level programing languages (assembly, machine language)
- High level languages use human friendly sets of instructions to create programs. Low level languages are not as human friendly and are written for the hardware.

Machine language vs High level language

print(“hello”)

The computer would translate this high language into a low level language for you → 01010101 00011101 00111100

verses writing this yourself

01010101 00011101 00111100

Clearly, high level languages are faster and less prone to error than machine languages

Binary

All low level languages are in binary. Aka a series of 1’s and 0’s. It’s the matrix all over again.

How binary works.

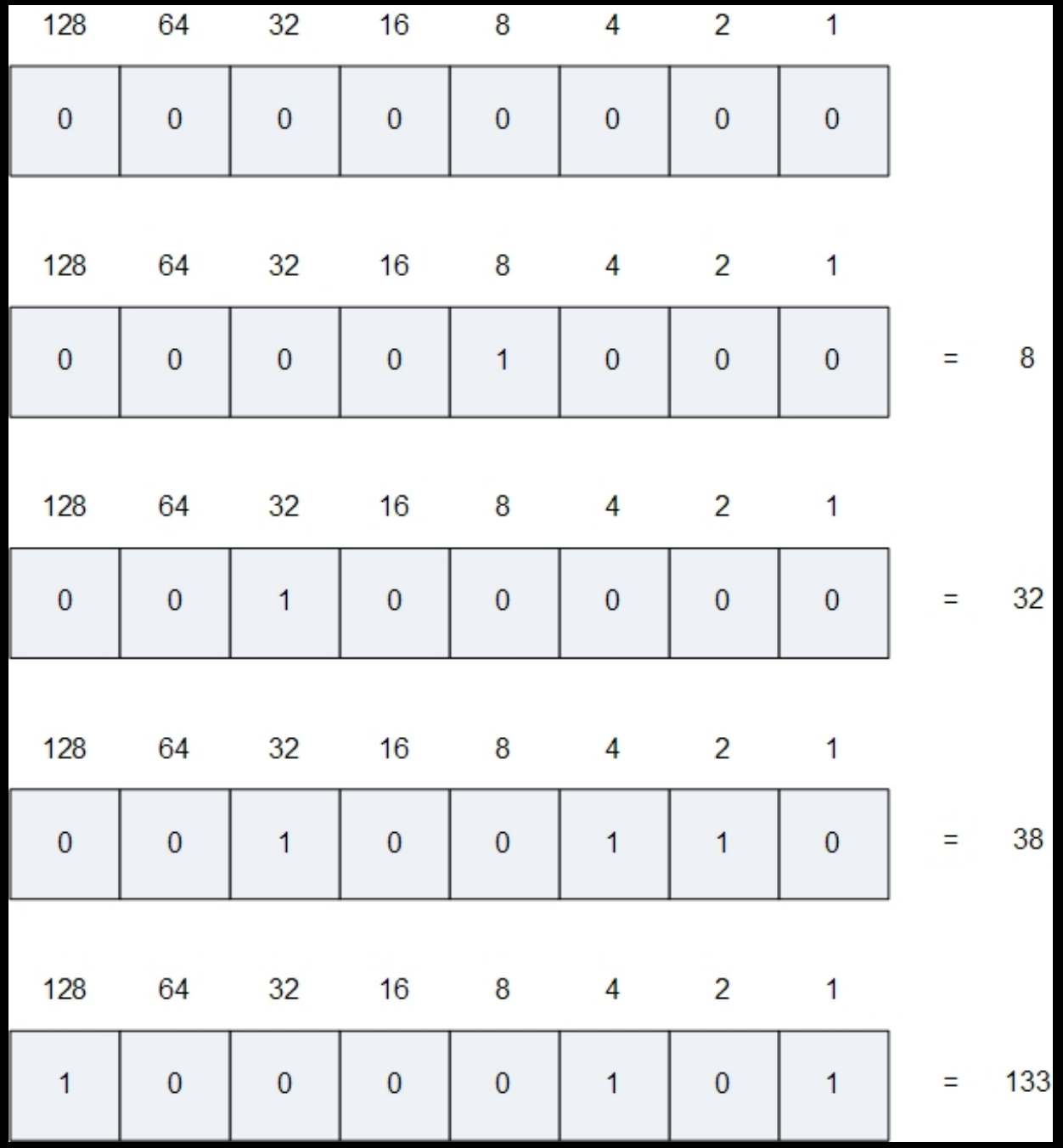
Binary is a series of bits that form 8byte patters that represent numeric values. Each value represents either on or off. You can think of them like little switches.

