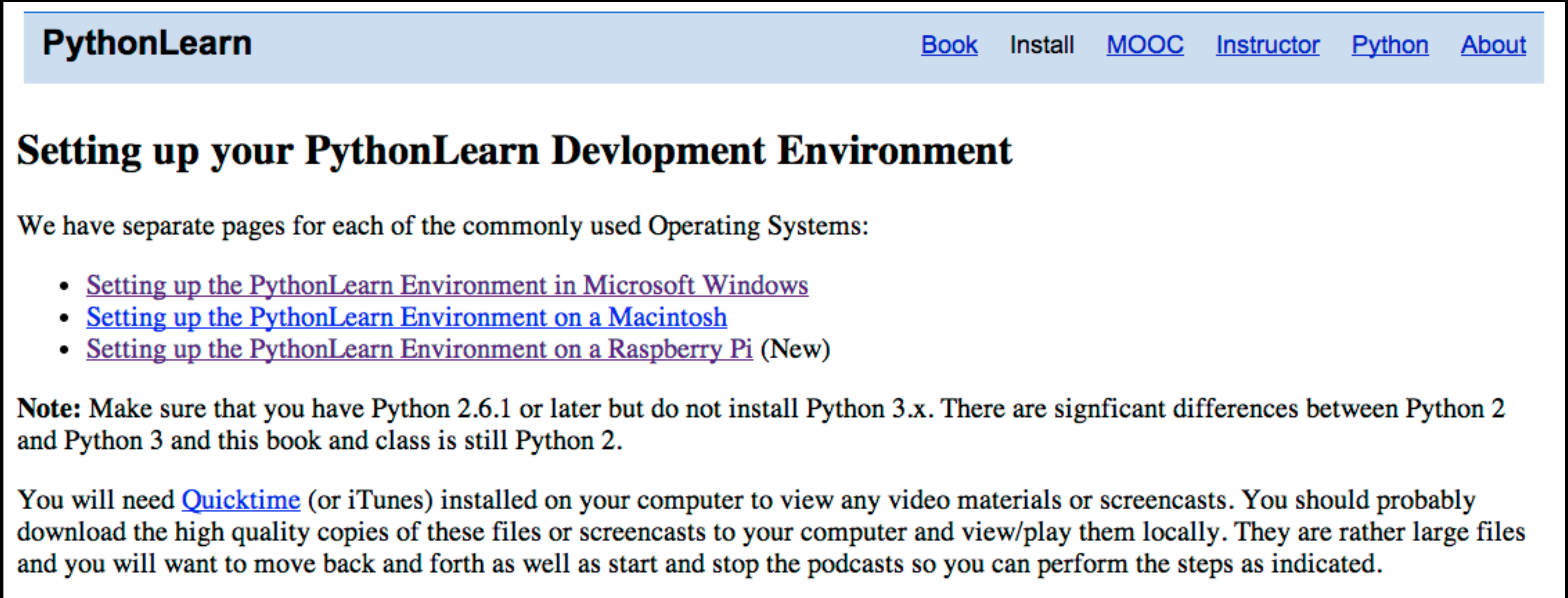
Why Program?

Chapter 1

Python for Informatics: Exploring Information
www.pythonlearn.com

Pre-Requisite: Please Install Python



Setting up your PythonLearn Devlopment Environment

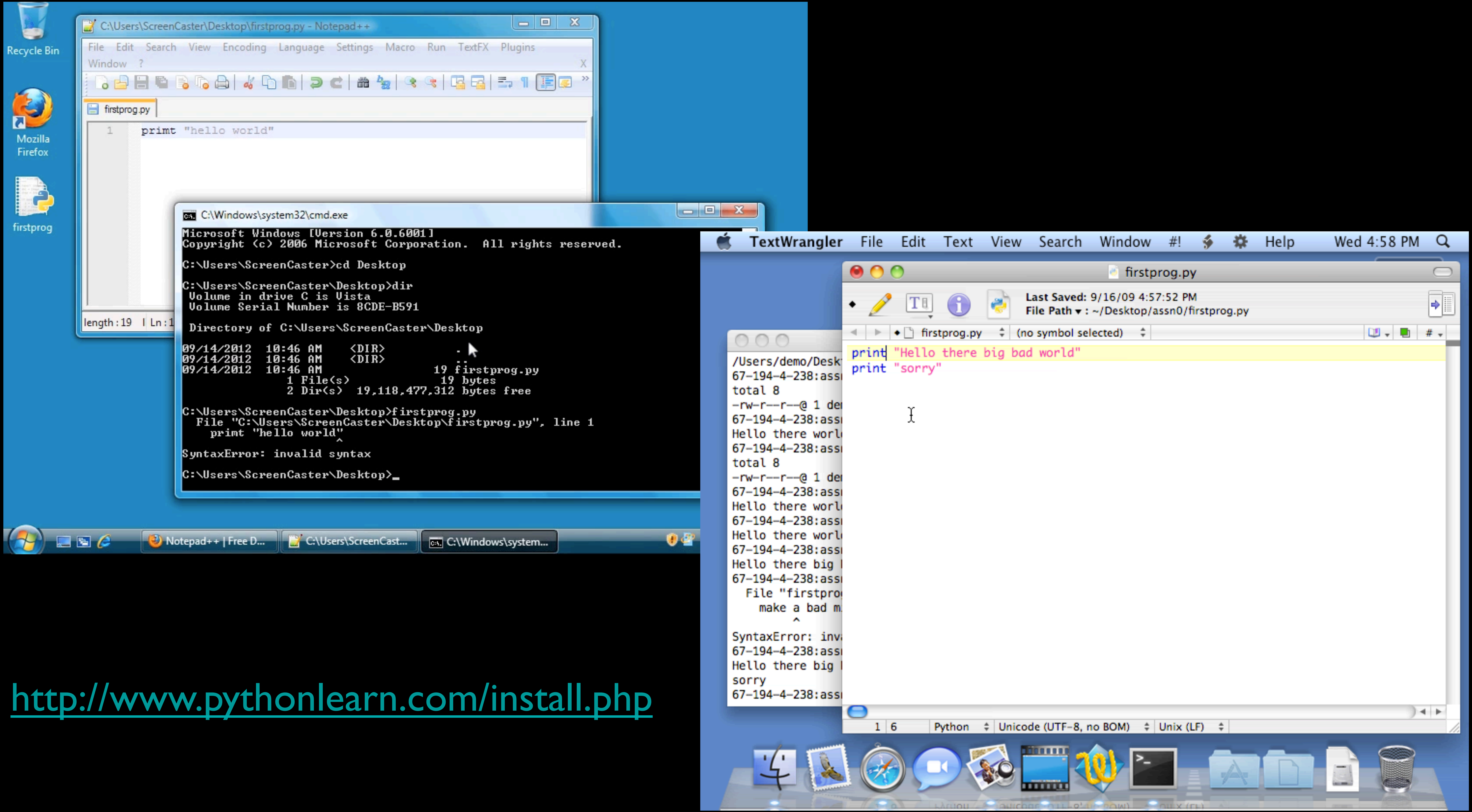
We have separate pages for each of the commonly used Operating Systems:

- Setting up the PythonLearn Environment in Microsoft Windows
- Setting up the PythonLearn Environment on a Macintosh
- Setting up the PythonLearn Environment on a Raspberry Pi (New)

Note: Make sure that you have Python 2.6.1 or later but do not install Python 3.x. There are signficant differences between Python 2 and Python 3 and this book and class is still Python 2.

