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General Assembly

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# PYTHON PROGRAMMING 101

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# GOALS FOR THE SESSION

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- Touch on fundamental Python programming techniques and tools
- Discover the key features of Python and how it compares to other programming languages
- Discuss its applications in data analysis and the types of problems it can solve
- Learn to code in Python
  - Variables
  - Lists, Dictionaries, Tuples
  - Functions
  - Program Control
  - Classes
- Apply your new skills to solve problems

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# INTRODUCTION TO PYTHON

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# WHAT CAN PROGRAMMING LANGUAGES DO

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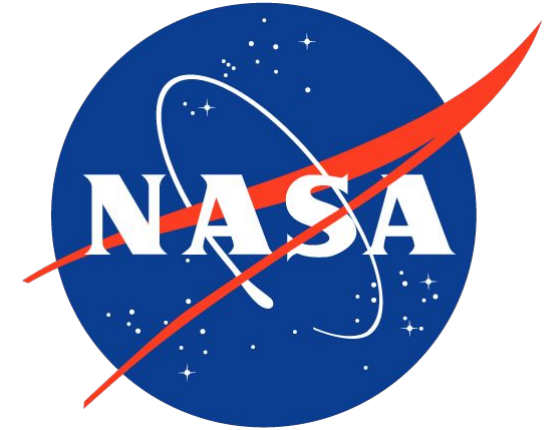
- **What can programming languages do?**
  - **Analyze** (Text, Numbers)
  - **Retrieve** (Information from files, webpages, databases)
  - **Send** (Information through e-mails, databases)
  - **Create/Edit** (Text files, Images)

# WHO USES PYTHON?

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Google

  
Pinterest



Quora



You Tube



venmo



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# HOW IS PYTHON USED

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## ‣Scripting Language

- Automating simple tasks (testing, building, deployment, monitoring)
- Acts as “glue” that holds other code together (can interact with C and Java code)

## ‣Website Design

- Django
- Flask

## ‣Analysis

- Machine Learning
- GIS
- Interfacing with Databases

## ‣Graphics

- Interfacing with Maya and Renderman
- Visualizing data analysis

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# EXAMPLES OF PYTHON IN INDUSTRY AND ACADEMIA

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## ‣Industry

- [Drug discovery](#)
- [Financial services](#)
- [Films and special effects](#)

## ‣Academia

- [Gravitational waves](#)
- [Scientific visualisation](#)
- [Biomolecule simulation](#)

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# WHY PYTHON?



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# **BENEFITS OF PYTHON**

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## **▸Benefits of using Python**

