

Python for Accounting Applications

Data Structures

1121PAA04

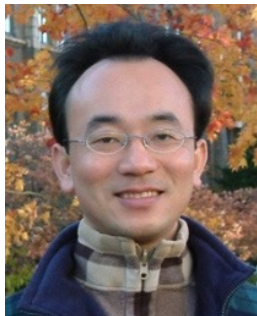
ACC2, NTPU (M5265) (Fall 2023)

Wed 6, 7, 8, (14:10-17:00) (9:10-12:00) (B3F10)

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Associate Professor

Institute of Information Management, National Taipei University

<https://web.ntpu.edu.tw/~myday>



Syllabus

Week	Date	Subject/Topics
1	2023/09/13	Introduction to Python for Accounting Applications
2	2023/09/20	Python Programming and Data Science
3	2023/09/27	Foundations of Python Programming
4	2023/10/04	Data Structures
5	2023/10/11	Control Logic and Loops
6	2023/10/18	Functions and Modules
7	2023/10/25	Files and Exception Handling
8	2023/11/01	Midterm Project Report

Syllabus

Week Date Subject/Topics

9 2023/11/08 Data Analytics and Visualization with Python

10 2023/11/15 Obtaining Data From the Web with Python

11 2023/11/22 Statistical Analysis with Python

12 2023/11/29 Machine Learning with Python

**13 2023/12/06 Text Analytics with Python and
Large Language Models (LLMs)**

14 2023/12/13 Applications of Accounting Data Analytics with Python

15 2023/12/20 Applications of ESG Data Analytics with Python

16 2023/12/27 Final Project Report

Python

Data Structures

Outline

- **Python Data Structures**
 - **Python Lists []**
 - **Python Tuples ()**
 - **Python Sets {}**
 - **Python Dictionaries {k:v}**

Python Data Structures

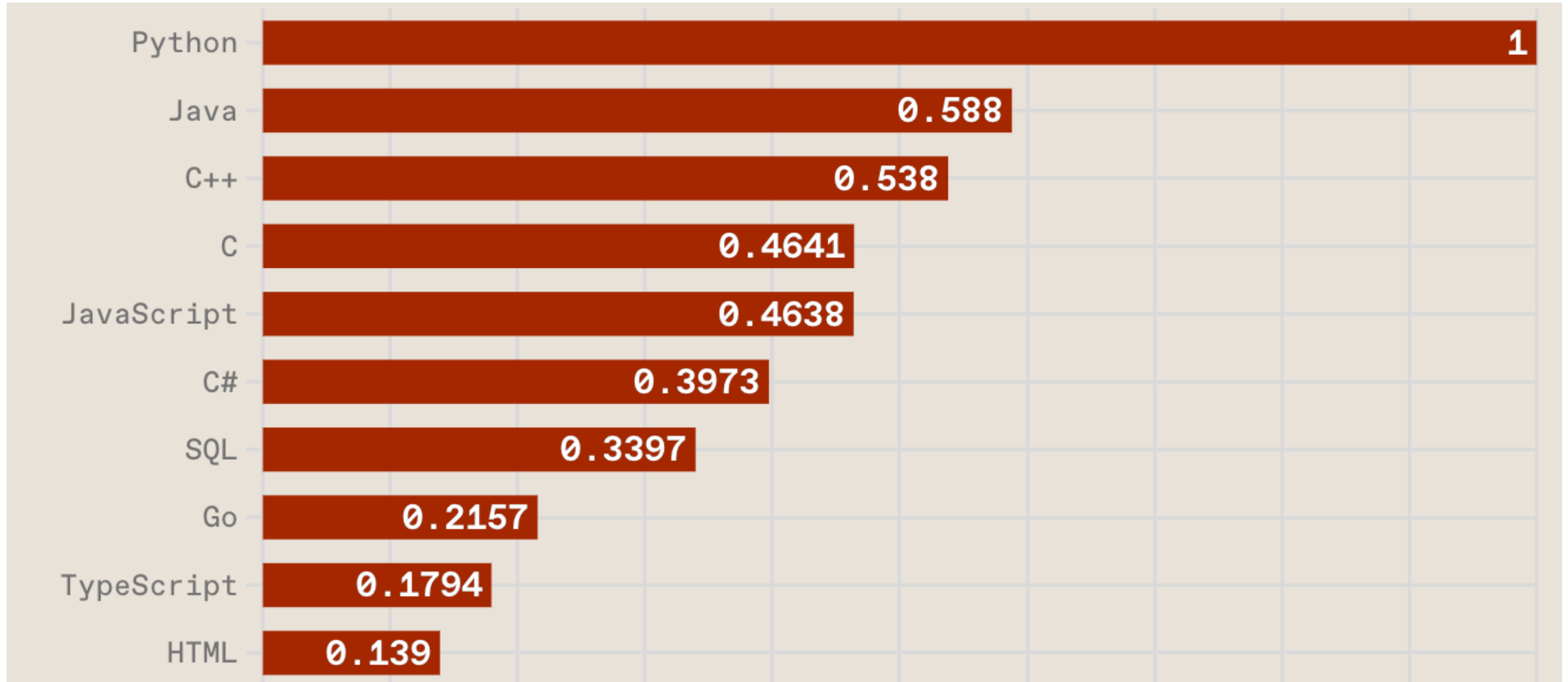
```
fruits = ["apple", "banana", "cherry"] #lists []
colors = ("red", "green", "blue") #tuples ()
animals = {'cat', 'dog'} #sets {}
person = {"name" : "Tom", "age" : 20} #dictionaries {}
```