You will need Quicktime (or iTunes) installed on your computer to view any video materials or screencasts. You should probably download the high quality copies of these files or screencasts to your computer and view/play them locally. They are rather large files and you will want to move back and forth as well as start and stop the podcasts so you can perform the steps as indicated.

http://www.pythonlearn.com/install.php


Recycle Bin
Mozilla Firefox
firstprog
C:\Users\ScreenCaster\Desktop\firstprog.py - Notepad++
File Edit Search View Encoding Language Settings Macro Run TextFX Plugins
Window ?
firstprog.py
length : 19 Ln : 1
C:\Windows\system32\cmd.exe
Notepad++ | Free D...
C:\Users\ScreenCast...
C:\Windows\system...
TextWrangler File Edit Text View Search Window #! Help
Wed 4:58 PM
firstprog.py
(no symbol selected)
1 6 Python Unicode (UTF-8, no BOM) Unix (LF)

```
primt "hello world"
```

```
Microsoft Windows [Version 6.0.6001]
Copyright (c) 2006 Microsoft Corporation.  All rights reserved.

C:\Users\ScreenCaster>cd Desktop

C:\Users\ScreenCaster\Desktop>dir
 Volume in drive C is Vista
 Volume Serial Number is 8CDE-B591

 Directory of C:\Users\ScreenCaster\Desktop

09/14/2012  10:46 AM    <DIR>          .
09/14/2012  10:46 AM    <DIR>          ..
09/14/2012  10:46 AM                19 firstprog.py
               1 File(s)             19 bytes
               2 Dir(s)  19,118,477,312 bytes free

C:\Users\ScreenCaster\Desktop>firstprog.py
  File "C:\Users\ScreenCaster\Desktop\firstprog.py", line 1
    primt "hello world"
                      ^
SyntaxError: invalid syntax

C:\Users\ScreenCaster\Desktop>_
```

Last Saved: 9/16/09 4:57:52 PM
File Path ▾ : ~/Desktop/assn0/firstprog.py

```
print "Hello there big bad world"
print "sorry"
```

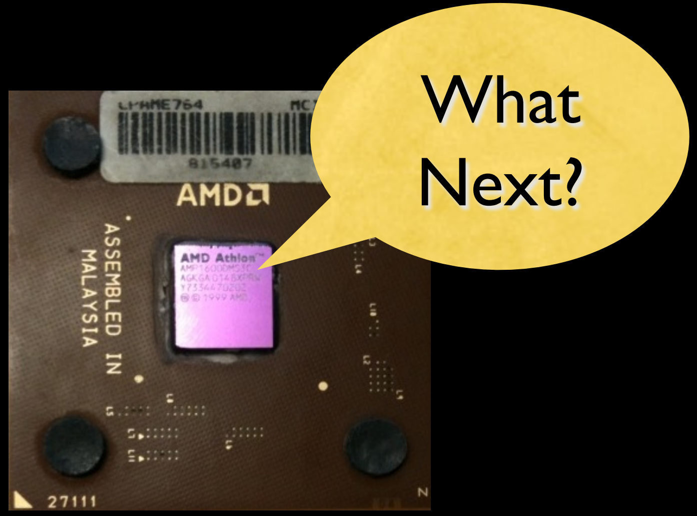
```
/Users/demo/Desk
67-194-4-238:ass
total 8
-rw-r--r--@ 1 de
67-194-4-238:ass
Hello there worl
67-194-4-238:ass
total 8
-rw-r--r--@ 1 de
67-194-4-238:ass
Hello there worl
67-194-4-238:ass
Hello there worl
67-194-4-238:ass
Hello there big 
67-194-4-238:ass
  File "firstpro
    make a bad m
           ^

SyntaxError: inv
67-194-4-238:ass
Hello there big 
sorry
67-194-4-238:ass
```

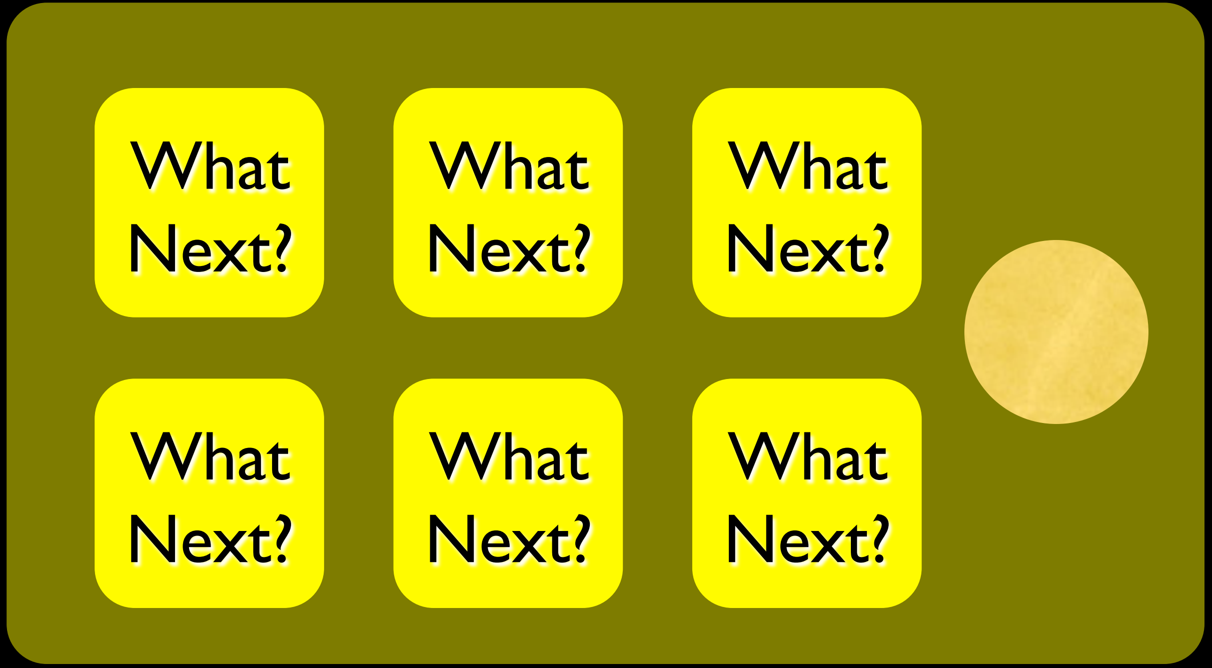
http://www.pythonlearn.com/install.php

Back to the Introduction...

Computers want to be helpful...

