Introduction

Python Programming

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Most of the slides are available on Senseable AI Lab homepage: https://sailab.space/courses/

Contents

1. Getting started with python

What is a program?

- Program
  - a sequence of instructions that specifies how to perform a computation
  - computation
    - something mathematical
      - e.g., solving equations or finding the roots of a polynomial
    - can also be a symbolic computation
      - e.g., searching and replacing text in a document or something graphical
        - processing an image or playing a video

Concept of programming language

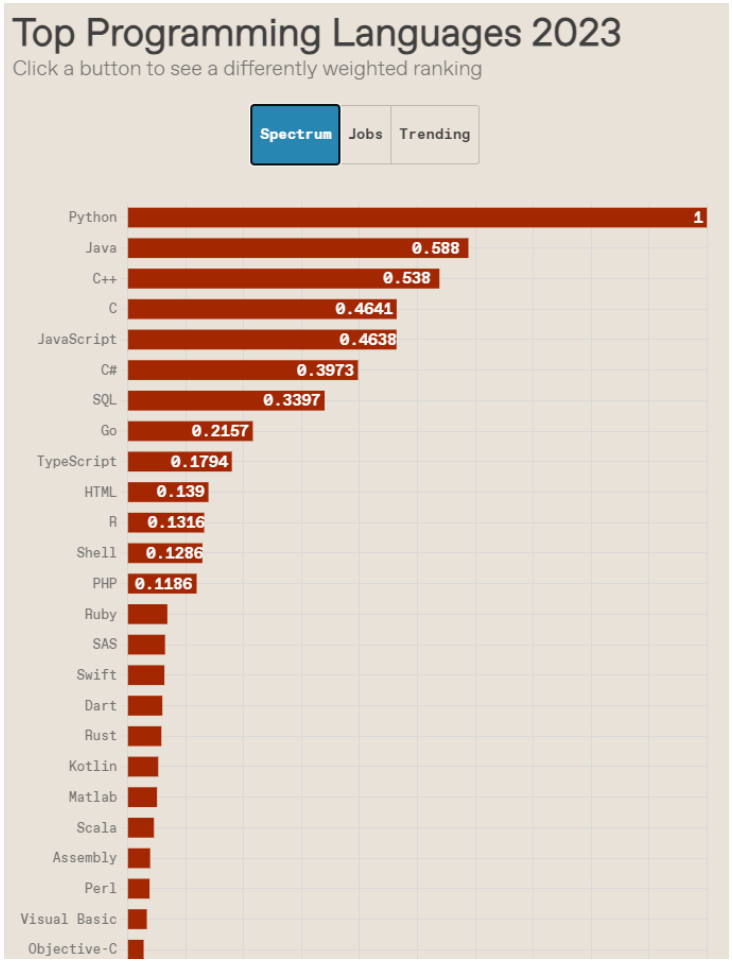
- Programming
  - to command the computer to do what a human thinks
  - all the work to create a program and also referred to as “development”

- Programming language
  - a tool to create software (e.g. Excel, League of Legend, etc.) that operates on a computer, using a language the computer can understand

- Programmer
  - a person who uses programming language to create software or apps (applications)

Programming language

- Over hundreds of types of programming languages
  - widely used languages: C, C++, Java, HTML, PHP, Python, etc.



IEEE Spectrum: The Top Programming Languages 2023

Basic instruction of languages

- The details looks different in different languages, but a few basic instructions appear in just about every language:
  - input: Get data from the keyboard, a file, the network, or some other device
  - output: Display data on the screen, save it in a file, send it over the network, etc.
  - math: Perform basic mathematical operations like addition and multiplication
  - conditional execution: Check for certain conditions and run the appropriate code
  - repetition: Perform some actions repeatedly, usually with some variations

Python

- A popular programming language
  - By Guido van Rossum, released in 1991
  - Supported by C++

- It is used for
  - web development (server-side)
  - software development
  - mathematics
  - system scripting, etc.

Guido van Rossum

Van Rossum at the Dropbox headquarters in 2014

Born	31 January 1956 (age 67)[1] The Hague,[2] Netherlands
Nationality	Dutch
Alma mater	University of Amsterdam
Occupation(s)	Computer programmer, author
Employer	Microsoft
Known for	Creating the Python programming language
Spouse	Kim Knapp (m. 2000)
Children	1[3]
Awards	Award for the Advancement of Free Software (2001)
Website	gvanrossum.github.io

What can Python do?

- Can be used on a server to create web applications
- Can be used alongside software to create workflows
- Can connect to database systems; also reading and modifying files
- Can be used to handle big data and perform complex mathematics
- Can based used for rapid prototyping or for production-ready software development

Why Python?

