Introduction to Python for Data Science

DSECLPFDS

BITS Pilani

Pilani|Dubai|Goa|Hyderabad

Parthasarathy

Agenda for CS #1

1) Ground Rules
2) Introduction to *DSECLPFDS*
   - Motivation & Objective of *DSECLPFDS*
   - Courseware
   - Books & Evaluation components
   - Pedagogy for DSECLPFDS ?
3) Course Schedule
4) Getting started with Module 1

Ground Rules!

- Mentally present – Observe!! Listen!!
- Keep your questions for the Q&A section / Discussion Forum
- Use the Discussion Forum in Canvas effectively
- Solve the exercises regularly!
- Go that “extra mile” ☺

$$1^{365} = 1$$

$$1.01^{365} = 37.8$$

Motivation for this course ?

Motivation

- As of now, Python is one of the most widely used programming languages in the Data Science field.
- Data Scientists just love Python! ❤️
- Python is easy to learn & has a great community for support!
- We would use Python for all the assignments / case-studies (For all the subjects in MTech DSE).

Course Objectives

What is this course about ?

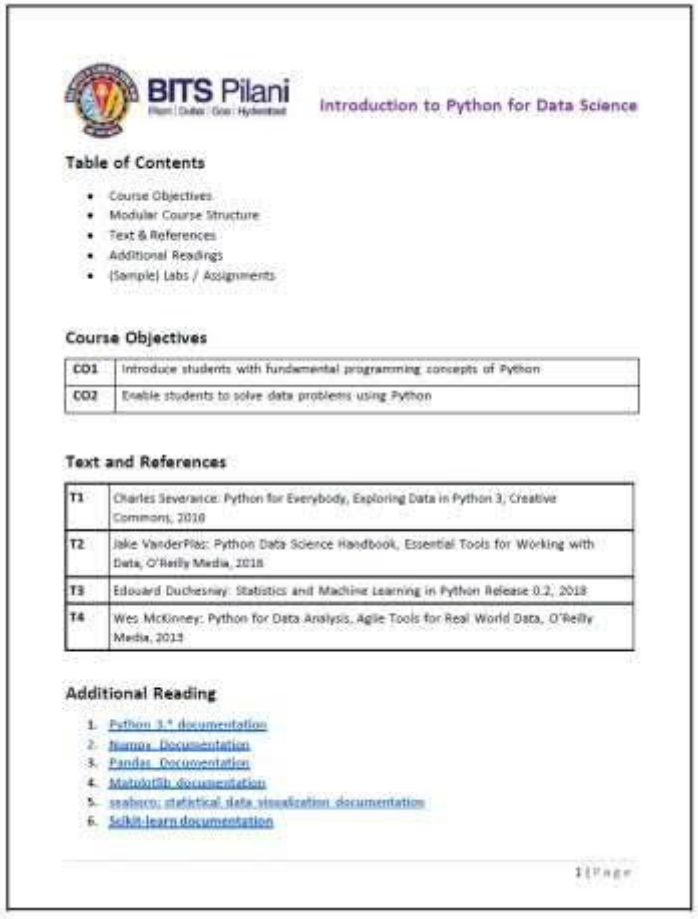
- Introduce the fundamental programming concepts of Python
- Enable you to solve data problems using Python
- Act as a kick-start / bridge for participants of the MTech DSE programme who are ***new*** to Python.

What is this course *not* about ?

- Comprehensive, in-depth discussion about Python programming.
- Comprehensive, in-depth discussion about data analysis using Python and related packages, libraries, and tools.

Courseware

- Available at : https://bits-pilani.instructure.com/courses/1319/files/265778/download



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Introduction to Python for Data Science

Table of Contents

- Course Objectives
- Modular Course Structure
- Text & References
- Additional Readings
- (Sample) Labs / Assignments