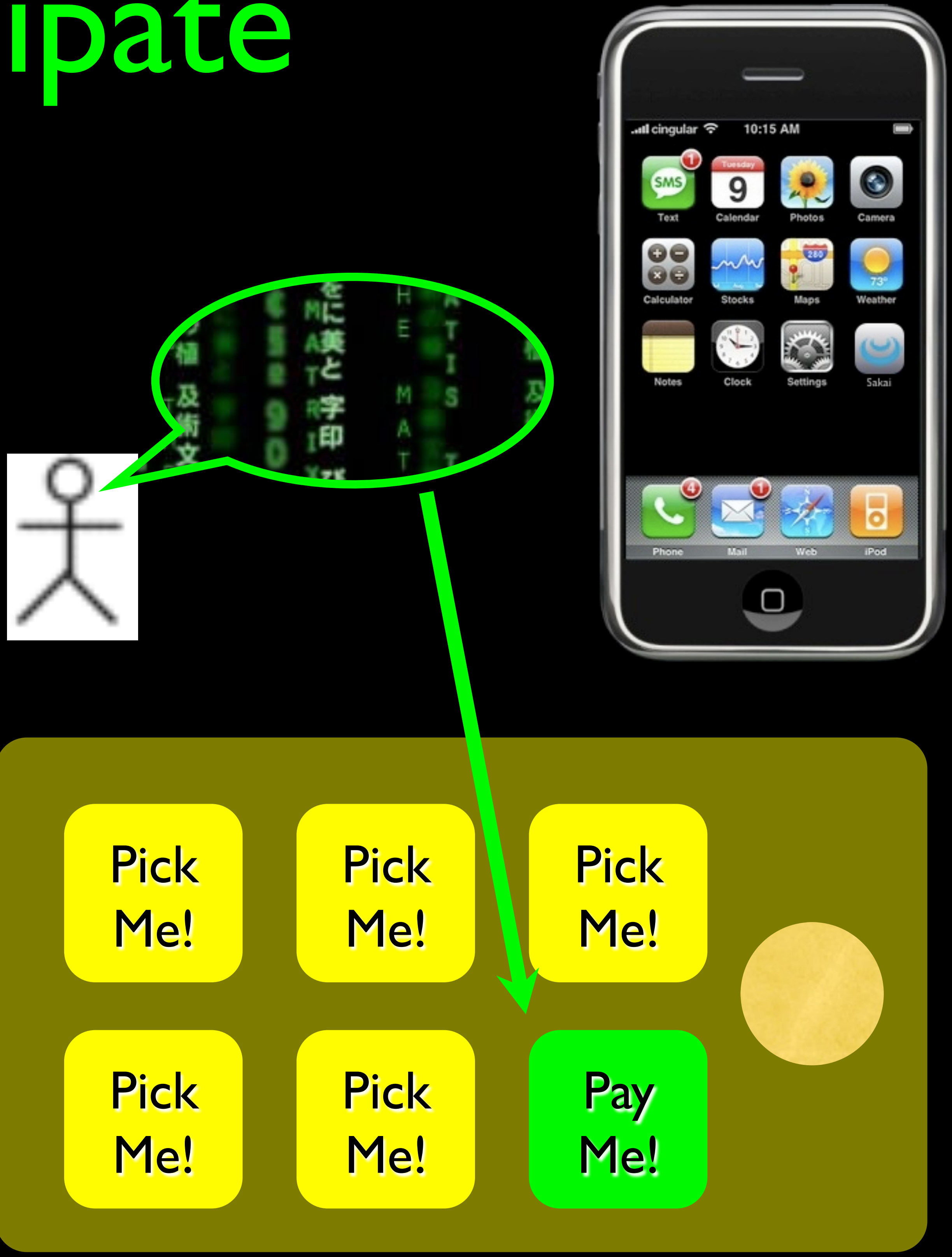
- Computers are built for one purpose - to do things for us
- But we need to speak their language to describe what we want done
- Users have it easy - someone already put many different programs (instructions) into the computer and users just pick the ones we want to use





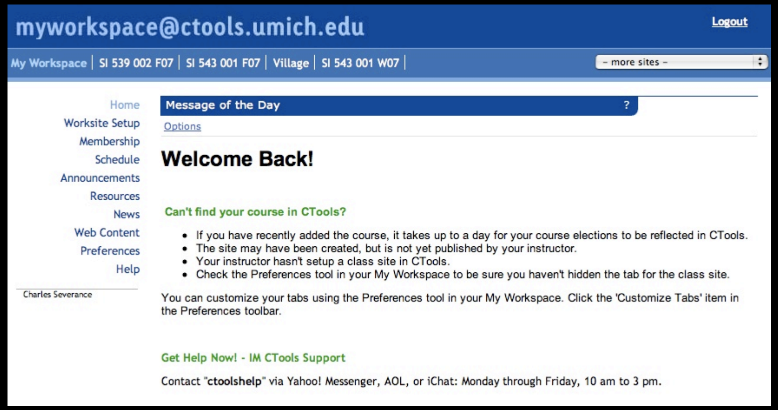
Programmers Anticipate Needs

- iPhone Applications are a market
- iPhone Applications have over 3 Billion downloads
- Programmers have left their jobs to be full-time iPhone developers
- Programmers know the ways of the program



Users .vs. Programmers

- Users see computers as a set of tools - word processor, spreadsheet, map, todo list, etc.
- Programmers learn the computer “ways” and the computer language
- Programmers have some tools that allow them to build new tools
- Programmers sometimes write tools for lots of users and sometimes programmers write little “helpers” for themselves to automate a task



Welcome Back!

Can't find your course in CTools?

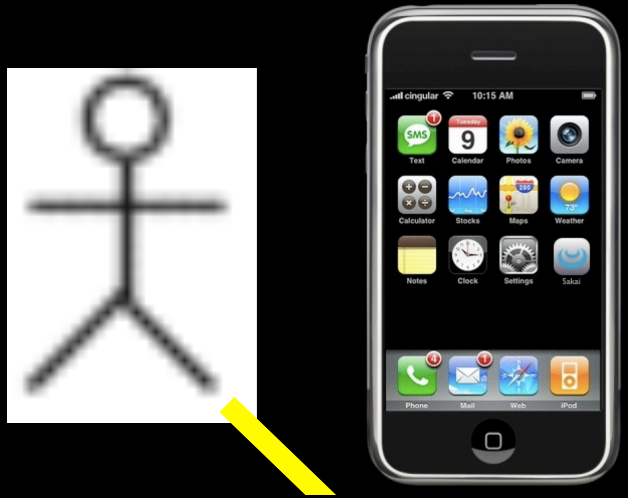
- If you have recently added the course, it takes up to a day for your course elections to be reflected in CTools.
- The site may have been created, but is not yet published by your instructor.
- Your instructor hasn't setup a class site in CTools.
- Check the Preferences tool in your My Workspace to be sure you haven't hidden the tab for the class site.

You can customize your tabs using the Preferences tool in your My Workspace. Click the 'Customize Tabs' item in the Preferences toolbar.

Get Help Now! - IM CTools Support

Contact "ctoolshelp" via Yahoo! Messenger, AOL, or iChat: Monday through Friday, 10 am to 3 pm.

User



Why be a programer?

- To get some task done - we are the user and programmer
  - Clean up survey data
- To produce something for others to use - a programming job
  - Fix a performance problem in the Sakai software
  - Add guestbook to a web site

What is Code? Software? A Program?

- A sequence of stored instructions
  - It is a little piece of our intelligence in the computer
  - It is a little piece of our intelligence we can give to others - we figure something out and then we encode it and then give it to someone else to save them the time and energy of figuring it out
- A piece of creative art - particularly when we do a good job on user experience

Programs for Humans...

http://www.youtube.com/watch?v=vlzwuFkn88U
http://www.youtube.com/watch?v=sN62PAKoBfE

Programs for Humans...

while music is playing:

  Left hand out and up
  Right hand out and up
  Flip Left hand
  Flip Right hand
  Left hand to right shoulder
  Right hand to left shoulder
  Left hand to back of head
  Right ham to back of head
  Left hand to right hit
  Right hand to left hit
  Left hand on left bottom
  Right hand on right bottom
  Wiggle
  Wiggle
  Jump

http://www.youtube.com/watch?v=vlzwuFkn88U

Programs for Humans...

```
while music is playing:
    Left hand out and up
    Right hand out and up
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    Left hand to back of head
    Right hand to back of head
    Left hand to right hip
    Right hand to left hip
    Left hand on left bottom
    Right hand on right bottom
    Wiggle
    Wiggle
    Jump
```

http://www.youtube.com/watch?v=vlzwuFkn88U
http://www.youtube.com/watch?v=sN62PAKoBfE

the clown ran after the car and the car ran into the tent and the tent fell down on the clown and the car

Programs for Python...