Binary Math

Each bit represents either if it should be counted or not. So 0 = don't count me. 1 = count me.

00000001 is 1
00000010 is 2
00000011 is 3
00000100 is 4
00000101 is 5

And so on…..



Ascii

Ascii is a way to translate binary into letters and numbers

ASCII Code: Character to Binary

0	0011 0000	O	0100 1111	m	0110 1101
1	0011 0001	P	0101 0000	n	0110 1110
2	0011 0010	Q	0101 0001	o	0110 1111
3	0011 0011	R	0101 0010	p	0111 0000
4	0011 0100	S	0101 0011	q	0111 0001
5	0011 0101	T	0101 0100	r	0111 0010
6	0011 0110	U	0101 0101	s	0111 0011
7	0011 0111	V	0101 0110	t	0111 0100
8	0011 1000	W	0101 0111	u	0111 0101
9	0011 1001	X	0101 1000	v	0111 0110
A	0100 0001	Y	0101 1001	w	0111 0111
B	0100 0010	Z	0101 1010	x	0111 1000
C	0100 0011	a	0110 0001	y	0111 1001
D	0100 0100	b	0110 0010	z	0111 1010
E	0100 0101	c	0110 0011	.	0010 1110
F	0100 0110	d	0110 0100	,	0010 0111
G	0100 0111	e	0110 0101	:	0011 1010
H	0100 1000	f	0110 0110	;	0011 1011
I	0100 1001	g	0110 0111	?	0011 1111
J	0100 1010	h	0110 1000	!	0010 0001
K	0100 1011	I	0110 1001	'	0010 1100
L	0100 1100	j	0110 1010	"	0010 0010
M	0100 1101	k	0110 1011	(	0010 1000
N	0100 1110	l	0110 1100	)	0010 1001
				space	0010 0000

Unicode

This is kind of the worm hole but…

There’s also Unicode! Unicode is more advanced mapping that allows for far more characters, other languages and so on. It can be 8, 16 or 32 bits.

