Why Program?

Chapter 1
Pre-Requisite: Please Install Python
Setting up your PythonLearn Development 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 significant 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
print "hello world"

print "Hello there big bad world"

print "sorry"
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
From a software creator's point of view, we build the software. The end users (stakeholders/actors) are our masters - who we want to please - often they pay us money when they are pleased. But the data, information, and networks are our problem to solve on their behalf. The hardware and software are our friends and allies in this quest.
Why be a programmer?

• 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
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 hand 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
  Wiggle
  Jump

http://www.youtube.com/watch?v=vlzwuFkn88U
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
http://www.youtube.com/watch?v=sN62PAKoBfE
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 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...
```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
```
Hardware Architecture
Software

Central Processing Unit

Main Memory

Input and Output Devices

Secondary Memory

What Next?

Generic Computer
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
Software

Input and Output Devices

Central Processing Unit

Main Memory

if \( x < 3 \): print

Secondary Memory

What Next?

Generic Computer
Software

Input and Output Devices

Central Processing Unit

Main Memory

Secondary Memory

Machine Language

What Next?

01001001
00111001
Totally Hot CPU

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

What Next?
Hard Disk in Action

http://www.youtube.com/watch?v=9eMWG3fwEU
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 initially 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.

```python
>>> 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
[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 win32
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
A short “Story” about how to count words in a file in Python.
Reserved Words

- You cannot 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

\[ x = 2 \quad \text{Assignment Statement} \]
\[ x = x + 2 \quad \text{Assignment with expression} \]
\[ \text{print } x \quad \text{Print statement} \]
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 execute 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

Program:

\[
\begin{align*}
x &= 2 \\
\text{print } x \\
x &= x + 2 \\
\text{print } x
\end{align*}
\]

Output:

\[
\begin{align*}
x &= 2 \\
\text{print } x \\
x &= x + 2 \\
\text{print } x
\end{align*}
\]

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

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

Output:

- Smaller
- Finis
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...
<table>
<thead>
<tr>
<th>25</th>
<th>1</th>
<th>114</th>
<th>117</th>
<th>150</th>
<th>152</th>
<th>120</th>
<th>46</th>
<th>19</th>
<th>126</th>
</tr>
</thead>
<tbody>
<tr>
<td>191</td>
<td>121</td>
<td>104</td>
<td>116</td>
<td>160</td>
<td>105</td>
<td>89</td>
<td>125</td>
<td>40</td>
<td>14</td>
</tr>
<tr>
<td>31</td>
<td>139</td>
<td>113</td>
<td>94</td>
<td>97</td>
<td>193</td>
<td>154</td>
<td>140</td>
<td>195</td>
<td>122</td>
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<tr>
<td>112</td>
<td>163</td>
<td>177</td>
<td>48</td>
<td>78</td>
<td>101</td>
<td>130</td>
<td>83</td>
<td>35</td>
<td>197</td>
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<td>44</td>
<td>54</td>
<td>106</td>
<td>143</td>
<td>59</td>
<td>38</td>
<td>3</td>
<td>41</td>
<td>93</td>
<td>81</td>
</tr>
<tr>
<td>20</td>
<td>104</td>
<td>4</td>
<td>11</td>
<td>131</td>
<td>107</td>
<td>71</td>
<td>159</td>
<td>65</td>
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<td>17</td>
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<td>129</td>
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<td>45</td>
<td>9</td>
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</tr>
<tr>
<td>179</td>
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<td>50</td>
<td>76</td>
<td>34</td>
<td>33</td>
<td>185</td>
<td>102</td>
<td>193</td>
<td>184</td>
</tr>
</tbody>
</table>

**What is the Largest Number?**
What is the Largest Number?
What is the Largest Number?
What is the Largest Number?

3  41  12  9  74  15

largest_so_far  -13  41  74
Summary

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