Course Objectives

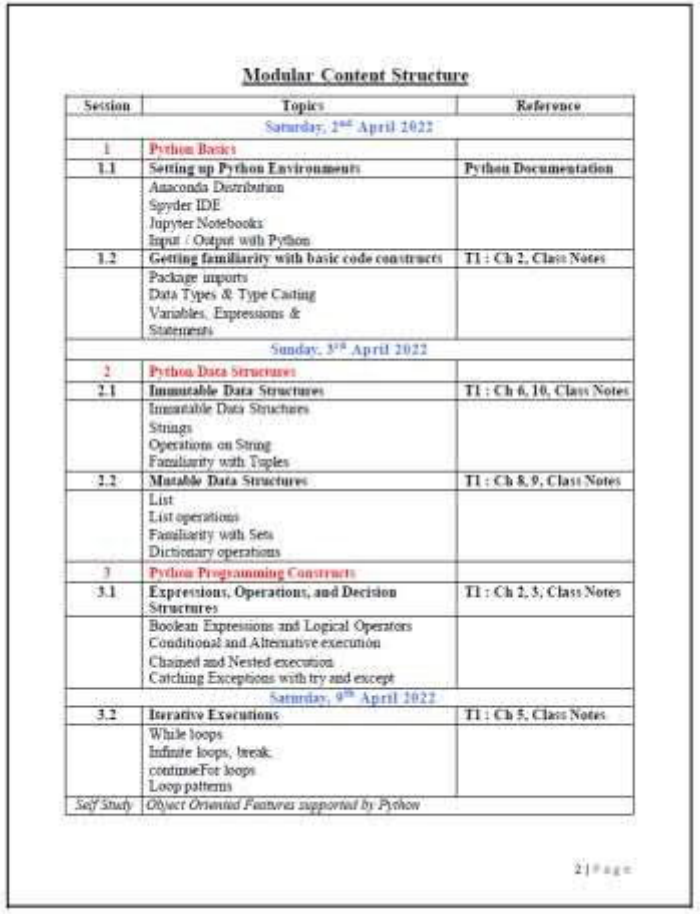
CO1	Introduce students with fundamental programming concepts of Python
CO2	Enable students to solve data problems using Python

Text and References

T1	Charles Severance: Python for Everybody, Exploring Data in Python 3, Creative Commons, 2016
T2	Jake VanderPlas: Python Data Science Handbook, Essential Tools for Working with Data, O'Reilly Media, 2016
T3	Edouard Duchesnay: Statistics and Machine Learning in Python Release 0.2, 2016
T4	Wes McKinney: Python for Data Analysis, Agile Tools for Real World Data, O'Reilly Media, 2013

Additional Reading

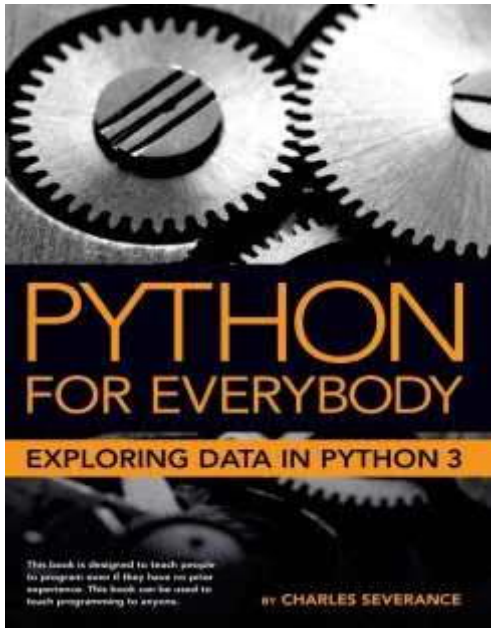
1. Python 3.* documentation
2. Numpy Documentation
3. Pandas Documentation
4. Matplotlib documentation
5. seaborn: statistical data visualization documentation
6. Scikit-learn documentation