▸Easy to learn

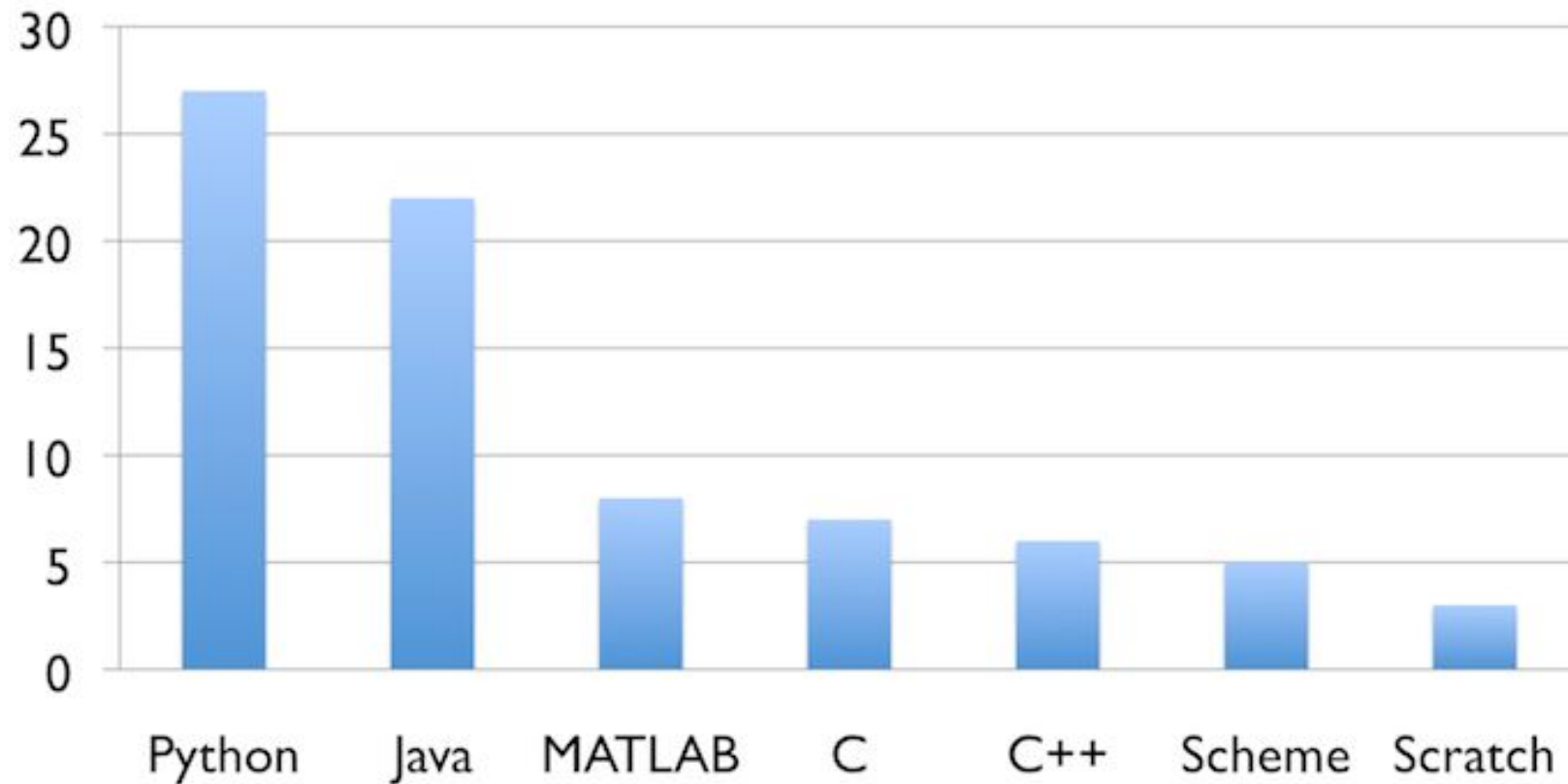
▸Fast Coding

▸Readable

▸Popularity

# PYTHON IS EASY TO LEARN

Number of top 39 U.S. computer science departments that use each language to teach introductory courses



# PYTHON IS READABLE

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```
x = 12 - 2
```

```
y = "Hello"
```

```
z = 3.45
```

```
if z == 3.45:
```

```
    x = x + 1
```

```
    y = y + " World"
```

```
print x
```

```
print y
```

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# PYTHON IS FAST TO CODE: C VS. JAVA VS. PYTHON

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Display the text, “Hello World!”

```
#include <stdlib.h>
#include <stdio.h>

int main(void)
{
    printf("Hello world!\n");
    return EXIT_SUCCESS;
}
```

C

```
public class HelloWorld
{
    public static void main(String[] args)
    {
        System.out.println("Hello world!");
    }
}
```

Java

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

Python

# PYTHON IS FAST TO CODE: C VS. JAVA VS. PYTHON

Determine if a string is a palindrome

```
#include <string.h>

int is_palindrome(const char *s)
{
    int i,l;
    l = strlen(s);
    for(i=0; i<l/2; i++)
    {
        if ( s[i] != s[l-i-1] ) return 0;
    }
    return 1;
}
```

C

```
public static boolean is_palindrome(String testMe){
    StringBuilder sb = new StringBuilder(testMe);
    return testMe.equals(sb.reverse().toString());
}
```

Java

