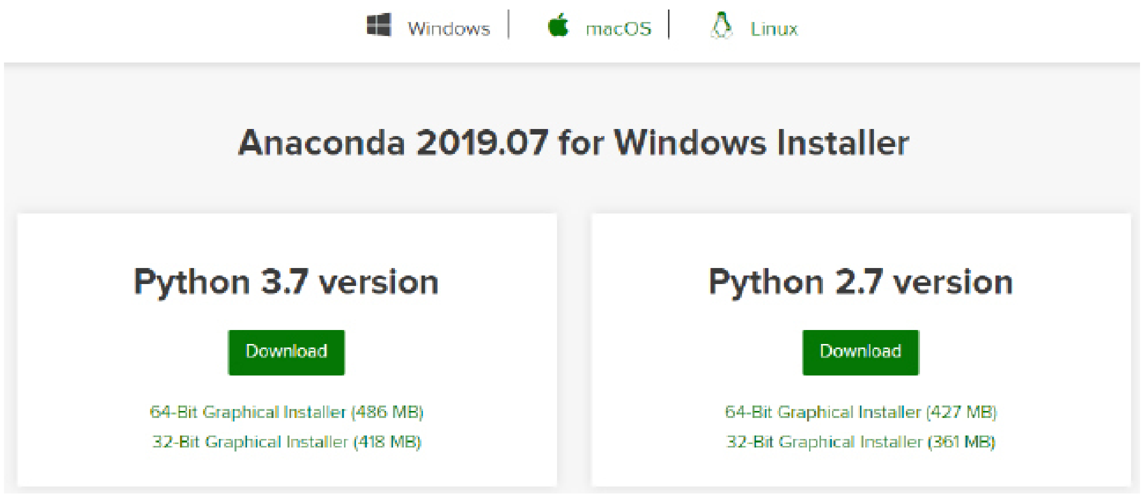
The time has come to install Python on Windows using an IDE. In fact, we will use Anaconda throughout this book right from installing Python to writing multi-threaded codes in the coming lectures. Now, let us get going with the installation.

This section explains how you can download and install Anaconda on Windows.

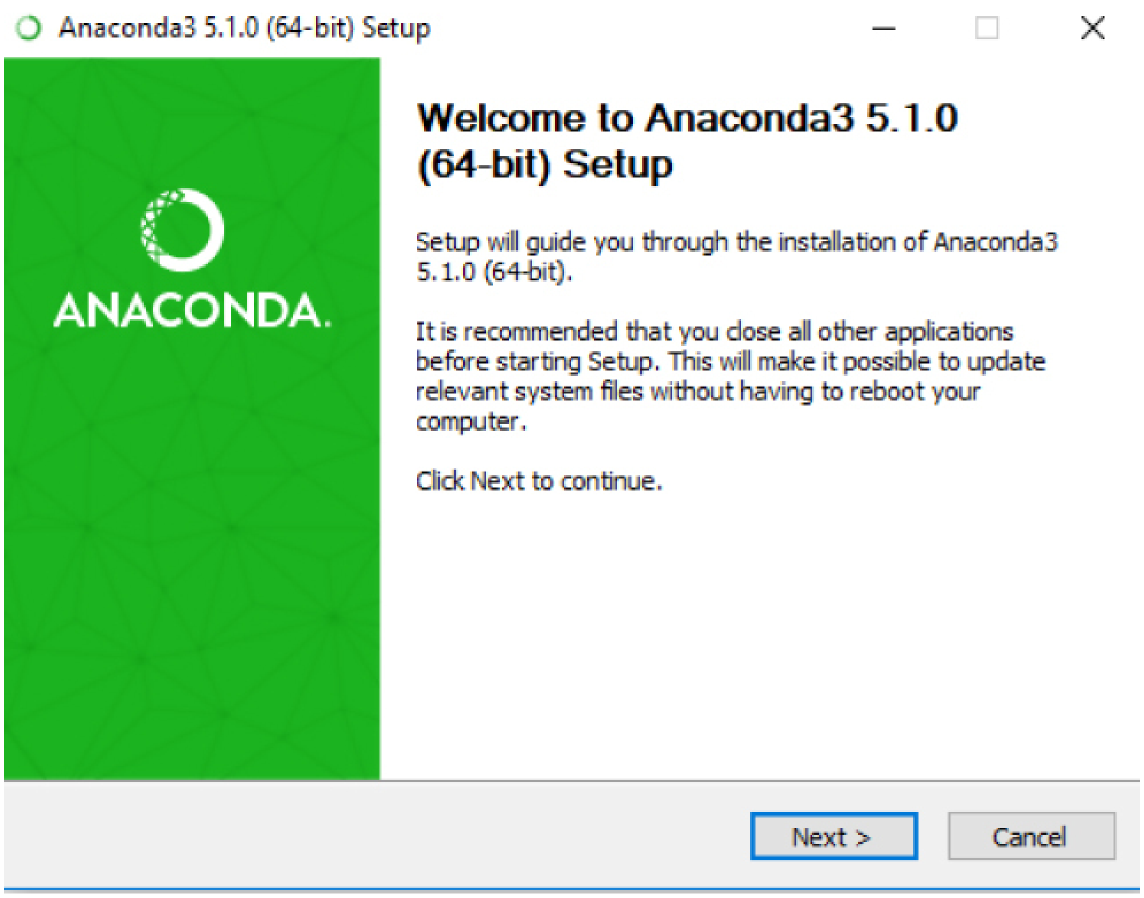
Download and install Anaconda by following these steps.

1. Open the following URL in your browser. [https://www.anaconda.com/distribution/](https://www.anaconda.com/distribution/)

2. The browser will take you to the following webpage. Select the latest versio Python (3.7 at the time of writing this book). Now, click the *Download* buttc download the executable file. Depending upon the internet speed, the file wi download within 2–3 minutes.


Windows
macOS
Linux
Anaconda 2019.07 for Windows Installer
Python 3.7 version
Download
64-Bit Graphical Installer (486 MB)
32-Bit Graphical Installer (418 MB)
Python 2.7 version
Download
64-Bit Graphical Installer (427 MB)
32-Bit Graphical Installer (361 MB)

3. Run the executable file after the download is complete. You will most likely the download file in your download folder. The file name should be along tł lines: “Anaconda3-5.1.0-Windows-x86_64.” The installation wizard will op when you run the file, as shown in the following figure. Click the *Next* buttc


Anaconda3 5.1.0 (64-bit) Setup

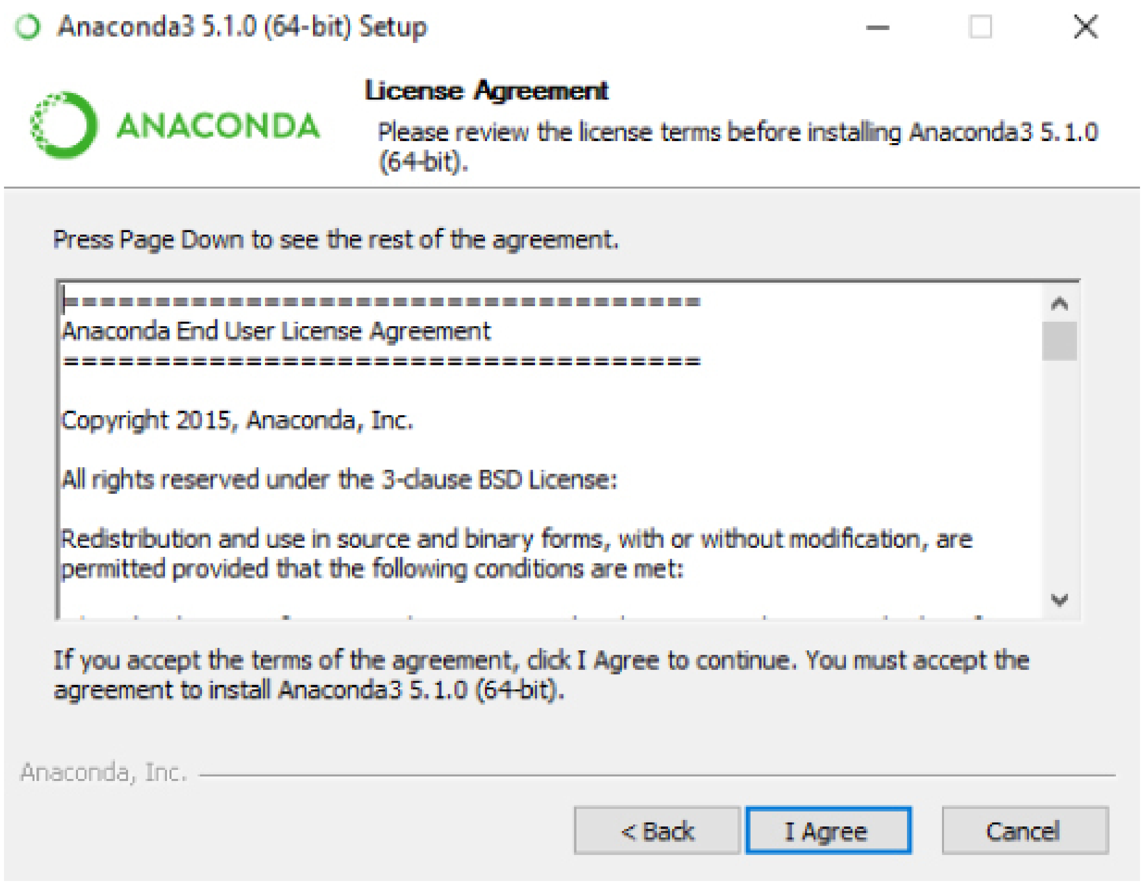
Welcome to Anaconda3 5.1.0 (64-bit) Setup

Setup will guide you through the installation of Anaconda3 5.1.0 (64-bit).

It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.

Click Next to continue.

4. Now click *I Agree* on the *License Agreement* dialog, as shown in the followi
   screenshot.


Anaconda3 5.1.0 (64-bit) Setup

License Agreement

Please review the license terms before installing Anaconda3 5.1.0 (64-bit).

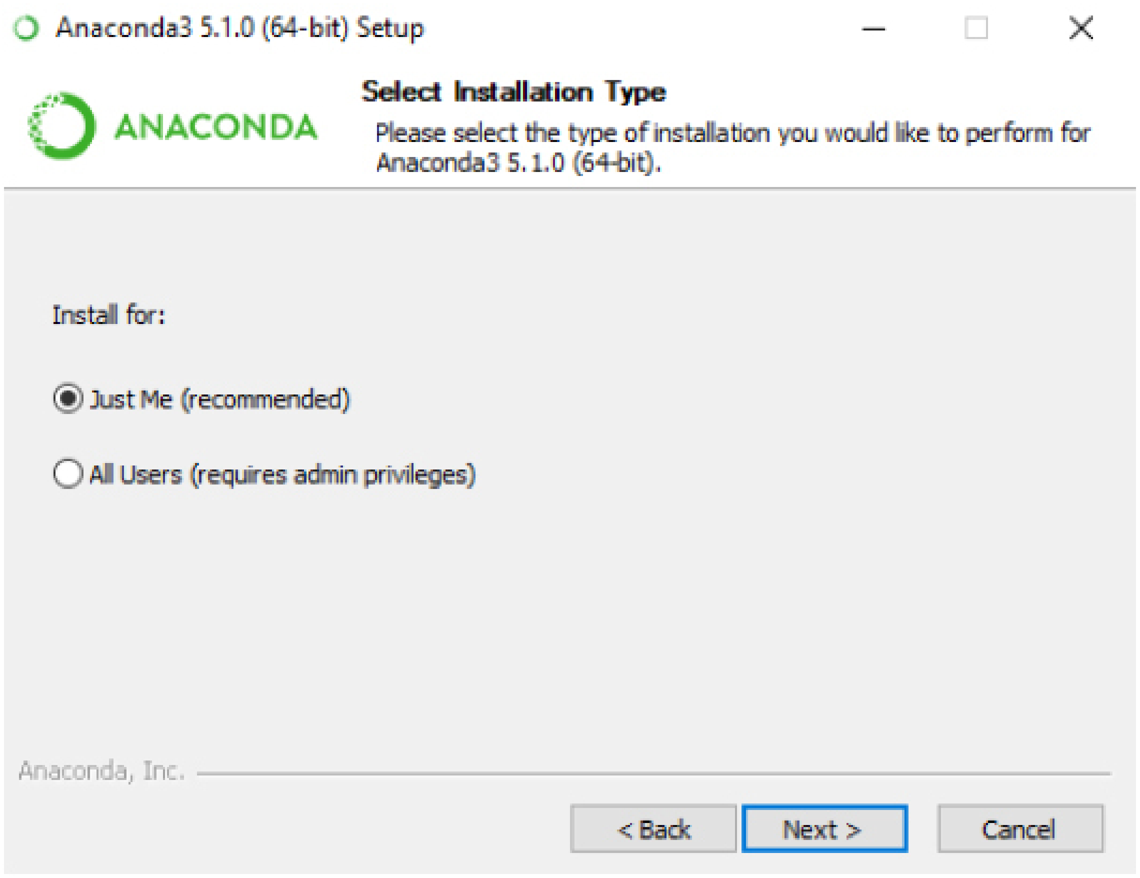
Press Page Down to see the rest of the agreement.

```
===================================
Anaconda End User License Agreement
===================================

Copyright 2015, Anaconda, Inc.

All rights reserved under the 3-clause BSD License:

Redistribution and use in source and binary forms, with or without modification, are
permitted provided that the following conditions are met:
```

If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install Anaconda3 5.1.0 (64-bit).

Anaconda, Inc.

5. Check the *Just Me* radio button from the *Select Installation Type* dialogue b
   Click the *Next* button to continue.


Anaconda3 5.1.0 (64-bit) Setup

**Select Installation Type**

Please select the type of installation you would like to perform for Anaconda3 5.1.0 (64-bit).

