Lab Exercises 1: Python Development Setup

1. Introduction

This guide introduces how to configure a basic Python development environment on your own computer, and also cover advanced topics such as:
(1) Using virtual environments for projects
(2) Installing third-party packages
(3) Managing multiple Python versions.

2. Objectives

(1) Install Python
(2) Install an editor
(3) Create and use virtual environments
(4) Manage Python Packages
(5) Use Vscode

3. Installation

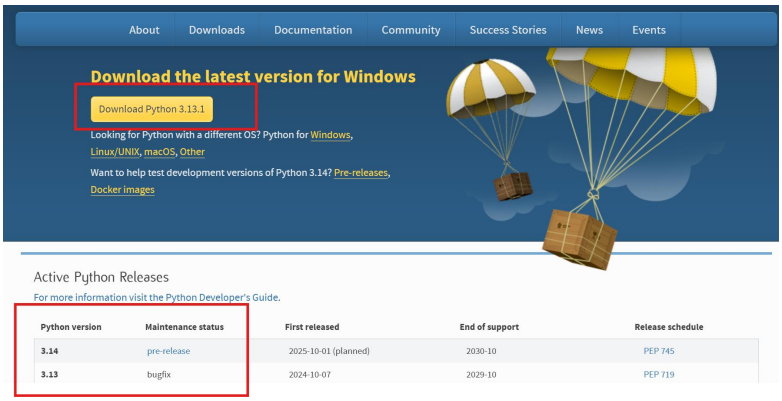
The following is a basic installation tutorial for Python. On macOS and Windows systems, the operations are similar.

NOTE: You can use any of the following configurations for Python development:

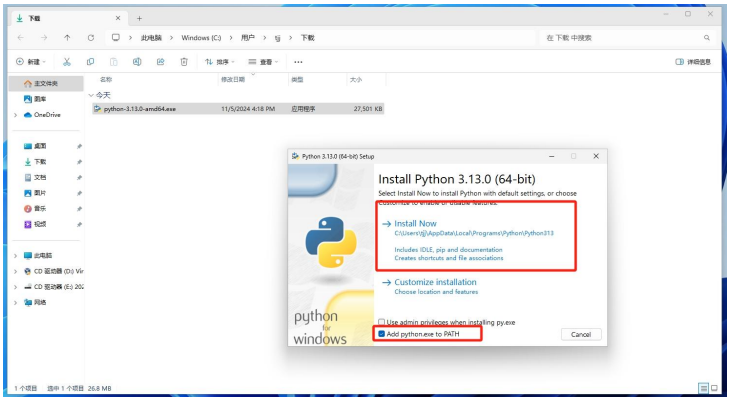
(1) Official Python
(2) Vscode + Anaconda (recommended)

3.1 Install Official Python

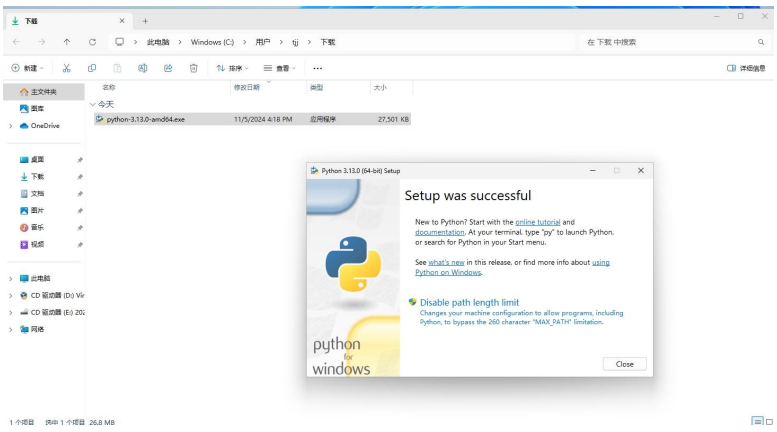
1. Visit the official website (https://www.python.org/downloads/) to download the latest stable release(e.g., Python3.13 (https://www.python.org/ftp/python/3.13.0/python-3.13.0-amd64.exe)).