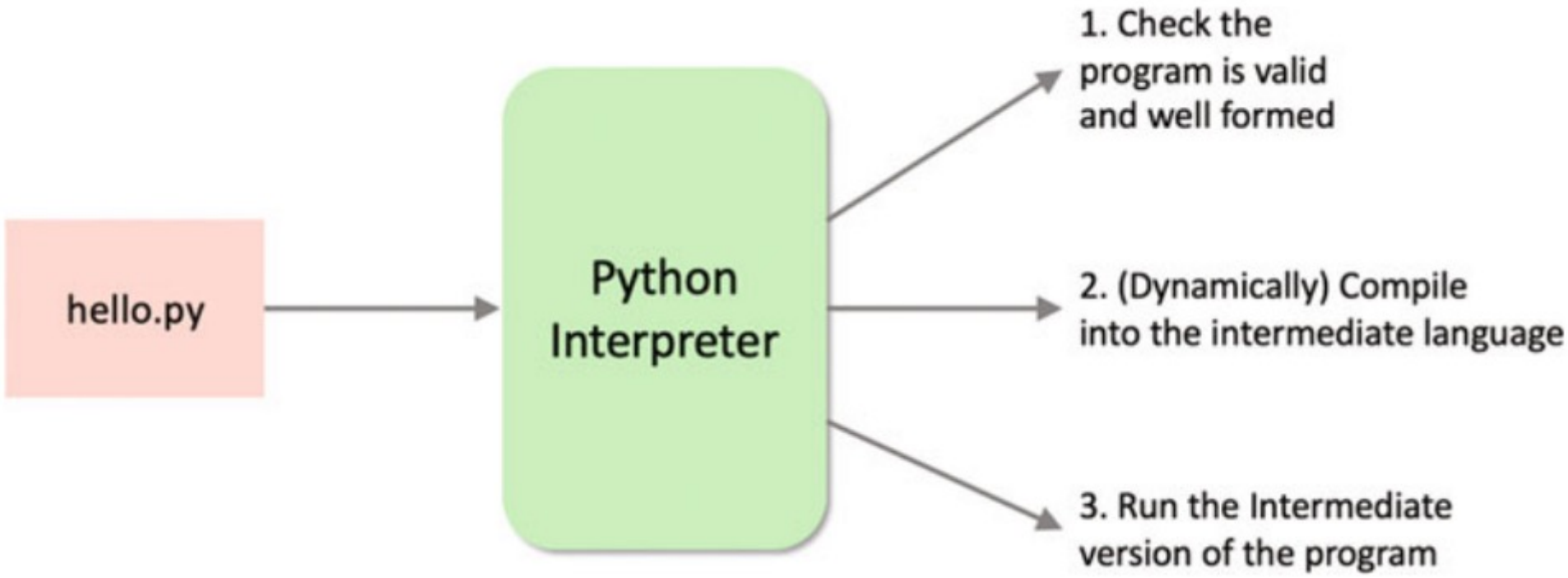
- Works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc.)
- A simple syntax similar with the English language
- Syntax that allow developers to write programs with fewer lines that some other languages
    - Designed for readability
- Runs on an **interpreter** system
    - Interpreter: code can be executed as soon as it is written; prototyping can be very quick
- Be treated in a procedural way, an object-oriented way or a functional way

Note: compiler language vs. interpreter language

- Compiler language
  - Batch translates source code into executable machine code, after which the translated file is executed (Executable files: .exe, .class, etc.)
  - Compile: The process of translating source code into machine code (by compiler)
  - C, C++, Java, etc.
- Interpreter language
  - Reads and executes source code line by line; does not create a separate executable file
  - By interpreter
  - Python, JavaScript, Perl, etc.
  - Execution speed: Compiler language are faster than script languages

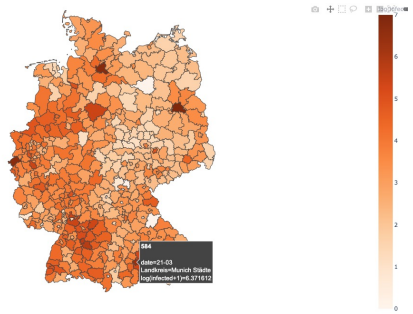
Note: compiler language vs. interpreter language