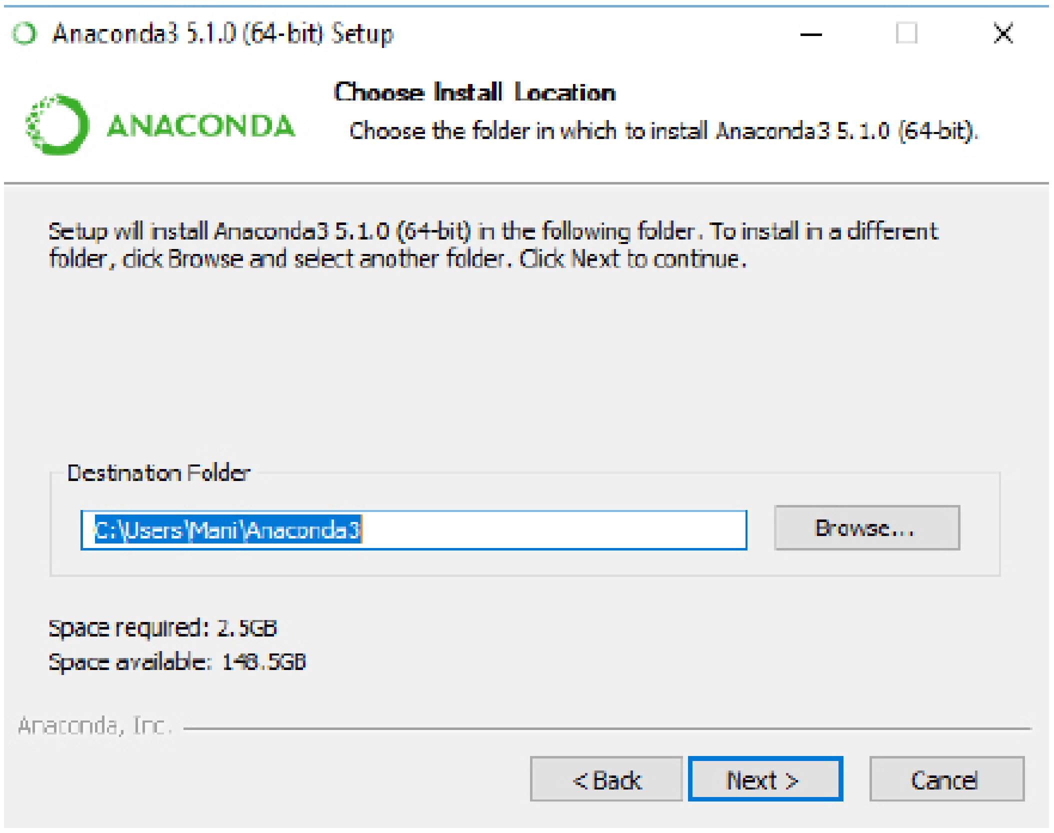
Install for:

(●) Just Me (recommended)

( ) All Users (requires admin privileges)

Anaconda, Inc.

6. Now, the *Choose Install Location* dialog will be displayed. Change the direc you want, but the default is preferred. The installation folder should at least GB of free space for Anaconda. Click the *Next* button.


Anaconda3 5.1.0 (64-bit) Setup

Choose Install Location

Choose the folder in which to install Anaconda3 5.1.0 (64-bit).

Setup will install Anaconda3 5.1.0 (64-bit) in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.

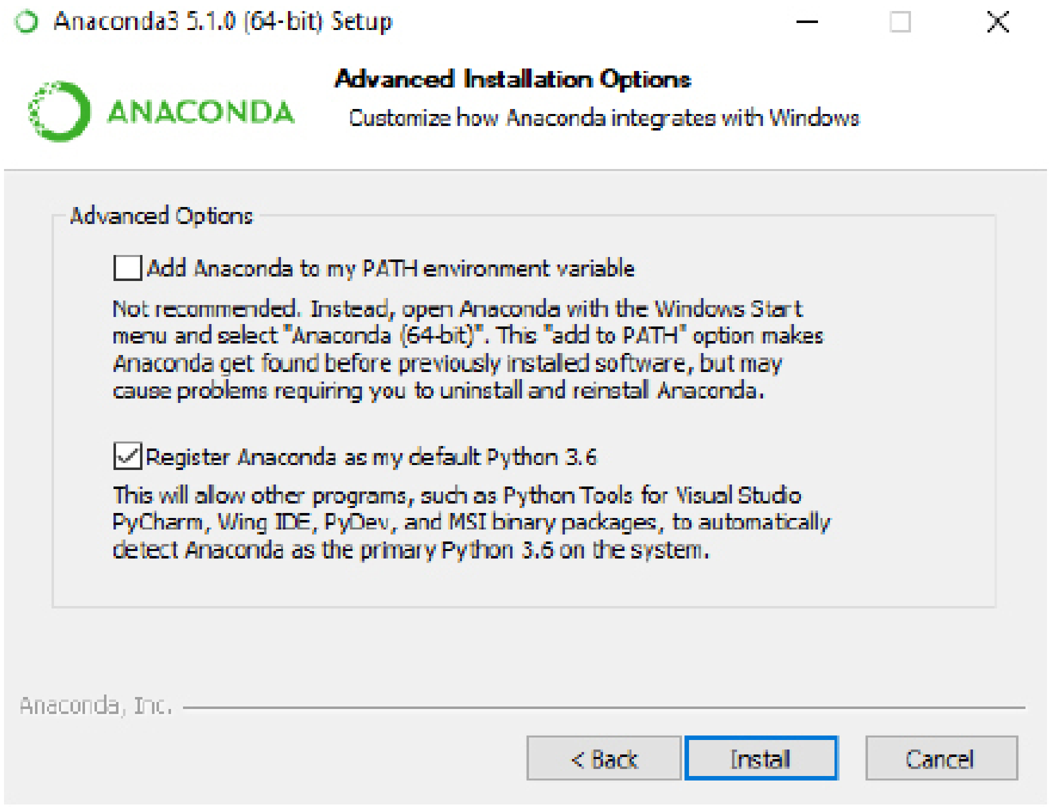
Destination Folder

C:\Users\Mani\Anaconda3

Space required: 2.5GB
Space available: 148.5GB

Anaconda, Inc.

7. Go for the second option, *Register Anaconda as my default Python 3.7* in th *Advanced Installation Options* dialogue box. Click the *Install* button. The installation starts. However, this can take some time to complete.


Anaconda3 5.1.0 (64-bit) Setup

ANACONDA

**Advanced Installation Options**

Customize how Anaconda integrates with Windows

Advanced Options

- [ ] Add Anaconda to my PATH environment variable

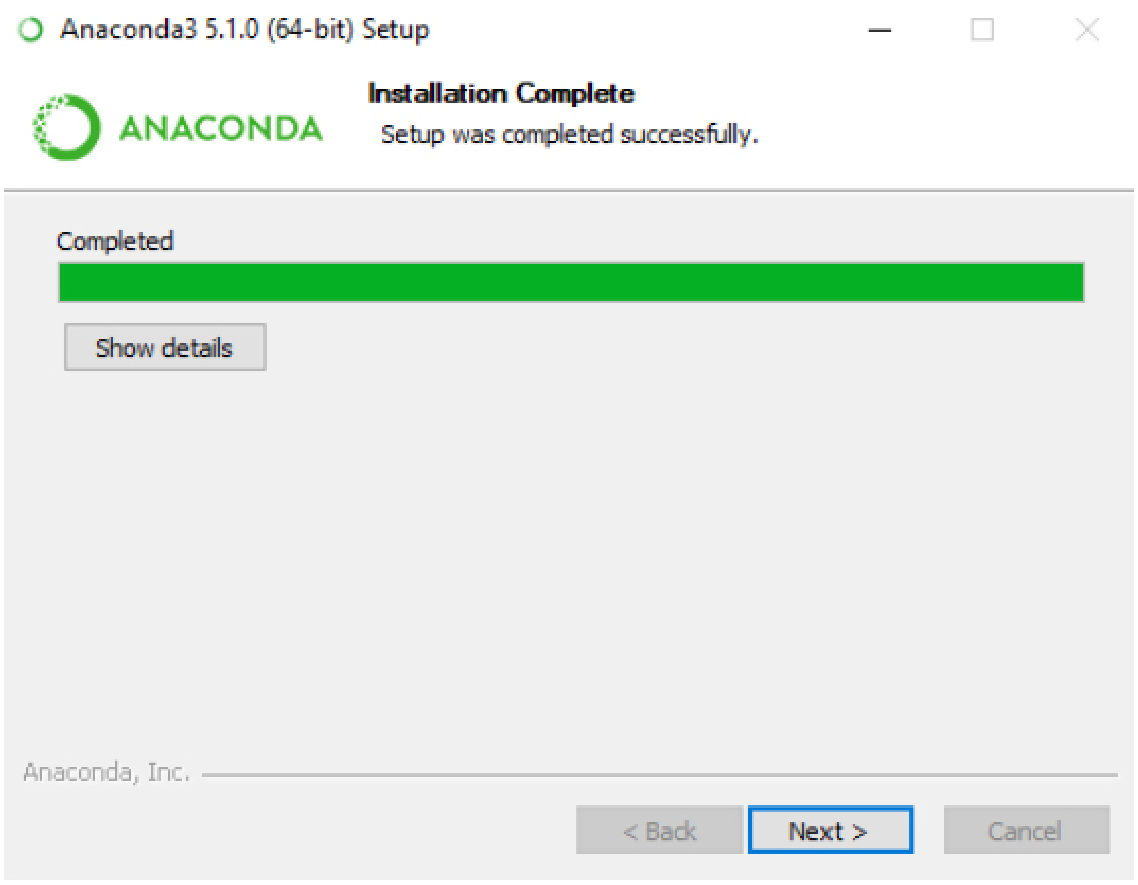
  Not recommended. Instead, open Anaconda with the Windows Start menu and select "Anaconda (64-bit)". This "add to PATH" option makes Anaconda get found before previously installed software, but may cause problems requiring you to uninstall and reinstall Anaconda.

- [✓] Register Anaconda as my default Python 3.6

  This will allow other programs, such as Python Tools for Visual Studio PyCharm, Wing IDE, PyDev, and MSI binary packages, to automatically detect Anaconda as the primary Python 3.6 on the system.

Anaconda, Inc.

8. Click *Next* once the installation is complete.

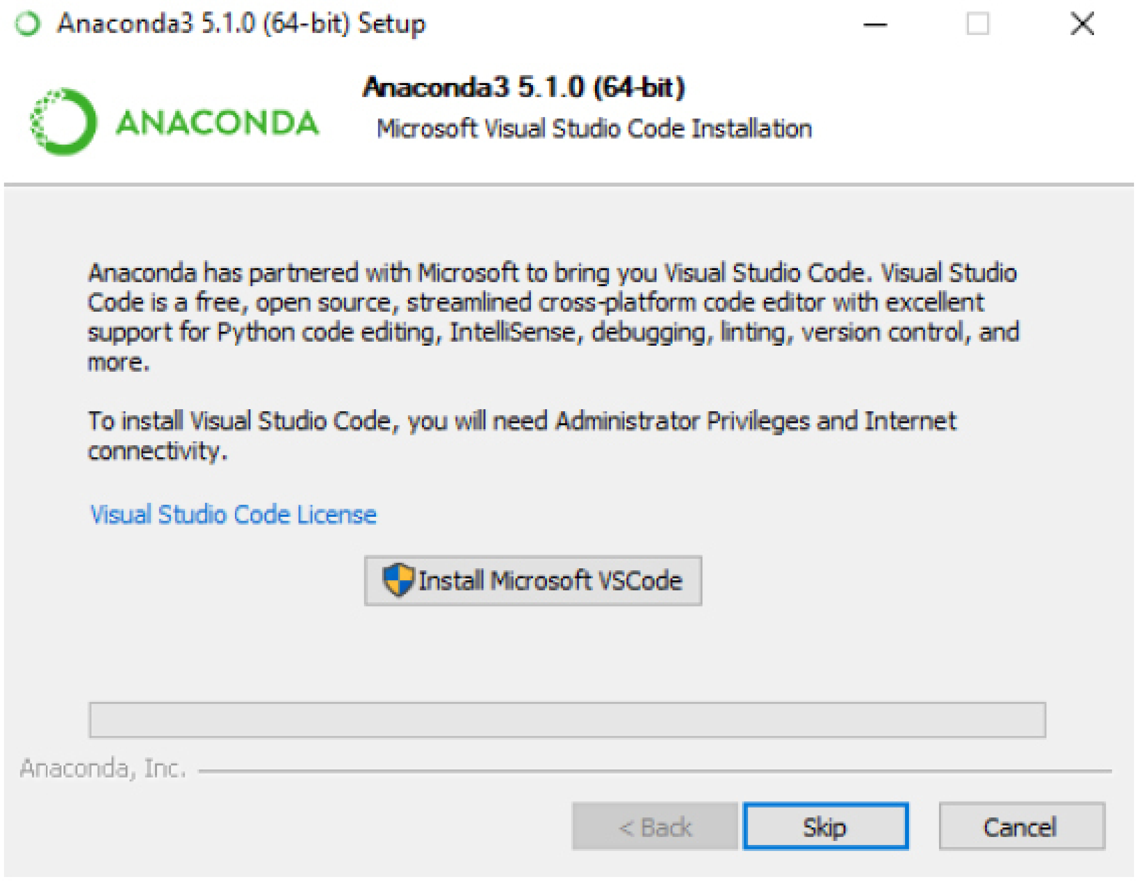

Anaconda3 5.1.0 (64-bit) Setup

**Installation Complete**

Setup was completed successfully.

Completed

9. Click Skip on the *Microsoft Visual Studio Code Installation* dialog box.


Anaconda3 5.1.0 (64-bit) Setup

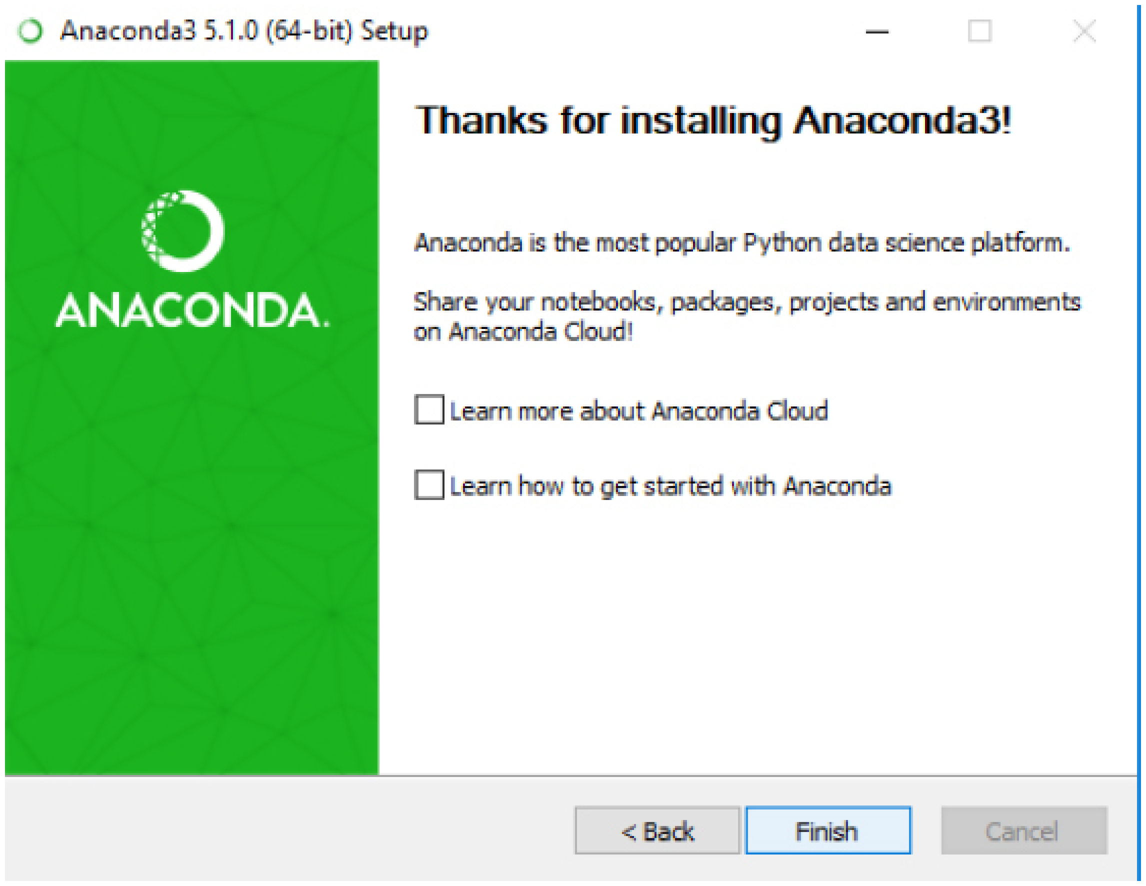
**Anaconda3 5.1.0 (64-bit)**
Microsoft Visual Studio Code Installation

Anaconda has partnered with Microsoft to bring you Visual Studio Code. Visual Studio Code is a free, open source, streamlined cross-platform code editor with excellent support for Python code editing, IntelliSense, debugging, linting, version control, and more.

