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1 Objectives

After performing this lab, students shall be able to understand:

- ✔ Python data types.
- ✔ Python operators (math, comparison, boolean)
- ✔ Python condition and loops
- ✔ Python functions

2 Python Interpreter (Anaconda Jupyter Notebook)

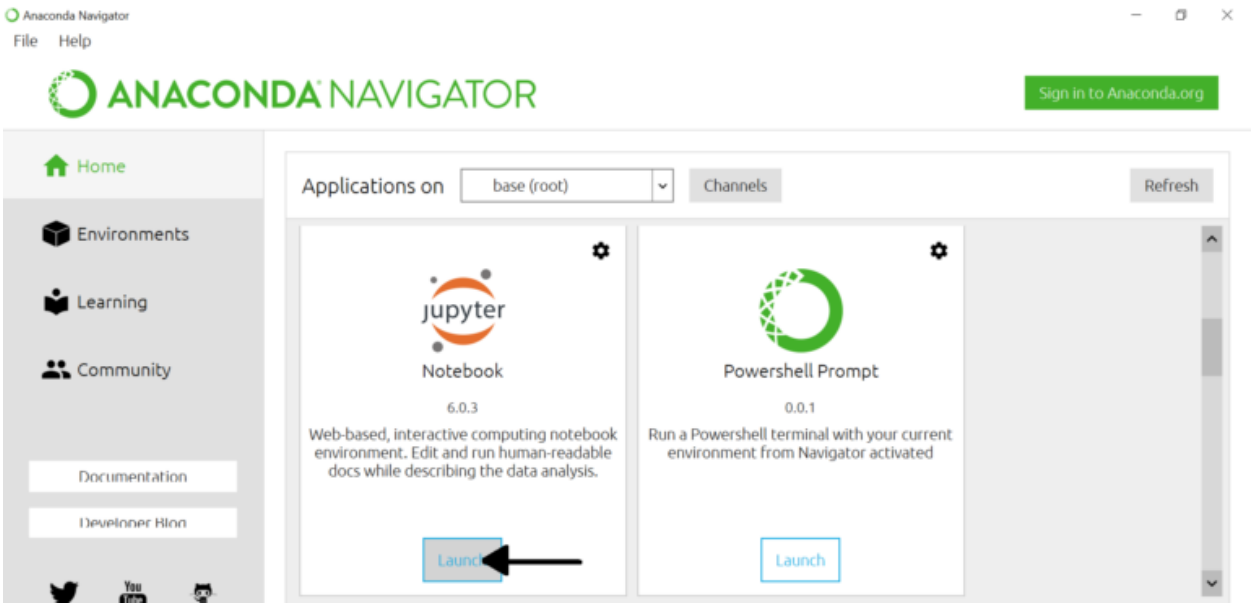
We will be working with Jupyter Notebook installed via Anaconda to run Python programs.

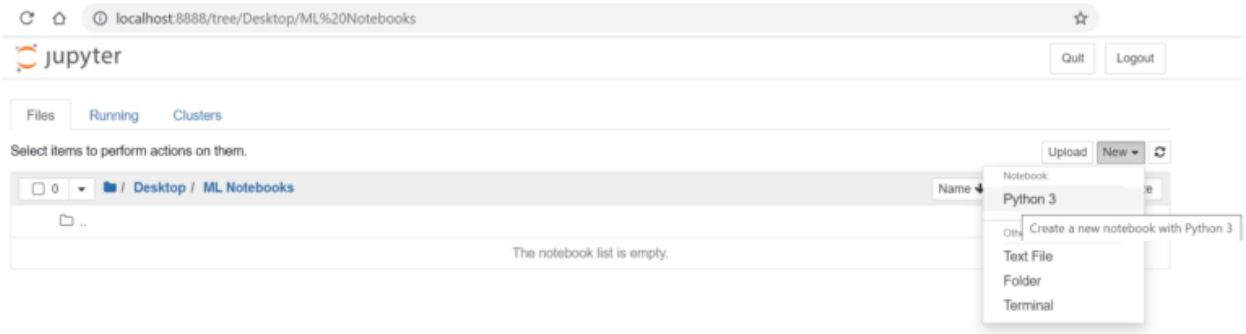
Anaconda is a free and open-source distribution of Python that includes Jupyter Notebook and many useful libraries for data science, machine learning, and general Python programming.