```
def is_palindrome(s):
    return s == s[::-1]
```

Python

# PYTHON IS POPULAR

PYPL	Tiobe	CodingDojo	IEEE Jobs	IEEE Open	IEEE Trending
Java	Java	SQL	C	C++	C
Python	C	Java	Java	Python	C++
PHP	C++	JavaScript	Python	C	Python
C#	C#	C#	C++	Java	Java
JavaScript	Python	Python	JavaScript	Swift	Swift
C++	JavaScript	C++	C#	JavaScript	R
C	PHP	PHP	PHP	C#	JavaScript
Objective-C	Assembly	iOS	Ruby	Ruby	Ruby
R	VB.NET	Ruby/Rails	HTML	PHP	Go
Swift	Perl		Swift	Ruby	C#
Matlab	Delphi		Assembly	HTML	PHP
Ruby	Ruby		Ruby	Go	Scala
VBA	Swift		Scala	Scala	Arduino
Visual Basic	Objective-C		Shell	Objective-C	Assembly
Scala	Matlab		Perl	Shell	Shell
Perl	Groovy		SQL	Arduino	Objective-C
lua	Visual Basic		Objective-C	Assembly	HTML
Delphi	Ruby		Matlab	Matlab	Rust
Go	Go		Visual Basic	Lua	Haskell
Haskell	PL/SQL		Go	Perl	Visual Basic

*Combined chart of language popularity metrics.*

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# USING PYTHON

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# PYTHON VERSIONS

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## ▸ Versions of Python

### ▸ Python 2 (Usually Python 2.7)

- More widely used (Pre-installed in Macs and Linux)
- More support from community
- More compatible libraries

### ▸ Python 3

- More support officially (under active development)