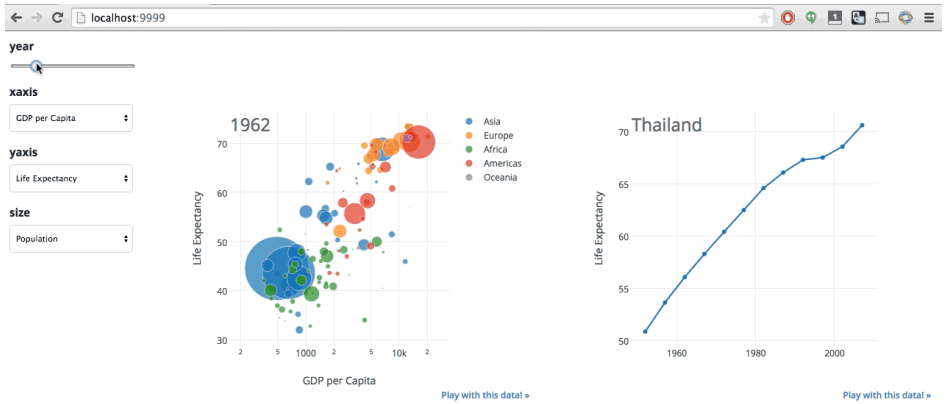
- Interpreter in Python

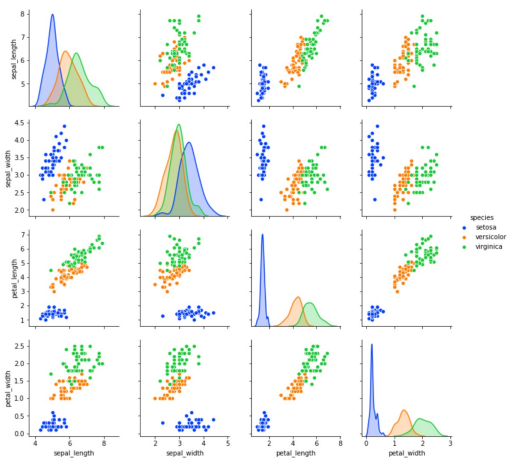


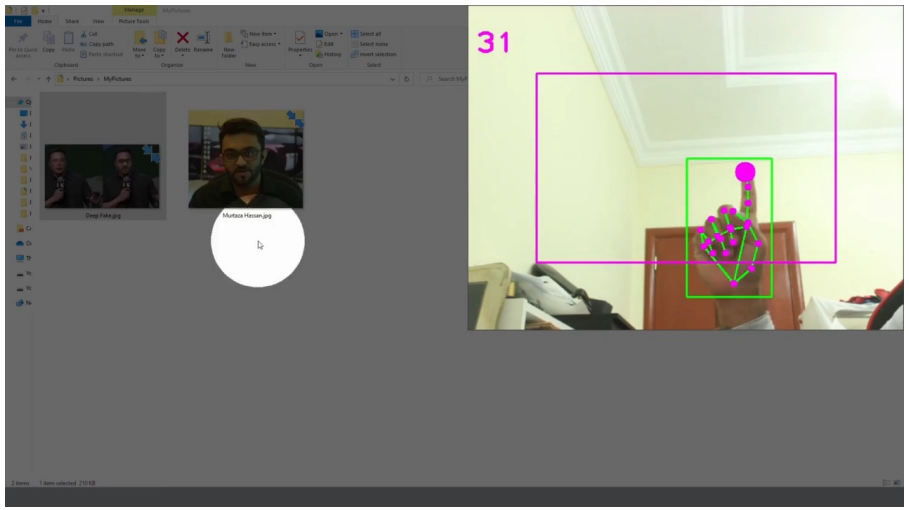
Why Python?

- Focused on “data analysis” and “artificial intelligence”
  - Provide a variety of data analytic tools and visualization packages









Good to know

- The most recent major version of Python is Python 3 (in detail, Python 3.XX version)
  - We shall be using in this lecture
  - Python 2.X versions; is still quite popular but not being updated with anything other than security updates

2. Python development env. settings

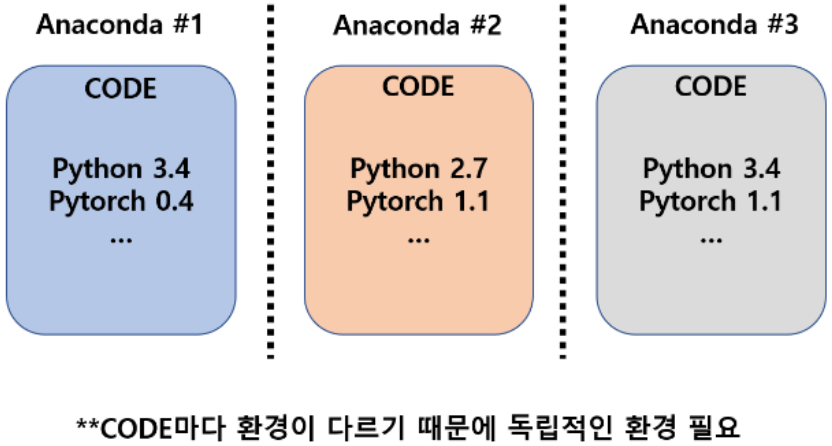
Development environment setting order

- 1. Virtual environment (Anaconda) setting up
- 2. IDE installation; Python installation and setting
- 3. Connecting to Anaconda virtual environment in VSCode
- 4. Installing packages in Anaconda
- 5. Introduction on various Python programming environment

Virtual environment setting up

- What is virtual environment?
  - Used to logically separate different versions/compatibilities of packages among multiple users (or multiple projects), allowing for the construction of projects in different environments within each virtual environment

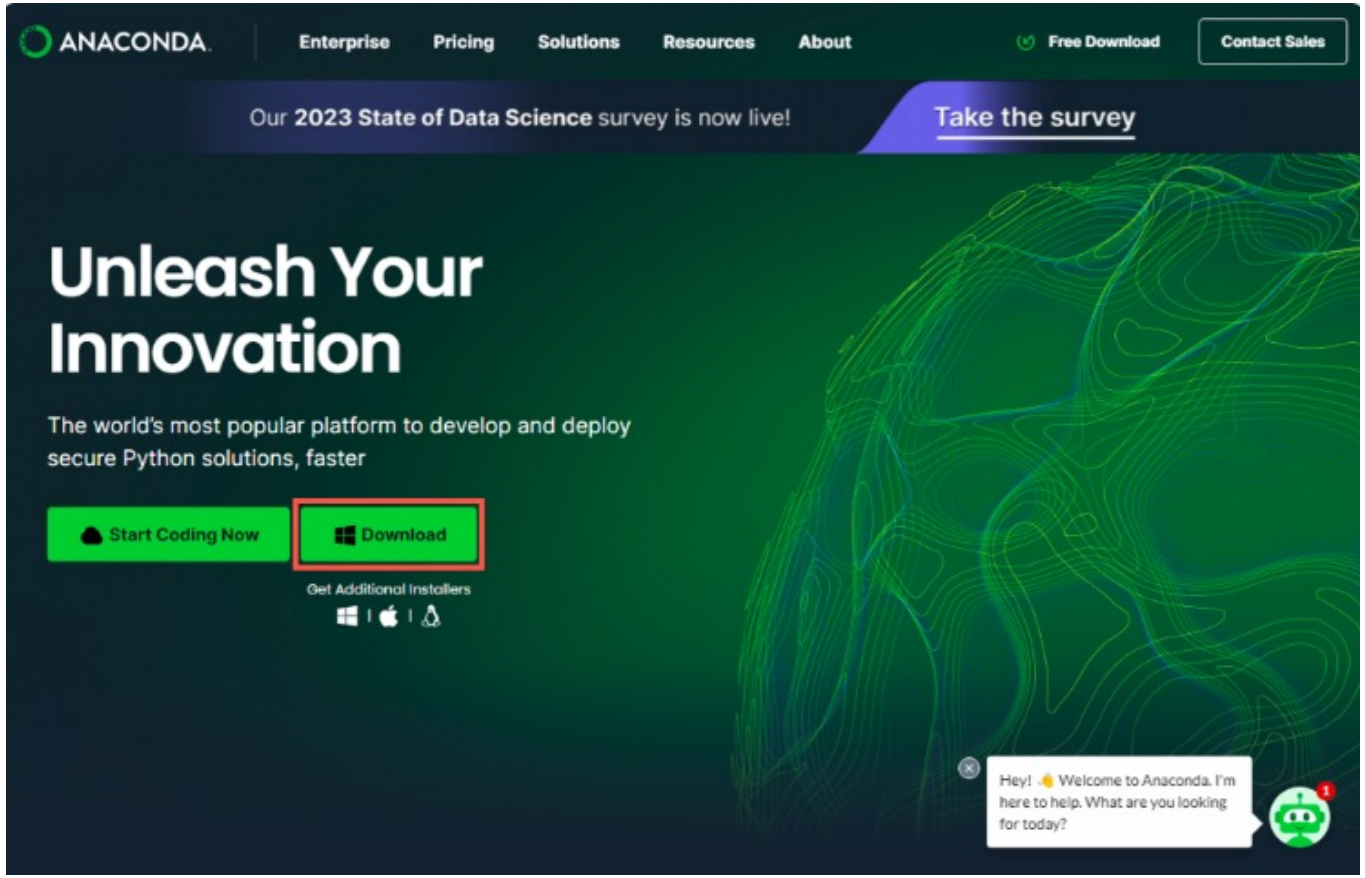
- Example of Anaconda virtual environment