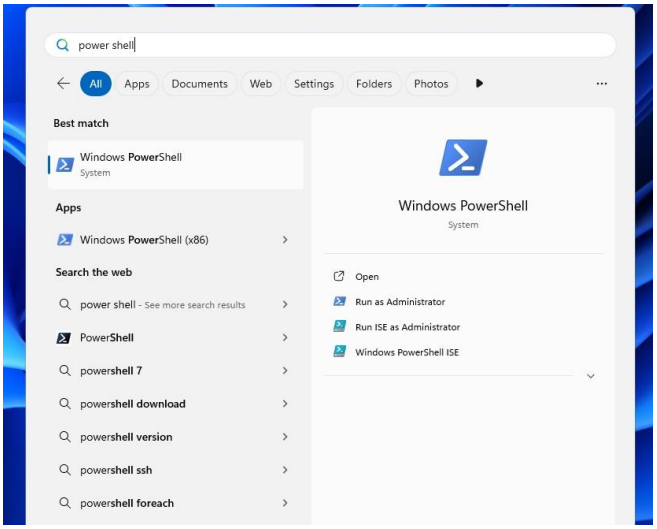
2. Double-click the installer to run it. On the first screen, Check the box labeled Add python.exe to PATH at the bottom. Click on Customize installation if you want to choose specific features or installation locations. Otherwise, click Install Now for default settings.



3. Wait for the installation process to complete. Once done, click Close to exit the installer.



4. Click on the Start button or press the Windows key on your keyboard. Type PowerShell in the search bar. Click on Windows PowerShell from the search results to open it.

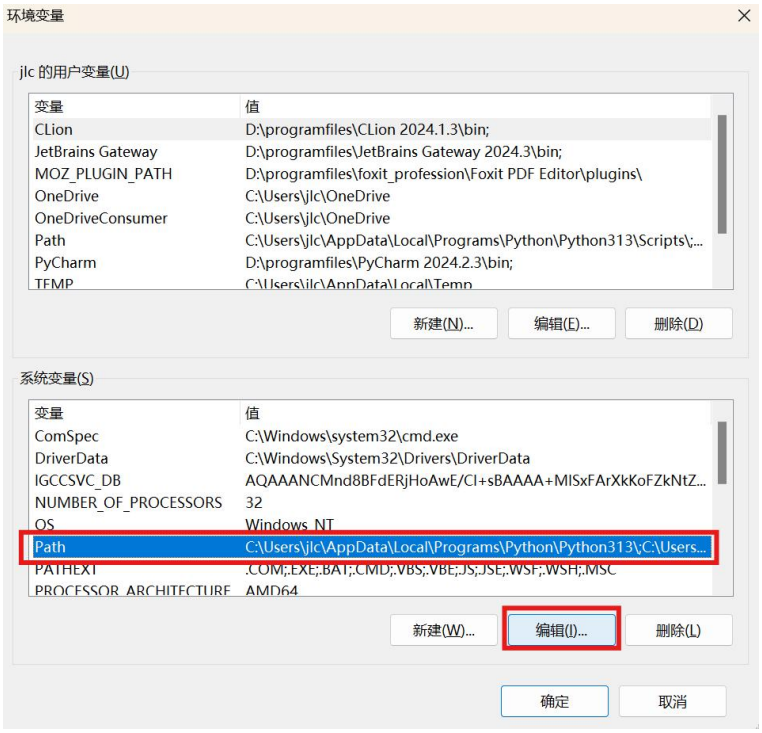


5. Type python --version and press Enter. You should see the installed Python version number.

```
PS C:\Users\tjj> python --version
Python 3.13.0
```

If it fails, you need to manually check your environment variable settings and add the folloing 2 lines into System variables.

```
C:\YourPath\Python\Python313\
C:\YourPath\Python\Python313\Scripts\
```