Programs for Python...

```
name = raw_input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()

counts = dict()
for word in words:
   counts[word] = counts.get(word,0) + 1
bigcount = None
bigword = None

for word,count in counts.items():
    if bigcount is None or count > bigcount:
        bigword = word
        bigcount = count
print bigword, bigcount
```

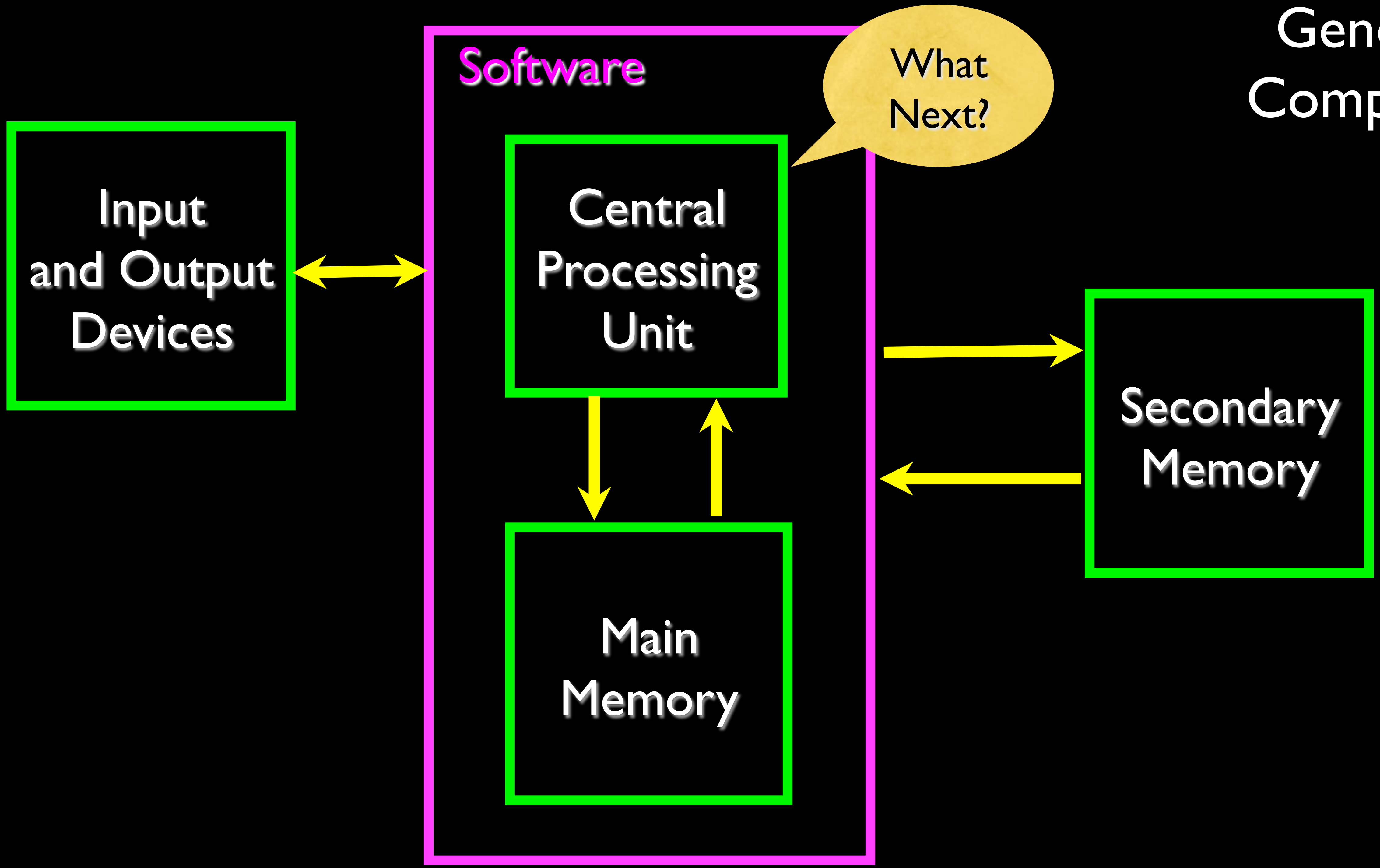
```
python words.py
Enter file: words.txt
to 16
```

```
python words.py
Enter file: clown.txt
the 7
```

Hardware Architecture

http://upload.wikimedia.org/wikipedia/commons/3/3d/RaspberryPi.jpg

Generic Computer



Software

What Next?