**CODE마다 환경이 다르기 때문에 독립적인 환경 필요

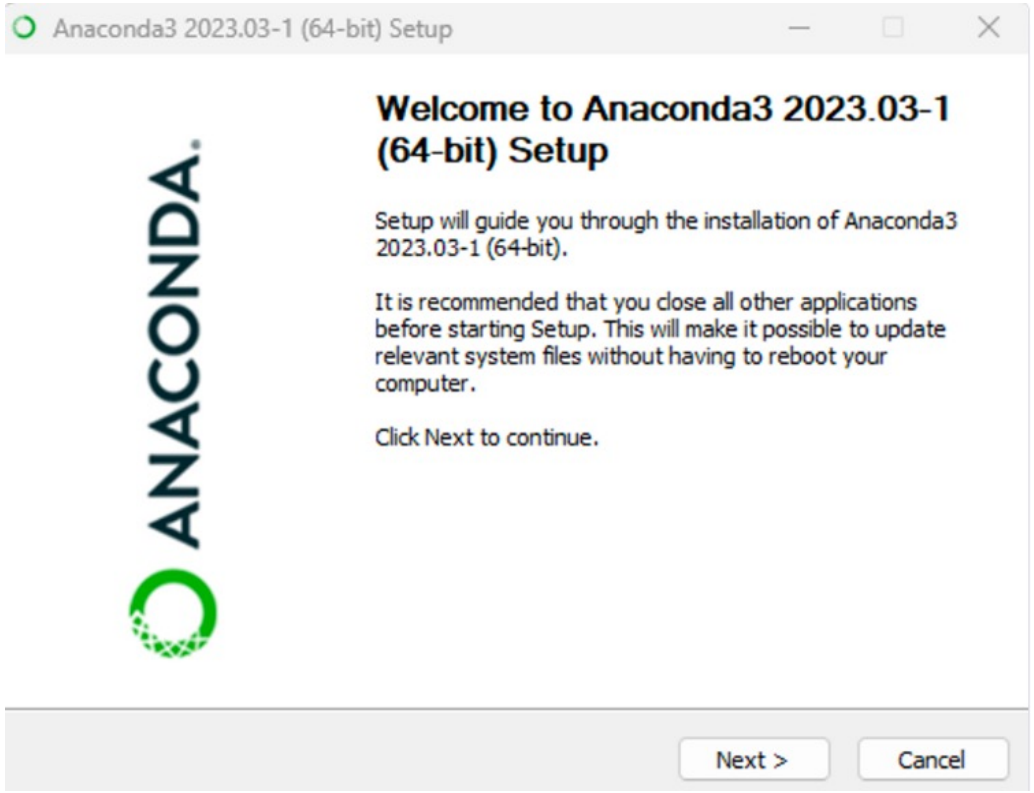
Virtual environment setting up

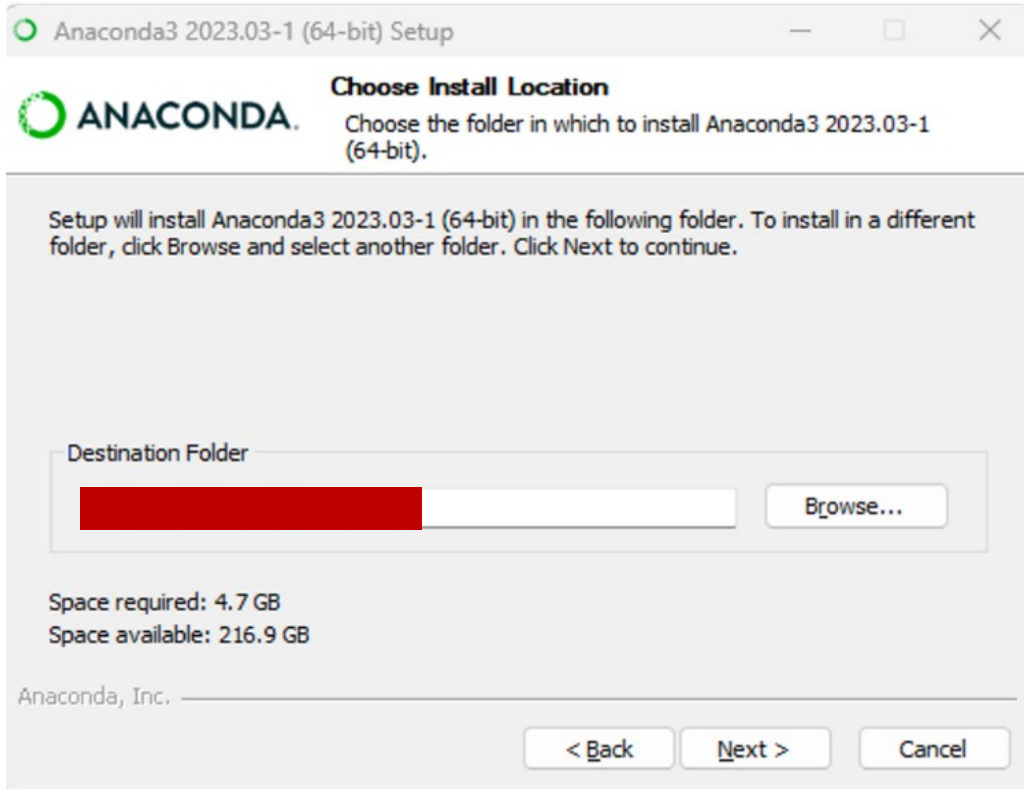
- 1. Download Anaconda
  - https://www.anaconda.com/