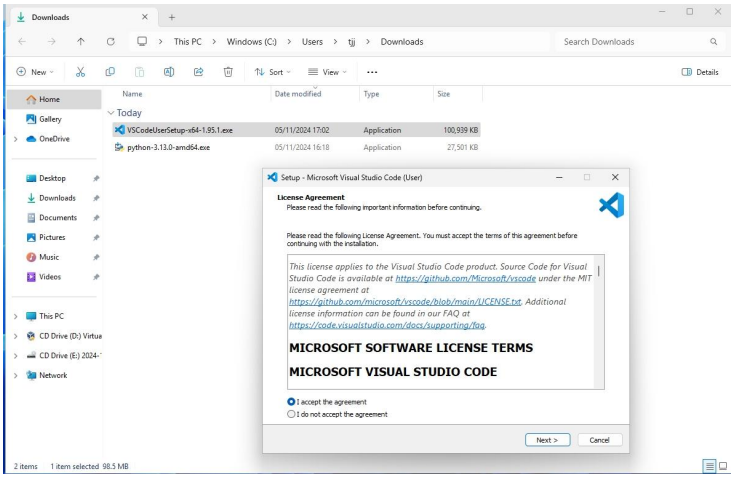


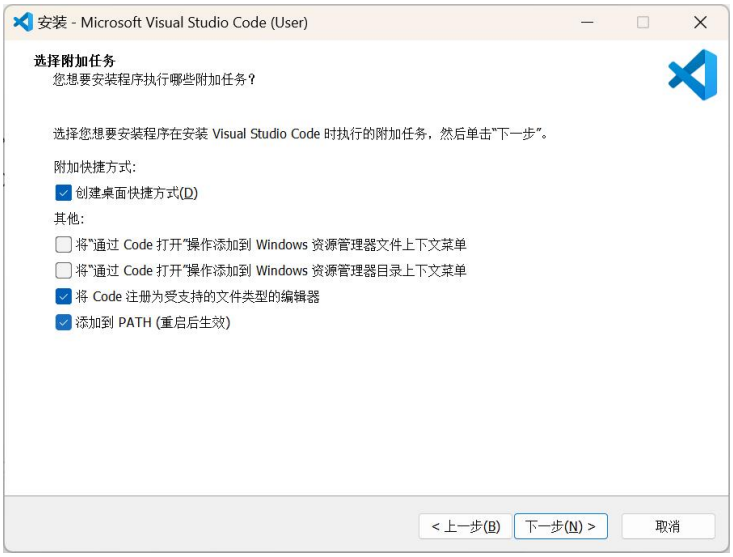
3.2 Install Vscode and Anaconda

3.2.1 Visual Studio Code (recommend)

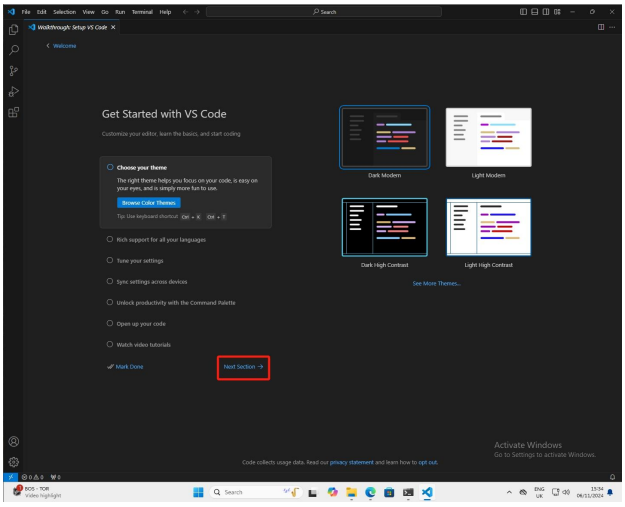
Visual Studio Code (VS Code) is a free, open-source code editor developed by Microsoft. It is widely used by developers for its versatility and extensive customization options.