To install Visual Studio Code, you will need Administrator Privileges and Internet connectivity.

Visual Studio Code License

10. You have successfully installed Anaconda on your Windows. Excellent job. next step is to uncheck both checkboxes on the dialog box. Now, click on th button.


Anaconda3 5.1.0 (64-bit) Setup

Thanks for installing Anaconda3!

Anaconda is the most popular Python data science platform.

Share your notebooks, packages, projects and environments on Anaconda Cloud!

☐ Learn more about Anaconda Cloud

☐ Learn how to get started with Anaconda

## 1.2.2. Mac Setup

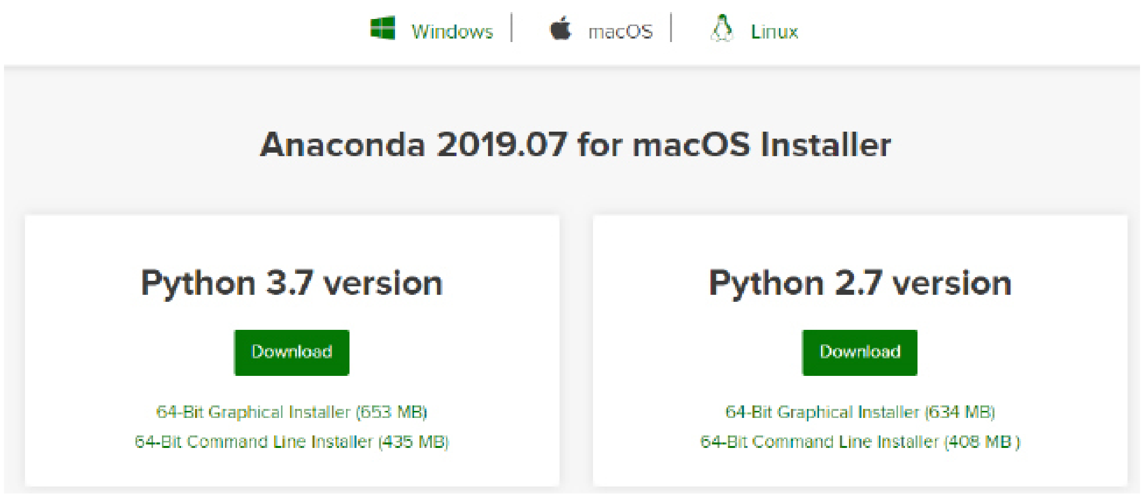
Anaconda's installation process is almost the same for Mac. It may differ graphically, but you will follow the same steps you followed for Windows. The only difference is that you have to download the executable file, which is compatible with the Mac operating system.

This section explains how you can download and install Anaconda on Mac.

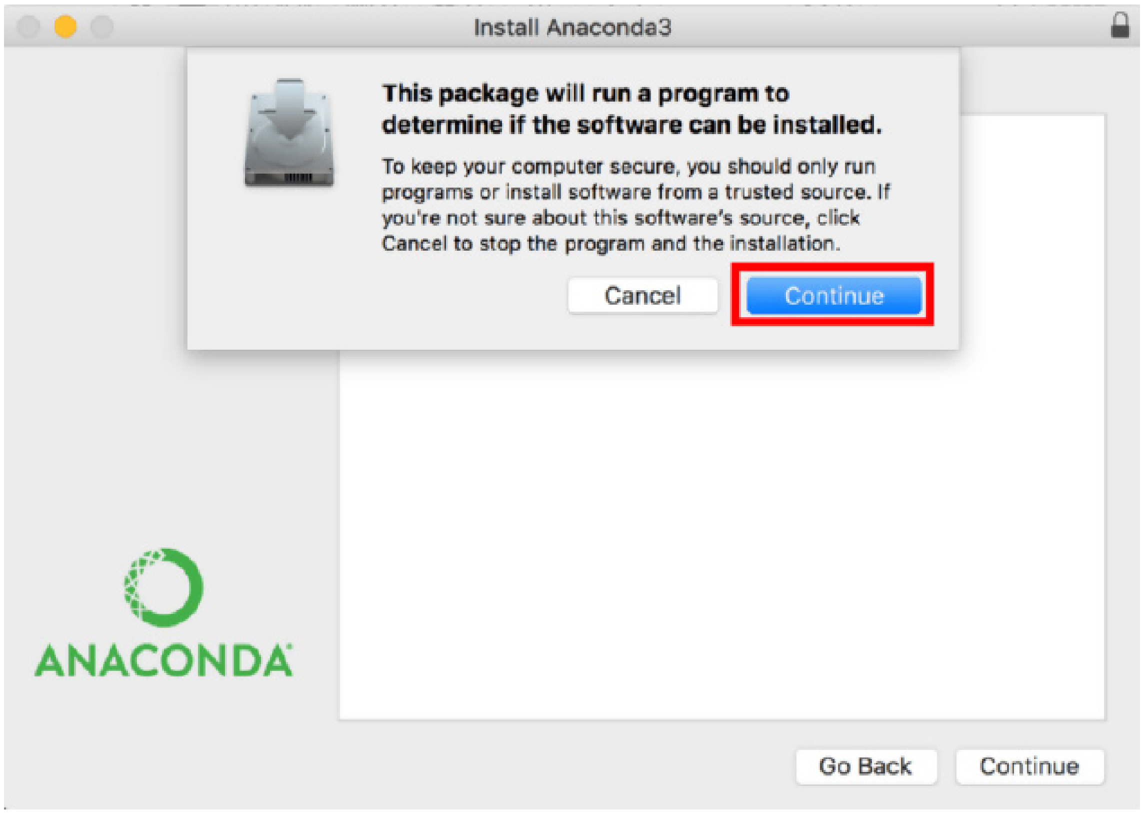
Download and install Anaconda by following these steps.

1. Open the following URL in your browser. ***https://www.anaconda.com/distribution/***

2. The browser will take you to the following webpage. Select the latest versio Python for Mac. (3.7 at the time of writing this book). Now, click the *Downl* button to download the executable file. Depending on the internet speed, the will download within 2–3 minutes.


Windows
macOS
Linux
Anaconda 2019.07 for macOS Installer
Python 3.7 version
Download
64-Bit Graphical Installer (653 MB)
64-Bit Command Line Installer (435 MB)
Python 2.7 version
Download
64-Bit Graphical Installer (634 MB)
64-Bit Command Line Installer (408 MB )

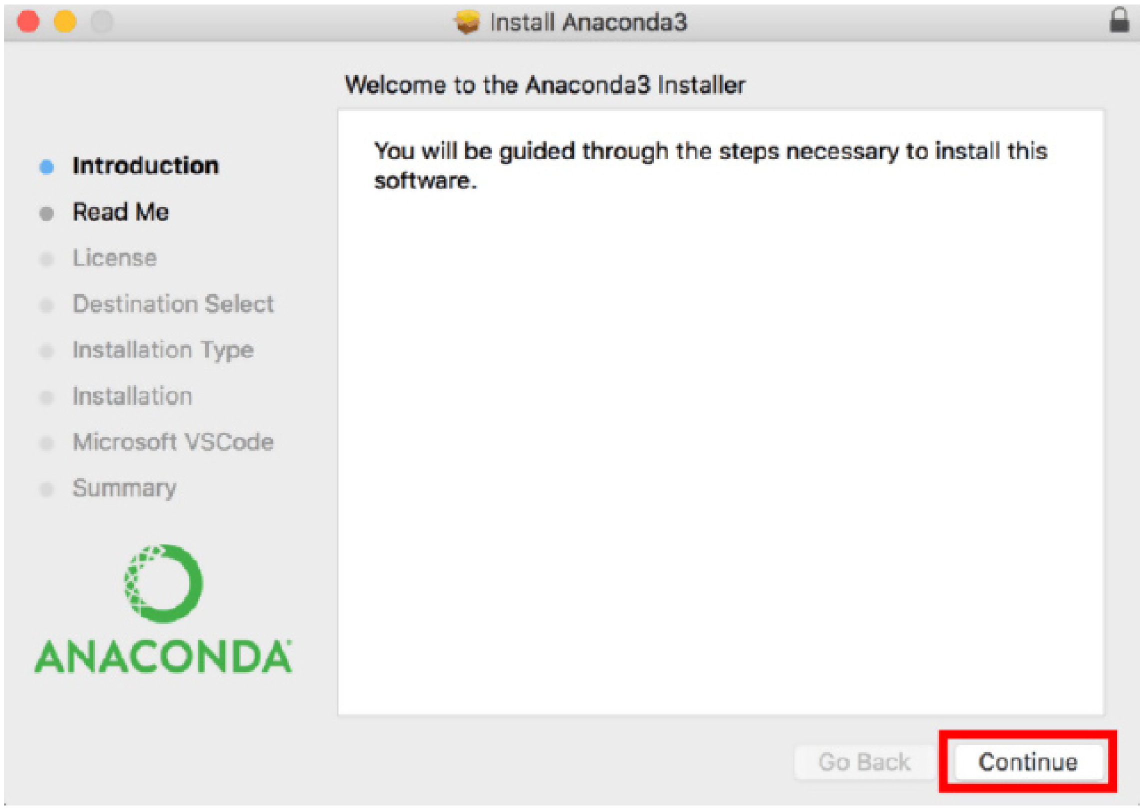
3. Run the executable file after the download is complete. You will most likely the download file in your download folder. The name of the file should be si to "Anaconda3-5.1.0-Windows-x86_64." The installation wizard will open you run the file, as shown in the following figure. Click the *Continue* button



**This package will run a program to determine if the software can be installed.**

To keep your computer secure, you should only run programs or install software from a trusted source. If you're not sure about this software's source, click Cancel to stop the program and the installation.

4. Now click *Continue* on the *Welcome to Anaconda 3 Installer* window, as sh the following screenshot.

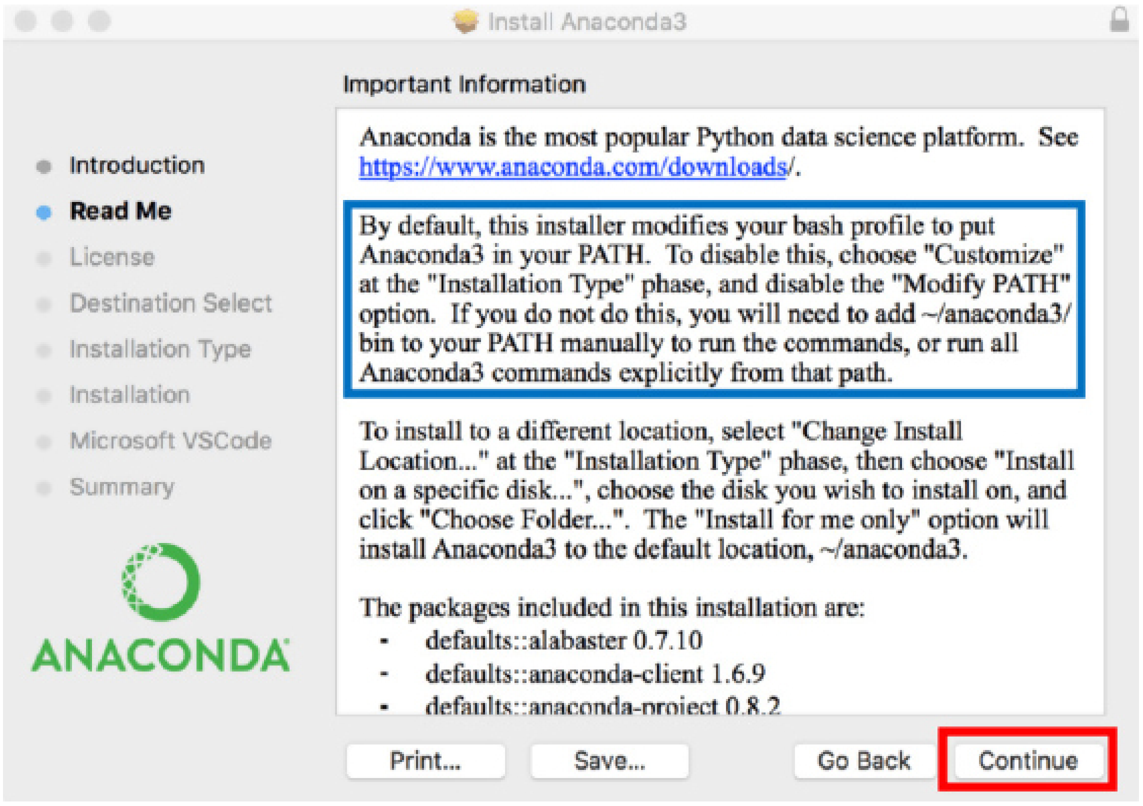


Install Anaconda3

Welcome to the Anaconda3 Installer

You will be guided through the steps necessary to install this software.

5. The *Important Information* dialog will pop up. Simply, click *Continue* to go the default version that is Anaconda 3.


Install Anaconda3

Important Information

Anaconda is the most popular Python data science platform. See https://www.anaconda.com/downloads/.