Python

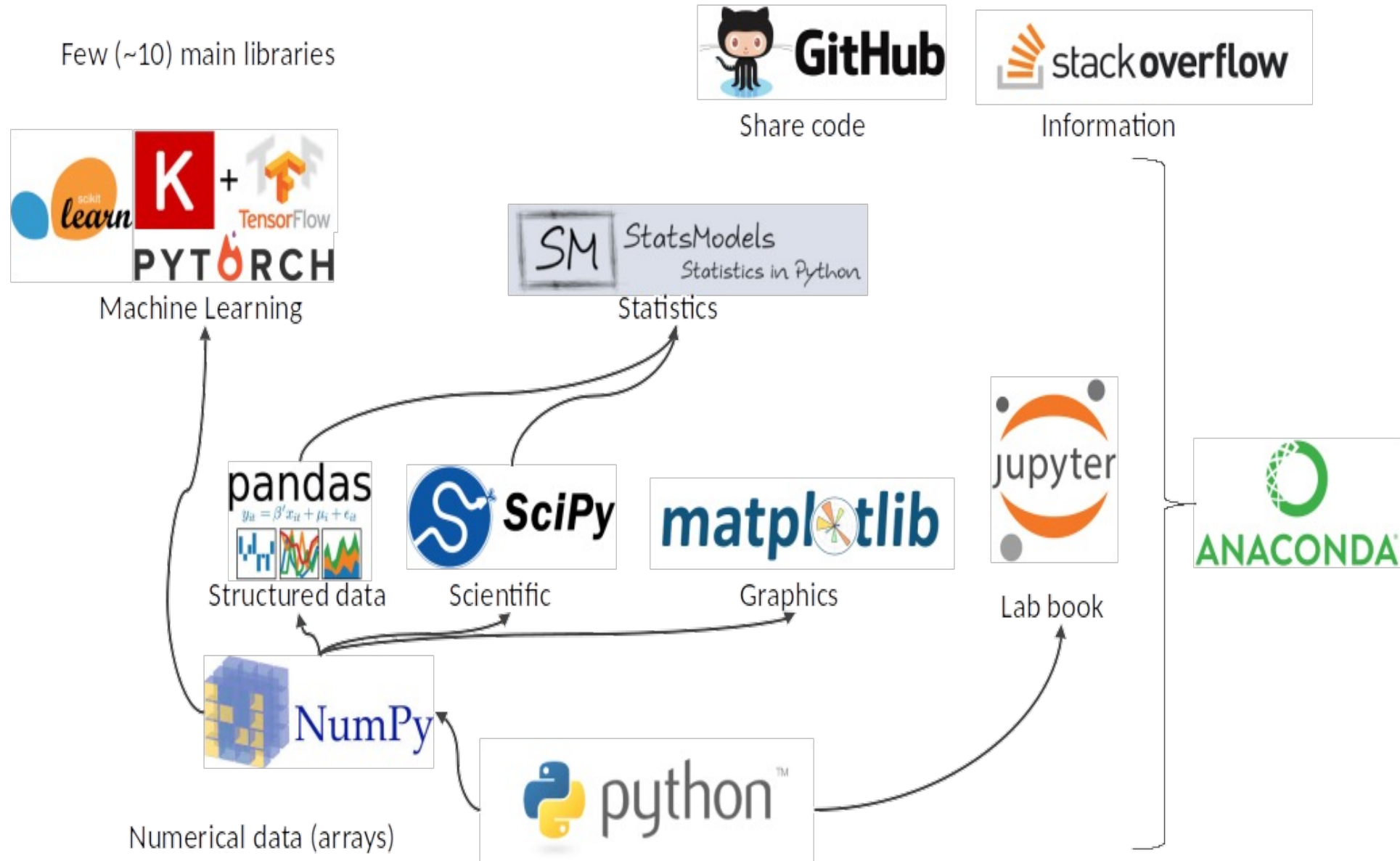
Programming

Top Programming Languages

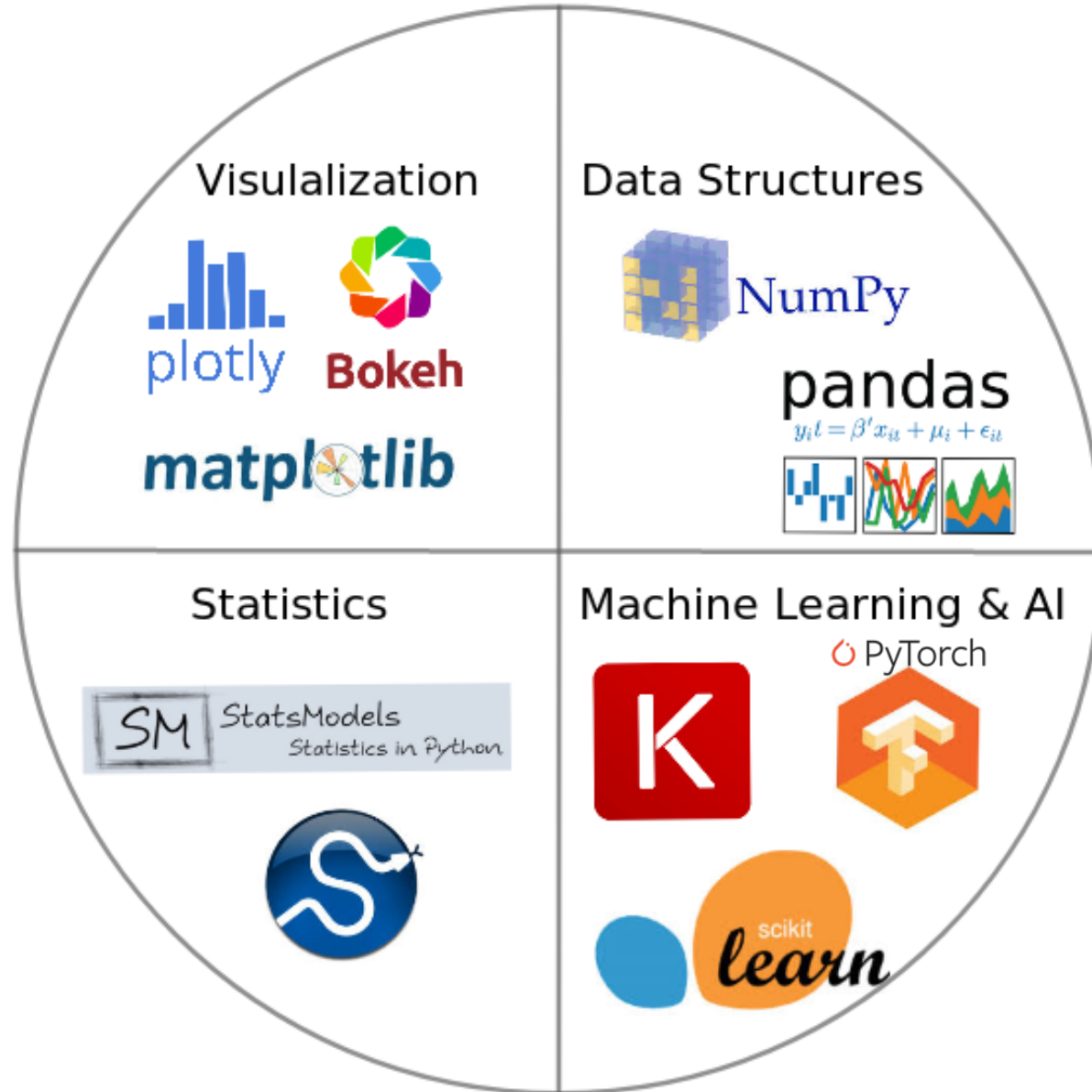


Python is an
interpreted,
object-oriented,
high-level
programming language
with
dynamic semantics.