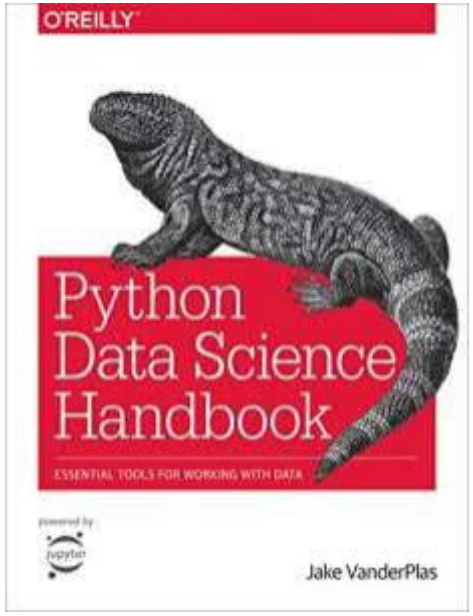
Modular Content Structure

Section	Topics	Reference
	Saturday, 2nd April 2022	
1	Python Basics	
1.1	Setting up Python Environments	Python Documentation
	Anaconda Distribution Spyder IDE Jupyter Notebooks Input / Output with Python	
1.2	Getting familiarity with basic code constructs	T1 : Ch 2, Class Notes
	Package imports Data Types & Type Casting Variables, Expressions & Statements	
	Sunday, 3rd April 2022	
2	Python Data Structures	
2.1	Immutable Data Structures	T1 : Ch 6, 10, Class Notes
	Immutable Data Structures Strings Operations on String Familiarity with Tuples	
2.2	Mutable Data Structures	T1 : Ch 8, 9, Class Notes
	List List operations Familiarity with Sets Dictionary operations	
3	Python Programming Constructs	
3.1	Expressions, Operations, and Decision Structures	T1 : Ch 2, 5, Class Notes
	Boolean Expressions and Logical Operators Conditional and Alternative execution Chained and Nested execution Catching Exceptions with try and except	
	Saturday, 9th April 2022	
3.2	Iterative Executions	T1 : Ch 5, Class Notes
	While loops Infinite loops, break continueFor loops Loop patterns	
Self Study	*Object Oriented Features supported by Python*	

Text Books



Charles Severance: Python for Everybody, Exploring Data in Python 3



Jake VanderPlas: Python Data Science Handbook

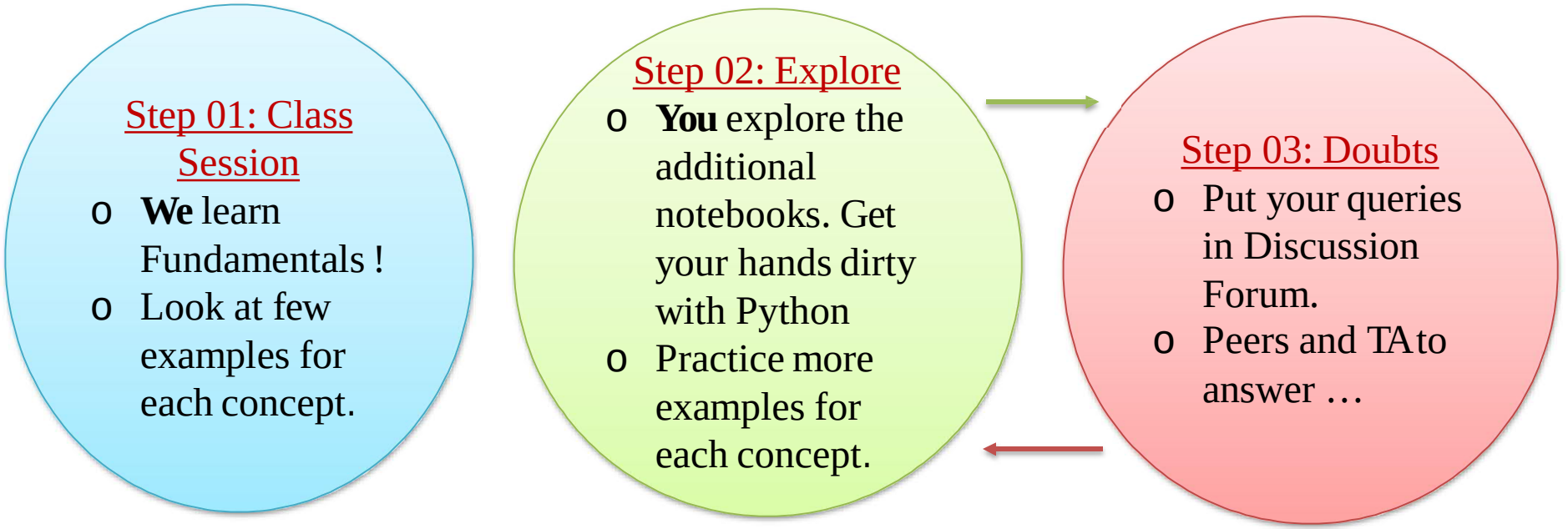
eBooks of both are made available in Canvas

Note: These are the prescribed ones. Please feel free to explore any Python materials that suits you.

Evaluation Components

- This course is **NOT evaluated** !!
- You will **not** have any exams for this course ☺
- Nevertheless, there would be some exercises for you to try and hone your skills. [No need to submit them].
- Fast-Paced sessions!
  - As this is not a semester course and is only a bridge course, the courses will be medium to fast – paced.
  - Please use the recording / speed option in Impartus to align it to your pace ☺

Pedagogy for this Course



Non-Beginners: You can directly start with Step 02 and also use this phase for additional learning which might help in future … You play an important role in Step 3 as well in answering your peer's queries.