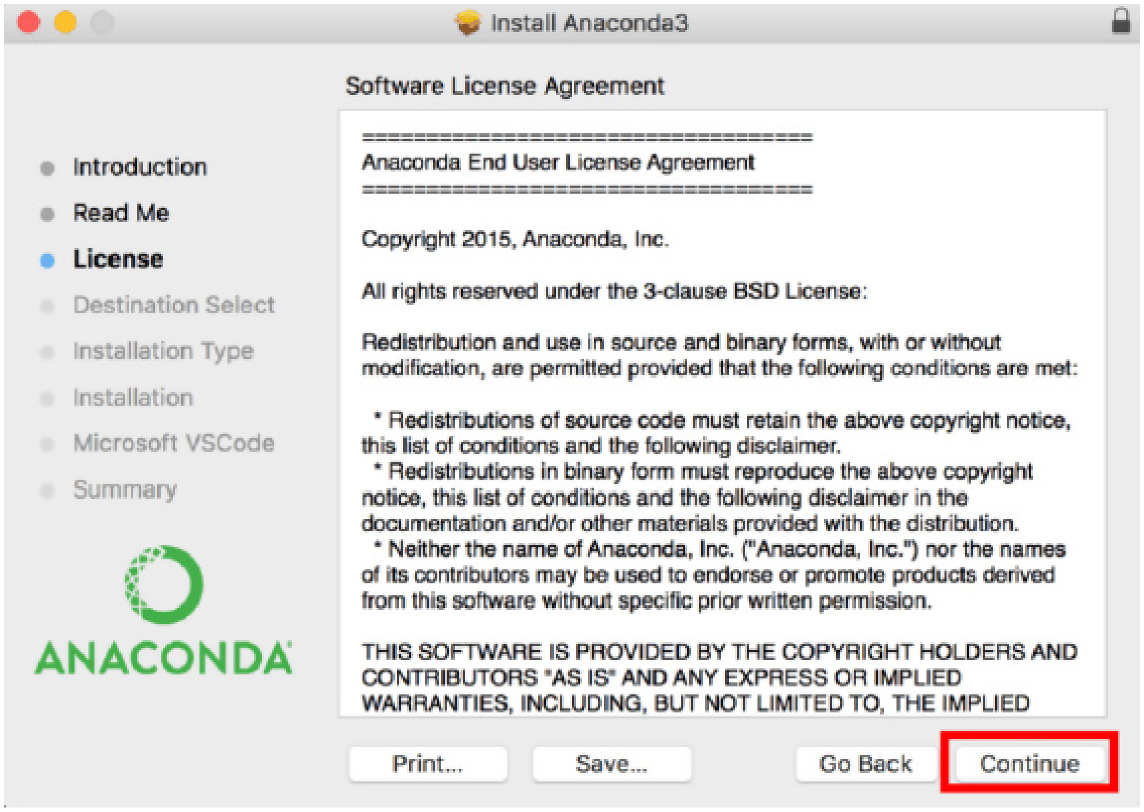
By default, this installer modifies your bash profile to put Anaconda3 in your PATH. To disable this, choose "Customize" at the "Installation Type" phase, and disable the "Modify PATH" option. If you do not do this, you will need to add ~/anaconda3/bin to your PATH manually to run the commands, or run all Anaconda3 commands explicitly from that path.

To install to a different location, select "Change Install Location..." at the "Installation Type" phase, then choose "Install on a specific disk...", choose the disk you wish to install on, and click "Choose Folder...". The "Install for me only" option will install Anaconda3 to the default location, ~/anaconda3.

The packages included in this installation are:

- defaults::alabaster 0.7.10
- defaults::anaconda-client 1.6.9
- defaults::anaconda-project 0.8.2

6. Click *Continue* on the *Software License Agreement* Dialog.


Install Anaconda3

Software License Agreement

```
===================================
Anaconda End User License Agreement
===================================
```

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All rights reserved under the 3-clause BSD License:

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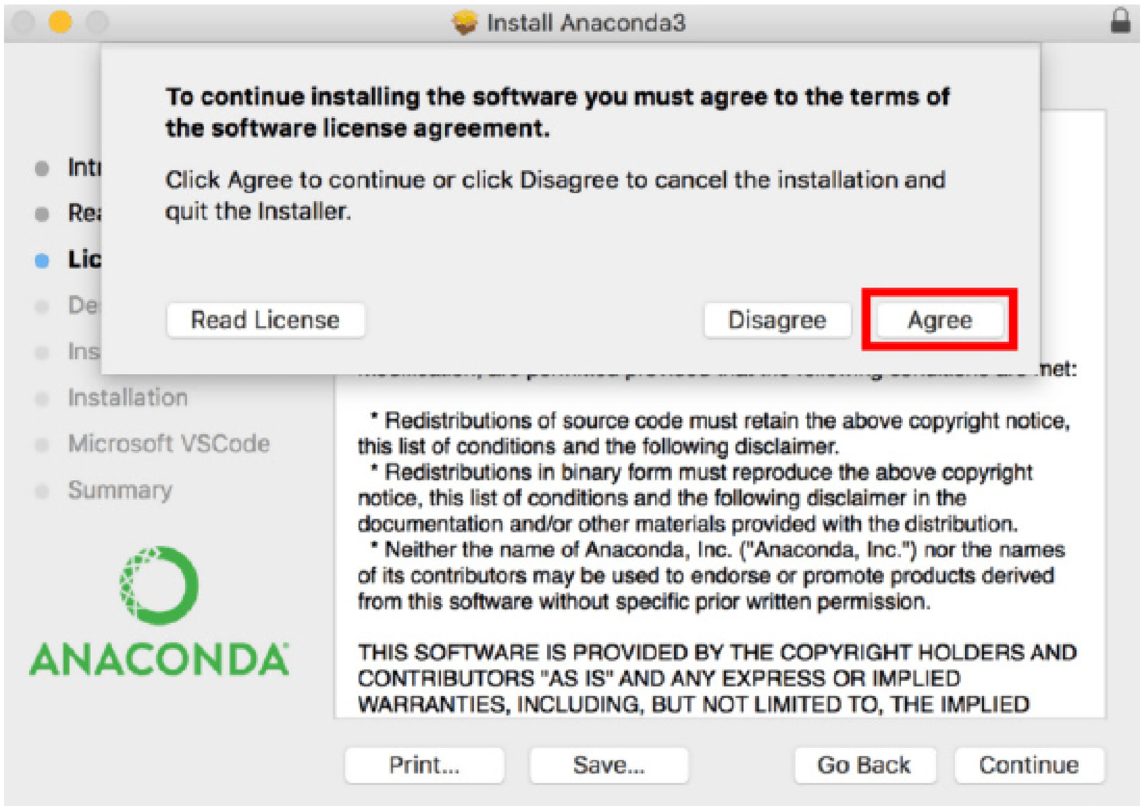
7. It is mandatory to read the license agreement and click the *Agree* button bef
can click the *Continue* button again.


Install Anaconda3

**To continue installing the software you must agree to the terms of the software license agreement.**

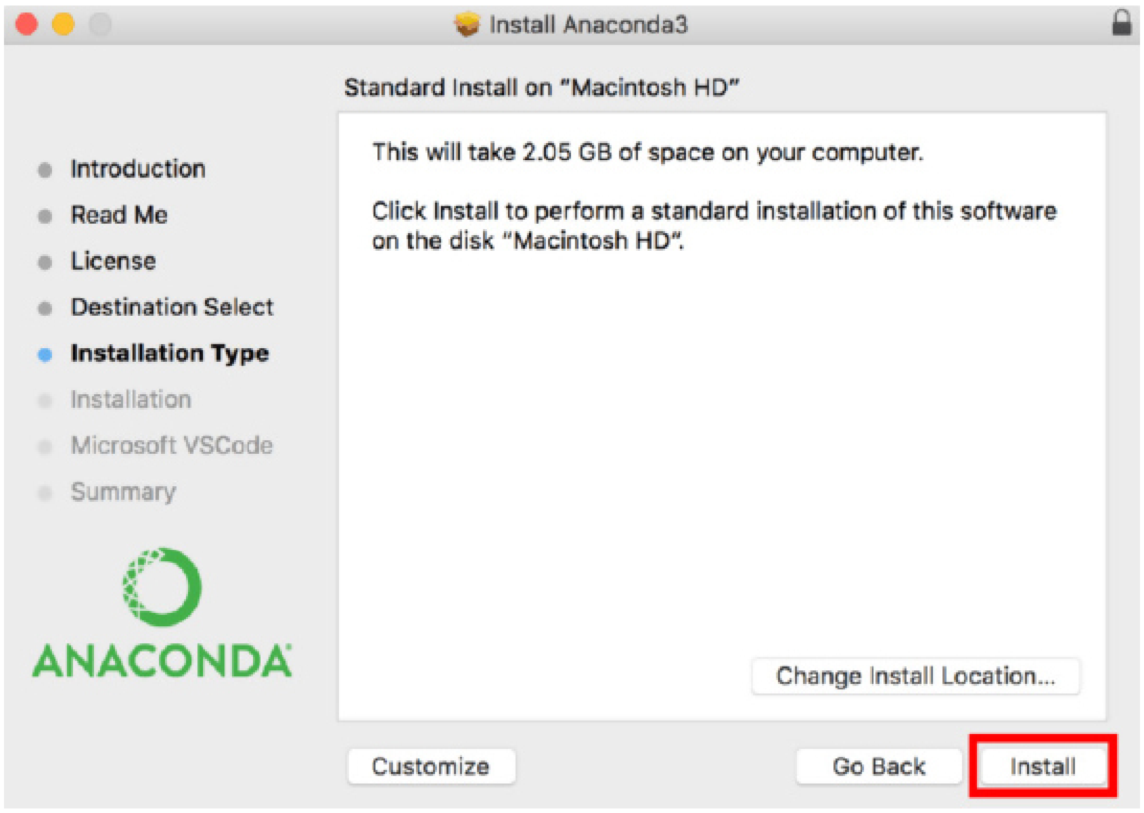
Click Agree to continue or click Disagree to cancel the installation and quit the Installer.

net:

* Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
* Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
* Neither the name of Anaconda, Inc. ("Anaconda, Inc.") nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED

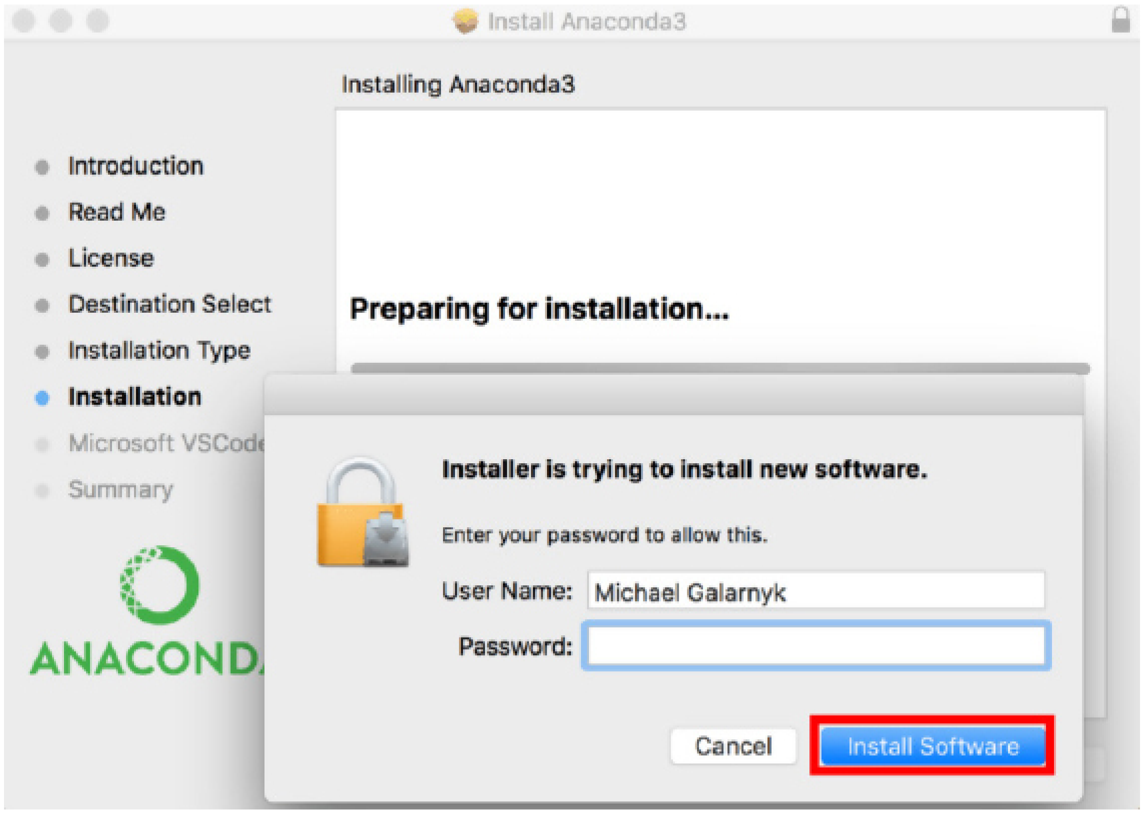
8. On the next window, simply click *Install* .


Standard Install on "Macintosh HD"

This will take 2.05 GB of space on your computer.

Click Install to perform a standard installation of this software on the disk "Macintosh HD".

The system alerts you to give your password. Use the same password you use to login to your Mac computer. Now, click on *Install Software* .



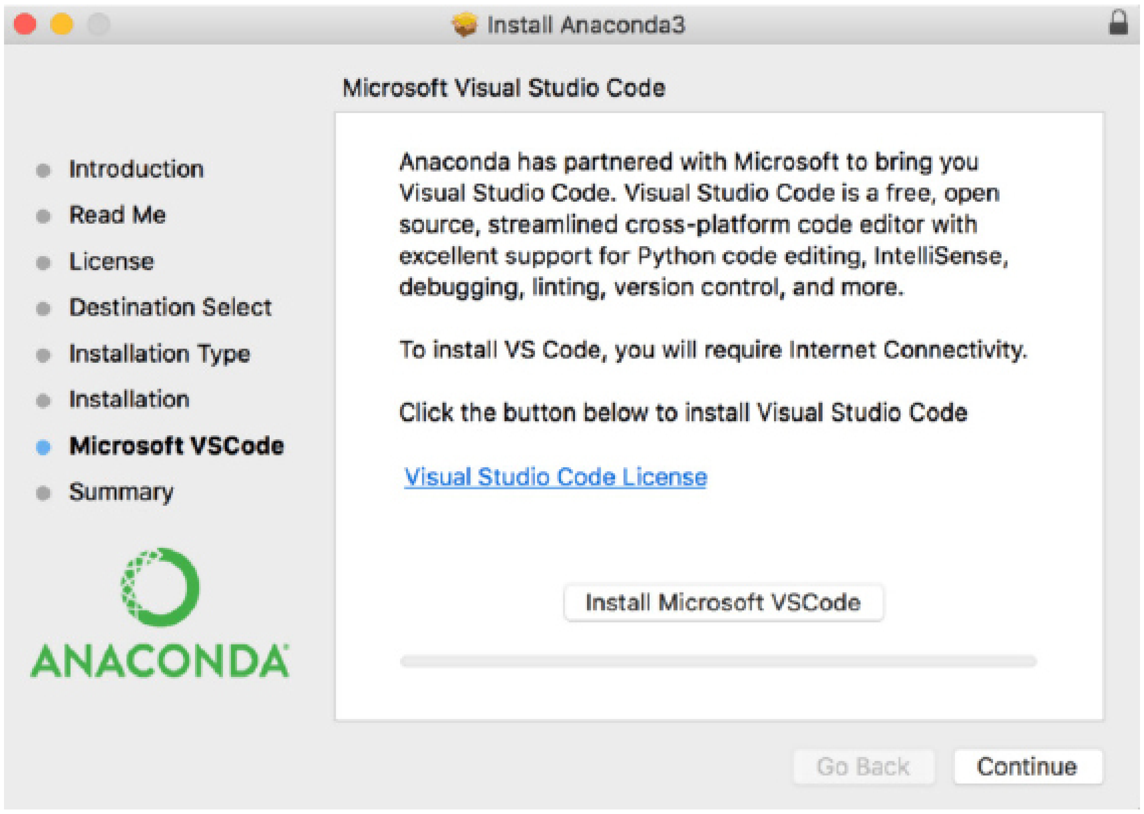
Installer is trying to install new software.

