

Rotman

INTRO TO PYTHON

Programming and Data Analysis Basics

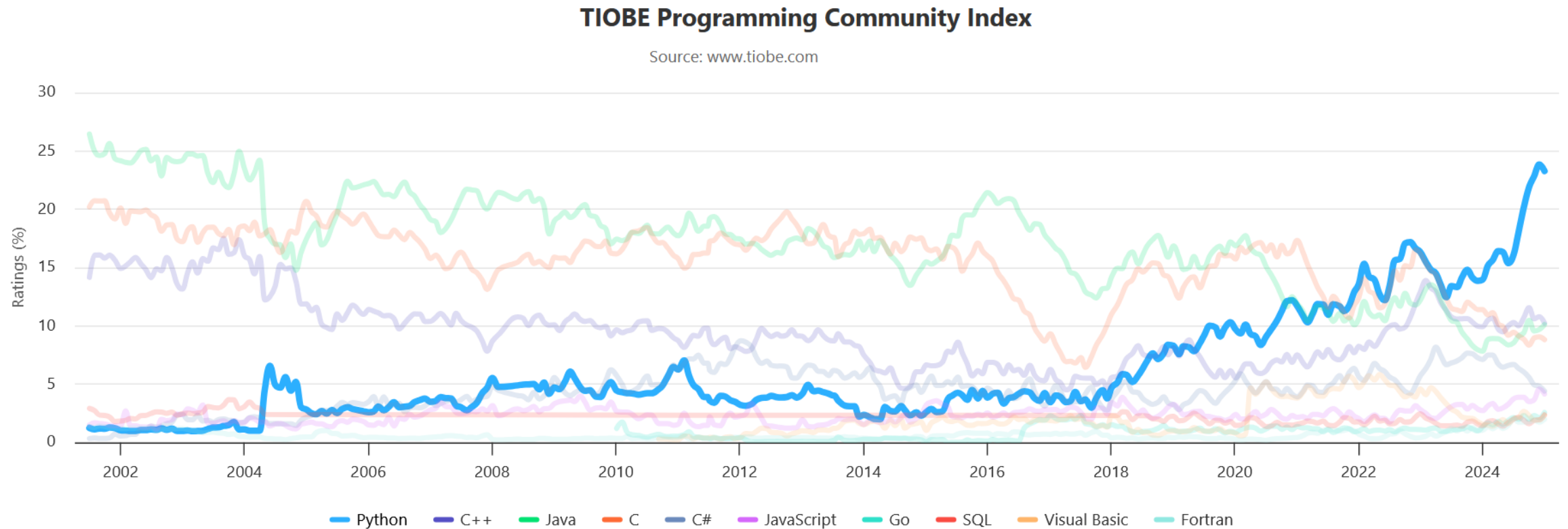
September 4, 2025 Prepared by Jay Cao / [MDAL](#) (Built on Niti's past slides)

Website: <https://rmdal.github.io/python-intro-2025-fall/>



Rotman School of Management
UNIVERSITY OF TORONTO

Popularity of Python – Number 1



Ref. <https://www.tiobe.com/tiobe-index/>

What Can Python Do – Just About Anything

- Statistical analysis
- Scientific computing
- Machine learning / AI
- Data visualization
- Others
 - Scripting & automation
 - Web development
 - Systems testing & prototyping
 - Desktop applications