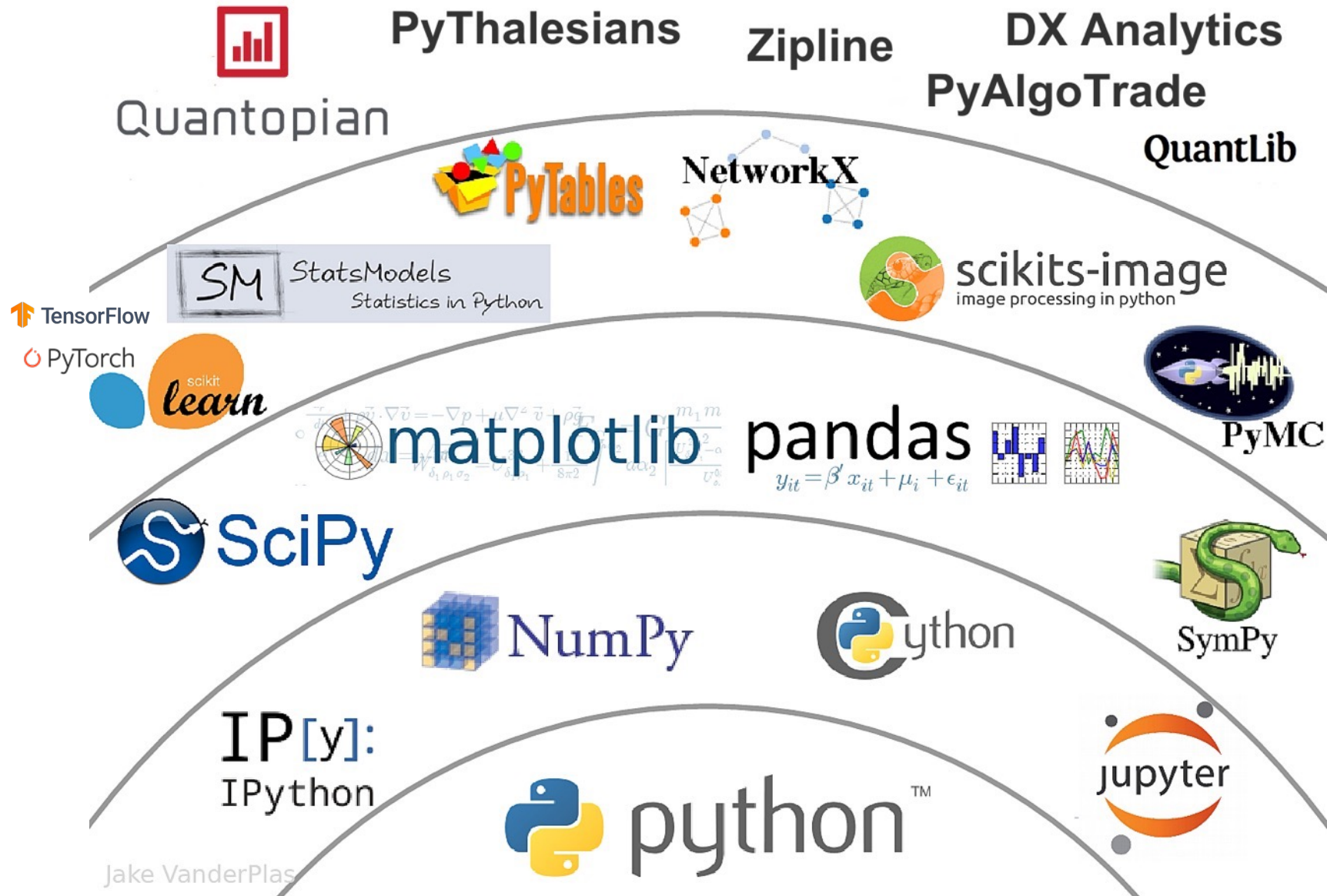
Python Ecosystem for Data Science



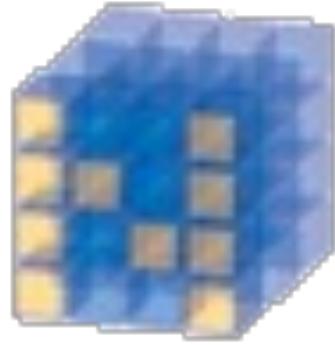
Python Ecosystem for Data Science



The Quant Finance PyData Stack



NumPy



NumPy

Base

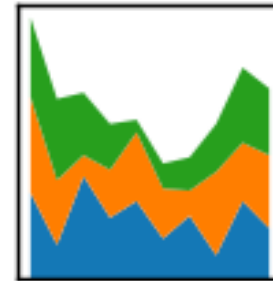
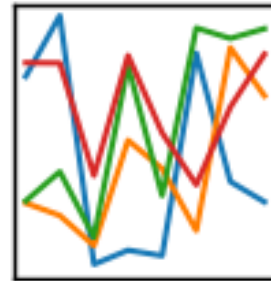
N-dimensional array
package

Python
matplotlib
matplotlib

Python Pandas

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$



- Python Tutorial
- Python HOME**
- Python Intro
- Python Get Started
- Python Syntax
- Python Comments
- Python Variables
- Python Data Types
- Python Numbers
- Python Casting
- Python Strings
- Python Booleans
- Python Operators
- Python Lists
- Python Tuples
- Python Sets
- Python Dictionaries
- Python If...Else
- Python While Loops
- Python For Loops
- Python Functions

Python Tutorial

[← Home](#)

[Next >](#)

Learn Python

Python is a popular programming language.

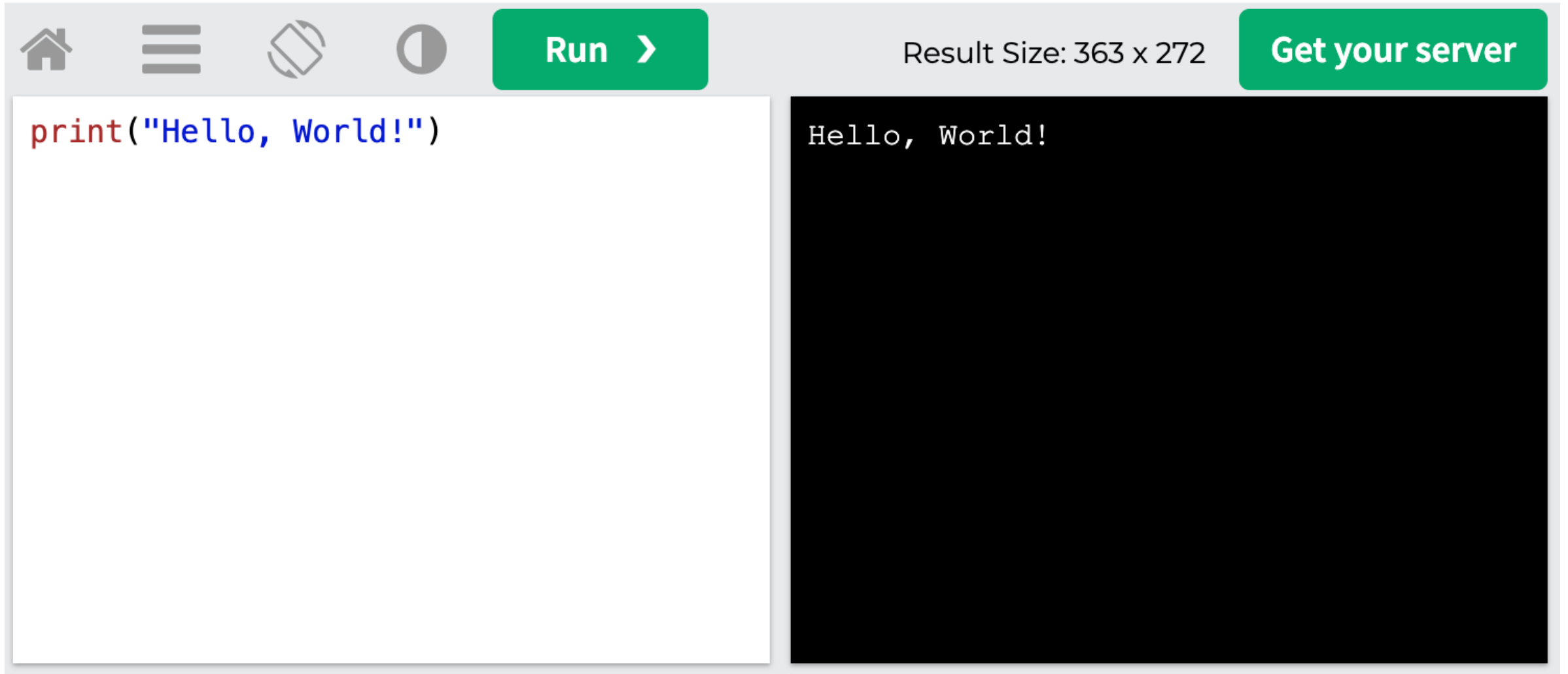
Python can be used on a server to create web applications.