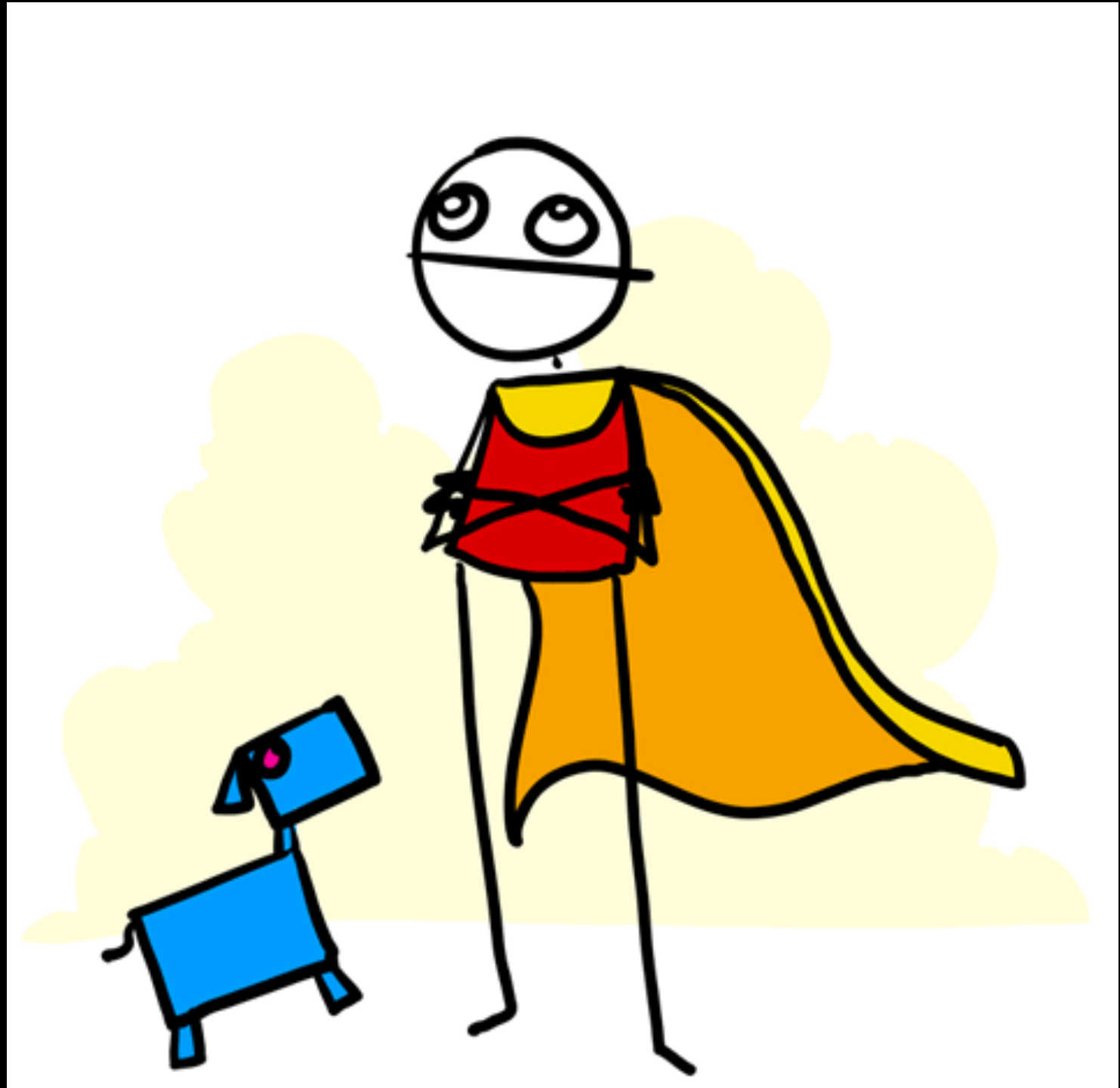
“an international encoding standard for use with different languages and scripts, by which each letter, digit, or symbol is assigned a unique numeric value that applies across different platforms and programs.”

Unicode is common online.

Python!

Python uses Unicode but because it’s higher level. You will almost never, ever think about this.

Where this gets bad is data from the internet but you don’t have to deal with in this class…. If you are lucky, you’ll never have to think this low level.



Interpreters & Compilers

An interpreter reads a high-level program and executes it, meaning that it does what the program says. It processes the program a little at a time, alternately reading lines and performing computations.

Compilers

A compiler reads the program and translates it completely before the program starts running. In this case, the high-level program is called the **source code**, and the translated program is called the **object code** or the **executable**. Once a program is compiled, you can execute it repeatedly without further translation.