1. Install VS Code
Go to the VS Code website (https://code.visualstudio.com/Download) and click Download for your operating system (Windows, macOS, or Linux). Once downloaded, open the installer and follow the on-screen instructions.



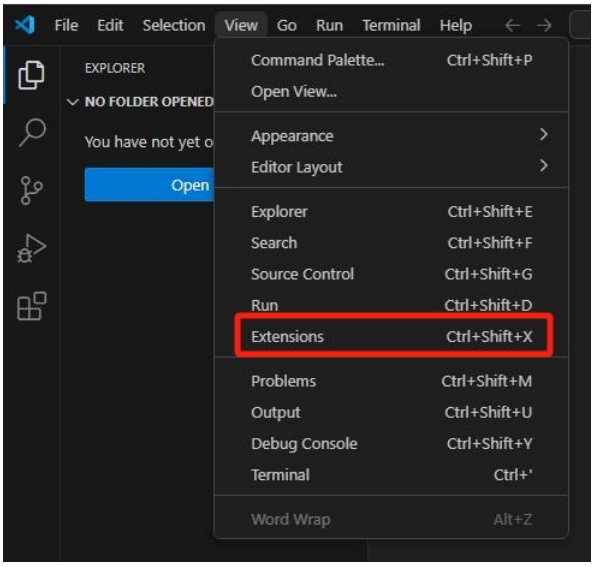


After installation, open VS Code.



2. Install Python Extension

(1) In VS Code, select View > Extensions to open the Extensions view.



(2) Filter the list of available extensions by entering python in the search box at the top of the Extensions view.
(3) Select the Python extension published by Microsoft. The details about that extension appear in a tabbed panel on the right. In either the Extensions panel, or in the main panel, select Install.

When the installation is complete, the Install button changes to a Settings icon in the Extensions view or two buttons, Disable and Uninstall in the main panel. This message lets you know that you've successfully installed the Python extension for Windows.

3.2.2 Pycharm (optional)

PyCharm (https://www.jetbrains.com/pycharm/download/) is an integrated development environment (IDE) specifically designed for Python programming. Developed by JetBrains, PyCharm offers a wide range of features that streamline the coding process, making it a popular choice among Python developers.

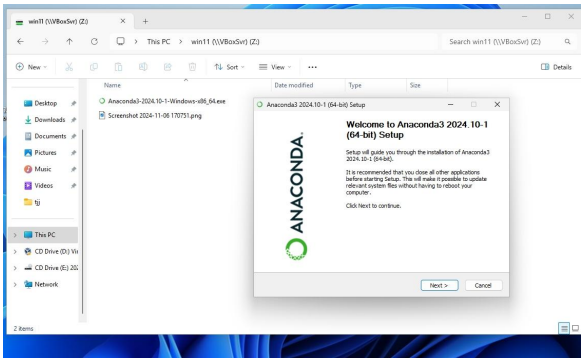
(1) PyCharm Professional Edition requires a subscription or a one-time purchase. It includes advanced features that are particularly useful for professional developers. JetBrains offers a special program (https://www.jetbrains.com/student/) for students to access their Professional Edition tools, including PyCharm, for free.
(2) PyCharm Community Edition is open-source and available for free to all users. It is suitable for students, hobbyists, and developers who need basic Python development capabilities.

3.2.3 Anaconda

If you’re in the data science community, you might already be using Anaconda (or

Miniconda). Anaconda is a sort of one-stop shop for data science software that supports more than just Python.

You can download Anaconda from the official website (https://www.anaconda.com/download/success) and install it with default settings.



4. Create and use virtual environments

4.1 Conda Source

We recommend using Tsinghua Tuna Mirror (https://mirrors.tuna.tsinghua.edu.cn/help/anaconda/) to download packages of conda.

First, you can find .condarc file:

(1) macOS: `${HOME}/.condarc`
(2) Windows: `C:\Users\<YourUserName>\.condarc`

For windows users, you can execute conda config --set show_channel_urls yes in your terminal if you can not find .condarc file.