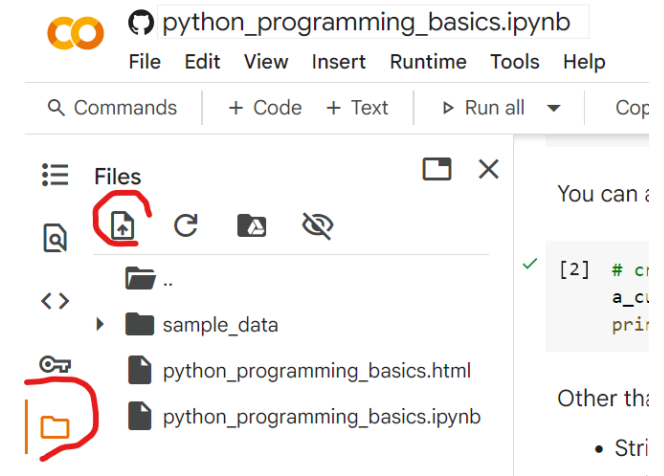
Install and Code in Python

- Notebook in the Cloud (**easiest** for beginners)
 - [Google Colab](#) (**Our Choice Today**)
 - [Uoft JupyterHub](#) (can use classic jupyter notebook or jupyterlab; **2G memory limit**)
- Notebook on your laptop
 - [Anaconda Python distribution](#)
 - Installation comes with Python, Jupyter Notebook, and many data science packages
 - Convenient for beginners (with a GUI launchpad)
 - But installation comes with a very large footprint (4.4G)
- [Python Official Distribution](#) + Development Environment (e.g. [VS Code](#))
 - Install additional packages/libraries on your own
 - Work with both pure Python code and Python notebook

More on Python Notebooks

- Python Notebook (.ipynb) vs Python Script (.py)
- Turn a Python Notebook to html (or pdf) for assignment submission
 - [Uoft JupyterHub](#)
 - If using jupyterlab: *File* → *Save and Export Notebook As*
 - If using classic jupyter notebook: *File* → *Download as*
 - [Google Colab](#): no easy download/export menu, need to use a trick
 - Step 1: download as a notebook file (.ipynb): *File* → *Download* → *Download .ipynb*
 - Step 2: upload the downloaded notebook file (see screenshot)
 - Step 3: in a code cell, run (change your_notebook_filename.ipynb accordingly):

```
!jupyter nbconvert your_notebook_filename.ipynb --to html
```

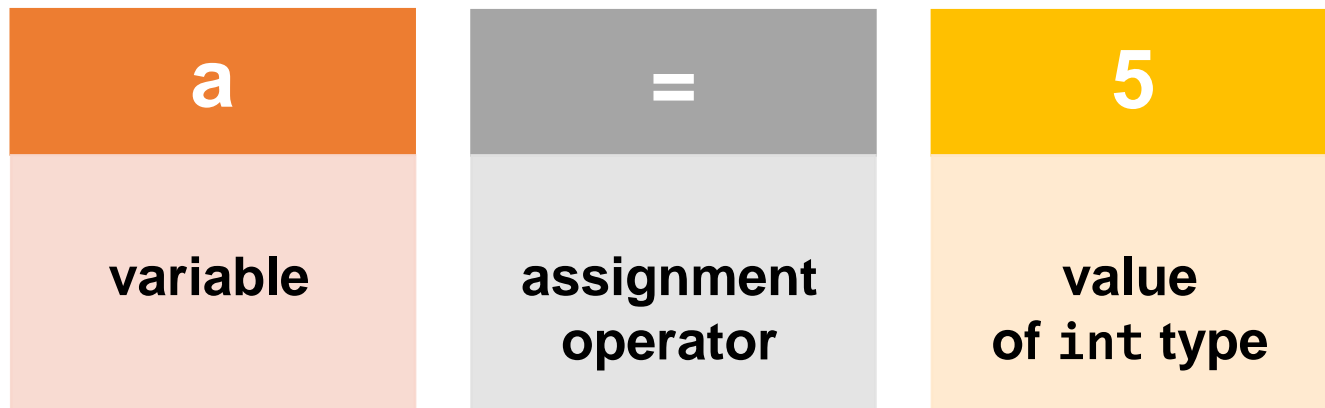


Plan for Today and Next Session

- Programming basics (companion notebook on workshop site)
 - Data structures
 - Programming structures
 - Functions
- Data analysis basics (companion notebook on workshop site)
 - Simple data processing (operations on 2D tables/dataframes)
 - Simple analysis on a stock price time series
 - Predict next-day stock price with a linear regression model

Basic Data Structure - 1

- What's data structure
 - a way of storing and organizing data/values of certain types
- Value, type, variable, and the assignment operator (=)