Python does both

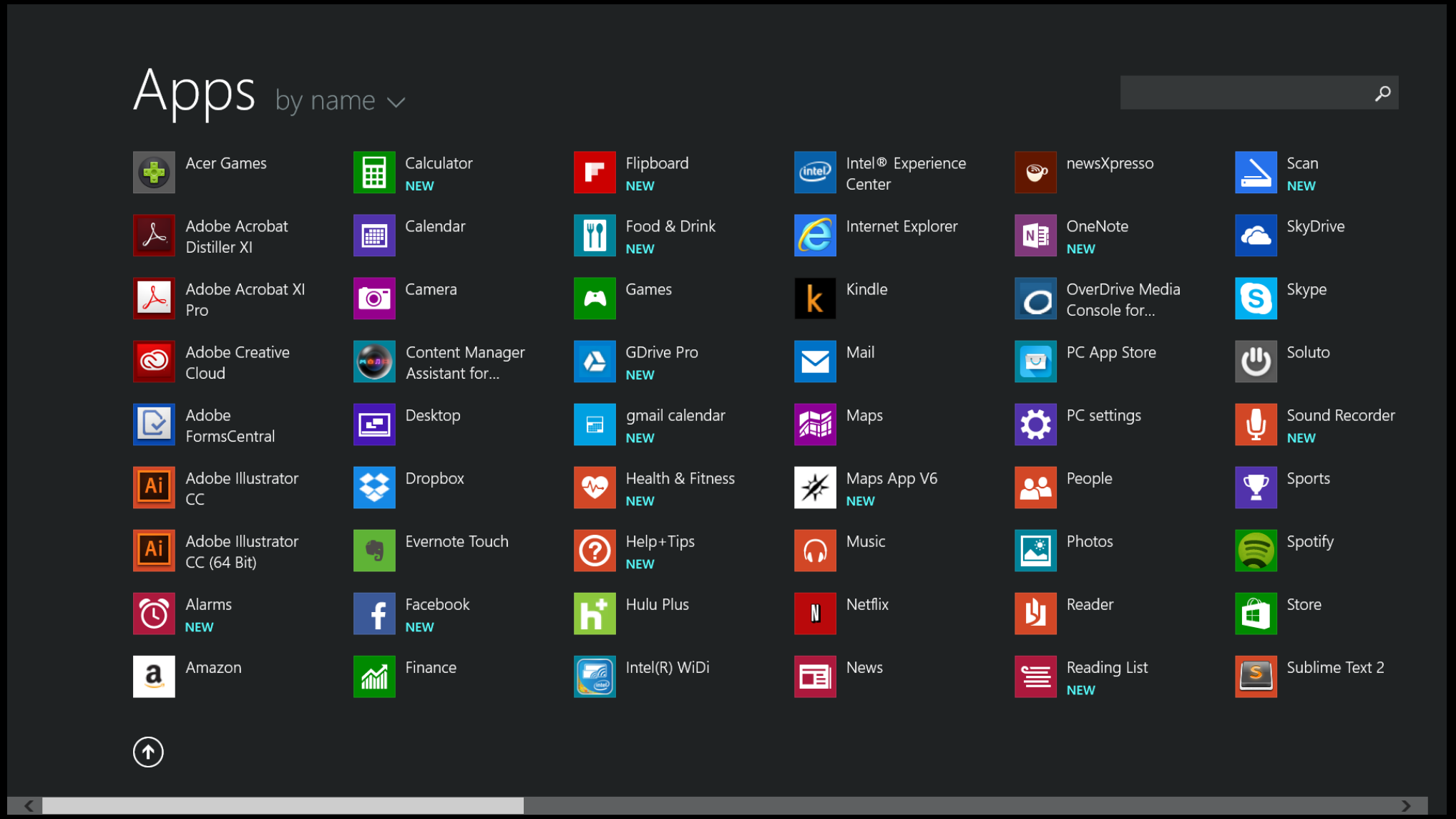
- Many modern languages use both processes. They are first compiled into a lower level language, called **byte code**, and then interpreted by a program called a **virtual machine**. Python uses both processes, but because of the way programmers interact with it, it is usually considered an interpreted language.

- There are two ways to use the Python interpreter: *shell mode* and *program mode*. In shell mode, you type Python expressions into the **Python shell**. In program mode you type them into a file.