Course Schedule

02/04/2022 – S1 (11AM)	03/04/2022 – S2 (11AM)	09/04/2022 – S3 (11AM)
o Motivation & Agenda o Python Basics o Setting up Python Environment o Getting familiarity with basic code constructs	o Python Data Structures o Immutable Data Structures o Mutable Data Structures o Expressions, Operations & Decision Structures	o Iterative Constructs o Functions o Files
10/04/2022 – S4 (11AM)	**16/04/2022 – S5 (11AM)**	**17/04/2022 – S6 (11AM)**
o SciPy Ecosystem o NumPy o Pandas Basics	o Data Exploration with Pandas o Visualization with Matplotlib	o Visualization with Seaborn o Brief Introduction to scikit-learn

Program & Programming Language

Computer Program

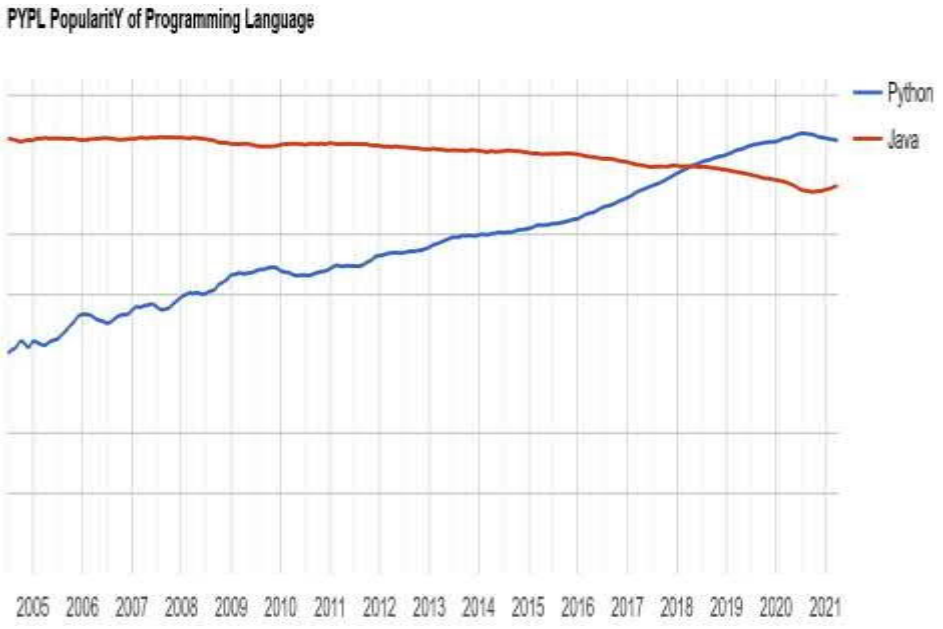
- Set of instructions that perform a specific task executed by computer
- Required by computer to function
- Written by programmer using programming languages
  - Like C, C++, Java, Python etc.
- Executed with compiler and interpreter

Python as a Programming Language

Why Python ?

Worldwide, Mar 2022 compared to a year ago:

Rank	Change	Language	Share	Trend
1		Python	28.27 %	-2.0 %
2		Java	18.03 %	+0.8 %
3		JavaScript	8.86 %	+0.4 %
4		C#	7.51 %	+0.6 %
5		C/C++	7.32 %	+0.6 %
6		PHP	5.71 %	-0.4 %
7		R	4.23 %	+0.5 %
8		Objective-C	2.28 %	-1.2 %
9	↑	TypeScript	2.11 %	+0.3 %
10	↓	Swift	2.01 %	+0.2 %



Worldwide, Python is the most popular language …
Source : http://pypl.github.io/PYPL.html

Python as a Programming Language

Python

- Designed by Guido van Rossum around 1990
- Not just a scripting language
- Easy to learn, read, use
- Extensible (add new modules)
- Highly readable
- Latest Version 3.9
- Most fond of language for Data Scientists

Touchy Feel Properties

- Open Source
  - copyrighted but use not restricted
  - owned by independent non-profit, PSF
- Mature (29 years old)
- Supportive user community
  - plenty of good books, too
  - Active user community
- Simple design, easy to learn
  - reads like “pseudo-code”
  - Suitable as first language
  - Suitable as last language :-) (Hopefully)

Python Applications

Use Python for...