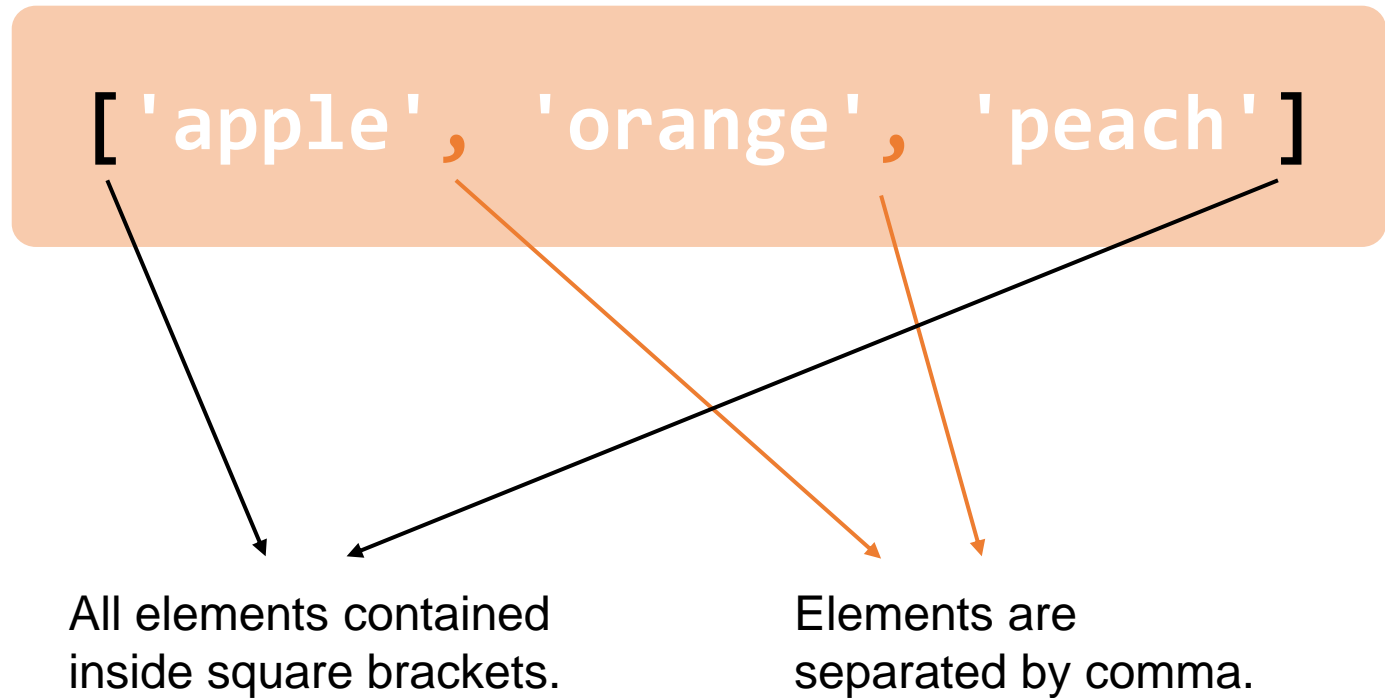
An assignment statement

Basic Data Structure - 2

- Basic numeric types: `int`, `float`, `complex`
- String type (`str`)
 - String index
 - Methods associated with string object