Hardware vs software

Hardware yo!

Software


Apps
by name
Acer Games
Calculator
NEW
Flipboard
NEW
Intel® Experience Center
newsXpresso
Scan
NEW
Adobe Acrobat Distiller XI
Calendar
Food & Drink
NEW
Internet Explorer
OneNote
NEW
SkyDrive
Adobe Acrobat XI Pro
Camera
Games
Kindle
OverDrive Media Console for...
Skype
Adobe Creative Cloud
Content Manager Assistant for...
GDrive Pro
NEW
Mail
PC App Store
Soluto
Adobe FormsCentral
Desktop
gmail calendar
NEW
Maps
PC settings
Sound Recorder
NEW
Adobe Illustrator CC
Dropbox
Health & Fitness
NEW
Maps App V6
NEW
People
Sports
Adobe Illustrator CC (64 Bit)
Evernote Touch
Help+Tips
NEW
Music
Photos
Spotify
Alarms
NEW
Facebook
NEW
Hulu Plus
Netflix
Reader
Store
Amazon
Finance
Intel(R) WiDi
News
Reading List
NEW
Sublime Text 2

How a program works

- A program lives on your hard disk
- The instructions of a program get loaded into ram. The machine code is fetched into your CPU
- These instructions get decoded and then executed on your CPU

Sublime text

For this class we will be using sublime text 3 and python 3.3

http://www.python.org/

http://www.sublimetext.com/3

Set sublime up to work with Python here:

http://dbader.org/blog/setting-up-sublime-text-for-python-development

Remember Python has 2 modes

- You can write a whole bunch of code and then run it from a file or you can run it from the command line (program mode)

Today, we will use a command line from Sublime Text called REPL (shell mode) A cool thing we will use for now is the online REPL command line here:

http://repl.it/languages/Python

Now let's write some code!

Input variables and output

Variables are types of data stored in containers. Think of them like a box that holds something in it

x = 10

x is the variable

= is the assignment operator and sets the value on the left of the equation to be equal to the variable on the right

10 is the type. It's an integer number. Or a hole number.

Variables can hold different type of data

- These basic or “scalar” types are
- Int = 10
- Float = 10.0
- Boolean = true or false (0 or 1)
- None = none… ☺ More on this later

Not Scalar but important

String = “a set of words or characters in quotes”

Special or reserved words (Thou shall not)

Do not put spaces in your file names or variable names

Do not use special characters &!$*+-~,/\%^()

Rule of thumb? Anything that's not a letter number or underscore is out of the running for a variable name

All variables must start with a letter or an underscore. No numbers first.

Here's Python's complete list of reserved words:

False class finally is return None continue for lambda try
True def from nonlocal while and del global not with
as elif if or yield assert else import pass break except in raise

Print(something)

Print is a function in python. A function is a set of instructions that does something. You somtimes put things into it. Sometimes it returns values.

Functions are like little machines.

I don’t really care how a coffee pot works. All I know is if I put water and coffee grinds into it, it makes coffee and I can take coffee out of it.

Python particulars

You can add numbers using +

You can multiply with *

You can divide with /

You can divide and truncate off the remainder using //

You can use ( ) to specify the order of operations
Please Excuse My Dear Aunt Sally

Strings

You can also add strings together. This is called concatenation

```
x = “hello “
y = “ world”
print(x + y)
```

Homework

By Wed:

1. Download and set up your IDE (Integrated Development Environment) aka Sublime 3 according to this guide:

http://dbader.org/blog/setting-up-sublime-text-for-python-development

2. Complete the first two sections of how to think like a computer scientist – General Introduction and Simple Python Data.

http://interactivepython.org/runestone/static/thinkcspy/toc.html#

3. Complete the assignment on NYU Classes for the first class

Optional: Read Chapter 1 in Starting out with Python.

Do this is if you got lost today or didn't understand anything in the lecture.