Jupyter Notebook is a web-based interactive environment that allows you to create and share documents containing live code, equations, visualizations, and explanatory text. It is widely used for data analysis, scientific computing, and learning Python.

Follow the instructions given below:

- Download and install Anaconda Distribution for your operating system (Windows / macOS / Linux).
- After installation, open Anaconda Navigator.
- From Anaconda Navigator, click on Launch under Jupyter Notebook.
- Your default web browser will open the Jupyter Notebook dashboard.
- Choose or create a folder where you want to save your notebook.
- Click on New → Python 3 (ipykernel) to create a new notebook.
- A new notebook will be created with the name Untitled.ipynb.
- Rename the notebook to your roll number by clicking on the notebook name at the top.
- Write your first Python program by typing the following statement in the first cell:
    - `print('Hello World')`
- Execute the cell by clicking the **Run** button at the top or by pressing **Shift + Enter**.
- The output will be displayed directly below the cell.


Anaconda Navigator
File Help
ANACONDA NAVIGATOR
Sign in to Anaconda.org
Home
Environments
Learning
Community
Documentation
Developer Blog
Applications on
base (root)
Channels
Refresh
jupyter
Notebook
6.0.3
Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.
Launch
Powershell Prompt
0.0.1
Run a Powershell terminal with your current environment from Navigator activated
Launch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jupyter
Quit
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Files
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Clusters
Select items to perform actions on them.
Upload
New
Desktop / ML Notebooks
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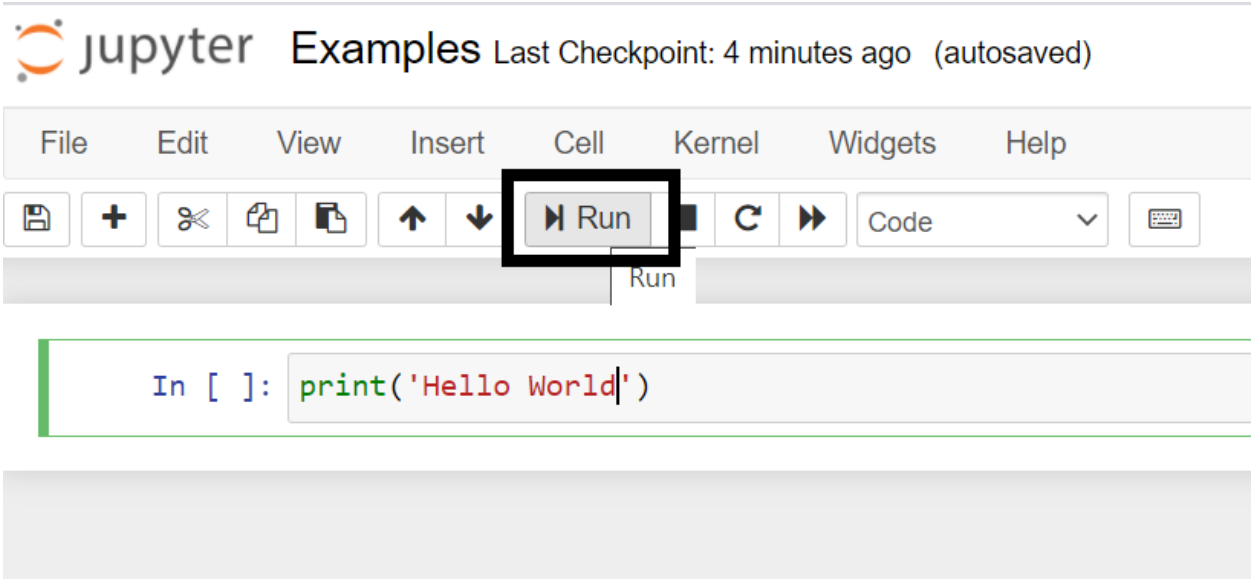
Notebook:
Python 3
Create a new notebook with Python 3
Text File
Folder
Terminal