Input and Output Devices

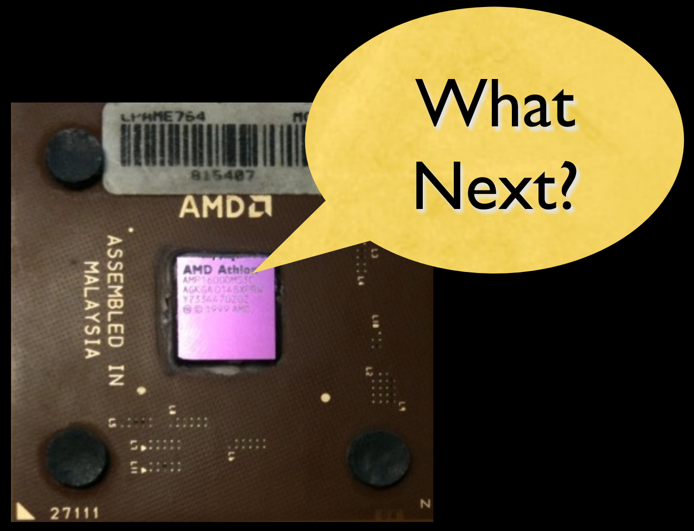
Central Processing Unit

Main Memory

Secondary Memory

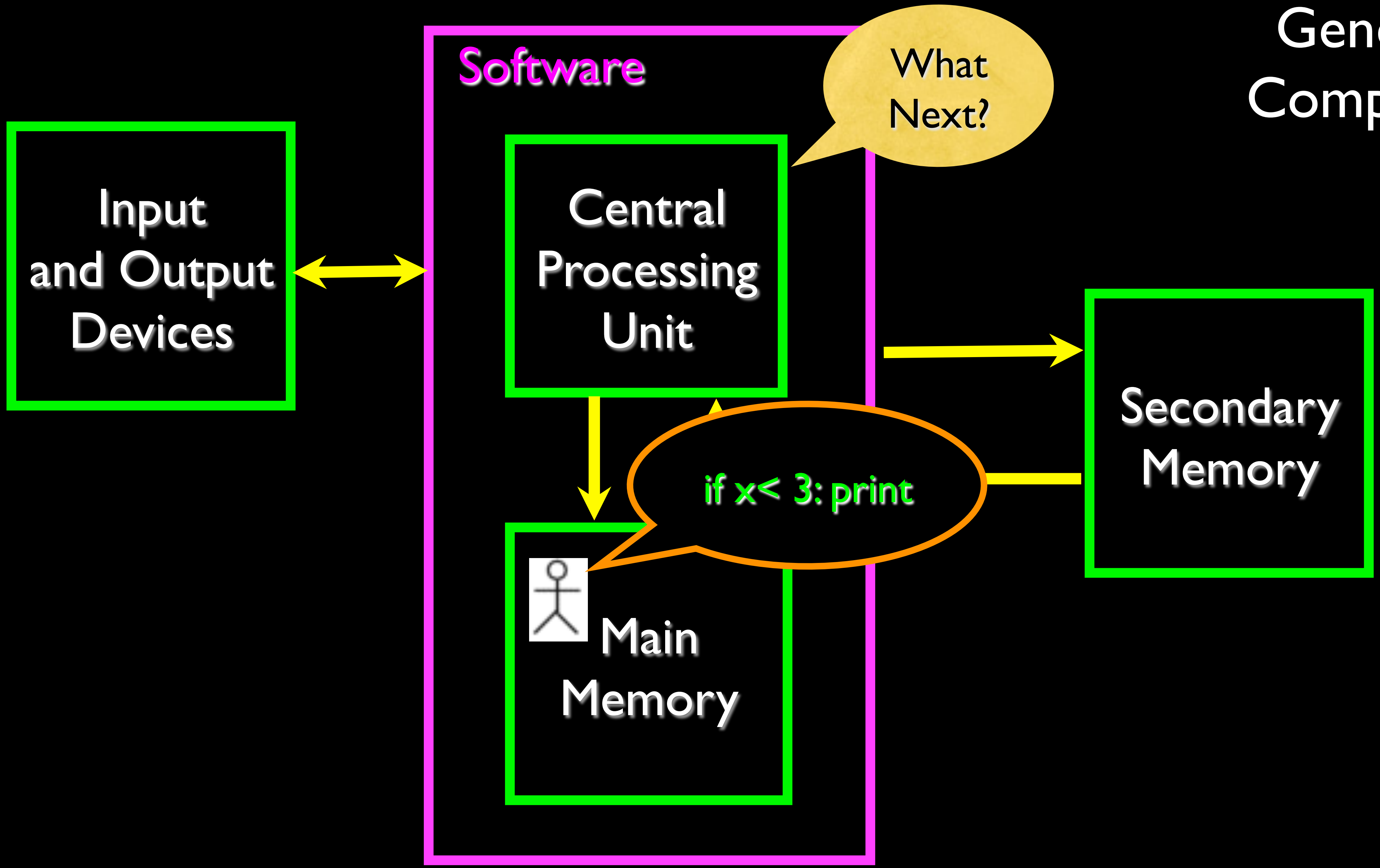
Definitions

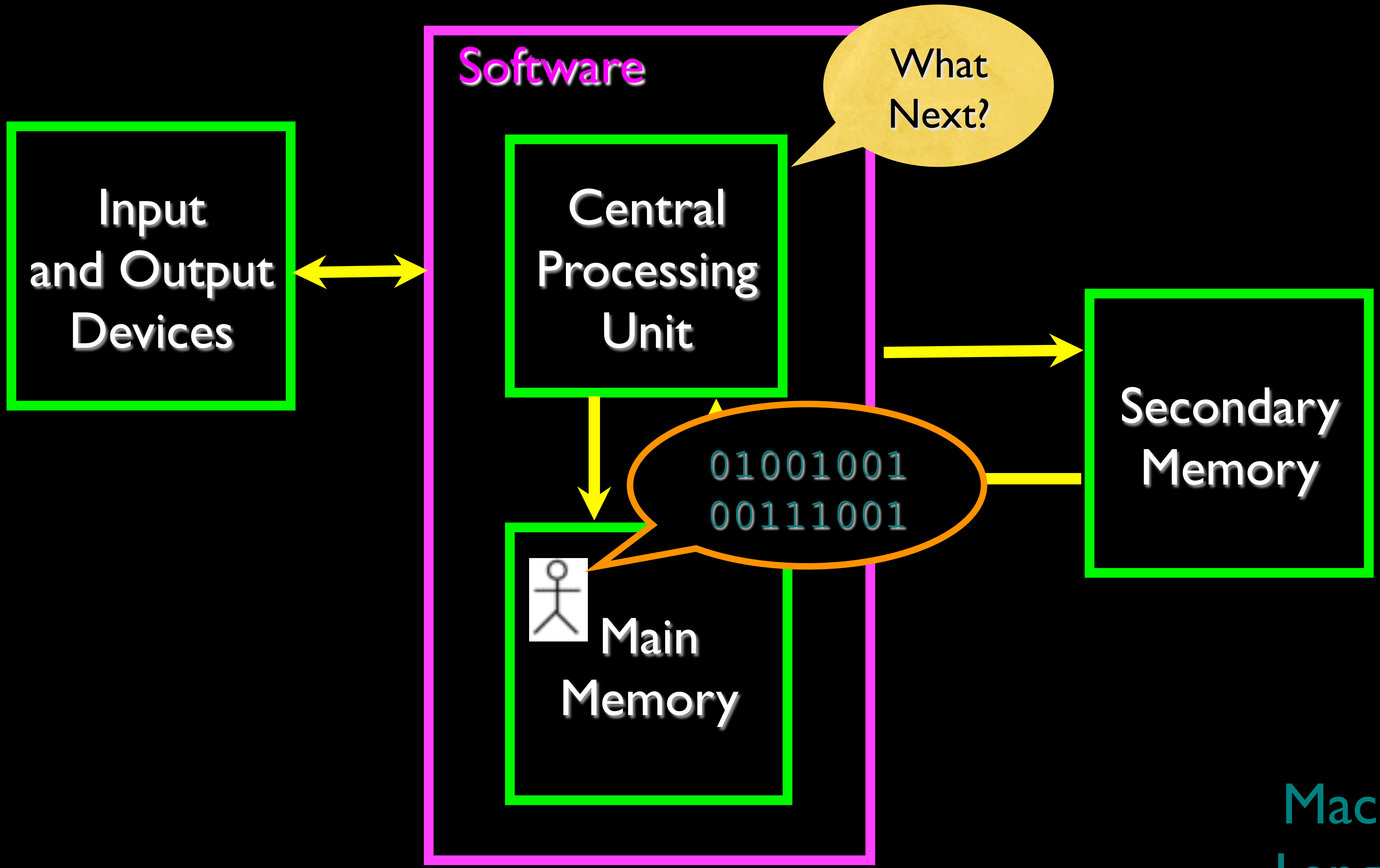
- Central Processing Unit: Runs the Program - The CPU is always wondering “what to do next”? Not the brains exactly - very dumb but very very fast



- Input Devices: Keyboard, Mouse, Touch Screen
- Output Devices: Screen, Speakers, Printer, DVD Burner
- Main Memory: Fast small temporary storage - lost on reboot - aka RAM
- Secondary Memory: Slower large permanent storage - lasts until deleted - disk drive / memory stick