- More consistent language
- More memory efficient

**▸ 2.7 is recommended for people beginning Python because of the wider support and most libraries can be run as is**



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# DOWNLOADING PYTHON

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- You can download Python from the official website:  
<https://www.python.org/downloads>
- You can also download a Python distribution:
  - All-in-One
  - Contains commonly used libraries pre-configured
- Recommended Distribution: Anaconda
  - <https://www.continuum.io/downloads>
  - Easiest to install new libraries
  - Contains a massive number of libraries
  - Contains different graphical interfaces to Python

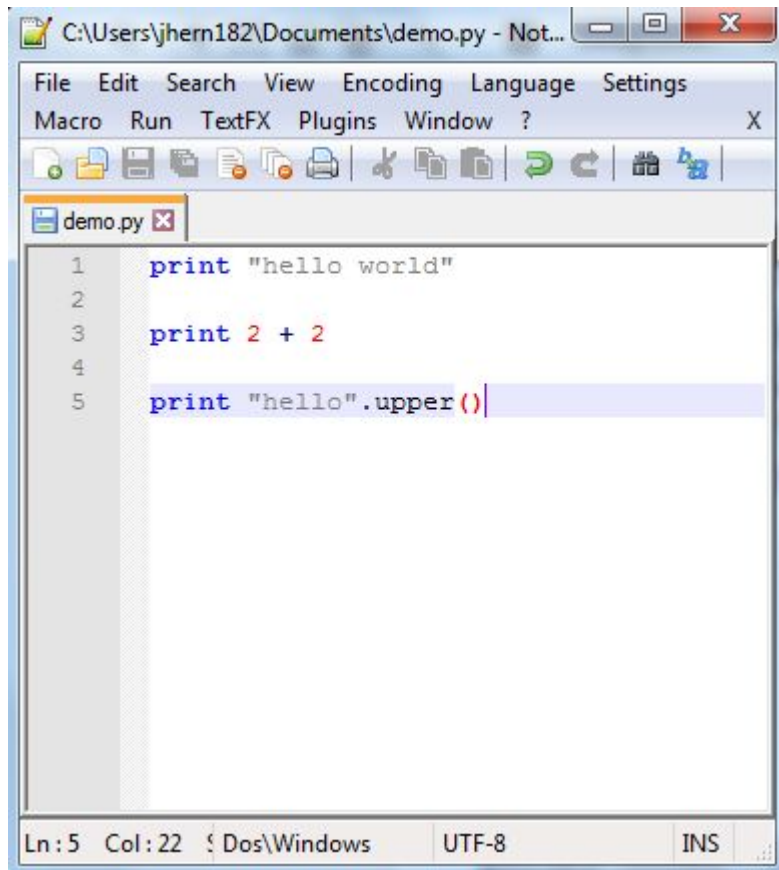
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# USING PYTHON - SIMPLEST METHOD

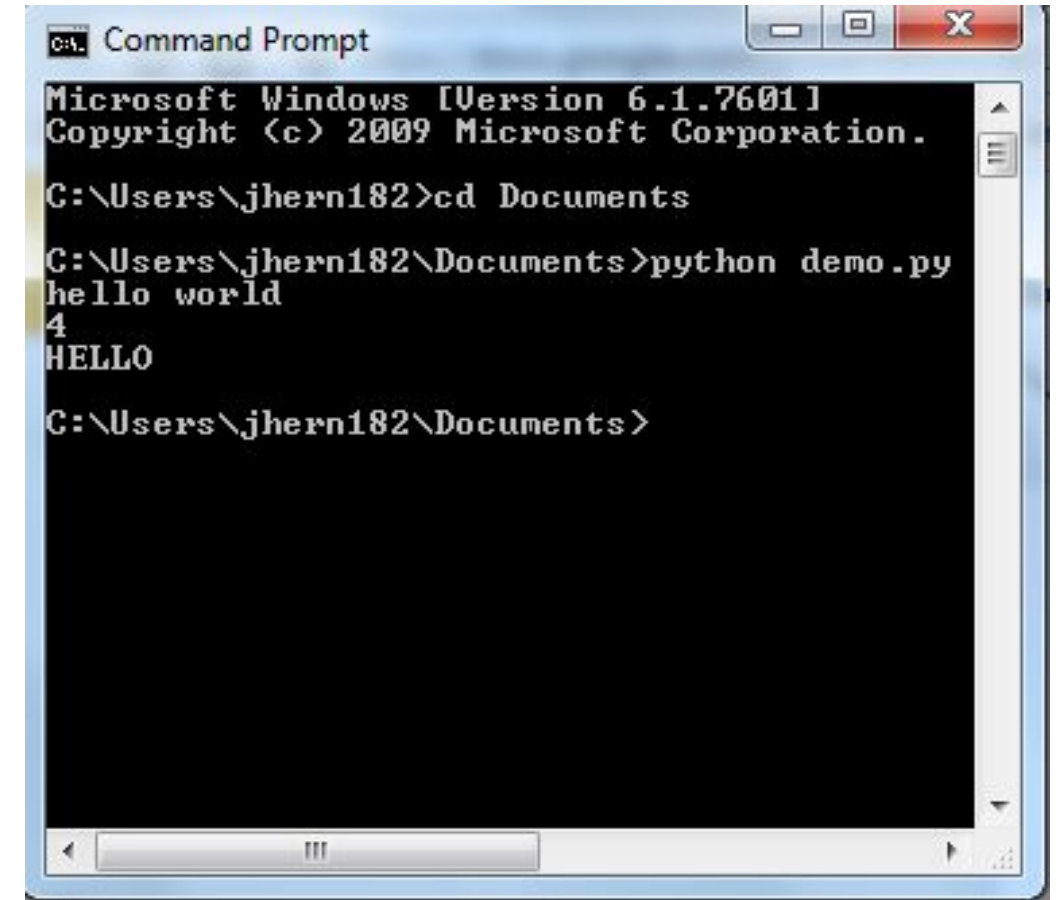
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- **Load** text-editor (Notepad, Notepad++, Sublime, Etc)
- **Write** the full code (also called a “script”)
- **Save** code as a text file and give it “.py” extension
- **Open** command prompt/terminal and navigate to folder where file is saved
- **Type and run:** *python nameofprogram.py*

# USING PYTHON - SIMPLEST METHOD