Web Development: Django , Pyramid , Bottle , Tornado , Flask , web2py

GUI Development: tkInter , PyGObject , PyQt , PySide , Kivy , wxPython

Scientific and Numeric: SciPy , Pandas , IPython

Software Development: Buildbot , Trac , Roundup

System Administration: Ansible , Salt , OpenStack

Python Ecosystem

Components of Python World :

- Core Python
- Distributions
- Frameworks / IDEs
- Third party Libraries

Core Python

- Programming Language itself
- Some standard modules are available
- Other packages needs to be explicitly installed

Python Distribution

- Python + packages
- Majority of packages, libraries are already available
- Package management is simplified
  - Anaconda from Continuum Analytics
  - IPython and its IPyKit variant

Python Ecosystem

Frameworks & IDEs

- Use frameworks to create code and develop applications
- Provides a defined structure to the developers so that they can focus on the core logic of the application rather than on other elements
- Python web framework
  - ✓ Django
  - ✓ Web2py
  - ✓ Flask
- Python IDEs
  - ✓ IDLE
  - ✓ PyCharm
  - ✓ Spyder
  - ✓ JupyterNotebooks

Third party Libraries

- Makes life of developers very simple
- Just need to know the right library to carry out a task
  - NumPy
  - Scipy
  - Pandas
  - Matplotlib
  - Seaborn
  - Bokeh
  - ScikitLearn
  - And List goes on …

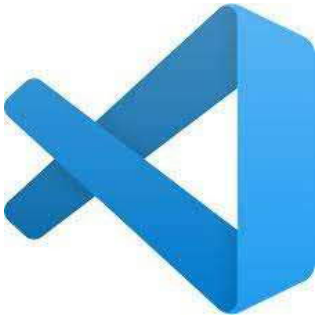
Python Installation

Three Ways :

- Install Python directly
  - Install the Python language with installer
  - Need to install other packages explicitly using pip install
  - https://www.python.org/downloads/
- Use Python distribution
  - The open-source Anaconda Distribution is the easiest way to perform Python coding
  - Works on Linux, Windows, and Mac OS X
  - https://docs.anaconda.com/anaconda/install/windows/
- Use Cloud based services
  - The simplest of all but needs internet connectivity to use
  - Microsoft Azure Notebooks
  - Google Collab

Integrated Development Environments (IDE) for Python

Common IDE's:



Our Favourite (For DSE):

- **.py** is a regular python file. It's plain text and contains just your code.
- **.ipynb** is a python notebook and it contains the notebook code, the execution results and other internal settings in a specific format.

Input / Output with Python

- print() can be used to output a message
- input() can be used to enter an input to the python program.
- # can be used to provide comments.
- “““(triple quotes) can be used to write documentation.

Demo:

- Let’s see how to launch Jupyter Notebook
- See the basics of Notebook
- Practice some I/O statements and comments.