Virtual environment setting up

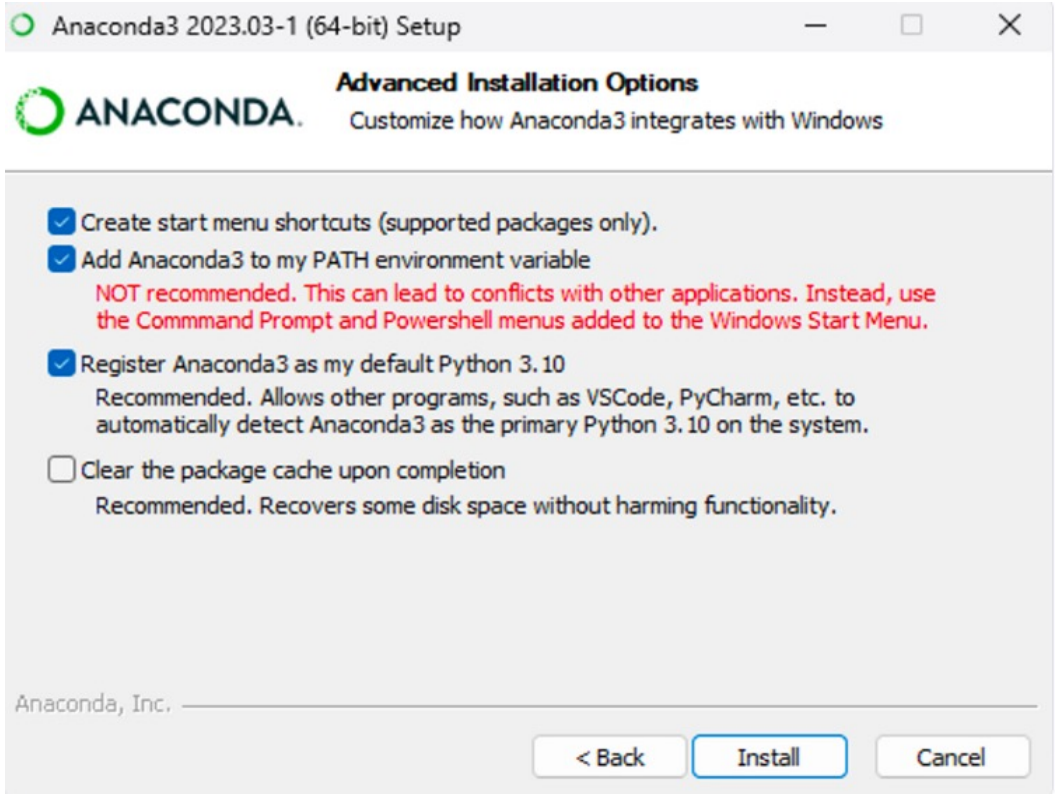
- 2. Install Anaconda
  - **** PLEASE CHECK “DESTINATION FOLDER” ****





Virtual environment setting up

- 2 . Install Anaconda
  - **** PLESE CAREFUL OPTIONS ****



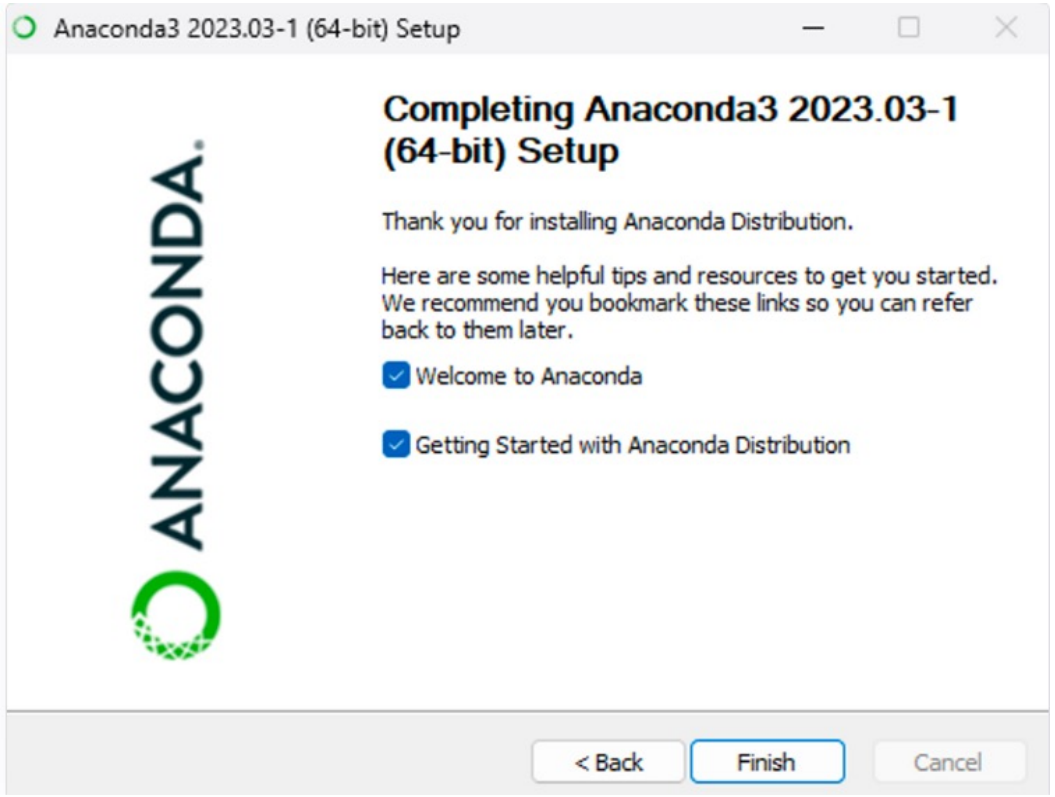
Add Anaconda3 to my PATH environment variable 체크 시