After that, you can modify the contents of .condarc to use tuna mirror (copy the following content and paste it):

```
channels:
  - defaults
show_channel_urls: true
default_channels:
  - https://mirrors.tuna.tsinghua.edu.cn/anaconda/pkgs/main
  - https://mirrors.tuna.tsinghua.edu.cn/anaconda/pkgs/r
  - https://mirrors.tuna.tsinghua.edu.cn/anaconda/pkgs/msys2
custom_channels:
  conda-forge: https://mirrors.tuna.tsinghua.edu.cn/anaconda/cloud
  pytorch: https://mirrors.tuna.tsinghua.edu.cn/anaconda/cloud
```

4.2 Common conda commands

Managing Conda Itself

1. Check Conda Version: `conda --version`
2. Update Conda: `conda update conda`

Managing Environments

1. Create a New Environment: `conda create -n your_env_name python=3.xx`
2. Activate an Environment: `conda activate your_env_name`
3. Deactivate an Environment: `conda deactivate`
4. List All Environments: `conda env list`
5. Remove an Environment: `conda remove -n your_env_name --all`
6. Export an Environment: `conda env export --name env_name > env_name.yml`
7. Create an Environment from a File: `conda env create -f env_name.yml`

Managing Packages

1. List Installed Packages: `conda list`
2. Install a Package: `conda install package_name`
3. Install a Specific Version of a Package: `conda install package_name=version`
4. Update a Package: `conda update package_name`
5. Remove a Package: `conda uninstall package_name`

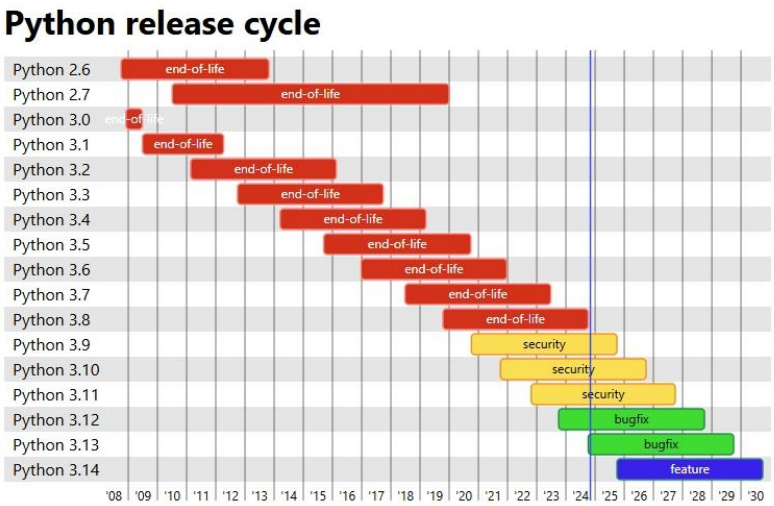
DO NOT MODIFY YOUR BASE ENVIRONMENT.

4.3 Create a virtual environment with conda

A Python virtual environment is an isolated environment that allows you to manage dependencies for a specific Python project without affecting other projects. It essentially creates a self-contained directory that contains a Python interpreter and copies of any necessary libraries.

0. Python version Management

Python has multiple versions, with the most significant division being between Python 2 and Python 3, which are not compatible with each other. Certain projects may require specific Python versions, so managing different versions is essential. Here, we introduce the conda tool, which helps in installing, switching, and using different Python versions.



1. Open Terminal or Command Prompt

Start by opening your terminal or command prompt where you have Conda installed. To create a new virtual environment, use the following command:

```
conda create --name your_env_name python=3.12
```

Replace `your_env_name` with the desired name for your new virtual environment.

2. Activate the Virtual Environment

Once the environment is created, activate it using the command:

```
conda activate your_env_name
```

This command switches your current Python environment to the newly created one.