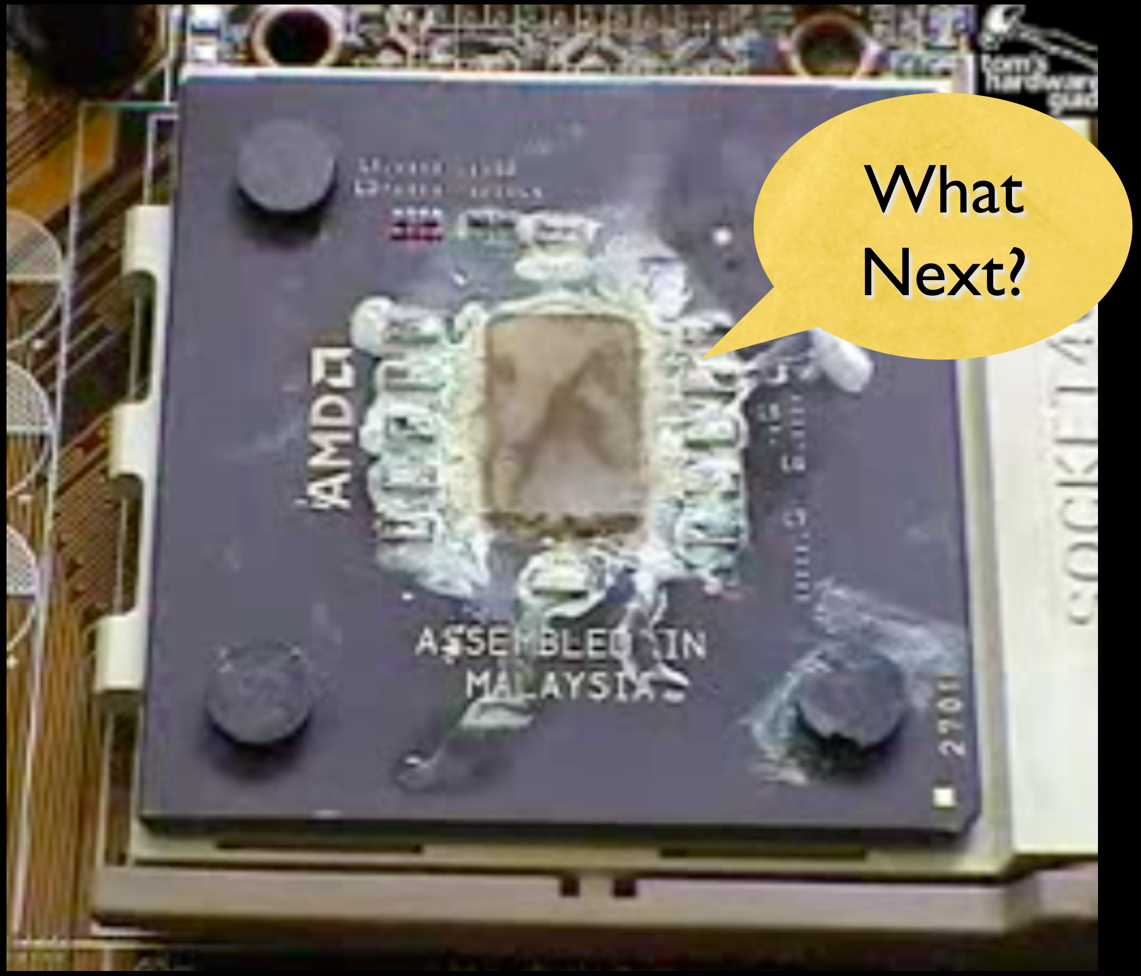
Generic Computer





Machine Language

Totally Hot CPU



http://www.youtube.com/watch?v=y39D4529FM4

Hard Disk in Action

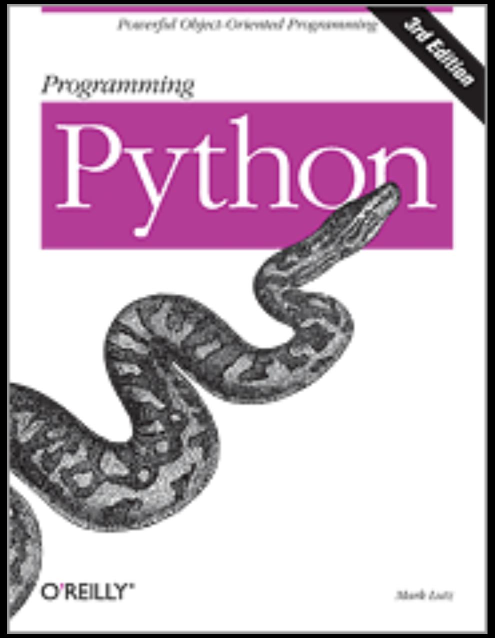
http://www.youtube.com/watch?v=9eMWG3fwiEU

Python as a Language

Parseltongue is the language of serpents and those who can converse with them. An individual who can speak Parseltongue is known as a Parselmouth. It is a very uncommon skill, and may be hereditary. Nearly all known Parselmouths are descended from Salazar Slytherin.

http://harrypotter.wikia.com/wiki/Parseltongue

Python is the language of the Python Interpreter and those who can converse with it. An individual who can speak Python is known as a Pythonista. It is a very uncommon skill, and may be hereditary. Nearly all known Pythonistas use software inititially developed by Guido van Rossum.



Early Learner: Syntax Errors

- We need to learn the Python language so we can communicate our instructions to Python. In the beginning we will make lots of mistakes and speak gibberish like small children.

- When you make a mistake, the computer does not think you are "cute". It says "syntax error" - given that it *knows* the language and you are just learning it. It seems like Python is cruel and unfeeling.

- You must remember that *you* are intelligent and *can* learn - the computer is simple and very fast - but cannot learn - so it is easier for you to learn Python than for the computer to learn English...

Talking to Python

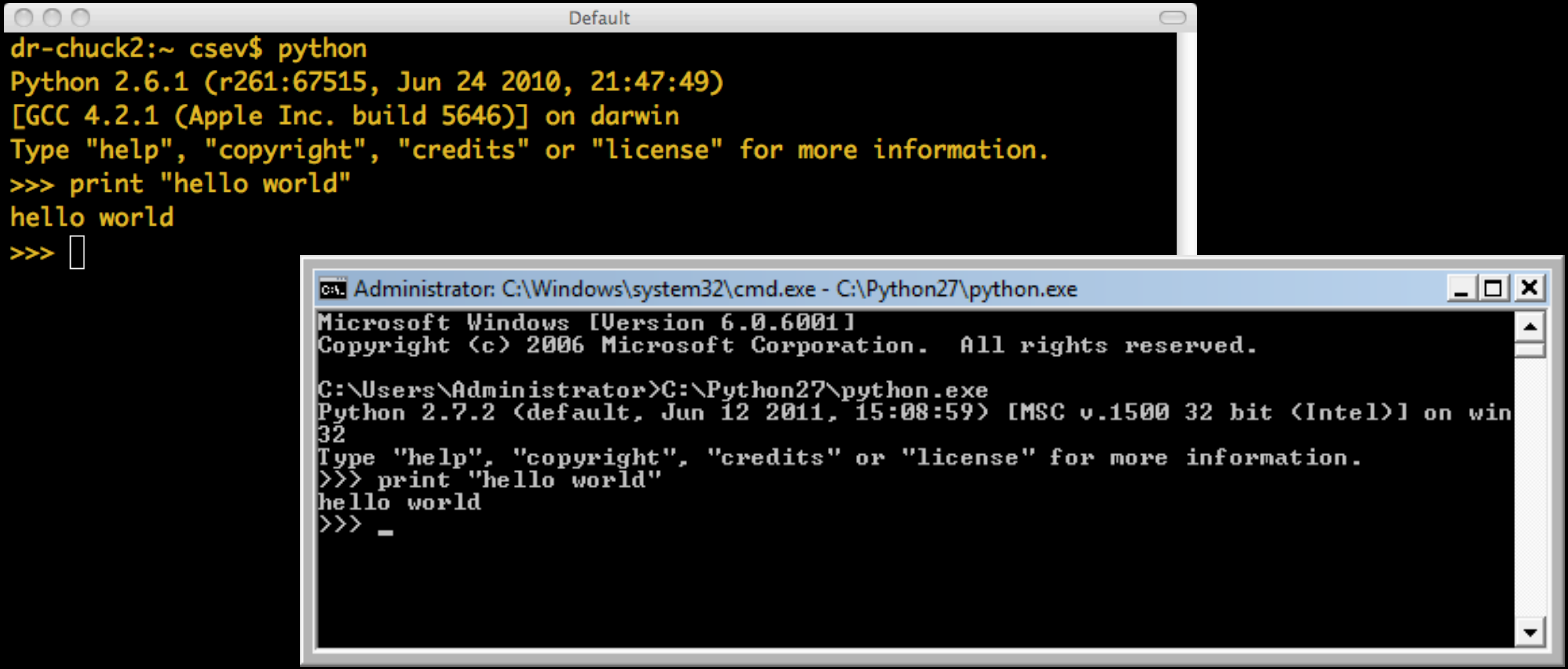
```
csev$ python
Python 2.5 (r25:51918, Sep 19 2006, 08:49:13)
[GCC 4.0.1 (Apple Computer, Inc. build 5341)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

What next?

