Introduction to Programming with Python

Day 1

Vivek Murugesan
vivek@bellatrix.aero

March 05, 2021

Course Overview

1. Introduction
2. Lists, Tuples, Dicts
3. Conditional and Looping Statements
4. Errors and Error Handlers
5. Functional Programming
6. External Libraries, Numpy, Scipy, Matplotlib
7. Advanced Plotting
8. Working with Files (CSV, Excel, Text)
9. GUI creation with Tkinter
10. Useful Utilities and Way Forward!

Introduction

Introduction to Programming?

- What is programming?
  - developing sequence of commands to instruct a computer how to do a task!
- Why learn programming?
  - Computers are fast!
  - Computers can work 24 x 7
  - Automate work
  - It is Fun
  - Many More Reasons!

Programming Language

- Computers can only understand binary language!
  - 1010100, 10001001010, 01000100101, etc
- Assembly Language
  - MOV r1,s1;
  - MOV r2,s2;
  - ADD s1,s2;
  - OUT s3;
- High Level Language
  - Human readable
  - Easy to write/develop/understand
  - Comes with own syntax, vocabulary

How Programs work?

The Translators can be of two types,

1. Compiler
2. Interpreter

Compiled Languages are C,C++,Java, Kotlin etc
Interpreted languages Python, Ruby, Perl, Julia etc
Then there are markup languages: HTML, XML, YAML etc

Introduction to Python

- Developed by Guido Van Rossum and released in 1991
- General Purpose High Level language
- Interpreted, Object oriented, garbage collected
- It is dynamically typed, easier syntax
- Application of Python
  - Mathematical Calculations
  - Prototyping and Scripting
  - Web Development
  - Software Development

Installing Python in Computer

- Installing in Windows
  - Go to : www.python.org/downloads/
  - Click on the Download Python Button (Version will be different anything above 3.0 is good)
  - Install the downloaded file

- Installing Code Editor
  - Go to: www.spyder-ide.org
  - Download the latest version (currently 4.2)
  - Install the downloaded file

- Checking Installation
  - Open Command Prompt
  - Type python --version
  - It will output the version number in the command prompt, if installed properly

Installing Python in Mobile

- Installing in Android
  - Download the Pydroid 3 (free) application from the Playstore

- Installing in iOS (iPhones and iPads)
  - Download the Pythonista (paid) or Pyto (free) application from the iStore

Writing your First Program!

- Open the Spyder Or any other Text Editor of your choice
- Type the following code

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

- Hit the Run button
- Voila! You should see the Output in the Console

Variables Declaration

1. A variable name must start with a letter or the underscore character.
2. A variable name cannot start with a number.
3. A variable name can only contain alpha-numeric characters and underscores (A-z, 09, and _).
4. Variable names are case sensitive (name, Name and NAME are three different variables).
5. The reserved words(keywords) cannot be used naming the variable.

Basic Input and Output

- For asking the user input we can use, input function

```
x=input("Enter the Value of X")
y=input("Enter the Value of Y")
```

- For printing the output we can use, print function

```
print("Hi There!")
x=10.0
print(x)
print("Value of X is:",x)
```

Datatypes in Python

Python Supports the following Datatypes

- int - whole numbers
- float - decimal numbers
- str - Strings and texts
- list - List of items grouped together
- duple - List of items grouped together
- dict - Data stored in key value pairs
- Other datatype boolean, sets,complex

Python Automatically detects the data types and we don't need to mention it explicitly!
The datatype of the particular variable can be accessed by type() function

Casting Data Types

- Convert one form of data type to other form

```
raw_input=input("Enter a value")
print(type(raw_input))
converted=int(raw_input)
print(type(converted))
```

```
list_one=[1,2,3,4,5,6]
print(type(list_one))
print(type(tuple(list_one)))
```

Operators in Python

Python Supports the following Operators

+	Addition
-	Subtraction
*	Multiplication
/	Division
//	Floor Division
%	Quotient

**	Raise to power
==	Equal to
>=	Addition
<=	Subtraction
and	Logical AND
or	Logical OR

Other mathematical functions are available in the math library

Try out!

- Ideal gas equation
  - Find the density of Air at 10 bar and 350K using the Ideal Gas Equation
  - Expand the program to find the density at user given pressure and Temperature
- Rocket equation
  - Find the momentum imparted to the thruster by firing a thruster with specific impulse of 300 seconds for 45 seconds. The initial mass of the spacecraft is 100 Kg and mass flow rate is 0.5kg/s
- Projectile Motion
  - Find the Range, Maximum Altitude and Duration of a projectile launched with 50m/s velocity at 40 degree angle

Hints

- **Ideal gas equation**

$$\rho = \frac{P}{RT}$$

- **Rocket equation**

$$\Delta V = V_e \ln \frac{m_0}{m_f}$$

- **Projectile Motion**

$$h = \frac{v_0^2 \sin^2 \theta}{2g};\ t = \frac{2v_0 \sin \theta}{g};\ d = \frac{v^2 \sin 2\theta}{g}$$

print(“Thank You!”)