jupyter
Examples
Last Checkpoint: 4 minutes ago (autosaved)
File
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Kernel
Widgets
Help
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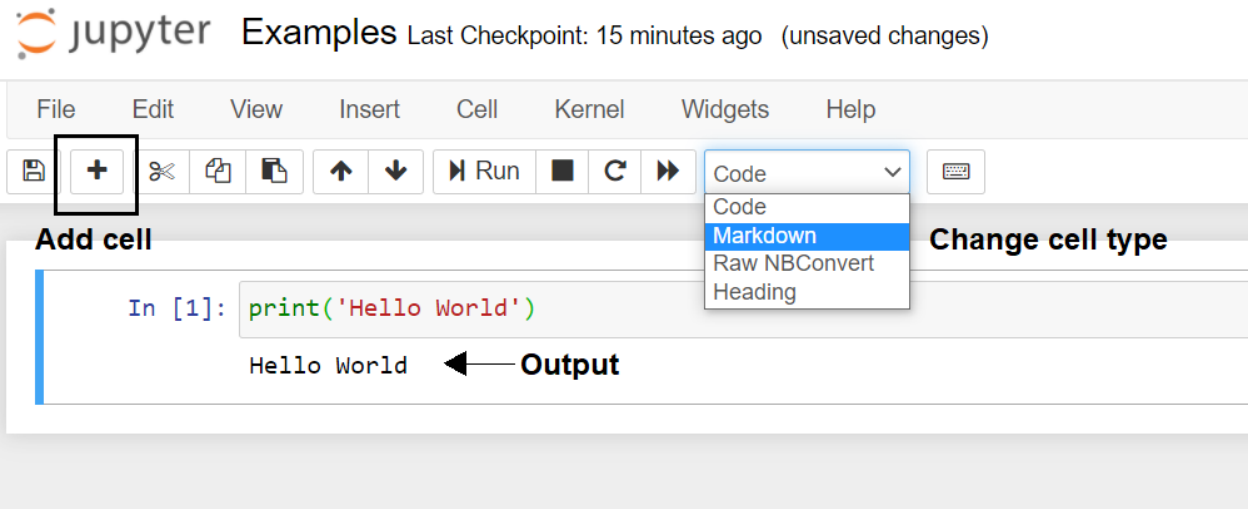
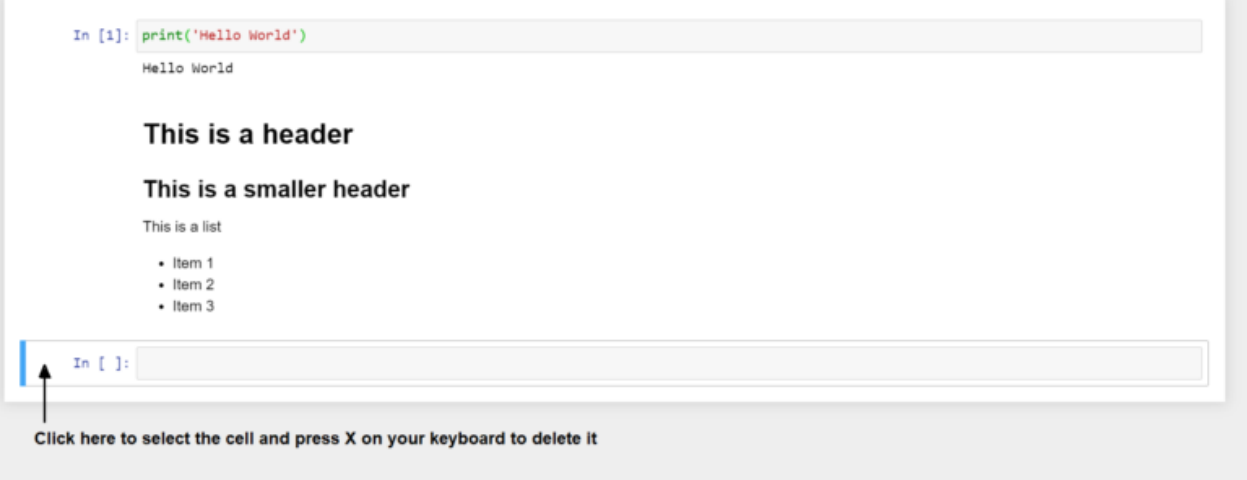
Code
Run
In [ ]:
print('Hello World')





For more information: https://learncodingfast.com/how-to-install-anaconda-and-use-jupyter-notebook/

3 Data Types

The following section describes the standard types that are built into the Python interpreter. These datatypes are divided into different categories like numeric, sequences, mapping etc. Typecasting is also discussed below.

3.1 Built-in Types

The following chart summarizes the standard data types that are built into the Python interpreter.