```
csev$ python
Python 2.5 (r25:51918, Sep 19 2006, 08:49:13)
[GCC 4.0.1 (Apple Computer, Inc. build 5341)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> x = 1
>>> print x
1
>>> x = x + 1
>>> print x
2
>>> exit()
```

This is a good test to make sure that you have Python correctly installed. Note that quit() also works to end the interactive session.

Lets Talk to Python...



```
dr-chuck2:~ csev$ python
Python 2.6.1 (r261:67515, Jun 24 2010, 21:47:49)
[GCC 4.2.1 (Apple Inc. build 5646)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> print "hello world"
hello world
>>> 
```

Administrator: C:\Windows\system32\cmd.exe - C:\Python27\python.exe

```
Microsoft Windows [Version 6.0.6001]
Copyright (c) 2006 Microsoft Corporation.  All rights reserved.

C:\Users\Administrator>C:\Python27\python.exe
Python 2.7.2 (default, Jun 12 2011, 15:08:59) [MSC v.1500 32 bit (Intel)] on win
32
Type "help", "copyright", "credits" or "license" for more information.
>>> print "hello world"
hello world
>>> _
```

What do we Say?

Elements of Python

- Vocabulary / Words - Variables and Reserved words (Chapter 2)
- Sentence structure - valid syntax patterns (Chapters 3-5)
- Story structure - constructing a program for a purpose

```
name = raw_input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()

counts = dict()
for word in words:
   counts[word] = counts.get(word,0) + 1
bigcount = None
bigword = None

for word,count in counts.items():
    if bigcount is None or count > bigcount:
        bigword = word
        bigcount = count
print bigword, bigcount
```

A short “Story” about how to count words in a file in Python.

```
python words.py
Enter file: words.txt
to 16
```

Reserved Words

- You can not use reserved words as variable names / identifiers

and del for is raise assert elif
from lambda return break else
global not try class except if or
while continue exec import pass
yield def finally in print

Sentences or Lines

`x = 2` ← Assignment Statement

`x = x + 2` ← Assignment with expression

`print x` ← Print statement

Variable   Operator   Constant   Reserved Word

Programming Paragraphs

Python Scripts

- Interactive Python is good for experiments and programs of 3-4 lines long
- But most programs are much longer so we type them into a file and tell python to run the commands in the file.
- In a sense we are “giving Python a script”
- As convention, we add “.py” as the suffix on the end of these files to indicate they contain Python

Writing a Simple Program

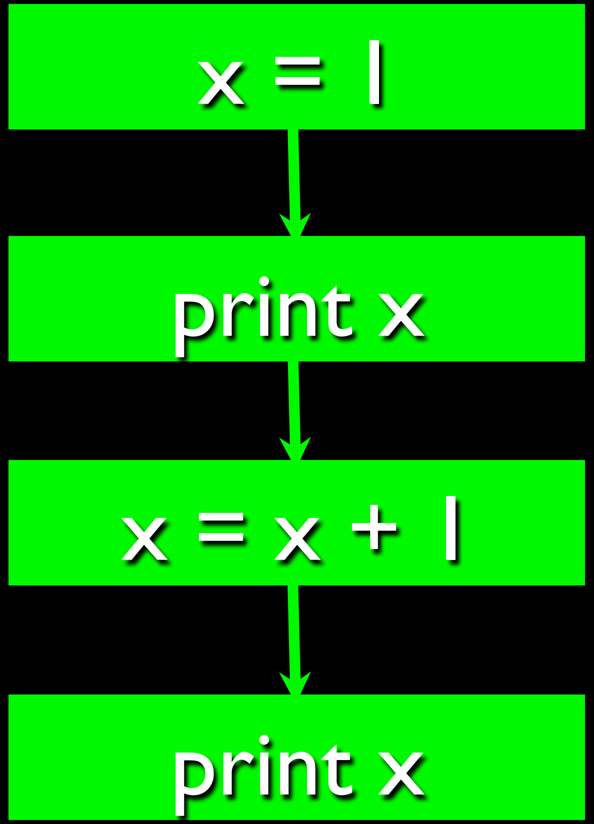
Interactive versus Script

- Interactive
  - You type directly to Python one line at a time and it responds
- Script
  - You enter a sequence of statements (lines) into a file using a text editor and tell Python to execut the statements in the file

Program Steps or Program Flow

- Like a recipe or installation instructions, a program is a sequence of steps to be done in order
- Some steps are conditional - they may be skipped
- Sometimes a step or group of steps are to be repeated
- Sometimes we store a set of steps to be used over and over as needed several places throughout the program (Chapter 4)

Sequential Steps



x = 1

print x

x = x + 1

print x

Program:

```
x = 2
print x
x = x + 2
print x
```

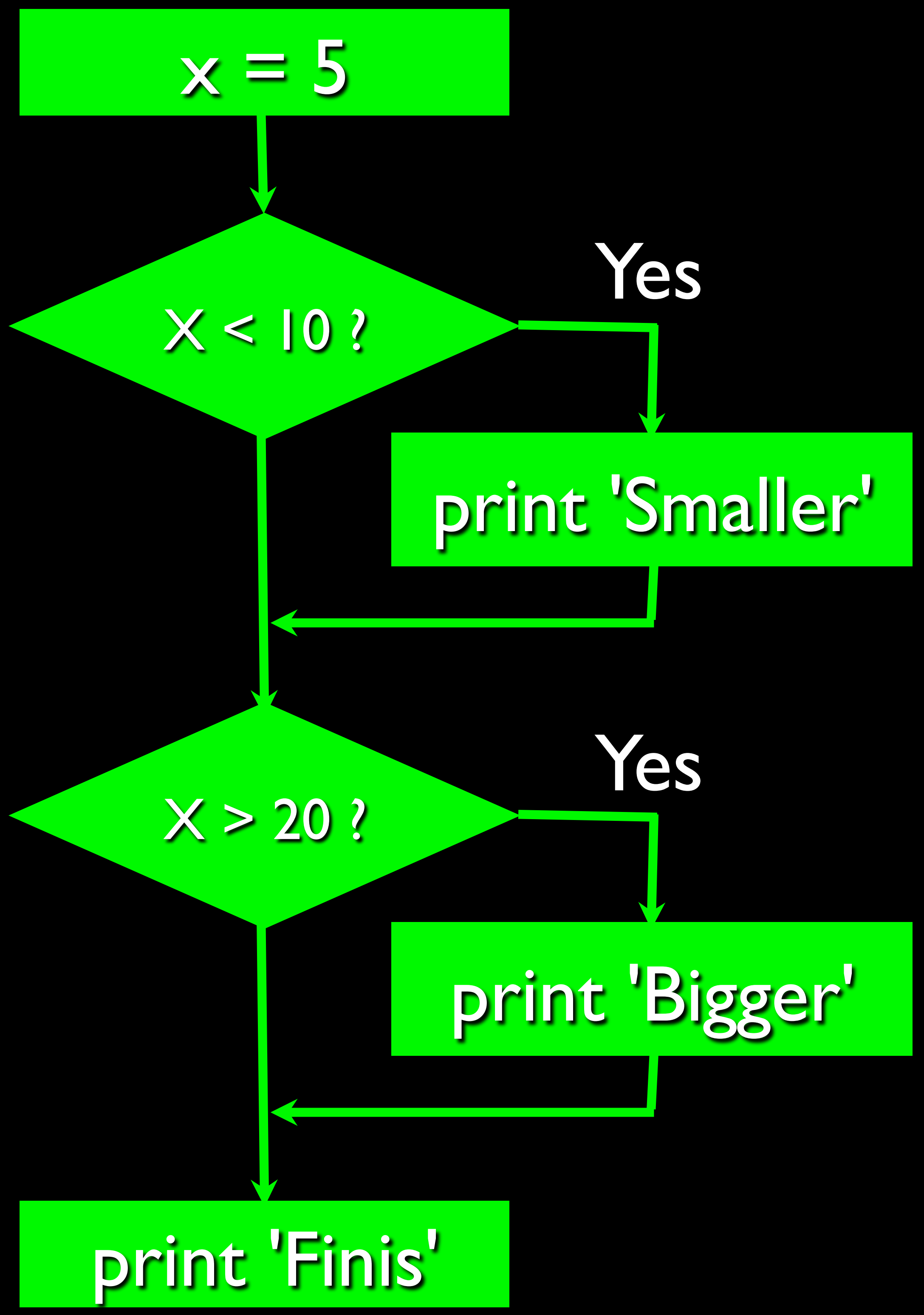
Output:

```
2
4
```

When a program is running, it flows from one step to the next.
We as programmers set up "paths" for the program to follow.

Chapter 2

Conditional Steps



Program:

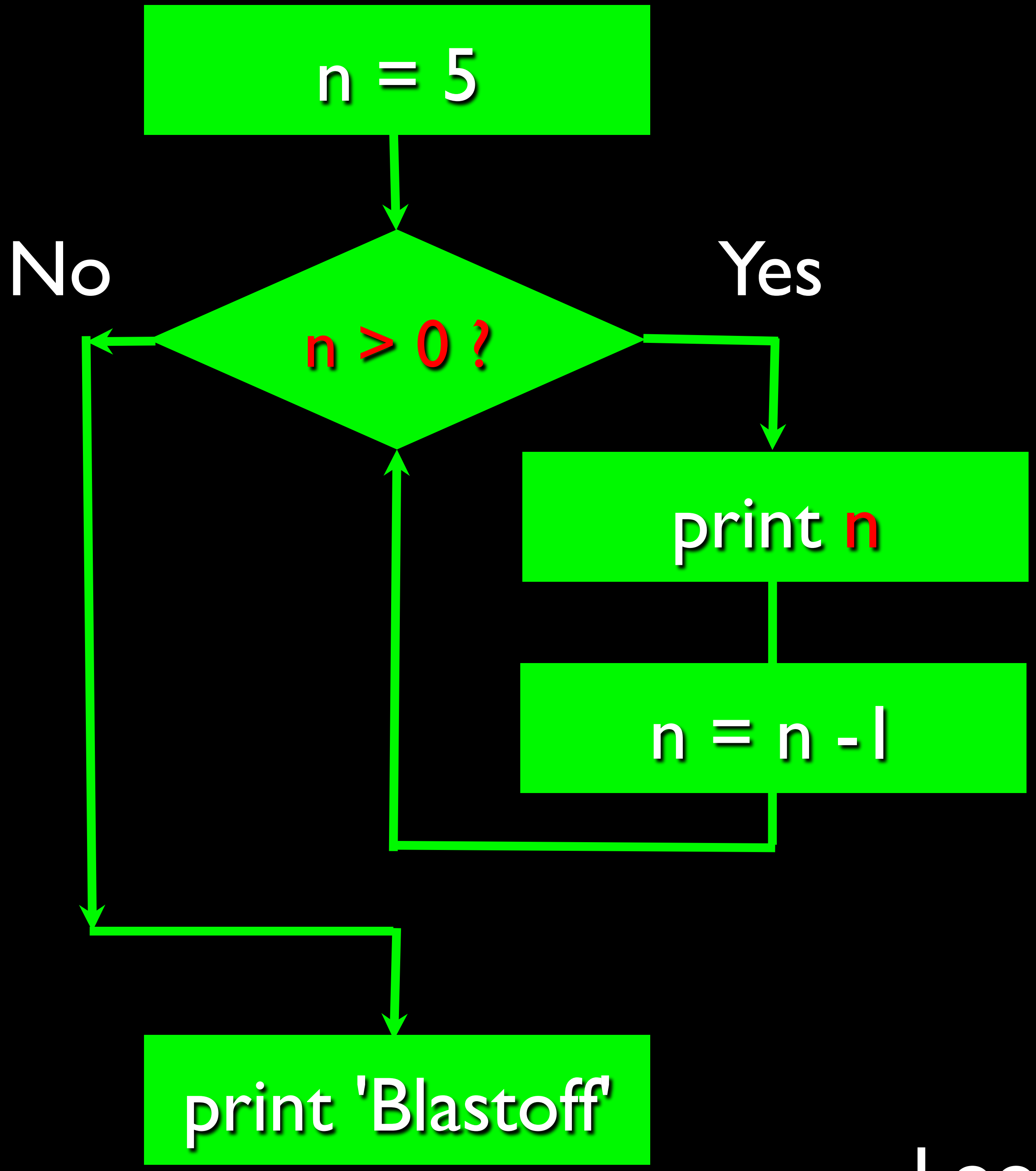
```
x = 5
if x < 10:
    print 'Smaller’
if x > 20:
     print 'Bigger'

print 'Finis'
```

Output:

```
Smaller
Finis
```

Repeated Steps



Program:

```
n = 5
while n > 0 :
    print n
    n = n – 1
print 'Blastoff!'
```

Output:

```
5
4
3
2
1
Blastoff!
```

Loops (repeated steps) have iteration variables that change each time through a loop. Often these iteration variables go through a sequence of numbers.

Chapter 5

An Animated Short Python Story...

Finding the largest number in a list of numbers...

What is the Largest Number?

```
 25   1  114 117 150 152 120  46  19 126
191 121 104 116 160 105  89 125  40  14
31 139 113  94  97 193 154 140 195 122
112 163 177  48  78 101 130  83  35 197
44  54 106 143  50  38   3  41  93  81
20 164   4  11 131   0 107  71 159  69
181 178 173 148  62 142 170  72  37 145
60 187 198  99  15  82  26   8 192  17
129  73  45   9  24 188  42 151  51 183
179  79  50  76  34  33 185 102 193 184
```

25	1	114	117	150	152	120	46	19	126
191	121	104	116	160	105	89	125	40	14
31	139	113	94	97	193	154	140	195	122
112	163	177	48	78	101	130	83	35	197
44	54	106	143	59	38	3	41	93	81
20	164	4	11	131	0	107	71	159	69
181	178	173	148	62	142	170	72	37	145
60	187	198	99	15	82	26	8	192	17
129	73	45	9	24	188	42	151	51	183
179	79	50	76	34	33	185	102	193	184

What is the Largest Number?

```
 25  1  114 117 150 152 120  46  19 126
197 121 104 116 160 005  89 125  40  14
31 139 113  94  97 149 154 140 195 122
112 163 177  48  78 101 130  83  35 197
44  54 106 143  59  38   3  41  93  81
20 164  4   11 131  0  107  71 159  69
181 178 173 148  62 142 170  72  37 145
60 187 169  99  15  82  26  8  092  17
129  73  45  9   24 188  42 151  51 183
179  79  50  76  34  33 185 102 193 184
```

What is the Largest Number?

What is the Largest Number?

3 41 12 9 74 15

largest_so_far -1 3 41 74

Summary

- This is a quick overview of Chapter 1
- We will revisit these concepts throughout the course
- Focus on the big picture