[Start learning Python now »](#)

Learning by Examples

With our "Try it Yourself" editor, you can edit Python code and view the result.

W3Schools Python: Try Python

A screenshot of the W3Schools Python Try Python interface. The interface has a light gray header with navigation icons (home, menu, refresh, moon) and a green 'Run >' button. To the right of the 'Run' button, it says 'Result Size: 363 x 272' and has a green 'Get your server' button. The main area is split into two panels: a white code editor on the left containing the Python code `print("Hello, World!")` and a black terminal window on the right displaying the output 'Hello, World!'.

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Get started learning Python with [DataCamp's free Intro to Python tutorial](#). Learn Data Science by completing interactive coding challenges and watching videos by expert instructors. [Start Now!](#)

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This site is generously supported by [DataCamp](#). DataCamp offers online interactive [Python Tutorials](#) for Data Science. Join **11 millions** other learners and get started learning Python for data science today!

Good news! You can save 25% off your Datacamp annual subscription with the code [LEARNPYTHON23ALE25](#) - [Click here to redeem your discount!](#)

Welcome

Welcome to the LearnPython.org interactive Python tutorial.

Whether you are an experienced programmer or not, this website is intended for everyone who wishes to learn the Python programming language.

You are welcome to join our group on [Facebook](#) for questions, discussions and updates.

After you complete the tutorials, you can get certified at [LearnX](#) and add your certification to your LinkedIn profile.

Just click on the chapter you wish to begin from, and follow the instructions. Good luck!

<https://www.learnpython.org/>

Google's Python Class



Filter

Overview

Python Set Up

Python Intro

Strings

Lists

Sorting

Dicts and Files

Regular Expressions

Utilities

Lecture Videos

1.1 Introduction, strings

1.2 Lists and sorting

1.3 Dicts and files

2.1 Regular expr

2.2 Utilities

2.3 Utilities urllib

2.4 Conclusions

Python Exercises



Google's Python Class

Welcome to Google's Python Class -- this is a free class for people with a little bit of programming experience who want to learn Python. The class includes written materials, lecture videos, and lots of code exercises to practice Python coding. These materials are used within Google to introduce Python to people who have just a little programming experience. The first exercises work on basic Python concepts like strings and lists, building up to the later exercises which are full programs dealing with text files, processes, and http connections. The class is geared for people who have a little bit of programming experience in some language, enough to know what a "variable" or "if statement" is. Beyond that, you do not need to be an expert programmer to use this material.

To get started, the Python sections are linked at the left -- [Python Set Up](#) to get Python installed on your machine, [Python Introduction](#) for an introduction to the language, and then [Python Strings](#) starts the coding material, leading to the first exercise. The end of each written section includes a link to the code exercise for that section's material. The lecture videos parallel the written materials, introducing Python, then strings, then first exercises, and so on. At Google, all this material makes up an intensive 2-day class, so the videos are organized as the day-1 and day-2 sections.

This material was created by [Nick Parlante](#) working in the engEDU group at Google. Special thanks for the help from my Google colleagues John Cox, Steve Glassman, Piotr Kaminski, and Antoine Picard. And finally thanks to Google and my director Maggie Johnson for the enlightened generosity to put these materials out on the internet for free under the [Creative Commons Attribution 2.5](#) license -- share and enjoy!

<https://developers.google.com/edu/python>

Google Colab

Table of contents

- Getting Started
- Highlighted Features
 - TensorFlow execution
- GitHub
- Visualization
- Forms
- Examples
- Local runtime support

SECTION

Welcome to Colaboratory!

Colaboratory is a free Jupyter notebook environment that requires no setup and runs entirely in the cloud. See our [FAQ](#) for more info.

Getting Started

- [Overview of Colaboratory](#)
- [Loading and saving data: Local files, Drive, Sheets, Google Cloud Storage](#)
- [Importing libraries and installing dependencies](#)
- [Using Google Cloud BigQuery](#)
- [Forms, Charts, Markdown, & Widgets](#)
- [TensorFlow with GPU](#)
- [Machine Learning Crash Course: Intro to Pandas & First Steps with TensorFlow](#)

Highlighted Features

Seedbank

Looking for Colab notebooks to learn from? Check out [Seedbank](#), a place to discover interactive machine learning examples.

TensorFlow execution

Colaboratory allows you to execute TensorFlow code in your browser with a single click. The example below adds two matrices.

$$\begin{bmatrix} 1. & 1. & 1. \end{bmatrix} + \begin{bmatrix} 1. & 2. & 3. \end{bmatrix} = \begin{bmatrix} 2. & 3. & 4. \end{bmatrix}$$

Connect Google Colab in Google Drive

The image shows a browser window with the Google Drive interface. The address bar displays 'https://drive.google.com/drive/u/2/my-drive'. The main header includes the Drive logo, a search bar, and navigation icons. On the left sidebar, the 'New' button is highlighted with a red dashed box. A dropdown menu is open, showing options like 'New folder...', 'Upload files...', 'Upload folder...', 'Google Docs', 'Google Sheets', 'Google Slides', and 'More'. The 'More' option is also highlighted with a red dashed box. A second dropdown menu is open from 'More', listing 'Google Forms', 'Google Drawings', 'Google My Maps', 'Google Sites', and 'Connect more apps'. The 'Connect more apps' option is highlighted with a red dashed box. The main content area shows a 'Files' section with a 'Name' column header and an upward arrow. A storage usage indicator shows '0 bytes of 15 GB used' with a 'UPGRADE STORAGE' link. A notification at the bottom left says 'Get Backup and Sync for Mac'.