Sr#	Categories	Data Type	Examples
1	Numeric Types	int	-2, -1, 0, 1, 2, 3, 4, 5, int(20)

2		float	-1.25, -1.0, --0.5, 0.0, 0.5, 1.0, 1.25, float(20.5)
3		complex	1j, complex(1j)
4	Text Sequence Type	str	'a', 'Hello!', str("Hello World")
5	Boolean Type	bool	True, False, bool(5)
6	Sequence Types	list	["apple", "banana", "cherry"], list(("apple", "banana", "cherry"))
7		tuple	("apple", "banana", "cherry"), tuple(("apple", "banana", "cherry"))
9	Mapping Type	dict	{"name" : "John", "age" : 36}, dict(name="John", age=36)
10	Set Types	set	{"apple", "banana", "cherry"}, set(("apple", "banana", "cherry"))
11		frozenset	frozenset({"apple", "banana", "cherry"})

Python has no command for declaring a variable for any datatype. A variable is created the moment you first assign a value to it. Variable names are case-sensitive. Just like in other languages, Python allows you to assign values to multiple variables in one line.

```
print("assigning values of different datatypes")
a, b, c, d = 4, "geeks", 3.14, True
print(a)
print(b)
print(c)
print(d)
```

3.2 Typecasting

The process of explicitly converting the value of one data type (int, str, float, etc.) to another data type is called type casting. Inbuilt functions int(), float() and str() shall be used for typecasting. int() can take a float or string literal as argument and returns a value of class 'int' type. In Type Casting, loss of data may occur as we enforce the object to a specific data type.

```
# cast to float
x=float(2)
y=float(30.0)
z=float("20")
print(x)
print(y)
print(z)

# cast to str
x=str(2)
y=str(30.0)
z=str("20")
print(x)
print(y)
print(z)

# Sum two numbers using typecast
num_int = 123
num_str = "456"
print("Data type of num_int:",type(num_int))
print("Data type of num_str before Type Casting:",type(num_str))
num_str = int(num_str)
print("Data type of num_str after Type Casting:",type(num_str))
num_sum = num_int + num_str
print("Sum of num_int and num_str:",num_sum)
print("Data type of the sum:",type(num_sum))
```

Notice the `type()` function used in the above example. Find out what it does. Execute the given example in Jupyter notebook to observe the result of type casting.

- **Type Cast int to float and string**

```
#integer
n = 100

#float
f = float(n)
print(f)
print(type(f))

#string
s = str(n)
print(s)
print(type(s))
```

- **Type Cast float to int and string**

```
#float
f = 100.05

#integer
n = int(f)
print(n)
print(type(n))

#string
s = str(f)
print(s)
print(type(s))
```

- **Type Cast string to int and float**

```
#string
s = '132'

#typecast to integer
n = int(s)
print(n)
print(type(n))

#typecast to float
s = '132.65'
f = float(s)
print(f)
print(type(f))
```

4 Operators

This section contains the details of different Python operators i.e. arithmetic operators, comparison operators and Boolean operators.

4.1 Arithmetic Operators

From **Highest** to **Lowest** precedence:

Operators	Operation	Example
**	Exponent	`2 ** 3 = 8`
%	Modulus/Remainder	`22 % 8 = 6`

Operators	Operation	Example
//	Integer division	`22 // 8 = 2`
/	Division	`22 / 8 = 2.75`
*	Multiplication	`3 * 3 = 9`
-	Subtraction	`5 - 2 = 3`
+	Addition	`2 + 2 = 4`

4.2 Comparison Operators

Operator	Meaning
`==`	Equal to
`!=`	Not equal to
`<`	Less than
`>`	Greater Than
`<=`	Less than or Equal to
`>=`	Greater than or Equal to

4.3 Boolean Operators

There are three Boolean operators: *`and`*, *`or`*, and *`not`*.

The *`and`* Operator's *Truth* Table:

Expression	Evaluates to
`True and True`	`True`
`True and False`	`False`
`False and True`	`False`
`False and False`	`False`

The *`or`* Operator's *Truth* Table:

Expression	Evaluates to
`True or True`	`True`
`True or False`	`True`
`False or True`	`True`
`False or False`	`False`

The `not` Operator's *Truth* Table:

Expression	Evaluates to
`not True`	`False`
`not False`	`True`

5 If-else Conditions

Python supports conditional statements i.e. `if, elif, else.` Comparison operators and Boolean operators written in the previous section can be used in if-elif-else statements.
Python uses indentation instead of curly-brackets to define the scope in the code.