3. Install Packages

You can now install packages into your virtual environment using Conda. For example, to install numpy, use:

```
conda install numpy
```

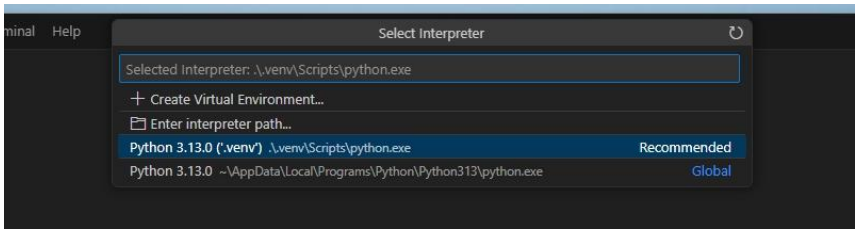
Wait a moment the new package will be installed.

5. Usage of Vscode

5.1 Select a virtual environment

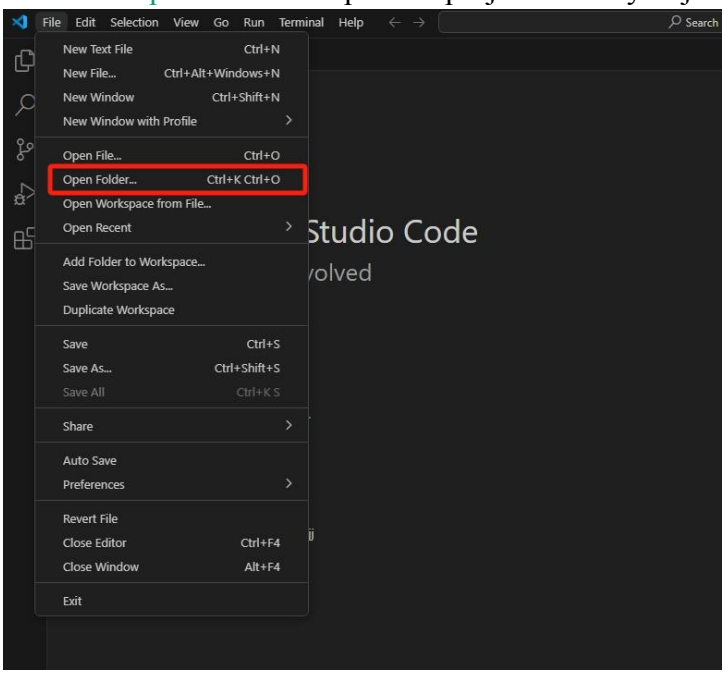
In VS Code, press Ctrl+Shift+P to open the Command Palette.

Type and select Python: Select Interpreter. Ensure your new environment is selected. It should look something like .\.venv\Scripts\python.exe. After this, you should see the selected interpreter in the bottom right corner.