Google Colab

The screenshot shows the Google Drive interface with a 'Connect apps to Drive' dialog box open. The dialog box has a search bar at the top with 'colab' entered and highlighted by a red dashed border. Below the search bar, there is a grid of app cards. Each card displays the app's logo, name, and user count. The apps listed are:

- ZIP Extractor**: Extract ZIP files to Google Drive. Extraction complete. 307,585 users.
- Lumin PDF**: Beautiful PDF Editor. The fast and simple PDF Viewer. 289,310 users.
- CloudConvert**: 373,161 users.
- Sejda**: Merge PDF - Split PDF - Sejda.com. 1106 reviews.
- DocHub**: Edit, Send & Sign PDFs. 2,131,600 users.
- Google Forms**: 4,803,614 users.

The background shows the Google Drive interface with a sidebar on the left containing navigation options like 'My Drive', 'Computers', 'Shared with me', 'Recent', 'Starred', 'Trash', 'Backups', and 'Storage'. The top navigation bar includes a search bar and various utility icons.

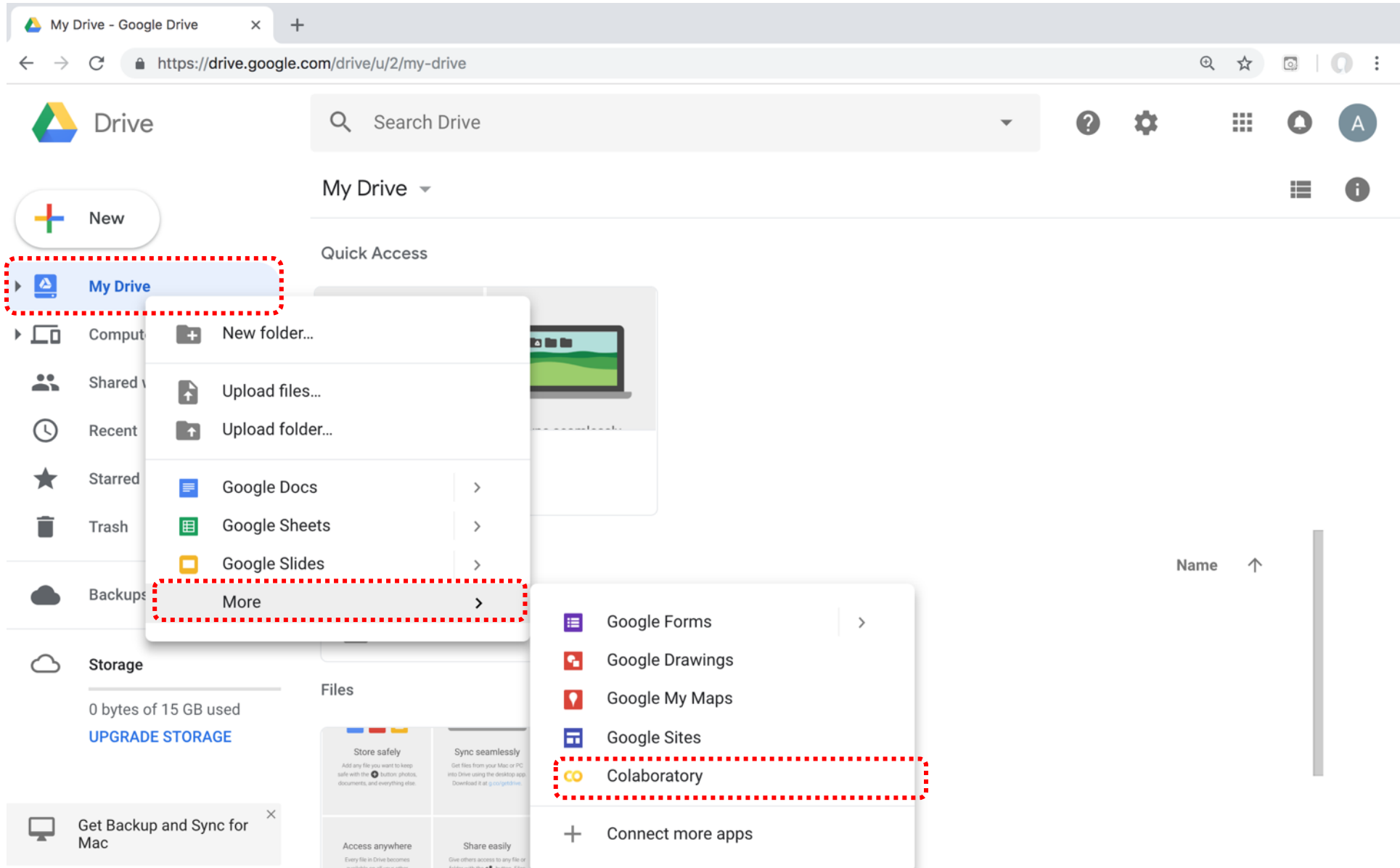
Google Colab

The image shows a browser window with the Google Drive interface. A modal dialog titled "Connect apps to Drive" is open in the center. The dialog has a search bar at the top with the text "colab" entered. Below the search bar, a list of apps is displayed. The first app, "Colaboratory", is highlighted with a red dashed border. The app's details include a yellow "CO" logo, the name "Colaboratory", the URL "https://colab.research.google.com", a description: "A data analysis tool that combines code, output, and descriptive text into one collaborative document.", and a rating of five stars with "(195)" reviews. A blue button with a white plus sign and the text "+ CONNECT" is positioned to the right of the app details. The background shows the Google Drive sidebar with options like "New", "My Drive", "Computers", "Shared with me", "Recent", "Starred", "Trash", "Backups", and "Storage". The top navigation bar includes the Drive logo, a search bar, and various utility icons.