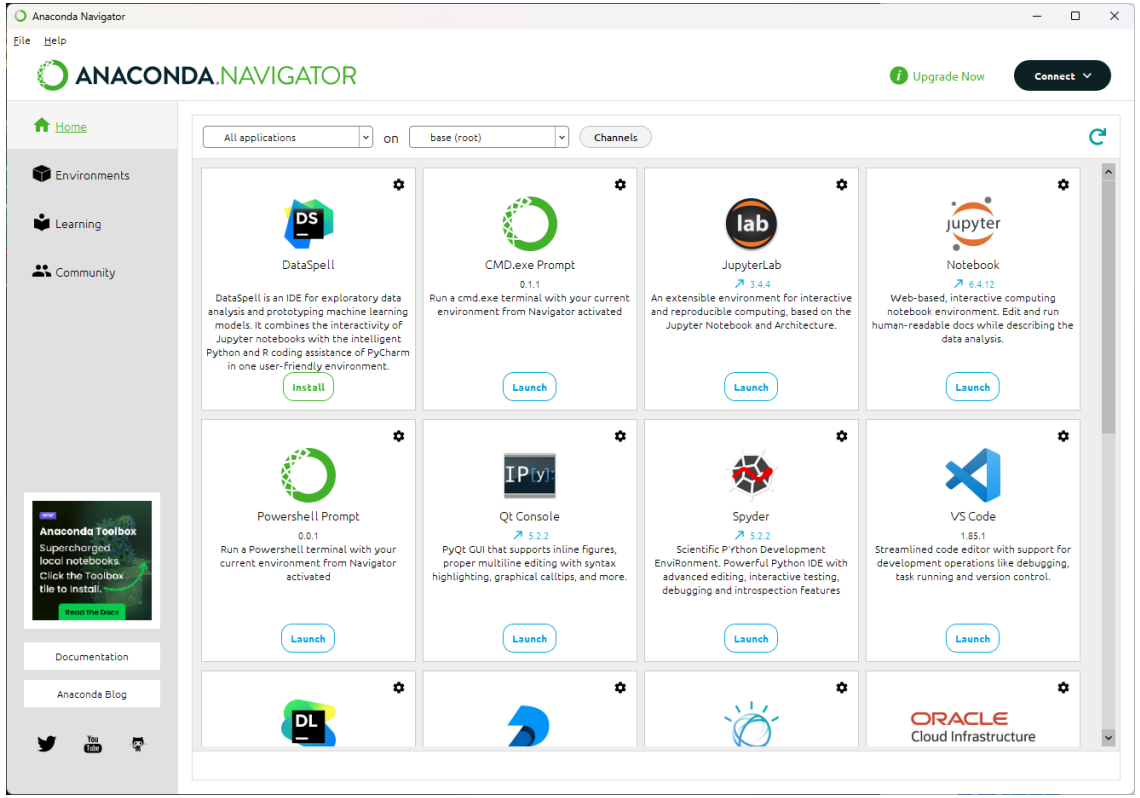
git, powershell, cmd와 같은 명령 프롬프트 창에서 anaconda 사용 가능