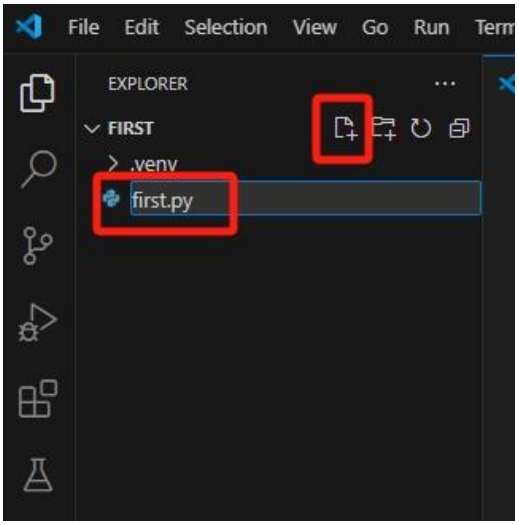


5.2 Create Python scripts

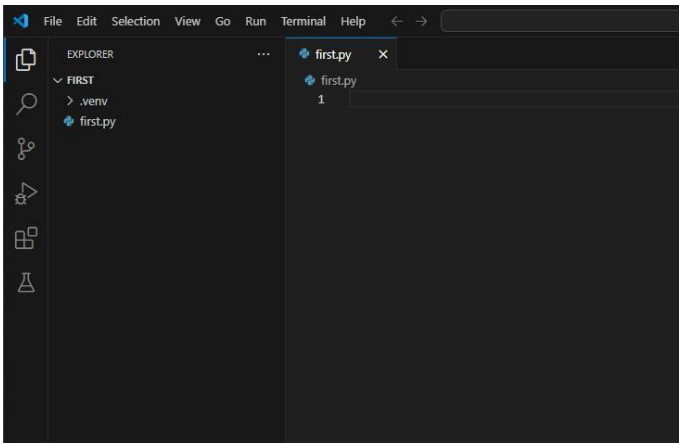
1. Create a new project folder in the File Explorer.
2. Use VS Code's File > Open Folder to open the project folder you just created.



4. From the File Explorer toolbar, select the New File button to create your .py file:



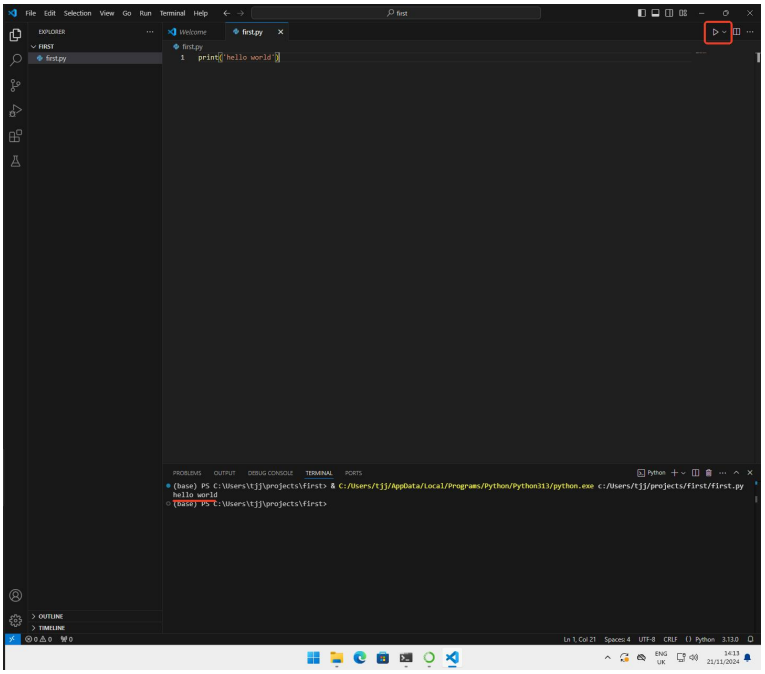
5. Name the file first.py, and VS Code will automatically open it in the editor:



6. Write Python code

```
print('hello world!')
```

7. Click the Run Python File play button in the top-right side of the editor.
The button opens a terminal panel in which your Python interpreter is automatically activated, then runs python3 first.py (macOS/Linux) or python first.py (Windows):



8. (Optional) Press Ctrl+` to open the Terminal. Find your current working path and press cd your_path to enter the working directory. In your terminal, press python first.py to execute your python scipt.

Congrats, you just ran your first Python code in Visual Studio Code!

5.3 Create a Jupyter Notebook

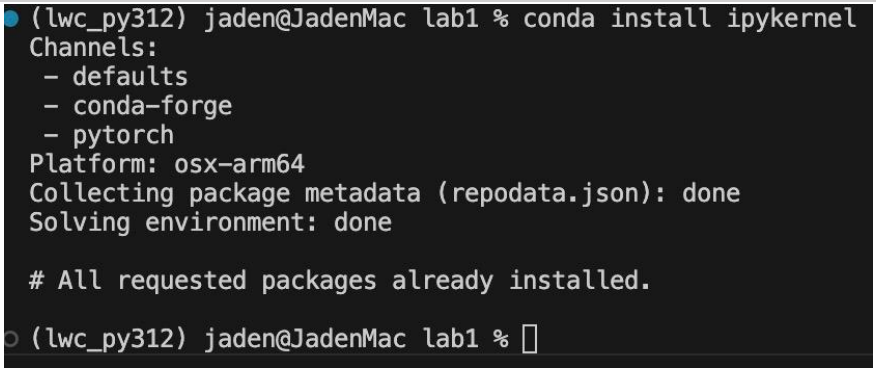
1. Install Required Extensions.