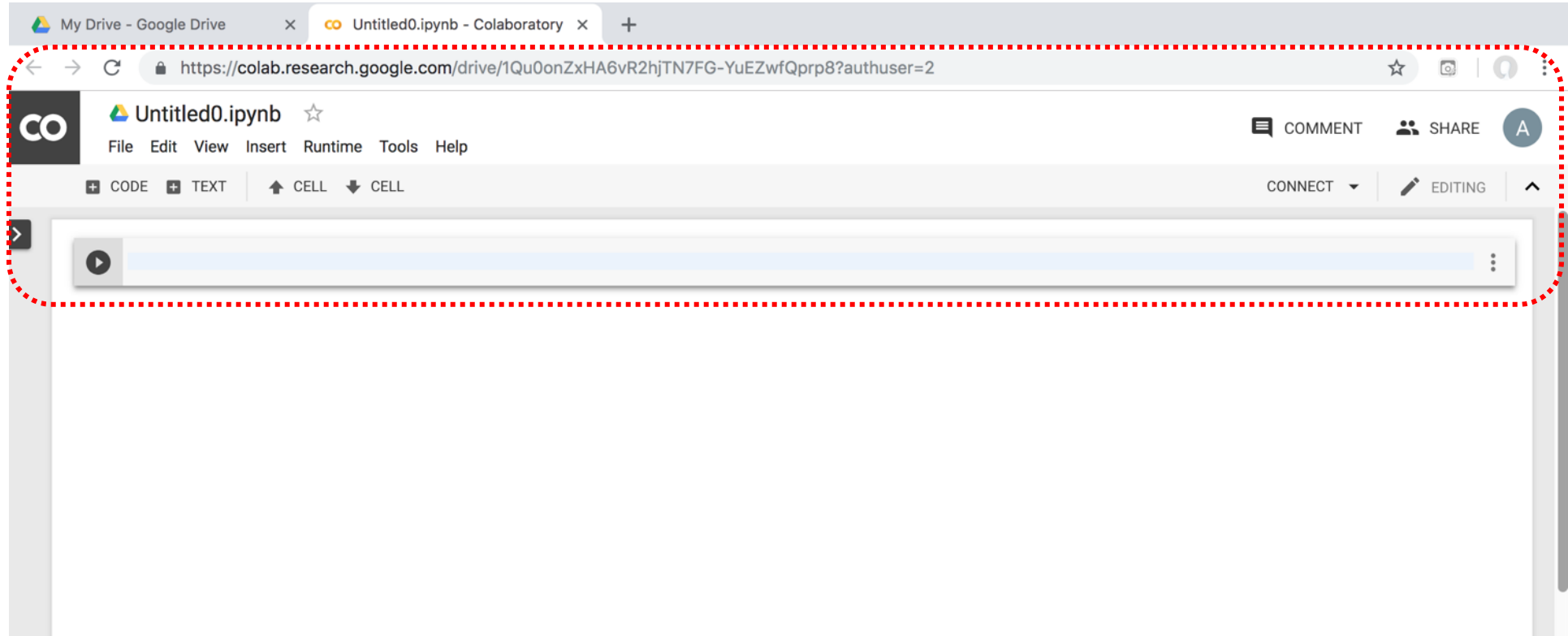
Connect Colaboratory to Google Drive

The screenshot shows the Google Drive web interface. A dialog box titled "Connect apps to Drive" is open, displaying a search for "colab". A confirmation message from Colaboratory is shown in the center, stating "Colaboratory was connected to Google Drive." and "Make Colaboratory the default app for files it can open" with a checked checkbox. An "OK" button is visible at the bottom right of the message. The background shows the Drive sidebar with categories like "My Drive", "Computers", "Shared with me", "Recent", "Starred", "Trash", "Backups", and "Storage". The storage status indicates "0 bytes of 15 GB used" with an "UPGRADE STORAGE" link. The top navigation bar includes the Drive logo, search bar, and various utility icons.

Google Colab



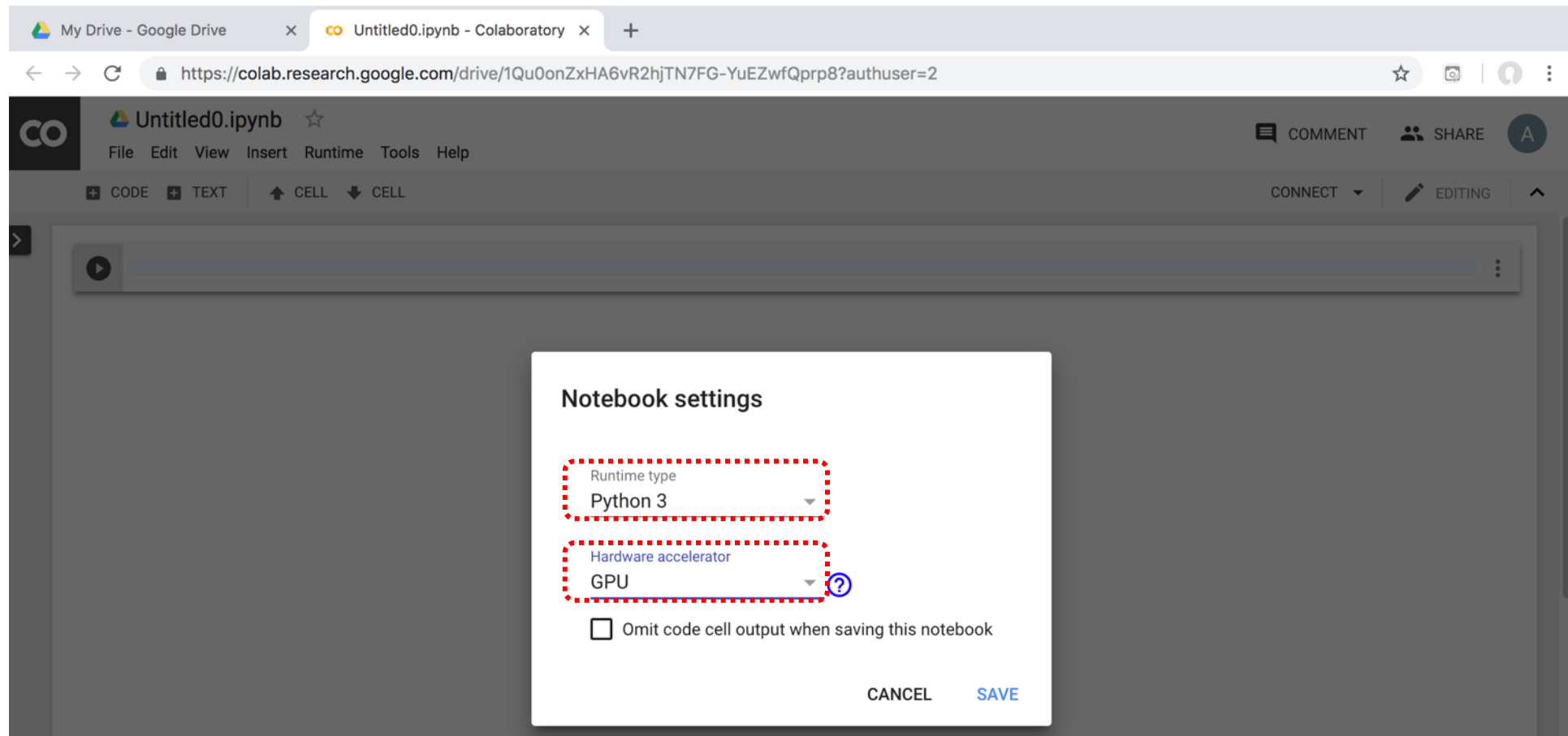
Google Colab



Google Colab

The image shows a browser window with two tabs: "My Drive - Google Drive" and "Untitled0.ipynb - Colaboratory". The address bar shows the URL: <https://colab.research.google.com/drive/1Qu0onZxHA6vR2hjTN7FG-YuEZwfQprp8?authuser=2>. The main interface displays the Google Colab logo and the file name "Untitled0.ipynb". A menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". The "Runtime" menu is open, showing options: "Run all" (⌘/Ctrl+F9), "Run before" (⌘/Ctrl+F8), "Run the focused cell" (⌘/Ctrl+Enter), "Run selection" (⌘/Ctrl+Shift+Enter), "Run after" (⌘/Ctrl+F10), "Interrupt execution" (⌘/Ctrl+M I), "Restart runtime..." (⌘/Ctrl+M .), "Restart and run all...", "Reset all runtimes...", "Change runtime type", and "Manage sessions". The "Runtime" menu title and the "Change runtime type" option are highlighted with red dashed boxes. On the right side of the interface, there are buttons for "COMMENT", "SHARE", "CONNECT", and "EDITING".