Enter your password to allow this.

User Name: Michael Galarnyk

Password:

9. Click *Continue* on the next window. You also have the option to install Micr
   VSCode at this point.



Microsoft Visual Studio Code

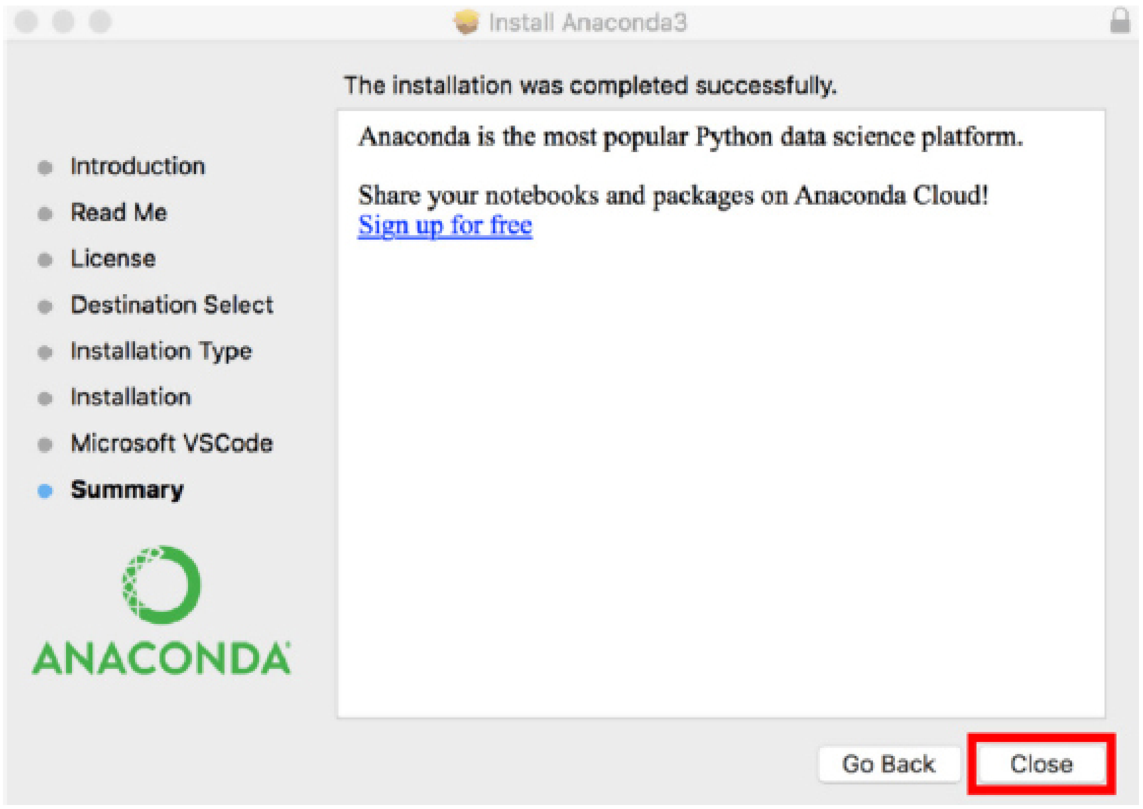
Anaconda has partnered with Microsoft to bring you Visual Studio Code. Visual Studio Code is a free, open source, streamlined cross-platform code editor with excellent support for Python code editing, IntelliSense, debugging, linting, version control, and more.

To install VS Code, you will require Internet Connectivity.

Click the button below to install Visual Studio Code

Visual Studio Code License

The next screen will display the message that the installation has completed successfully. Click *Close* to close the installer.



The installation was completed successfully.

Anaconda is the most popular Python data science platform.

Share your notebooks and packages on Anaconda Cloud!
Sign up for free

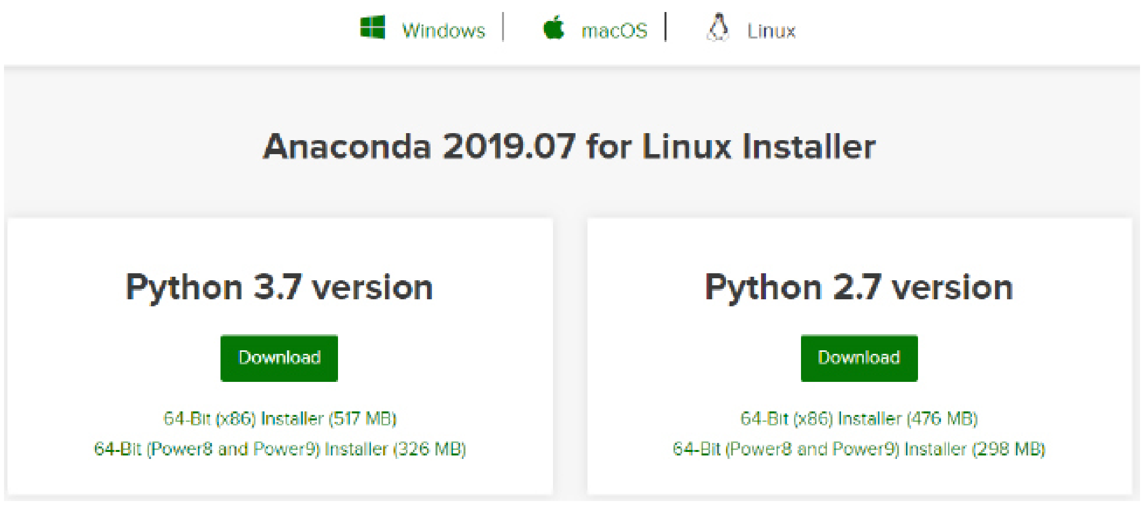
There you have it. You have successfully installed Anaconda on your Mac computer. Now, you can write Python code in Jupyter and Spyder the same way you wrote it in Windows.

## 1.2.3. Linux Setup

We have used Python's graphical installers for installation on Windows and Mac. However, we will use the command line to install Python on Ubuntu or Linux. Linux is also more resource-friendly, and the installation of software is particularly easy, as well.

Follow these steps to install Anaconda on Linux (Ubuntu distribution).

1. Go to the following link to copy the installer bash script from the latest avai
   version.
   https://www.anaconda.com/distribution/


Windows
macOS
Linux
Anaconda 2019.07 for Linux Installer
Python 3.7 version
Download
64-Bit (x86) Installer (517 MB)
64-Bit (Power8 and Power9) Installer (326 MB)
Python 2.7 version
Download
64-Bit (x86) Installer (476 MB)
64-Bit (Power8 and Power9) Installer (298 MB)

2. The second step is to download the installer bash script. Log into your Linu computer and open your terminal. Now, go to /temp directory and download bash you downloaded from Anaconda's home page using curl.

```
$ cd / tmp

$ curl –o https://repo.anaconda.com.archive/Anaconda3-5.2.0-Linux-x86_64.sh
```

3. You should also use the cryptographic hash verification through SHA-256 checksum to verify the integrity of the installer.

```
$ sha256sum Anaconda3-5.2.0-Linux-x86_64.sh
```

You will get the following output.

```
09f53738b0cd3bb96f5b1bac488e5528df9906be2480fe61df40e0e0d19e3d48 Anaconda3-5.2.0-Linux-
x86_64.sh
```

4. The fourth step is to run the Anaconda Script, as shown in the following fig

```
$ bash Anaconda3-5.2.0-Linux-x86_64.sh
```

The command line will produce the following output. You will be asked to review the license agreement. Keep on pressing *Enter* until you reach the end.

```
Output

Welcome to Anaconda3 5.2.0

In order to continue the installation process, please review the license agreement.
```

```
Please, press Enter to continue
>>>
…
Do you approve the license terms? [yes|No]
```

Type Yes when you get to the bottom of the License Agreement.

5. The installer will alert you to choose the installation location after you agree license agreement. Simply press *Enter* to choose the default location. You ca specify a different location if you want.

```
Output
Anaconda3 will now be installed on this location:
/home/tola/anaconda3

- Press ENTER to confirm the location
- Press CTRL-C to abort the installation
- Or specify a different location below

[/home/tola/anaconda3] >>>
```

The installation will proceed once you press *Enter* . Once again, you have to be patient as the installation process takes some time to complete.

6. You will receive the following result when the installation is complete. If yo to use conda command, type *Yes* .

```
Output
…
Installation finished.
Do you wish the installer to prepend Anaconda3 install location to path in your /home/tola/.bashrc?
[yes|no] [no]>>>
```

At this point, you will also have the option to download the Visual Studio Code. Type *yes* or *no* to install or decline, respectively.

7. Use the following command to activate your brand-new installation of Anac

```
$ source `/.bashrc
```

8. You can also test the installation using the conda command.

```
$ conda list
```

Congratulations. You have successfully installed Anaconda on your Linux system.

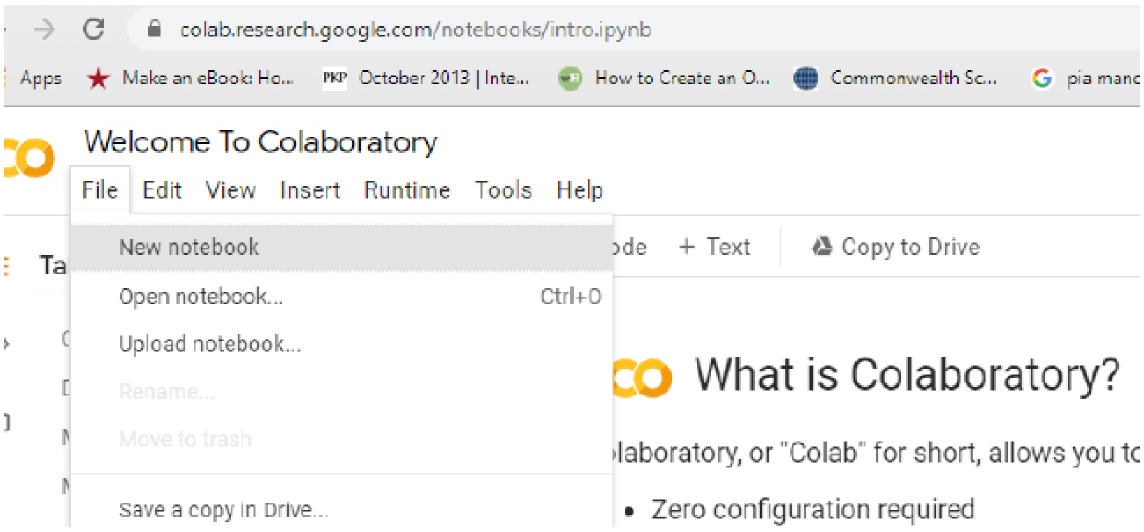
## 1.2.4. Using Google Colab Cloud Environment

In addition to local Python environments such as Anaconda, you can run deep learning applications on Google Colab as well, which is Google's platform for deep learning with GPU support. All the codes in this book have been run using Google Colab. Therefore, I would suggest that you use Google Colab too.

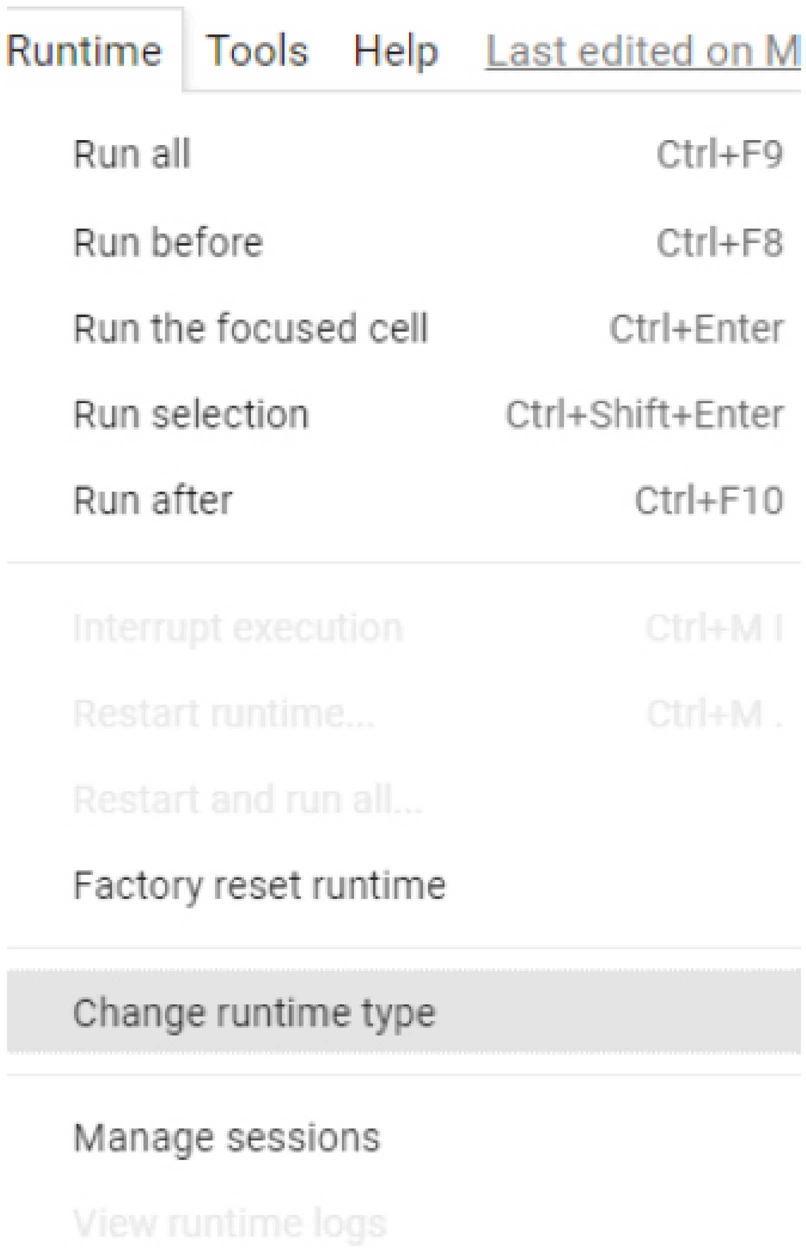
To run deep learning applications via Google Colab, all you need is a Google/Gmail account. Once you have a Google/ Gmail account, you can simply go to:

https://colab.research.google.com/

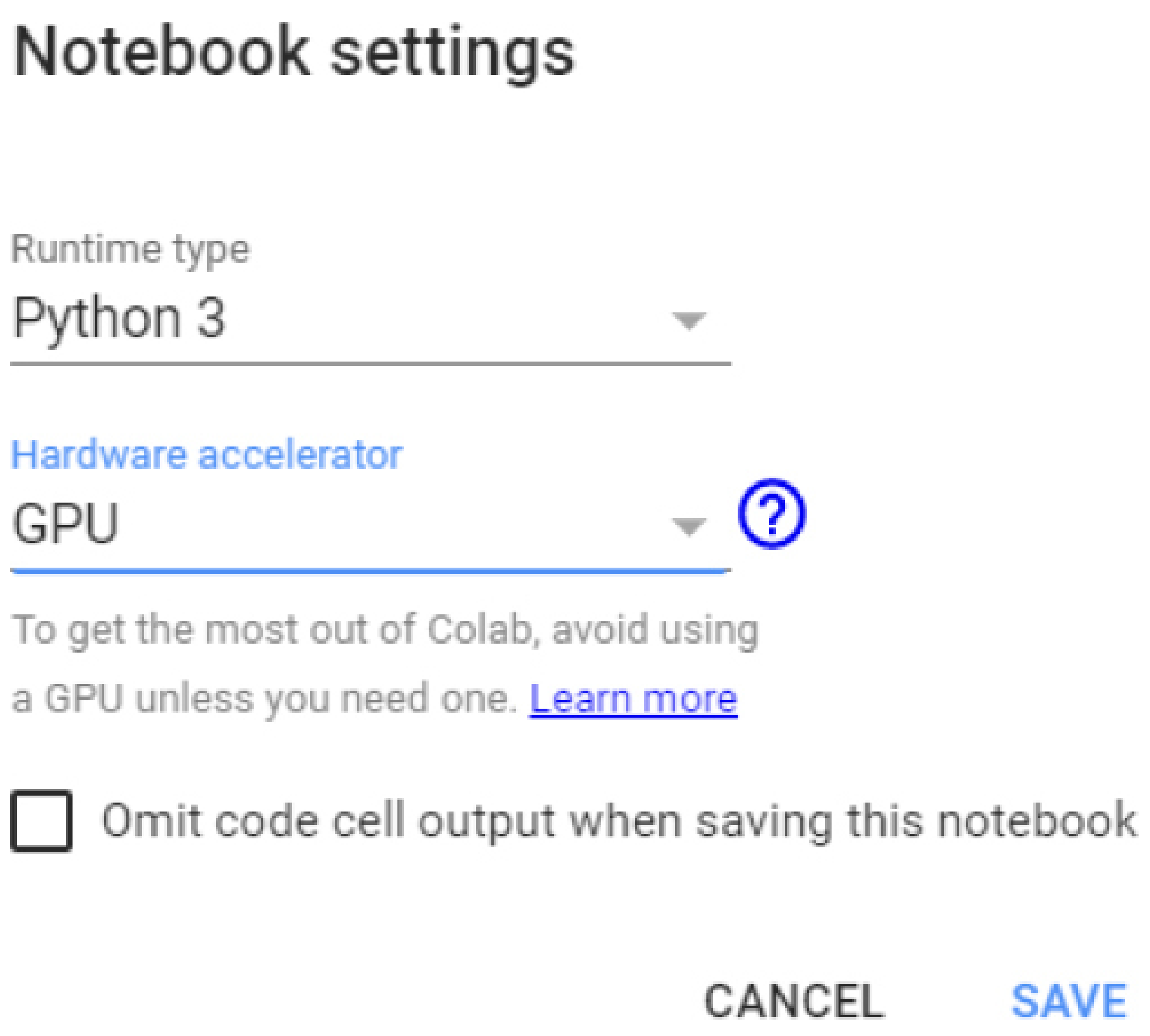
Next, click on File -> New notebook, as shown in the following screenshot.



Next, to run your code using GPU, from the top menu, select Runtime -> Change runtime type as shown in the following screenshot:



You should see the following window. Here from the dropdown list, select GPU, and click the *Save* button.



Notebook settings

Runtime type
Python 3

Hardware accelerator
GPU

To get the most out of Colab, avoid using a GPU unless you need one. Learn more

☐ Omit code cell output when saving this notebook

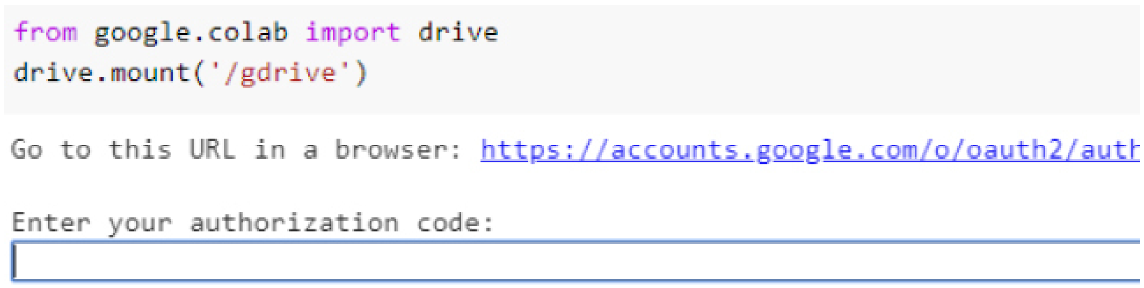
To make sure you are running the latest version of TensorFlow, execute the following script in the Google Colab notebook cell. The following script will update your TensorFlow version.

```
pip install --upgrade tensorflow
```

To check if you are really running TensorFlow version > 2.0, execute the following script.

```
import tensorflow as tf
print (tf.__version__)
```

With Google Cloud, you can import the datasets from your Google drive. Execute the following script, and click on the link that appears as shown below:

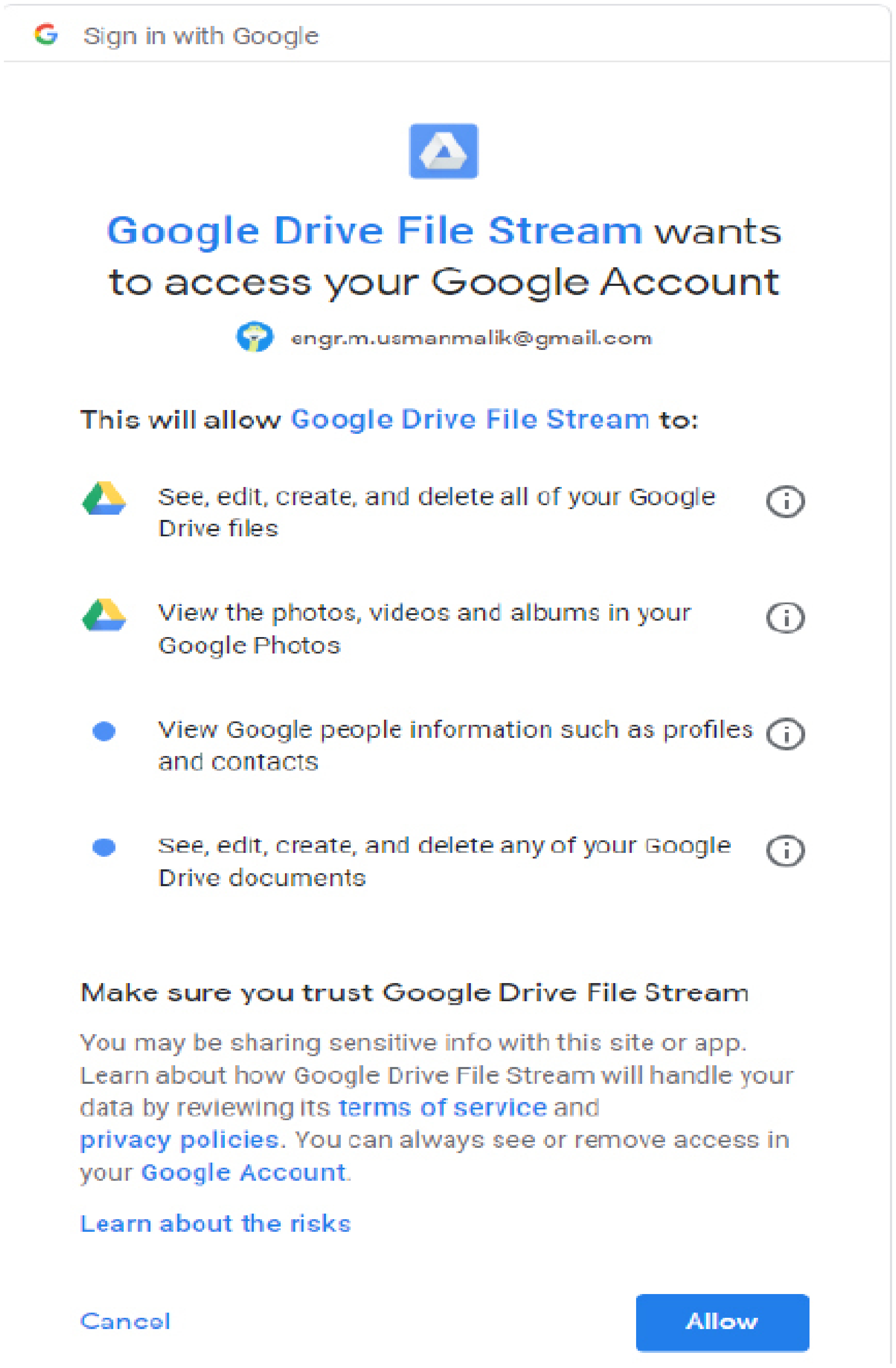


```
from google.colab import drive
drive.mount('/gdrive')
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth

Enter your authorization code:
```

You will be prompted to allow Google Colab to access your Google drive. Click *Allow* button as shown below:



Sign in with Google

Google Drive File Stream wants to access your Google Account

engr.m.usmanmalik@gmail.com

This will allow Google Drive File Stream to:

See, edit, create, and delete all of your Google Drive files

View the photos, videos and albums in your Google Photos

View Google people information such as profiles and contacts

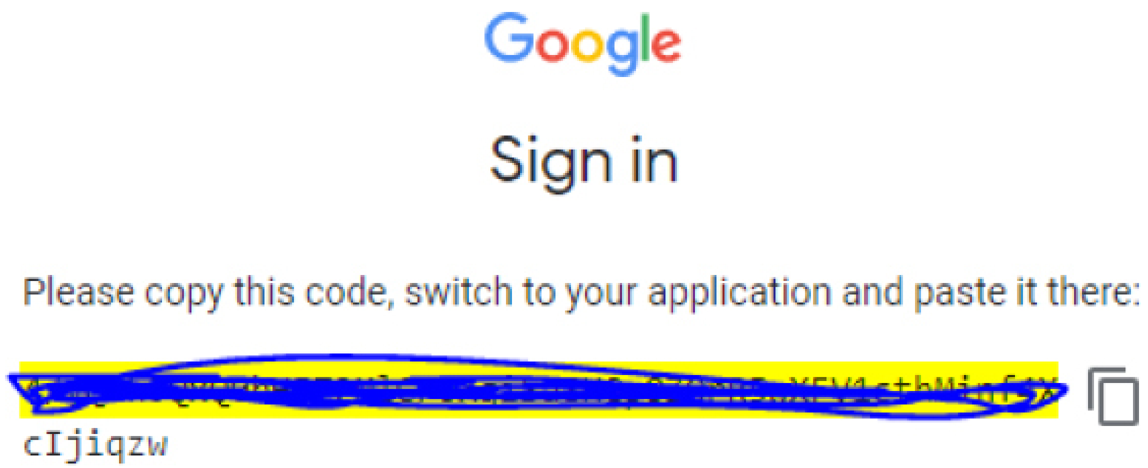
See, edit, create, and delete any of your Google Drive documents

Make sure you trust Google Drive File Stream

You may be sharing sensitive info with this site or app. Learn about how Google Drive File Stream will handle your data by reviewing its terms of service and privacy policies. You can always see or remove access in your Google Account.

Learn about the risks

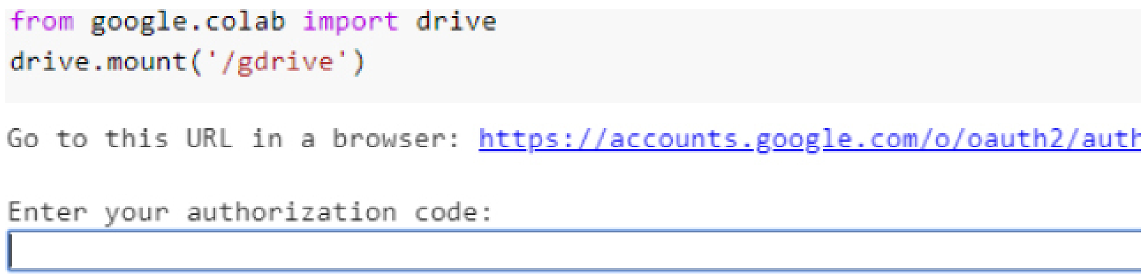
You will see a link appear, as shown in the following image (the link has been blinded here).