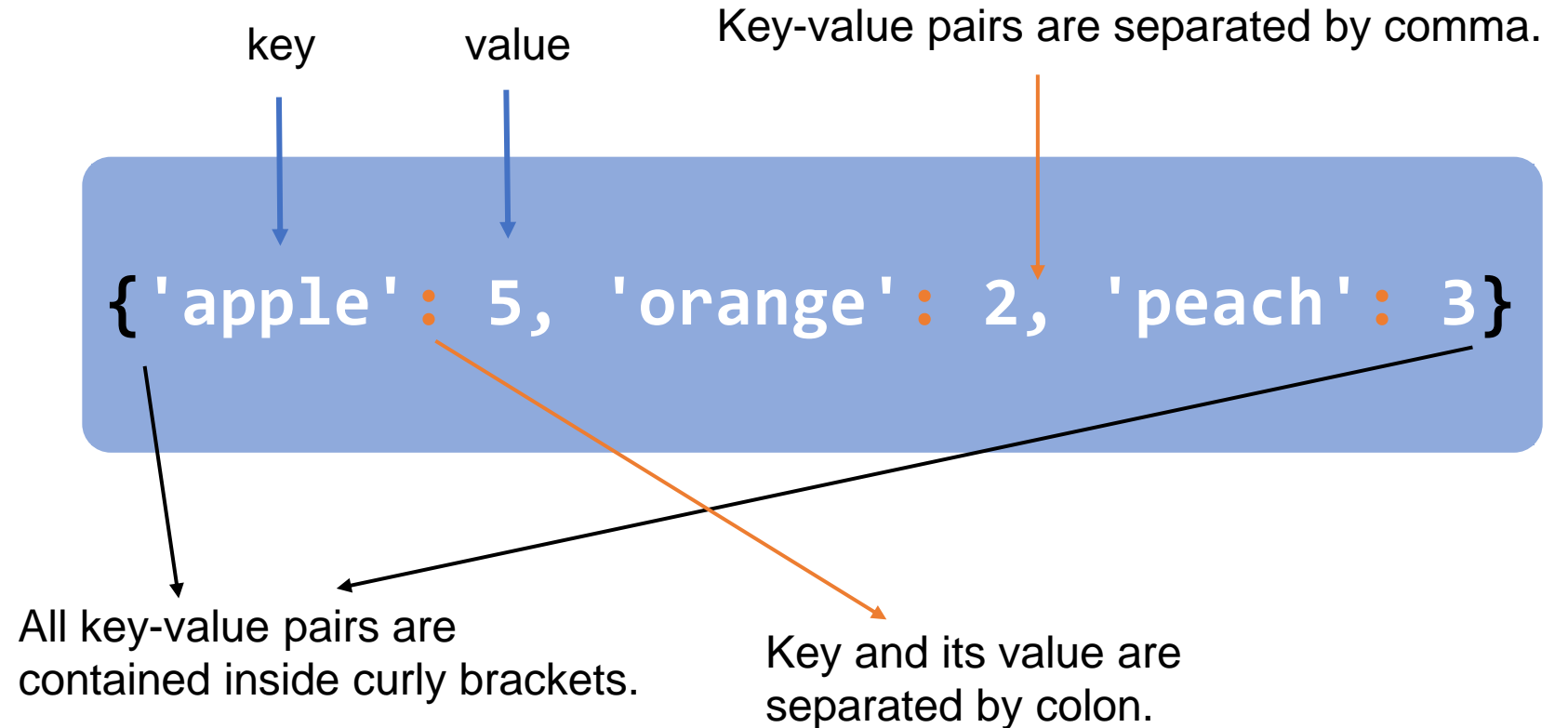
More DS Native to Python - List

- Mutable
- Ordered
- indexed

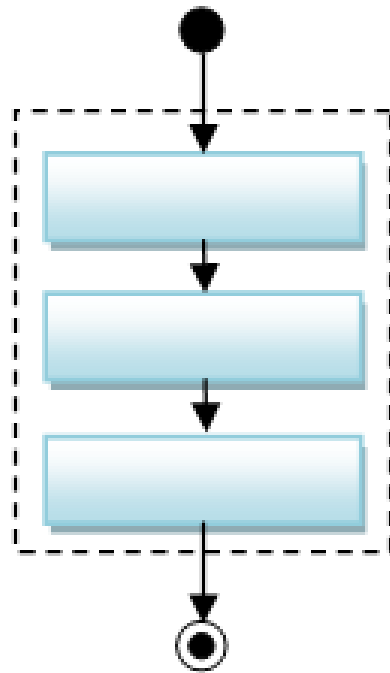


More DS Native to Python - Dictionary

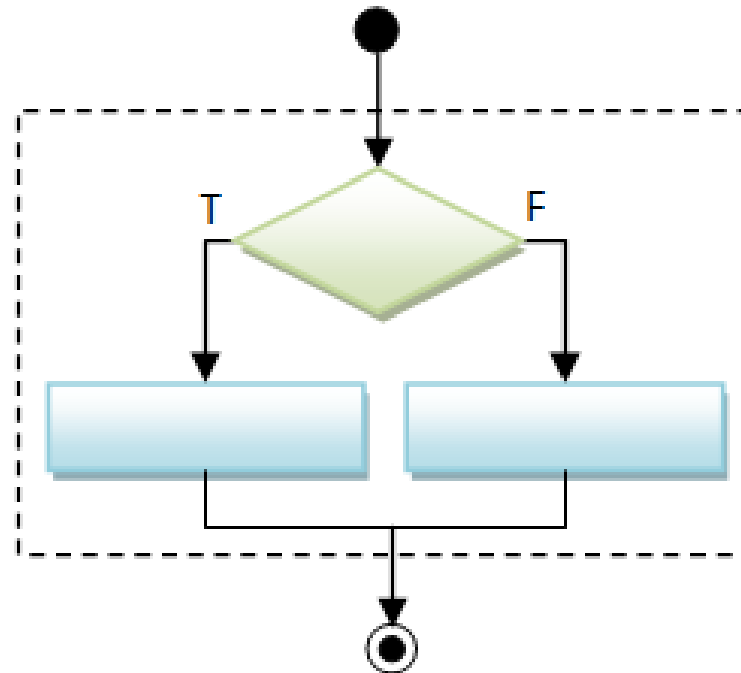