```
1 print "hello world"
2
3 print 2 + 2
4
5 print "hello".upper()
```



```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.

C:\Users\jhern182>cd Documents

C:\Users\jhern182\Documents>python demo.py
hello world
4
HELLO

C:\Users\jhern182\Documents>
```

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# USING PYTHON - ADVANCED METHODS

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- There are other ways of running Python code
- We might want to **type/run code line-by-line** and get an instant result
  - Use **Ipython**
- We might want to **run the code in the same window as our text editor**
  - Use **Spyder**
- We might want to **display the results below specific segments of the code**
  - Use **Jupyter**

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# PYTHON GRAPHICAL INTERFACES

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- **Included in Anaconda are three commonly used graphical interfaces with Python**
  - **IPython:** For executing Python commands line by line and interacting with the results
  - **Spyder:** For creating larger scripts and executing them in the same window
  - **Jupyter:** For displaying code with its results, all in the same document

# IPYTHON

```
IPython 3.2.0 -- An enhanced Interactive Python.
Anaconda is brought to you by Continuum Analytics.
Please check out: http://continuum.io/thanks and https://anaconda.org
?          -> Introduction and overview of IPython's features.
%quickref  -> Quick reference.
help       -> Python's own help system.
object?    -> Details about 'object', use 'object??' for extra details.

In [1]: print("Hello world!")
Hello world!

In [2]: 2 * 3
Out[2]: 6

In [3]:
```

**IPython** lets you run short segments of code and instantly see their the results

IPython is ideal when you have a simple task, want to debug, or want to learn Python's commands

# SPYDER

The screenshot displays the Spyder Python IDE interface. The main window is divided into three panes:

- Editor (Left):** Contains a Python script named `questionnaire.py`. The script includes comments in Swedish and English, imports `pandas`, and defines a `reverseScoring` function. It reads a CSV file, processes the data, and writes the result to another CSV file.
- Variable explorer (Top Right):** Shows a table of variables in the current namespace.
- IPython console (Bottom Right):** Displays the output of the script, including a `UnicodeEncodeError` and a warning about `SettingWithCopyWarning`.

Name	Type	Size	Value
firstnames	list	4	['Date', 'Informed', 'Sex', 'Age']
frame	DataFrame	(234, 26)	Column names: Date, Informed, Sex, Age, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8, Y9, Y10, Y11, Y12, Y13, Y14, Y15, Y16, Y17, Y18, Y19, Y20
i	int	1	9
idx	int	1	0
iv	list	20	['Y1', 'Y2', 'Y3', 'Y4', 'Y5', 'Y6', 'Y7', 'Y8', 'Y9', 'Y10', ...]
lastnames	list	2	['EduYears', 'Sub_id']
names	list	26	['Date', 'Informed', 'Sex', 'Age', 'Y1', 'Y2', 'Y3', 'Y4', 'Y5', 'Y6', ...]
row	unicode	1	1. Mycket sällan

The IPython console shows the following output:

```
File "/usr/local/lib/python2.7/dist-packages/spyderlib/widgets/externalshell/sitecustomize.py", line 699, in runfile
execfile(filename, namespace)
File "/usr/local/lib/python2.7/dist-packages/spyderlib/widgets/externalshell/sitecustomize.py", line 81, in execfile
builtins.execfile(filename, *where)
File "/home/erik/Dokument/Programming/Python/datawrangling/questionnaire.py", line 30, in <module>
row = str(row)
UnicodeEncodeError: 'ascii' codec can't encode characters in position 11-12: ordinal not in range(128)

/home/erik/Dokument/Programming/Python/datawrangling/questionnaire.py:31: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy
frame[iv[idx]][i] = int(row[0])

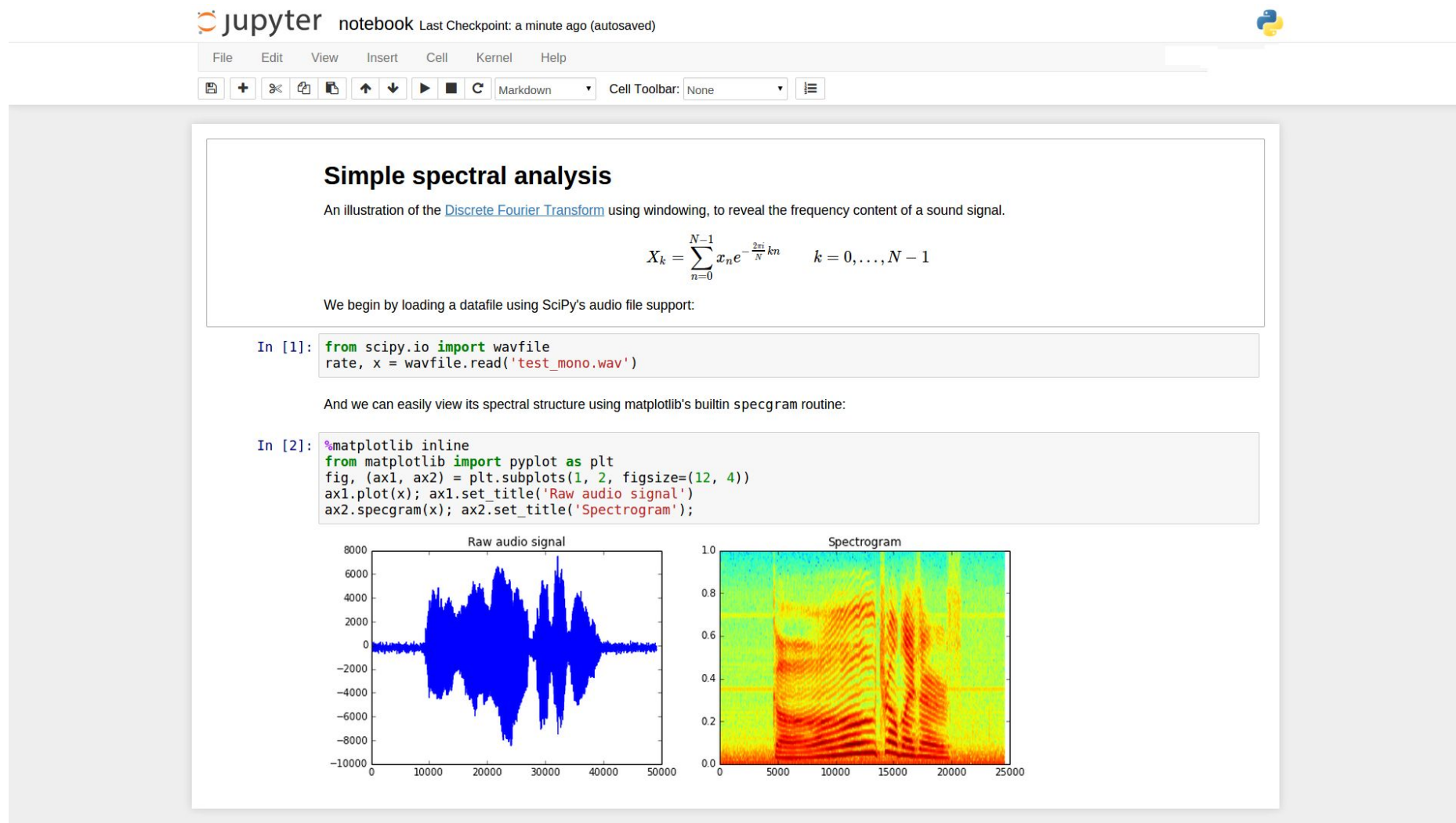
In [2]:
```

**Spyder** lets you create a script (left) and run the script (bottom-right) in the same window.

You can also see the variables you've created (top-right)



# JUYPTER



**Jupyter** lets you create a notebook (similar to a document) that has code segments and the results from the code segments right below.

These documents can be shared easily and edited by the audience to get new results



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# ONLINE OPTIONS TO ACCESSING PYTHON

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- Even if you do not have Python installed, you can still program in it on your computer using free cloud-based options
- Similar to IPython:
  - <https://repl.it/languages/python>
  - <https://www.pythonanywhere.com/try-ipython>
- Online Alternative to Jupyter
  - <https://try.jupyter.org>
  - <https://tmpnb.org>

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# CODING IN PYTHON

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# CODING IN PYTHON

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- **Case (Upper and lower) matter in Python**
  - If you say: `a=2`
  - Asking for “a” will return 2
  - Asking for “A” will give you nothing unless you’ve assigned a value to it
- **Each new line is a new command**
  - **If you want Python to display “hello” and then display “goodbye”, you have have to say:**
    - `print “hello”`
    - `print “goodbye”`
  - **Cannot say:** `print “hello” print “goodbye”`
  - You can use a semicolon to indicate a new line

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# CODING IN PYTHON

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## ‣ **Indentation matters in Python**

- Typically used after a colon
- Used similar to how curly brackets {} are used in other languages