Sign in

Please copy this code, switch to your application and paste it there:

[redacted]
cIjiqzw

Copy this link. Paste it in the field in the Google Colab cell, as shown below:


```
from google.colab import drive
drive.mount('/gdrive')

Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth

Enter your authorization code:
```

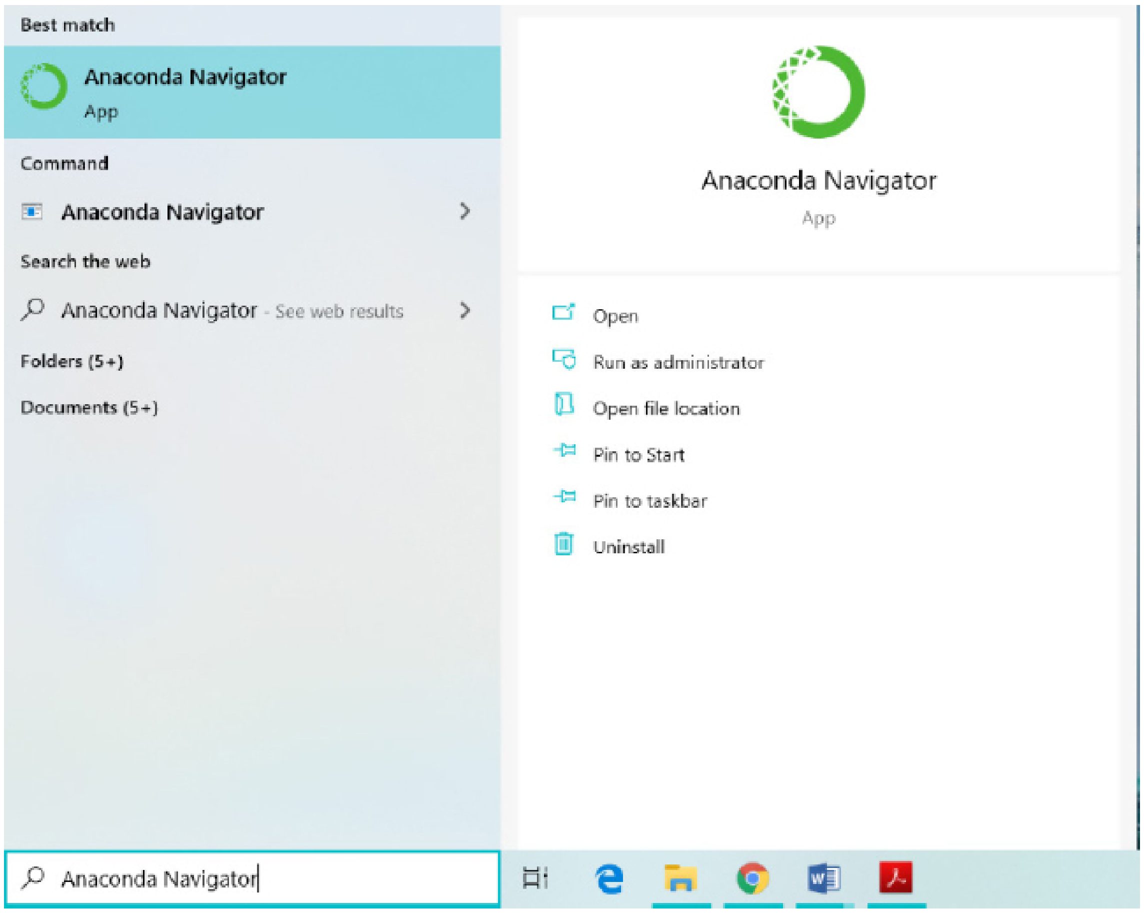
## 1.3. Python Crash Course

If you are familiar with the foundational concepts of the Python programming language, you can skip this section. For those who are absolute beginners to Python, this section provides a very brief overview of some of the most basic concepts of Python. Python is a very vast programming language, and this section is by no means a substitute for a complete Python Book. However, if you want to see how various operations and commands are executed in Python, you are welcome to follow along the rest of this section.

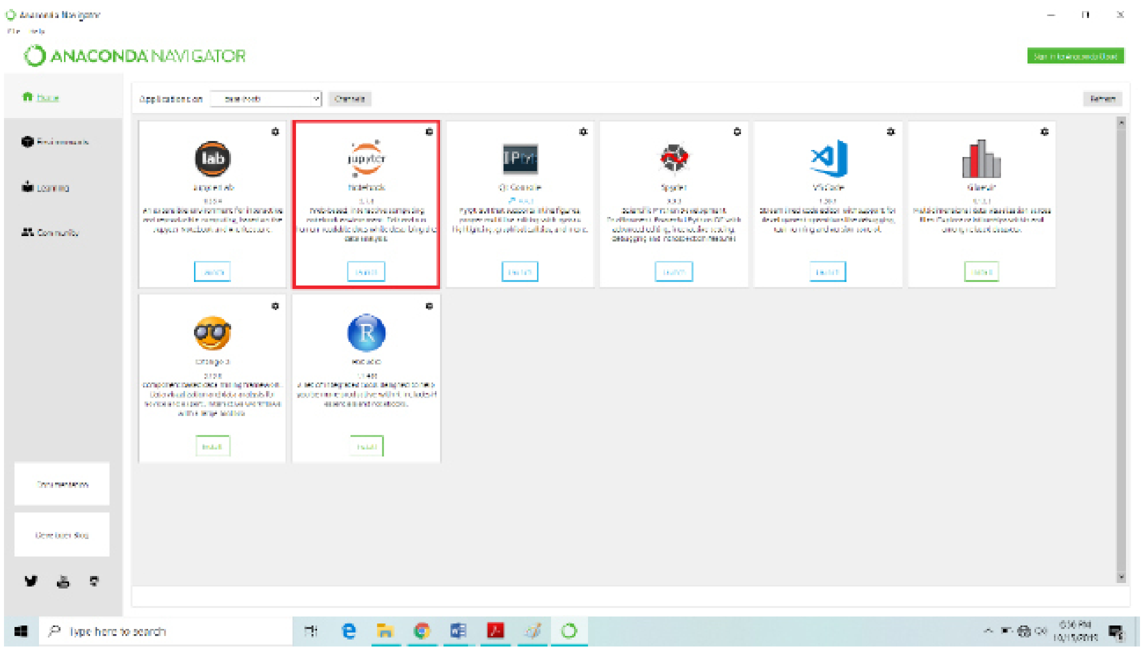
### 1.3.1. Writing Your First Program

The installation of Python on your computer is complete. You have established a unique environment in the form of Anaconda. Now, it is time to write your first program, that is the Hello World!

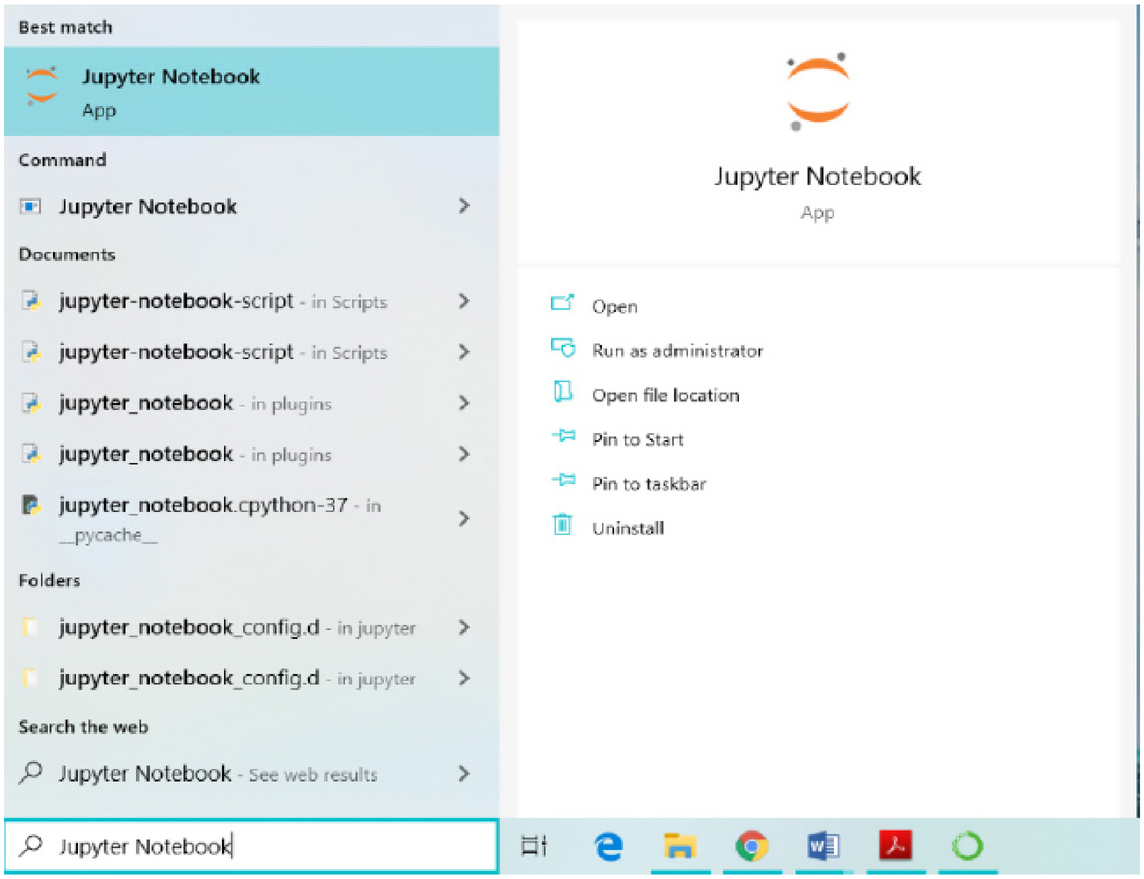
In order to write a program in Anaconda, you have to launch Anaconda Navigator. Search *Anaconda Navigator* in your Windows Search Box. Now, click on the Anaconda Navigator application icon, as shown in the following figure.



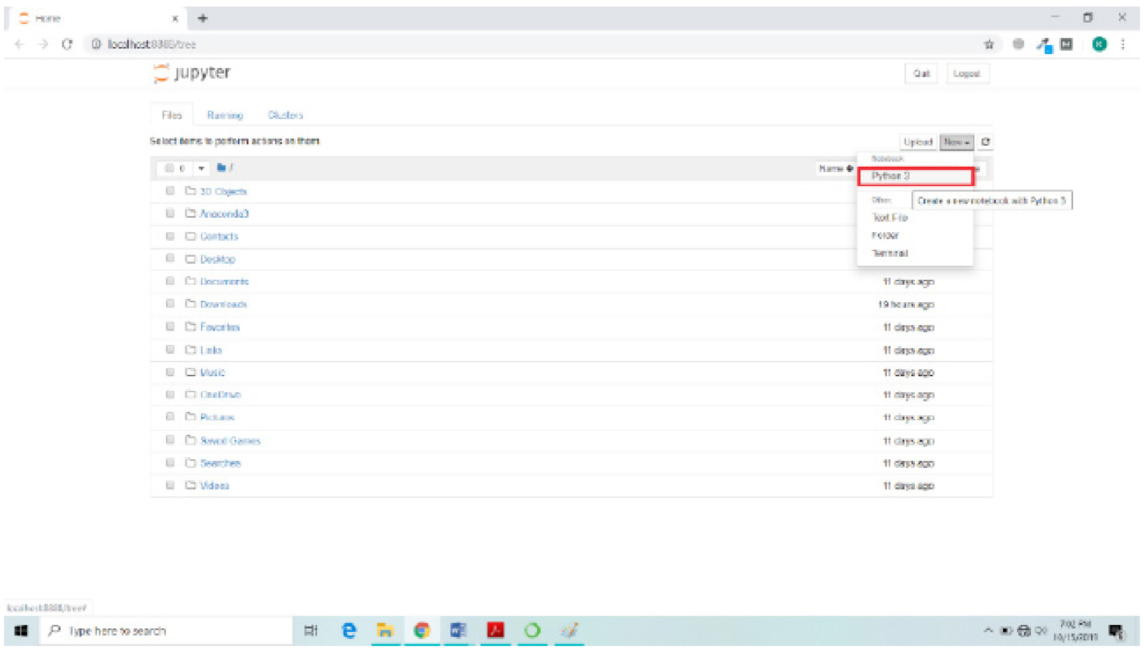
Once you click on the application, the Anaconda's Dashboard will open. The Dashboard offers you a myriad of tools to write your code. We will use the *Jupyter Notebook* , the most popular of these tools, to write and explain the code throughout this book.



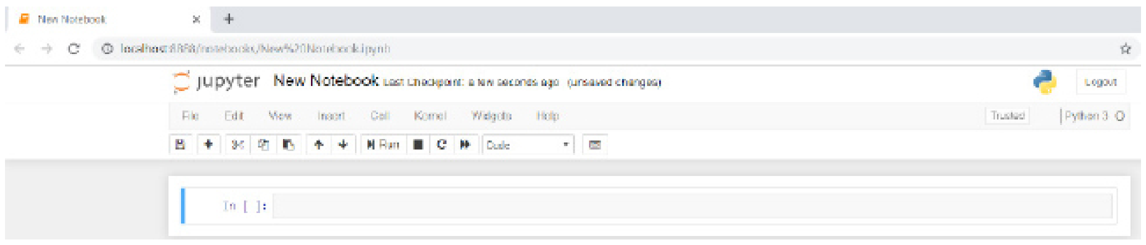
The Jupyter Notebook is available at second from the top of the Dashboard. You can use Jupyter Notebook even if you don't have access to the internet as it runs right in your default browser. Another method to open Jupyter Notebook is to type *Jupyter Notebook* in the Windows search bar. Subsequently, click on the Jupyter Notebook application. The application will open in the new tab of your browser.


Best match
Jupyter Notebook
App
Command
Jupyter Notebook
Documents
jupyter-notebook-script - in Scripts
jupyter-notebook-script - in Scripts
jupyter_notebook - in plugins
jupyter_notebook - in plugins
jupyter_notebook.cpython-37 - in __pycache__
Folders
jupyter_notebook_config.d - in jupyter
jupyter_notebook_config.d - in jupyter
Search the web
Jupyter Notebook - See web results
Jupyter Notebook
Jupyter Notebook
App
Open
Run as administrator
Open file location
Pin to Start
Pin to taskbar
Uninstall

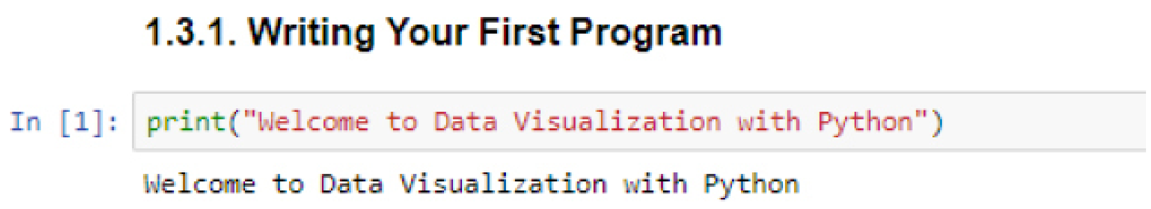
The top right corner of Jupyter Notebook's own Dashboard houses a *New* button, which you have to click to open a new document. A dropdown containing several options will appear. Click on *Python 3* .



A new Python notebook will appear for you to write your programs. It looks as follows.


New Notebook
localhost:8888/notebooks/New%20Notebook.ipynb
jupyter New Notebook Last Checkpoint: a few seconds ago (unsaved changes)
Logout
File Edit View Insert Cell Kernel Widgets Help
Trusted
Python 3
Run
Code
In [ ]:

Jupyter Notebook consists of cells, as evident from the above image, making its layout very simple and straightforward. You will write your code inside these cells. Let us write our first ever Python program in Jupyter Notebook.