체크하지 않으면 Windows 시작 메뉴에서만 실행 가능

Virtual environment setting up

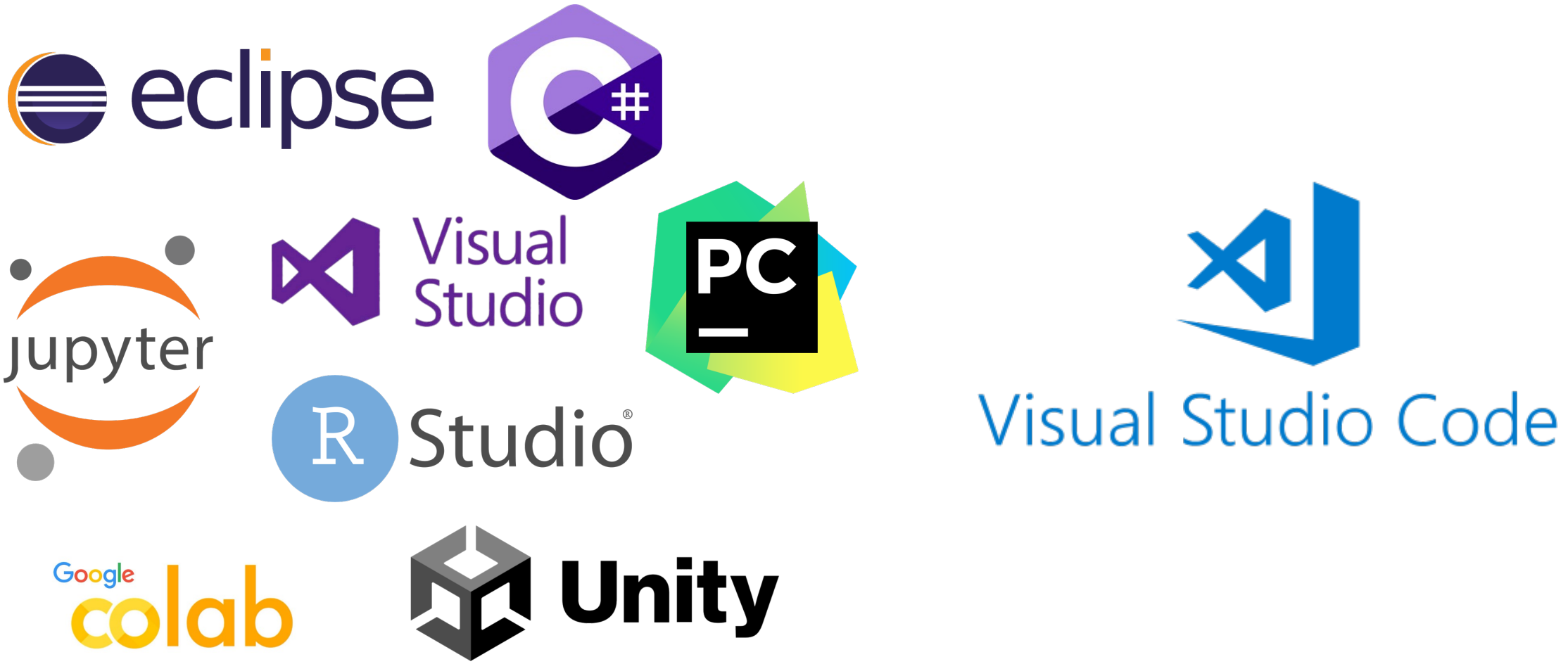
- 3. Complete
  - Run “Anaconda Navigator” to check if Anaconda is installed successfully
  - Jupyter Notebook is also available for Python programming