Basic Code Constructs

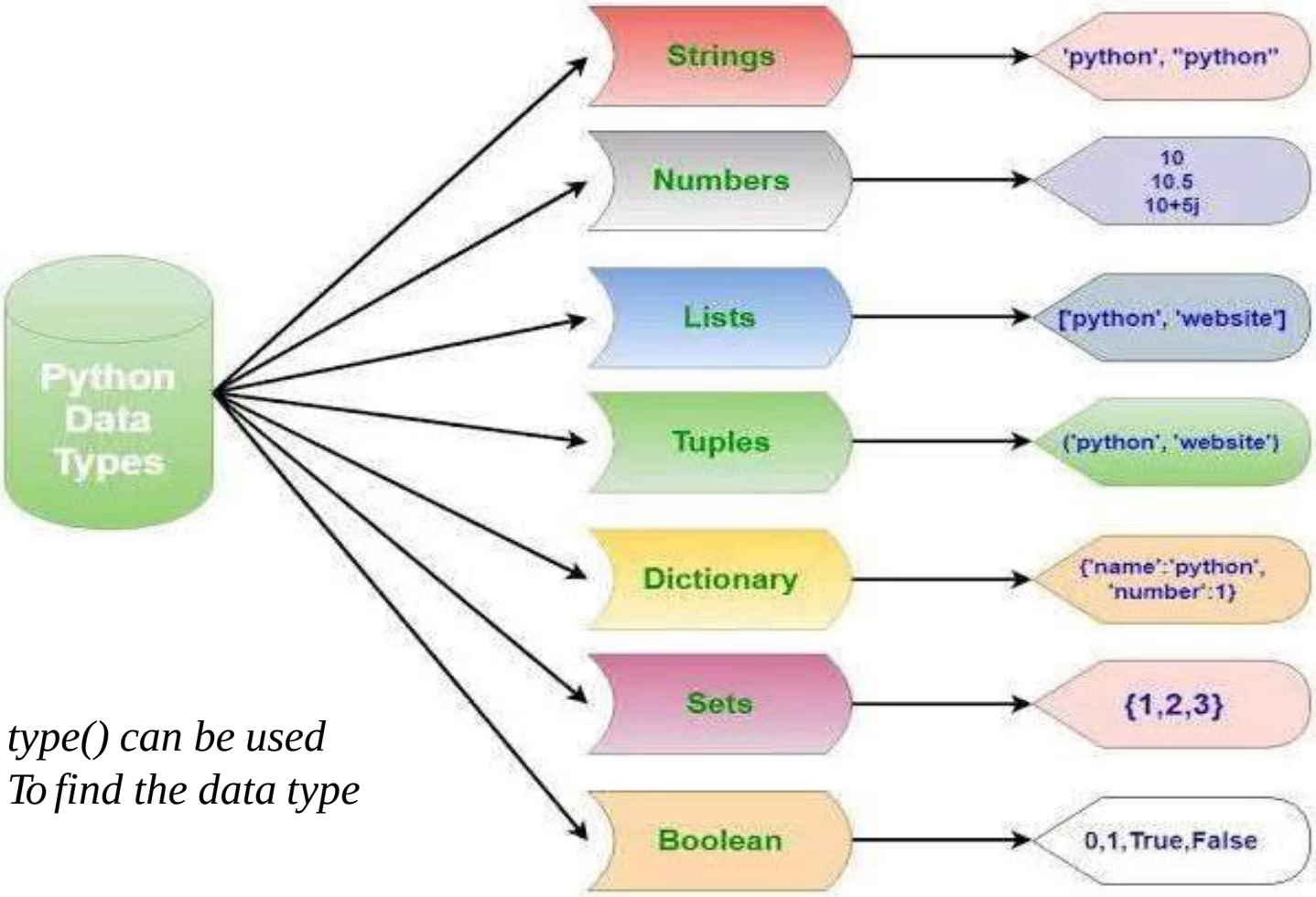
Imports:

- Import in Python is similar to #include in C/C++. Python modules can get access to code from another module by importing the file/function using import.
- Ex: import math
- print(math.pi)

Variable

- A Python variable is a reserved memory location to store values. In other words, variables are containers for storing data values.
- *Python has no command for declaring a variable.*
- A variable is created the moment you first assign a value to it.
- Ex: a = 100

Data Types in Python

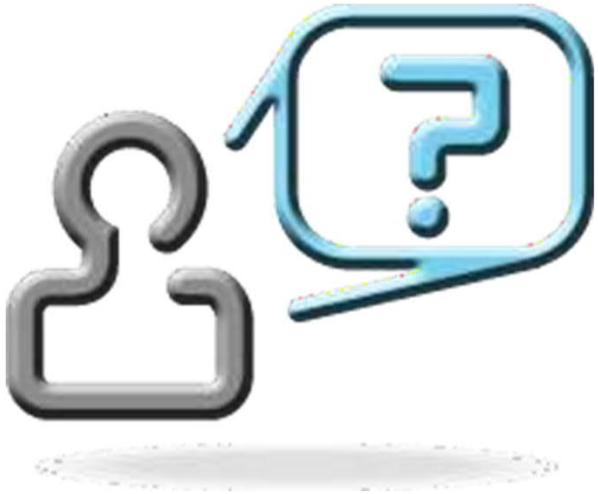


type() can be used
To find the data type

Data Types in Python

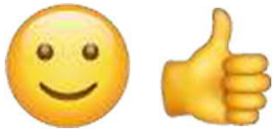
Name	Type	Description
Integers	int	Whole numbers, such as: 3 300 200
Floating point	float	Numbers with a decimal point: 2.3 4.6 100.0
Strings	str	Ordered sequence of characters: "hello" 'Sammy' "2000" "楽しい"
Lists	list	Ordered sequence of objects: [10,"hello",200.3]
Dictionaries	dict	Unordered Key:Value pairs: {"mykey" : "value" , "name" : "Frankie"}
Tuples	tup	Ordered immutable sequence of objects: (10,"hello",200.3)
Sets	set	Unordered collection of unique objects: {"a","b"}
Booleans	bool	Logical value indicating True or False

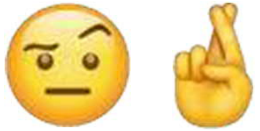
type() can be used to find the data type



Post your queries in the Discussion Forum!!

Feedback

 : 5

 : 3

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Thank You for your time & attention !

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