1.3.1. Writing Your First Program

```
In [1]: print("Welcome to Data Visualization with Python")

        Welcome to Data Visualization with Python
```

The above script basically prints a string value in the output using the **print()** method. The **print()** method is used to print on the console, any string passed to it. If you see the following output, you have successfully run your first Python program.

**Output:**

```
Welcome to Data Visualization with Python
```

Let’s now explore some of the other important Python concepts starting with Variables and Data Types.

**Requirements – Anaconda, Jupyter, and Matplotlib**

- All the scripts in this book have been executed via Jupyter notebook. Therefore, you should have Jupyter notebook installed.
- It goes without saying that we will be using the Matplotlib library.

- The Numpy and Pandas libraries should also be installed before this chapter.

**Hands-on Time – Source Codes**

All IPython notebook for the source code of all the scripts in this chapter can be found in Resources/Chapter 1.ipynb. I would suggest that you write all the code in this chapter yourself and see if you can get the same output as mentioned in this chapter.

### 1.3.2. Python Variables and Data Types

Data types in a programming language refers to the type of data that the language is capable of processing. The following are the major data types supported by Python.

a. Strings

b. Integers

c. Floating Point Numbers

d. Booleans

e. Lists

f. Tuples

g. Dictionaries

A variable is an alias for the memory address where actual data is stored. The data or the values stored at a memory address can be accessed and updated via the variable name. Unlike other programming languages like C++, Java, and C#, Python is loosely typed, which means that you don't have to define the data type while creating a variable. Rather, the type of data is evaluated at runtime.

The following example demonstrates how to create different data types and how to store them in their corresponding variables. The script also prints the type of the variables via the **type()** function.

**Script 2:**

```
# A string Variable
first_name = “Joseph”
```

```
print(type(first_name))

# An Integer Variable
age = 20
print(type(age))

# A floating point variable
weight = 70.35
print(type(weight))

# A floating point variable
married = False
print(type(married))

#List
cars = [“Honda”, “Toyota”, “Suzuki”]
print(type(cars))

#Tuples
days = (“Sunday”, “Monday”, “Tuesday”, “Wednesday”, “Thursday”, “Friday”, “Saturday”)
print(type(days))

#Dictionaries
days2 = {1:”Sunday”, 2:”Monday”, 3:”Tuesday”, 4:”Wednesday”, 5:”Thursday”, 6:”Friday”,
7:”Saturday”}
print(type(days2))
```

**Output:**

```
<class ‘str’>
<class ‘int’>
<class ‘float’>
<class ‘bool’>
<class ‘list’>
<class ‘tuple’>
<class ‘dict’>
```

### 1.3.3. Python Operators

Python programming language contains the following types of operators:

a. Arithmetic Operators

b. Logical Operators

c. Comparison Operators

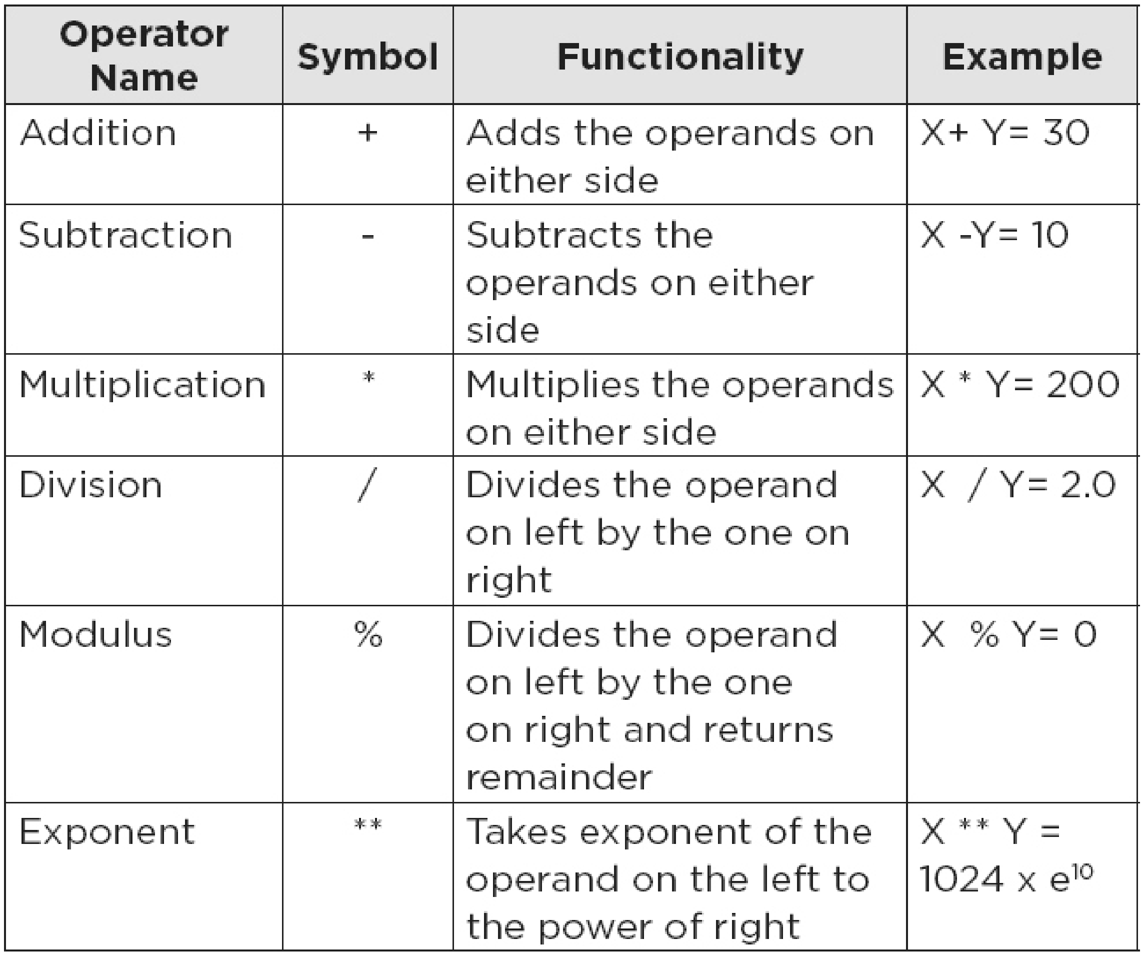
d. Assignment Operators

e. Membership Operators

Let’s briefly review each of these types of operators.

**Arithmetic Operators**

These operators are used to execute arithmetic operations in Python. The following table sums up the arithmetic operators supported by Python. Suppose X = 20 and Y = 10.



| Operator Name | Symbol | Functionality | Example |
|---|---|---|---|
| Addition | + | Adds the operands on either side | X+ Y= 30 |
| Subtraction | - | Subtracts the operands on either side | X -Y= 10 |
| Multiplication | * | Multiplies the operands on either side | X * Y= 200 |
| Division | / | Divides the operand on left by the one on right | X / Y= 2.0 |
| Modulus | % | Divides the operand on left by the one on right and returns remainder | X % Y= 0 |
| Exponent | ** | Takes exponent of the operand on the left to the power of right | X ** Y = 1024 x $e^{10}$ |

Here is an example of arithmetic operators with output:

**Script 3:**

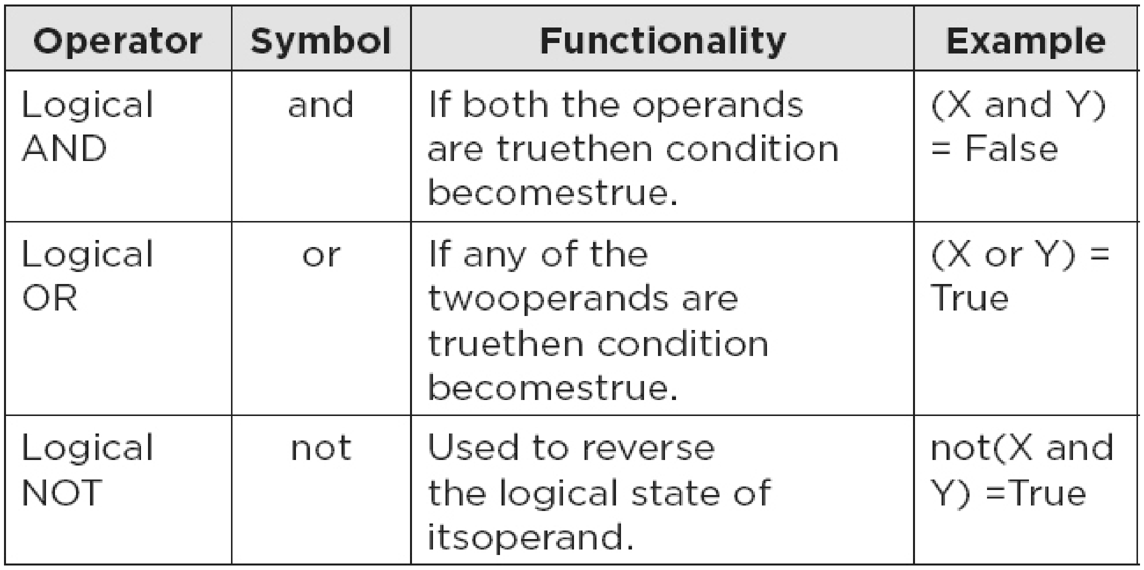
```
X = 20
Y = 10
print(X + Y)
print(X - Y)
print(X * Y)
print(X / Y)
print(X ** Y)
```

**Output:**

```
30
10
200
2.0
10240000000000
```

**Logical Operators**

Logical operators are used to perform logical **AND, OR** , and **NOT** operations in Python. The following table summarizes the logical operators. Here **X** is **True** , and **Y** is **False** .



| Operator | Symbol | Functionality | Example |
|---|---|---|---|
| Logical AND | and | If both the operands are truethen condition becomestrue. | (X and Y) = False |
| Logical OR | or | If any of the twooperands are truethen condition becomestrue. | (X or Y) = True |
| Logical NOT | not | Used to reverse the logical state of itsoperand. | not(X and Y) =True |

Here is an example that explains the usage of Python logical operators.

**Script 4:**

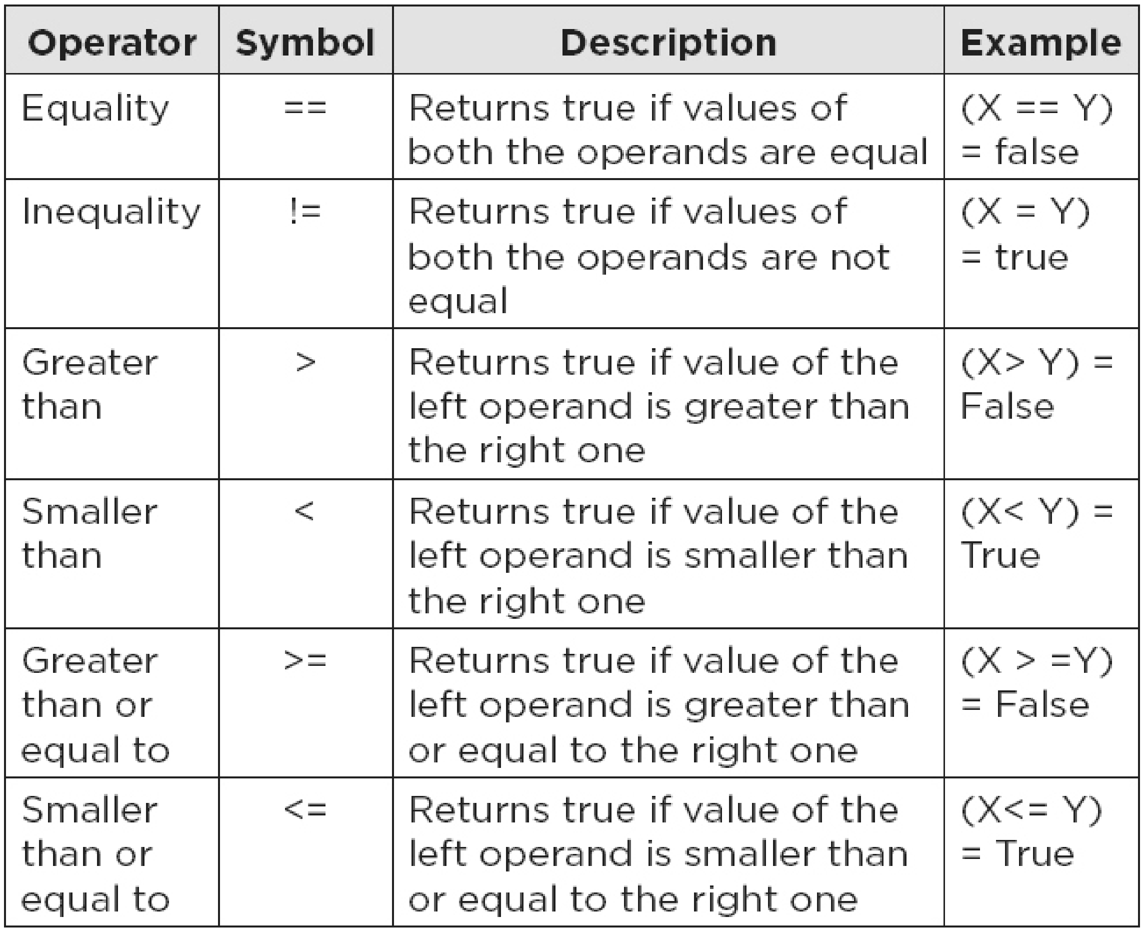
```
X = True
Y = False
print(X and Y)
print(X or Y)
print(not(X and Y))
```

**Output:**

```
False
True
True
```

## Comparison Operators

Comparison operators, as the name suggests, are used to compare two or more than two operands. Depending upon the relation between the operands, comparison operators return Boolean values. The following table summarizes comparison operators in Python. Here, X is 20, and Y is 35.



| Operator | Symbol | Description | Example |
|---|---|---|---|
| Equality | == | Returns true if values of both the operands are equal | (X == Y) = false |
| Inequality | != | Returns true if values of both the operands are not equal | (X = Y) = true |
| Greater than | > | Returns true if value of the left operand is greater than the right one | (X> Y) = False |
| Smaller than | < | Returns true if value of the left operand is smaller than the right one | (X< Y) = True |
| Greater than or equal to | >= | Returns true if value of the left operand is greater than or equal to the right one | (X > =Y) = False |
| Smaller than or equal to | <= | Returns true if value of the left operand is smaller than or equal to the right one | (X<= Y) = True |

The comparison operators have been demonstrated in action in the following example:

**Script 5**

```
X = 20
Y = 35

print(X == Y)
print(X != Y)
print(X > Y)
```