5.1 if Statement Example:

```
name = 'Alice'
if name == 'Alice':
    print('Hi, Alice.')
```

5.2 if-else Statement Example:

```
name = 'Bob'
if name == 'Alice':
    print('Hi, Alice.')
else:
    print('Hello, stranger.')
```

5.3 if-elif-else Statement Example:

```
name = 'Bob'
age = 30
if name == 'Alice':
    print('Hi, Alice.')
elif age < 12:
    print('You are not Alice, kiddo.')
else:
    print('You are neither Alice nor a little kid.')
```

Python conditional statements only require `if` statement to execute. Both `elif` and `else` are optional and used as per requirement.

6 Loops

Python has two types of loops i.e. `while`, `for`. Use Jupyter notebook to execute all code snippets given in the examples below to observe their results.

6.1 While Loop Example with break Statement

With the `while` loop we can execute a set of statements as long as a condition is true or the loop execution reaches a `break` statement.

```
while True:
    print('Please type your name.')
    name = input()
    if name == 'your name':
        break
print('Thank you!'
```

`input()` in the above example is a built-in Python function which is discussed in the functions section below.

6.2 While Loop Example with continue Statement

When the program reaches a `continue` statement, the program execution immediately jumps back to the start of the loop.

```
while True:
    print('Who are you?')
    name = input()
    if name != 'Joe':
        continue
    print('Hello, Joe. What is the password? (It is a fish.)')
    password = input()
    if password == 'swordfish':
        break
print('Access granted.')
```

6.3 for Loop Example with range()

```
print('My name is')
for i in range(5):
    print('Jimmy Five Times ({})'.format(str(i)))
```

6.4 for Loop Example with range() arguments

The `range()` function can also be called with three arguments. The first two arguments will be the start and stop values, and the third will be the step argument. The step is the amount that the variable is increased by after each iteration.

```
for i in range(0, 10, 2):
    print(i)
```

7 Functions

This section contains the details of Python user defined or custom function along with a few examples of Python built-in functions.

7.1 Custom Functions

Programmers can define their own functions in Python. Functions can contain all types of Python statements like variables, conditions and loops etc.

7.1.1 Simple Function Example

A function in Python starts with `def` keyword followed by the function name with round brackets. Function parameters can be passed depending on the requirement.

```
def hello(name):
     print('Hello {}'.format(name))
hello('Alice') #Hello Alice
hello('Bob') #Hello Bob
```

7.1.2 Function Example with Return Statement

A return statement consists of the following:

- The return keyword.
- The value or expression that the function should return.

```
import random #Syntax to import Python libraries
def getAnswer(answerNumber):
    if answerNumber == 1:
        return 'It is certain'
    elif answerNumber == 2:
        return 'It is decidedly so'
    elif answerNumber == 3:
        return 'Yes'
    elif answerNumber == 4:
        return 'Reply hazy try again'
    elif answerNumber == 5:
        return 'Ask again later'
    elif answerNumber == 6:
        return 'Concentrate and ask again'
    elif answerNumber == 7:
        return 'My reply is no'
    elif answerNumber == 8:
        return 'Outlook not so good'
    elif answerNumber == 9:
        return 'Very doubtful'

r = random.randint(1, 9)
fortune = getAnswer(r)
print(fortune)
```

7.2 Built-in Functions

The Python interpreter has a number of functions built into it that are always available. We have already covered a few built-in functions in the datatypes section above. Refer to this link for the complete list of Python built-in functions.

7.2.1 Built-in Function Examples

Execute the code given below in your Jupyter notebook to find the results of built-in functions.

```
# abs integer number
num = -5
print('Absolute value of -5 is:', abs(num))
# Notice print here, it is also a built-in function

# abs floating number
fnum = -1.45
print('Absolute value of 1.45 is:', abs(fnum))

# input function
x = input('Enter your name:')
print('Hello, ' + x)

# max function
number = [3, 2, 8, 5, 10, 6]
largest_number = max(number);
print("The largest number is:", largest_number)

# print usage
print('Hands-on','python','programming','lab',sep='\n')

# sum function
my_list = [1,3,5,2,4]
print "The sum of my_list is", sum(my_list)
```