- Mutable
- Unordered
- Key-value pair



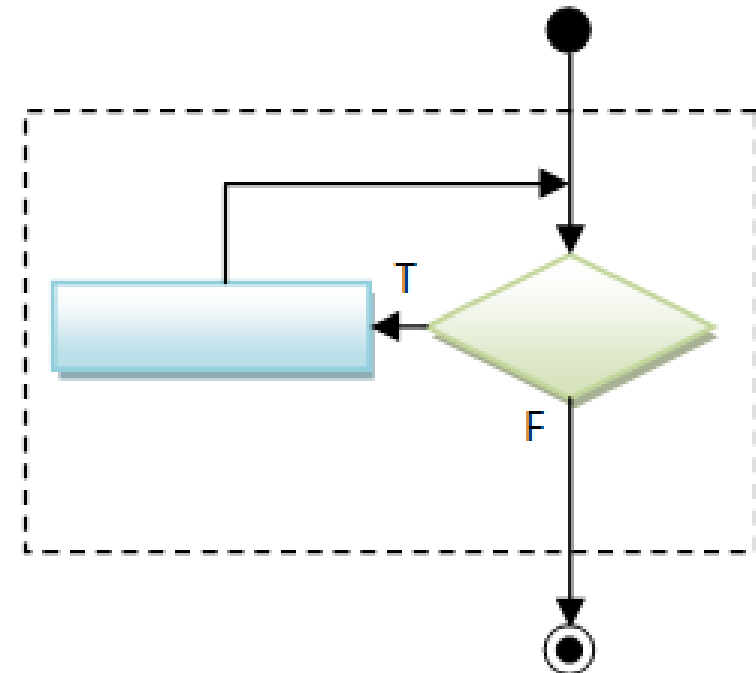
Programming Structures



Sequential



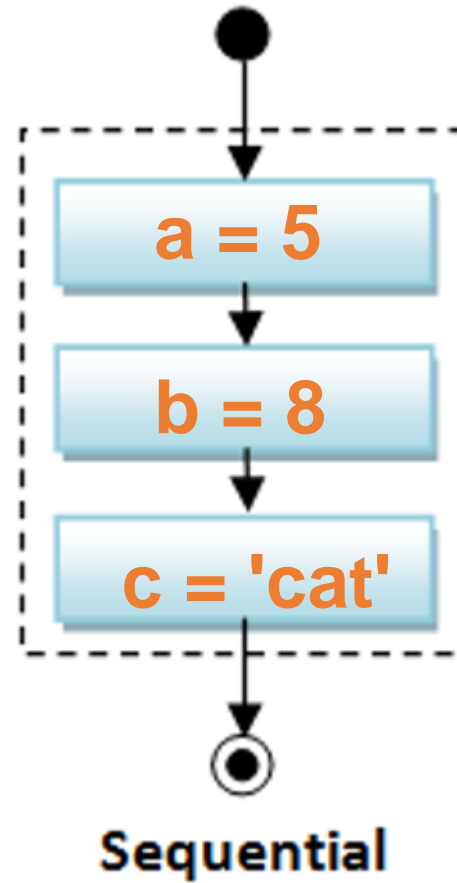
Conditional (Decision)