Run Jupyter Notebook Python3 GPU Google Colab



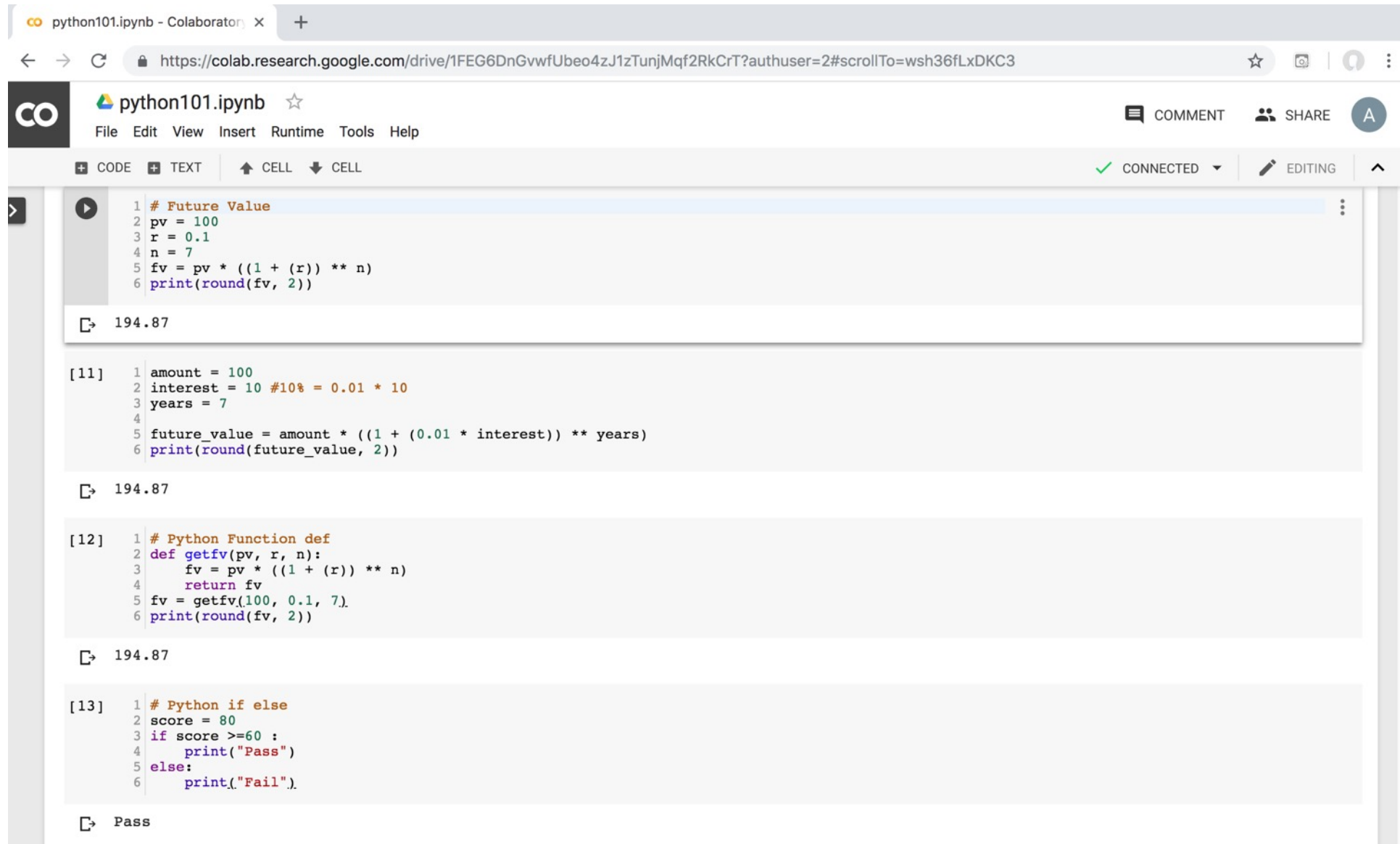
Google Colab Python Hello World

```
print('Hello World')
```



Python in Google Colab (Python101)

<https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT>



The screenshot shows a Google Colab notebook titled "python101.ipynb". The interface includes a browser address bar with the URL <https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT?authuser=2#scrollTo=wsh36fLxDKC3>. The notebook has a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". The top right shows "COMMENT", "SHARE", and a user profile icon. The notebook is in "EDITING" mode and is "CONNECTED".

The notebook contains four code cells:

- Cell 1:** A code cell with the following Python code:

```
1 # Future Value
2 pv = 100
3 r = 0.1
4 n = 7
5 fv = pv * ((1 + (r)) ** n)
6 print(round(fv, 2))
```

The output is "194.87".
- Cell [11]:** A code cell with the following Python code:

```
1 amount = 100
2 interest = 10 #10% = 0.01 * 10
3 years = 7
4
5 future_value = amount * ((1 + (0.01 * interest)) ** years)
6 print(round(future_value, 2))
```

The output is "194.87".
- Cell [12]:** A code cell with the following Python code:

```
1 # Python Function def
2 def getfv(pv, r, n):
3     fv = pv * ((1 + (r)) ** n)
4     return fv
5 fv = getfv(100, 0.1, 7)
6 print(round(fv, 2))
```

The output is "194.87".
- Cell [13]:** A code cell with the following Python code:

```
1 # Python if else
2 score = 80
3 if score >=60 :
4     print("Pass")
5 else:
6     print("Fail").
```

The output is "Pass".

<https://tinyurl.com/aintpupython101>





Python

Programming

Python Hello World

```
print("Hello World")
```

```
print("Hello World")
```

Python Syntax

comment

```
# comment
```

Python Syntax

Indentation

the spaces at the beginning of a code line
4 spaces

```
score = 80
if score >= 60 :
    print("Pass")
```

Python Variables

```
# Python Variables  
x = 2  
price = 2.5  
word = 'Hello'  
  
word = 'Hello'  
word = "Hello"  
word = '''Hello'''
```

Python Variables

```
x = 2
```

```
y = x + 1
```

python_version()

```
# comment  
from platform import python_version  
print("Python Version:", python_version())
```

Python Version: 3.10.12

Python Data Types

```
x = "Hello World"    #str
x = 2                #int
x = 2.5              #float
x = 7j                #complex
```

Python Data Types

```
x = ["apple", "banana", "cherry"] #list
x = ("apple", "banana", "cherry") #tuple
x = range(6) #range
x = {"name" : "Tom", "age" : 20} #dict
x = {"apple", "banana", "cherry"} #set
x = frozenset({"apple", "banana", "cherry"})
#frozenset
```


Python Data Types

```
x = True #bool
x = b"Hello" #bytes
x = bytearray(5) #bytearray
x = memoryview(bytes(5)) #memoryview
x = None #NoneType
```

Python Casting

```
x = str(3) # x will be '3'  
y = int(3) # y will be 3  
z = float(3) # z will be 3.0  
print(x, type(x))  
print(y, type(y))  
print(z, type(z))
```

```
3 <class 'str'>  
3 <class 'int'>  
3.0 <class 'float'>
```