Open your terminal, activate your own virtual environment, and install a package:

```
pip install ipykernel
```

or you can use

```
conda install ipykernel
```

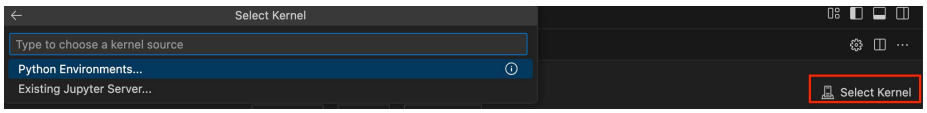


2. Create a New Jupyter Notebook

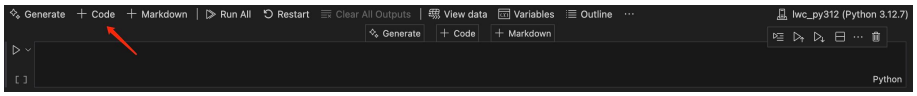
Click on the "File" menu and select New File. Save the new file with a .ipynb extension, for example, my_notebook.ipynb. You can now start writing your Jupyter notebook code in this file.

3. Write Code in Cells

(1) Open my_notebook.ipynb, click Select Kernel and select Python Environment. Chosse your own virtual environment.



(2) To add a new code cell, click on the +code button in the toolbar or press Alt + Enter.



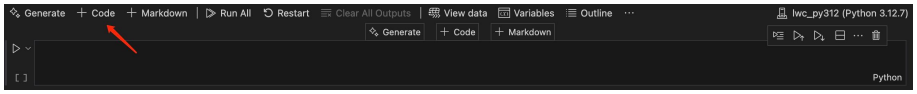
(3) Write your Python code in the cell.

(4) To execute the code in a cell, click on the Run button or press Shift + Enter

(5) To add an extra cell, press Shift+Enter or Click right button -> Insert Cell -> Insert Code Cell Below (or Above).

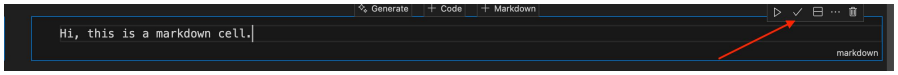
4. **Write Markdown in Cells**

(1) To add a new markdown cell, click on the +Markdown button in the toolbar.



(2) Write your markdown code in the cell.

To execute the code in a cell, click on the Run button.



5. Save and Export

Save your Jupyter notebook by clicking on the save icon or using Ctrl + S.

You can export your notebook to various formats using the "File" menu.

Exercises

1. Create your own environment

Create a virtual conda environment named <yourname>_2043, i.e. jaden_2043.

Install the following packages:

```
numpy
matplotlib
scikit-learn
seaborn
pandas
```

```
scipy
```

Uninstall the following packages:

```
pandas
scipy
```

2. Two sum

Write a Python program, define two integer variables, and output the sum of the two numbers.

baseline:

```
x = 20
y = 43
z = x + y
print("x + y=", z)
```

2. Generating random numbers

Write a Python program using the NumPy library to generate an array containing 10 random integers.

baseline:

```
import numpy as np
result = np.random.randint(low=0, high=2043, size=10)
print(result)
```

3. Plotting a figure

Write a Python program using the Matplotlib library to plot a simple line graph showing the temperature variation for each day of a week.

baseline:

```
import matplotlib.pyplot as plot
temperature_list = [13, 15, 19, 16, 20, 15, 14]
plt.plot(temperature_list)
plt.show()
```

4. Using Notebook

Create two Jupyter Notebooks to implement Exercise 2 and Exercise 3 respectively.