Loop (Iteration)

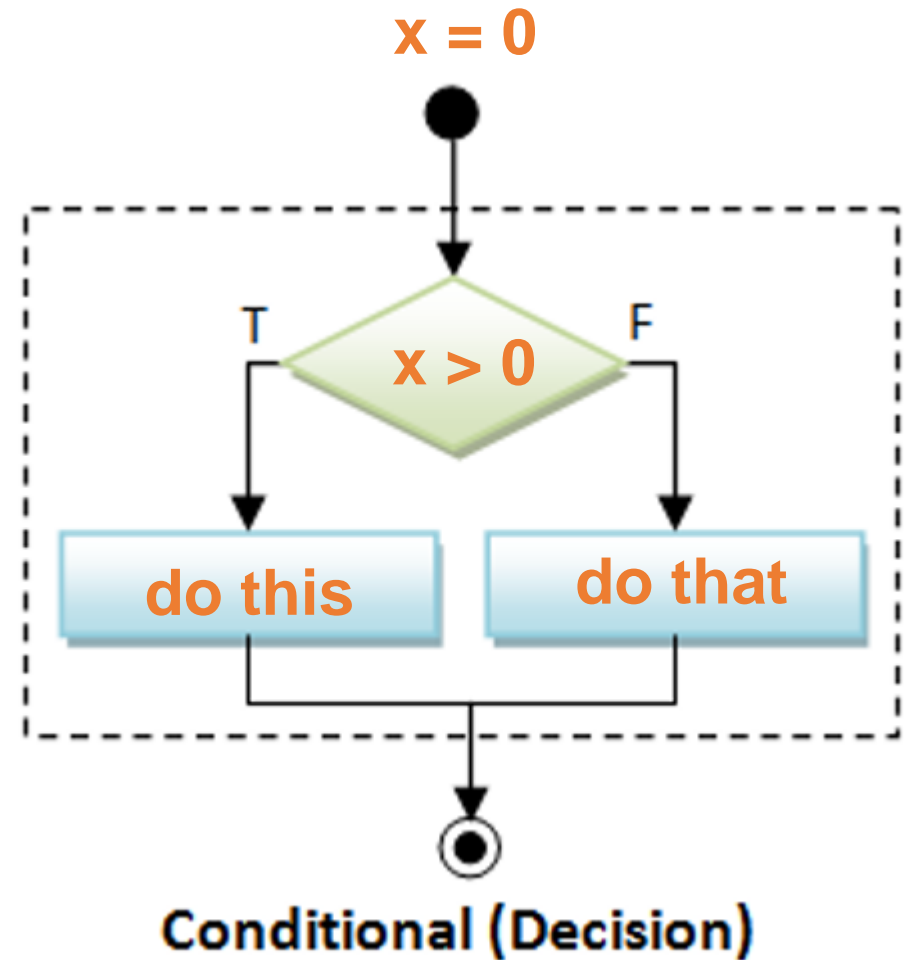
Sequential

- Code executes in sequence



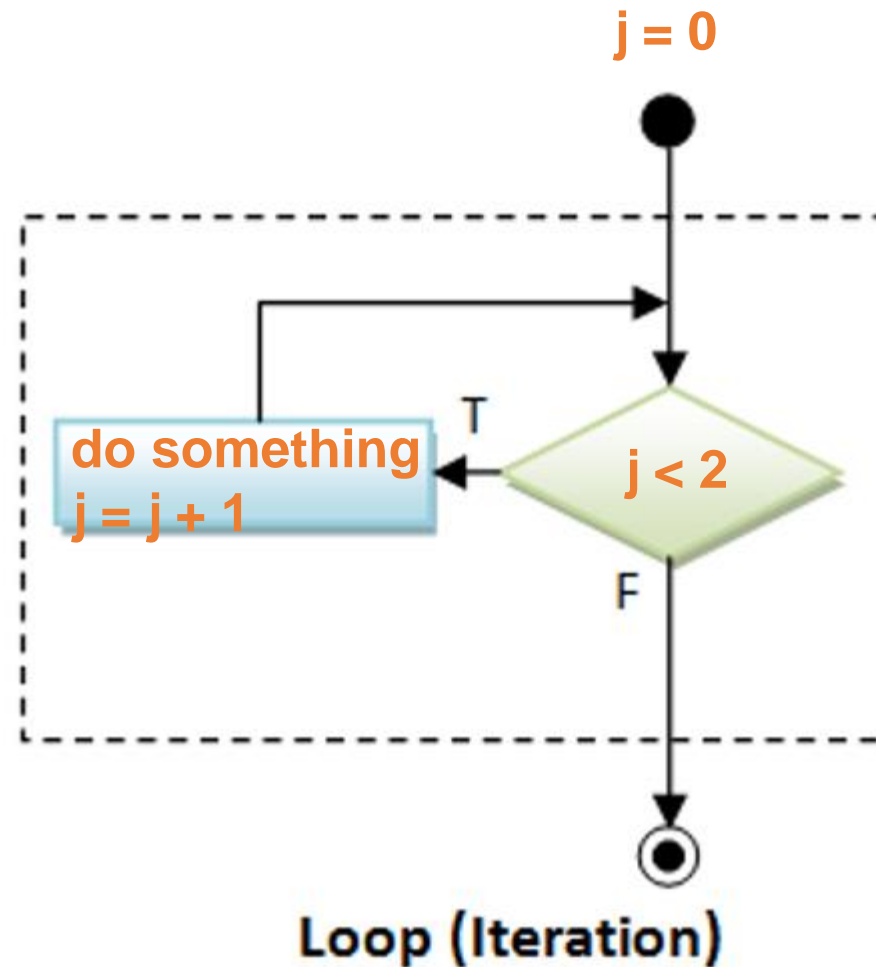
Conditional

- Whether a certain block of code is executed or not depends on whether a condition is satisfied.



Iterative

- A block of code repeatedly executed for either identical tasks or similar tasks



Function – Custom Functions

- What's a function
 - a logical block of code
 - input -> output
- Why write functions
 - Reusability
 - Abstraction
 - Maintainability

Declare a function
with **def** keyword

Give it a
meaningful name

Parameters (input)) on
which the function is
designed to work upon

```
def celsuis_to_fahr(celsuis):  
    fahr = 9/5 *celsuis + 32  
    return fahr
```

Block of code
that defines
the operations
to run

Return
statement

Value to return (output)

Other Functions

- Built-in functions
- A method is
 - A functions associated with an object (an instance of a class)
 - Accessed using the dot operator (.)

```
# create a list
num_list = [4, 8, 10, 15]
```

```
# print() and sum() are
# built-in functions
print(sum(num_list))
```

```
# remove is a method associated
# with a list object
num_list.remove(10)
print(num_list)
```


Functions/Methods From Other Packages

- Third-party packages/libraries offer functions for various of tasks
- Useful data science packages
 - [numpy](#): operations on vectors and matrices/arrays.
 - [pandas](#): processing 2D tables (dataframes).
 - [matplotlib](#): plotting.
 - [scikit-learn](#): machine learning.

```
# import the numpy module
import numpy as np

# create a 2x3 array
# array() is a function provided by numpy
ar = np.array([[1, 2, 3],
               [4, 5, 6]])

# print the array
print(ar)

# find the largest element in the array
# max() is a method associated with the array object
print(ar.max())

# find the array's shape
# shape is an attribute of the array object;
# it's not a method or function
print(ar.shape)
```

Data Analysis Basics

- Let's walk through the notebook together
 - Simple data processing (operations on 2D tables/dataframes)
 - Simple analysis on a stock price time series
 - Predict next-day stock price with a linear regression model