Python Numbers

```
x = 2 # int
y = 3.4 # float
z = 7j #complex
print(x, type(x))
print(y, type(y))
print(z, type(z))
```

```
2 <class 'int'>
3.4 <class 'float'>
7j <class 'complex'>
```

Python Arithmetic Operators

Operator	Name	Example
+	Addition	$7 + 2 = 9$
-	Subtraction	$7 - 2 = 5$
*	Multiplication	$7 * 2 = 14$
/	Division	$7 / 2 = 3.5$
//	Floor division	$7 // 2 = 3$ (Quotient)
%	Modulus	$7 \% 2 = 1$ (Remainder)
**	Exponentiation	$7 ** 2 = 49$

Python Basic Operators

```
print('7 + 2 =', 7 + 2)
print('7 - 2 =', 7 - 2)
print('7 * 2 =', 7 * 2)
print('7 / 2 =', 7 / 2)
print('7 // 2 =', 7 // 2)
print('7 % 2 =', 7 % 2)
print('7 ** 2 =', 7 ** 2)
```

7 + 2 = 9
7 - 2 = 5
7 * 2 = 14
7 / 2 = 3.5
7 // 2 = 3
7 % 2 = 1
7 ** 2 = 49

Python Booleans: True or False

```
# Python Booleans: True or False  
print(3 > 2)  
print(3 == 2)  
print(3 < 2)
```

Python BMI Calculator

```
# BMI Calculator in Python
height_cm = 170
weight_kg = 60
height_m = height_cm/100
BMI = (weight_kg/(height_m**2))

print("Your BMI is: " + str(round(BMI,1)))
```

Your BMI is: 20.8

Future value
of a specified
principal amount,
rate of interest, and
a number of years

How much is your \$100 worth after 7 years?

```
# How much is your $100 worth after 7 years?  
fv = 100 * 1.1 ** 7  
print('fv = ', round(fv, 2))  
# output = 194.87
```

```
fv = 194.87
```

Future Value

```
# Future Value
pv = 100
r = 0.1
n = 7

fv = pv * ((1 + (r)) ** n)
print(round(fv, 2))
```

194.87

Future Value

```
# Future Value
amount = 100
interest = 10 #10% = 0.01 * 10
years = 7

future_value = amount * ((1 + (0.01 * interest)) ** years)
print(round(future_value, 2))
```

194.87

Python

Data Structures

Python Data Types

```
x = ["apple", "banana", "cherry"] #list
x = ("apple", "banana", "cherry") #tuple
x = {"name" : "Tom", "age" : 20} #dict
x = {"apple", "banana", "cherry"} #set
```

Python Collections

- **There are four collection data types in the Python programming language**
- **List []**
 - **a collection which is ordered and changeable. Allows duplicate members.**
- **Tuple ()**
 - **a collection which is ordered and unchangeable. Allows duplicate members.**
- **Set {}**
 - **a collection which is unordered, unchangeable, and unindexed. No duplicate members.**
- **Dictionary {k:v}**
 - **a collection which is ordered and changeable. No duplicate members.**

Python Dictionaries {k:v}

- **As of Python version 3.7, dictionaries are ordered.**
- **In Python 3.6 and earlier, dictionaries are unordered.**

Lists []

```
x = [60, 70, 80, 90]
print(len(x))
print(x[0])
print(x[1])
print(x[-1])
```

4
60
70
90

Lists []

- **len():** how many items
- **type():** data type
- **list() constructor:** creating a new list

Python List Methods

• Method	Description
• <code>append()</code>	Adds an element at the end of the list
• <code>clear()</code>	Removes all the elements from the list
• <code>copy()</code>	Returns a copy of the list
• <code>count()</code>	Returns the number of elements with the specified value
• <code>extend()</code>	Add the elements of a list (or any iterable), to the end of the current list
• <code>index()</code>	Returns the index of the first element with the specified value
• <code>insert()</code>	Adds an element at the specified position
• <code>pop()</code>	Removes the element at the specified position
• <code>remove()</code>	Removes the item with the specified value
• <code>reverse()</code>	Reverses the order of the list
• <code>sort()</code>	Sorts the list

Tuples ()

A **tuple** in Python is a collection that **cannot be modified**.
A tuple is defined using **parenthesis**.

```
x = (10, 20, 30, 40, 50)
print(x[0])           10
print(x[1])           20
print(x[2])           30
print(x[-1])          50
```

Sets {}

```
animals = {'cat', 'dog'}
print('cat' in animals)      True
print('fish' in animals)    False
animals.add('fish')
print('fish' in animals)    True
print(len(animals))        3
animals.add('cat')
print(len(animals))        3
animals.remove('cat')
print(len(animals))        2
```

Dictionary {key : value}

Python Dictionary

Key → Value

'EN' → 'English'

'FR' → 'French'

```
k = { 'EN': 'English', 'FR': 'French' }  
print(k['EN'])
```

English

Python Data Structures

```
fruits = ["apple", "banana", "cherry"] #lists []
colors = ("red", "green", "blue") #tuples ()
animals = {'cat', 'dog'} #sets {}
person = {"name" : "Tom", "age" : 20} #dictionaries {}
```

Python for Accounting Applications

Python Lists

```
expenses = [72.50, 80.75, 50.00, 90.25]
total_expenses = sum(expenses)
print("Total expenses:", total_expenses)
```

```
Total expenses: 293.5
```

Python for Accounting Applications

Python Tuples

```
accounts = ("Cash", 1001), ("Accounts Receivable", 1002),  
("Inventory", 1003)  
for account in accounts:  
    print("Account name:", account[0], "Account number:", account[1])
```

Account name: Cash Account number: 1001

Account name: Accounts Receivable Account number: 1002

Account name: Inventory Account number: 1003

Python for Accounting Applications

Python Sets

```
account_numbers = {1001, 1002, 1003}
new_account_number = 1004
if new_account_number not in account_numbers:
    print("Account number", new_account_number, "is not in use.")
```

Account number 1004 is not in use.

Python for Accounting Applications

Python Dictionaries

```
accounts = {"1001": {"name": "Cash", "balance": 500.00, "type": "Asset"},
"1002": {"name": "Accounts Receivable", "balance": 1000.00, "type": "Asset"},
"2001": {"name": "Accounts Payable", "balance": 750.00, "type": "Liability"}}
for account_number, account_info in accounts.items():
    print("Account number:", account_number)
    print("Account name:", account_info["name"])
    print("Account balance:", account_info["balance"])
    print("Account type:", account_info["type"])
```

Account number: 1001

Account name: Cash

Account balance: 500.0

Account type: Asset

Account number: 1002

Account name: Accounts Receivable

Account balance: 1000.0

Account type: Asset

Account number: 2001

Account name: Accounts Payable

Account balance: 750.0

Account type: Liability

Summary

- **Python Data Structures**
 - **Python Lists []**
 - **Python Tuples ()**
 - **Python Sets {}**
 - **Python Dictionaries {k:v}**

References

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