- Cannot indent a line unless needed for the code

## ‣ **Spacing (mostly) doesn't matter in Python**

- On the same line, you can have as many spaces as you want
- All three lines will run the same

‣ `print 2+2`

‣ `print 2 + 2`

‣ `print 2 + 2`

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# USING JUPYTER

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# **INSTRUCTIONS ON USING JUPYTER**

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‣ **In Jupyter**

‣ **Open a notebook / Create a new notebook**

‣ **Write the code**

‣ **Run the code**

# INSTRUCTIONS ON USING JUPYTER

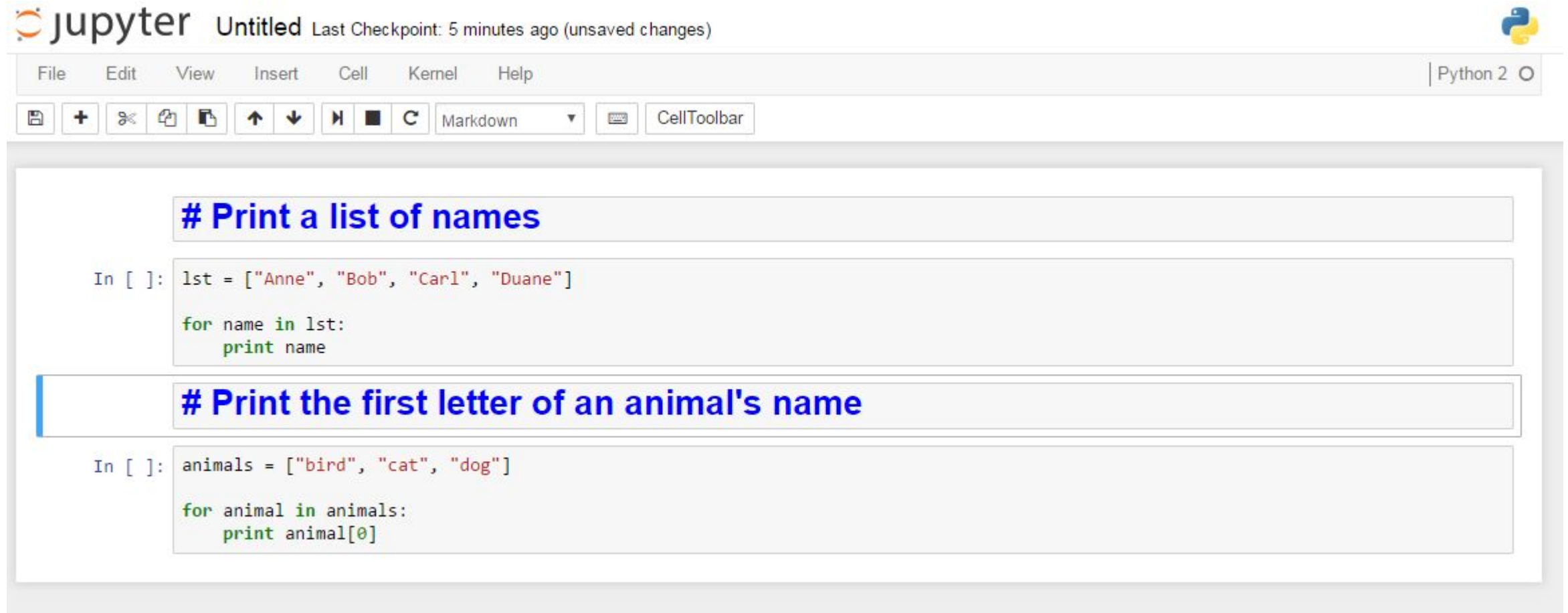
## ► Open a notebook / Create a new notebook



The screenshot displays the JupyterLab web interface. At the top left is the Jupyter logo, and at the top right, it says "Hosted by Rackspace" with a Rackspace logo. Below the header, there are three tabs: "Files", "Running", and "Clusters". The "Files" tab is active, showing a file browser. A message above the file list says "Select items to perform actions on them." The file list contains several folders ("communities", "datasets", "featured") and notebooks ("Welcome Julia - Intro to Gadfly.ipynb", "Welcome R - demo.ipynb", "Welcome to Haskell.ipynb", "Welcome to Python.ipynb", "Welcome to Spark with Python.ipynb", "Welcome to Spark with Scala.ipynb"). On the right side of the file list, there are buttons for "Upload", "New", and a refresh icon. The "New" button is clicked, opening a dropdown menu. The menu is divided into two sections: "Text File", "Folder", and "Terminal" at the top; and "Notebooks" followed by a list of languages: "Apache Toree - Scala", "Bash", "Haskell", "Julia 0.3.2", "Python 2", "Python 3", "R", and "Ruby 2.1.5". The "Python 2" option is highlighted, and a tooltip next to it says "Create a new notebook with Python 2".

# INSTRUCTIONS ON USING JUPYTER

## ► Write the code



The screenshot displays the Jupyter Notebook web interface. At the top, the Jupyter logo is followed by the text "jupyter Untitled Last Checkpoint: 5 minutes ago (unsaved changes)". A menu bar includes "File", "Edit", "View", "Insert", "Cell", "Kernel", and "Help". On the right, it says "Python 2" with a dropdown arrow. Below the menu is a toolbar with icons for saving, adding, deleting, and duplicating cells, as well as navigation and execution controls. A dropdown menu is set to "Markdown".

The first code cell has a blue header "# Print a list of names". The code in the cell is:

```
In [ ]: lst = ["Anne", "Bob", "Carl", "Duane"]  
  
for name in lst:  
    print name
```

The second code cell has a blue header "# Print the first letter of an animal's name". The code in the cell is:

```
In [ ]: animals = ["bird", "cat", "dog"]  
  
for animal in animals:  
    print animal[0]
```



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# INSTRUCTIONS ON USING JUPYTER

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## ► Run the code

**Tip: Press Ctrl and Enter at the same time to run a section of code in Jupyter**

### Print a list of names

```
In [1]: lst = ["Anne", "Bob", "Carl", "Duane"]  
  
for name in lst:  
    print name
```

```
Anne  
Bob  
Carl  
Duane
```

### Print the first letter of an animal's name

```
In [2]: animals = ["bird", "cat", "dog"]  
  
for animal in animals:  
    print animal[0]
```

```
b  
c  
d
```

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# CODE-ALONG IN JUPYTER

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- **Launch jupyter** on your computer (Three options)
  - Go to the start menu or where your programs are saved, and click on the jupyter notebook icon
  - Or, open the command line and type: jupyter-notebook
  - Or, Go to the following webpage: <https://try.jupyter.org>
- **Download** the following file to where your notebook folders are: <https://goo.gl/It7gy8>
- **Open** it in the Jupyter notebook file explorer (Or click “Upload” at top-right and select the file from its folder)

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# NEXT STEPS

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# PYTHON LIBRARIES

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- **Explore different libraries**

- **Python Module of the Week:** <https://pymotw.com/2/contents.html>

- **Python Package library:** <https://pypi.python.org/pypi?%3Aaction=browse>

- **GitHub:**

- <https://github.com/vinta/awesome-python>

- <https://github.com/trending/python?since=monthly>

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# HOW TO INSTALL ADDITIONAL LIBRARIES

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## ‣ **Option 1: Install via Anaconda command line Installer**

‣ Go to the command line\terminal and type: `conda install libraryname`

## ‣ **Option 2: Install via pip command line Installer**

‣ Go to the command line\terminal and type: `pip install libraryname`

## ‣ **Option 3: Install via Anaconda Package Manager**

‣ Open the Anaconda Navigator

‣ Click on “Environments”

‣ Select “Not Installed” from the drop-down menu

‣ Scroll to find library or use search box

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# PYTHON NEWSLETTERS

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## ▸ Stay Informed

- PyCoders: <http://pycoders.com>
- Python Tips: <http://newsletter.pythontips.com>
- Python Weekly: <http://www.pythonweekly.com>

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# PYTHON JOBS

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## ‣ Explore the Python Job Market

‣ <https://www.python.org/jobs>

‣ <http://pythonjobs.github.io>

‣ <http://jobs.pythonweekly.com>

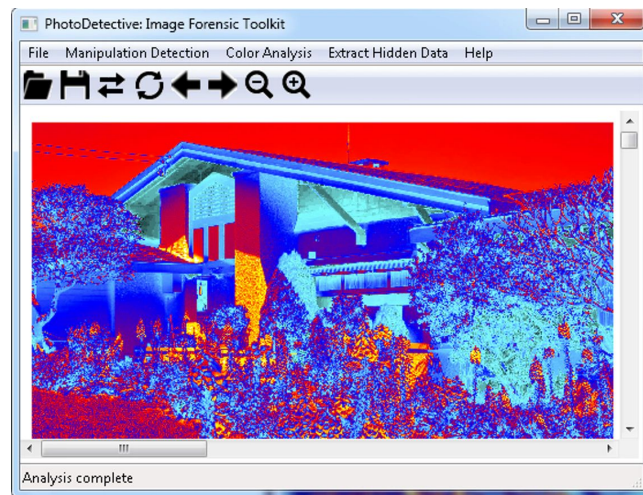
# APPLY PYTHON: APPS

## ► Create Applications

► Graphical Interfaces: <https://wiki.wxpython.org/Getting%20Started>

► Desktop Apps (Mac, Win, Linux): <http://www.pyinstaller.org>

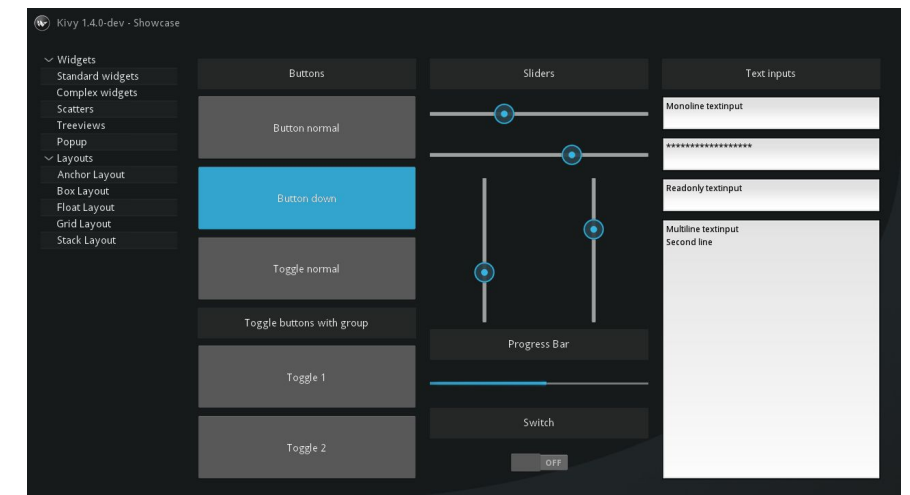
► Smartphone Apps: <https://kivy.org>



Forensic Image Analysis Program  
GUI created with Wx Python



PyInstaller to convert Python  
programs to executables



Interface of Kivy to create Smartphone Apps  
from Python scripts



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# APPLY PYTHON: DATA SCIENCE

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‣ **Data Science:** How can you use Python to extract meaning from Data?

‣ Make predictions

‣ Understand underlying segments



‣ **Part-time Data Science:** <https://generalassemb.ly/education/data-science>

‣ **Immersive Course:** <https://generalassemb.ly/education/data-science-immersive>

‣ **Part-time Data Analytics:** <https://generalassemb.ly/education/data-analytics>

‣ If interested **contact admissions ASAP** to make sure pre-work is completed:  
[chicago@generalassemb.ly](mailto:chicago@generalassemb.ly)

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# SUMMARY

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# SUMMARY

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- Python provides a language that is easy to learn, fast to code, readable, popular
- As a programming language Python offers the ability to analyze, retrieve, send, create, and edit information
- Python is accessible on most operating systems for free and Anaconda provides an all-in-one distribution
- Python code can be created and executed via Spyder, Ipython, or Jupyter notebooks
- Knowing Python opens the door to many applications such as creating webpages, designing apps, and conducting data science, among others