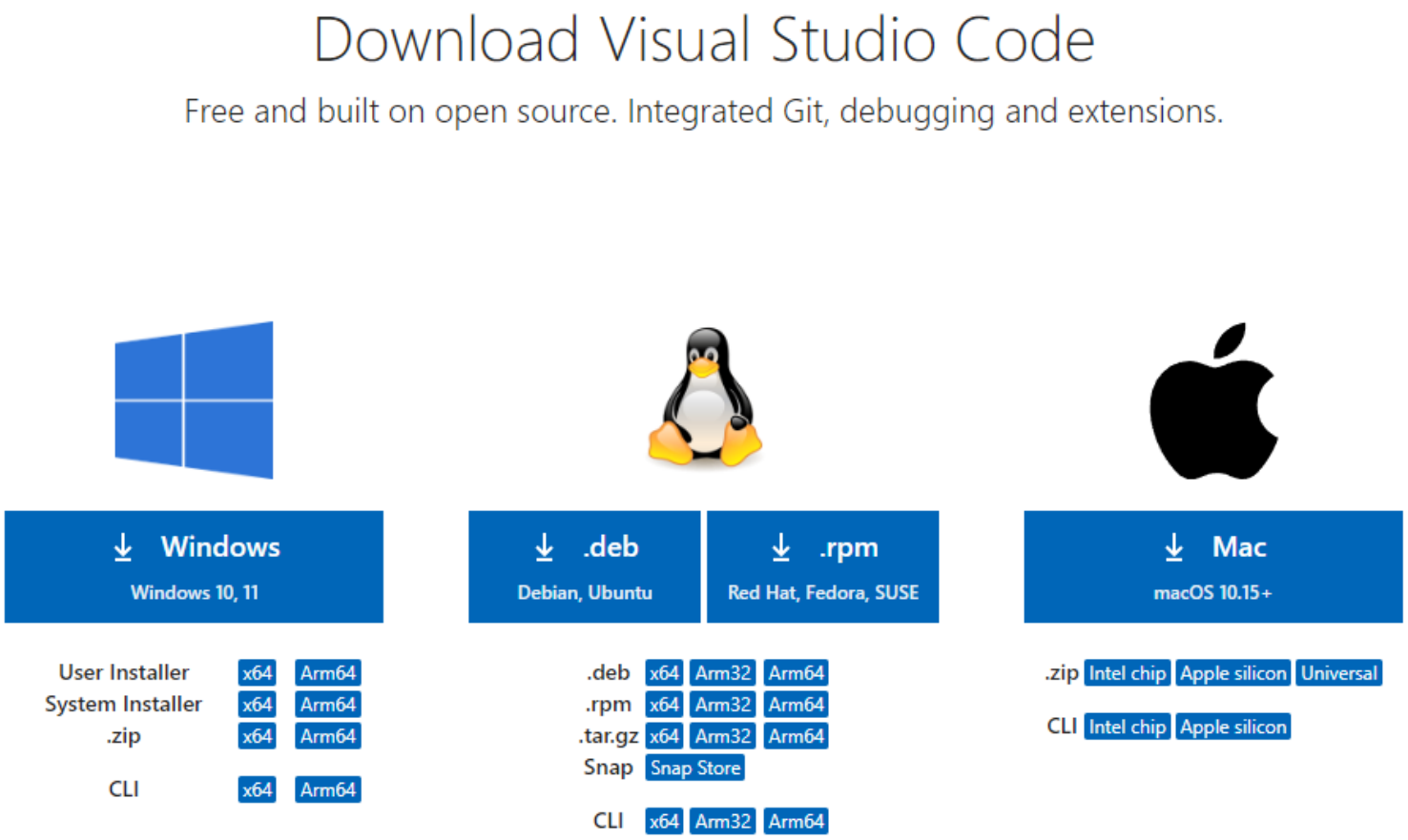
IDE installation

- IDE
  - Integrated Development Editor



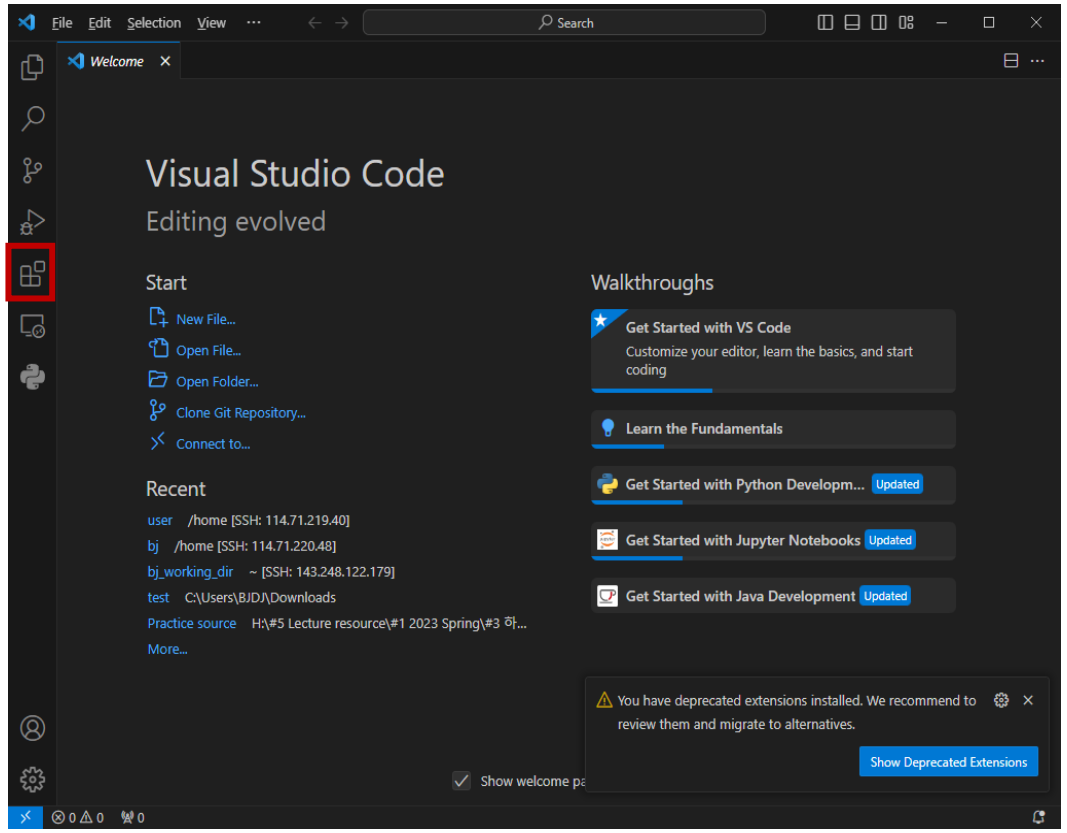
IDE installation

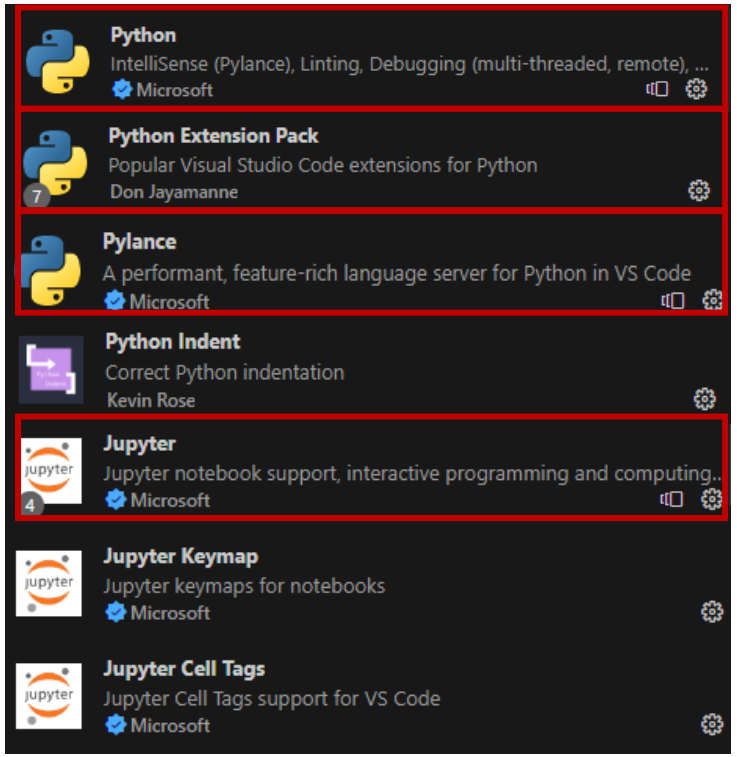
- 1. Download VSCode
  - https://code.visualstudio.com/download

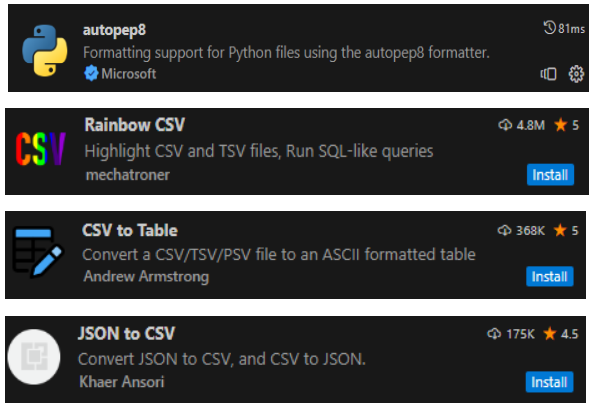


Python installation and setting

- 2. Install and run VSCode
- 3. Extension setting in VSCode (Python installation)
  - Various extensions for your development life

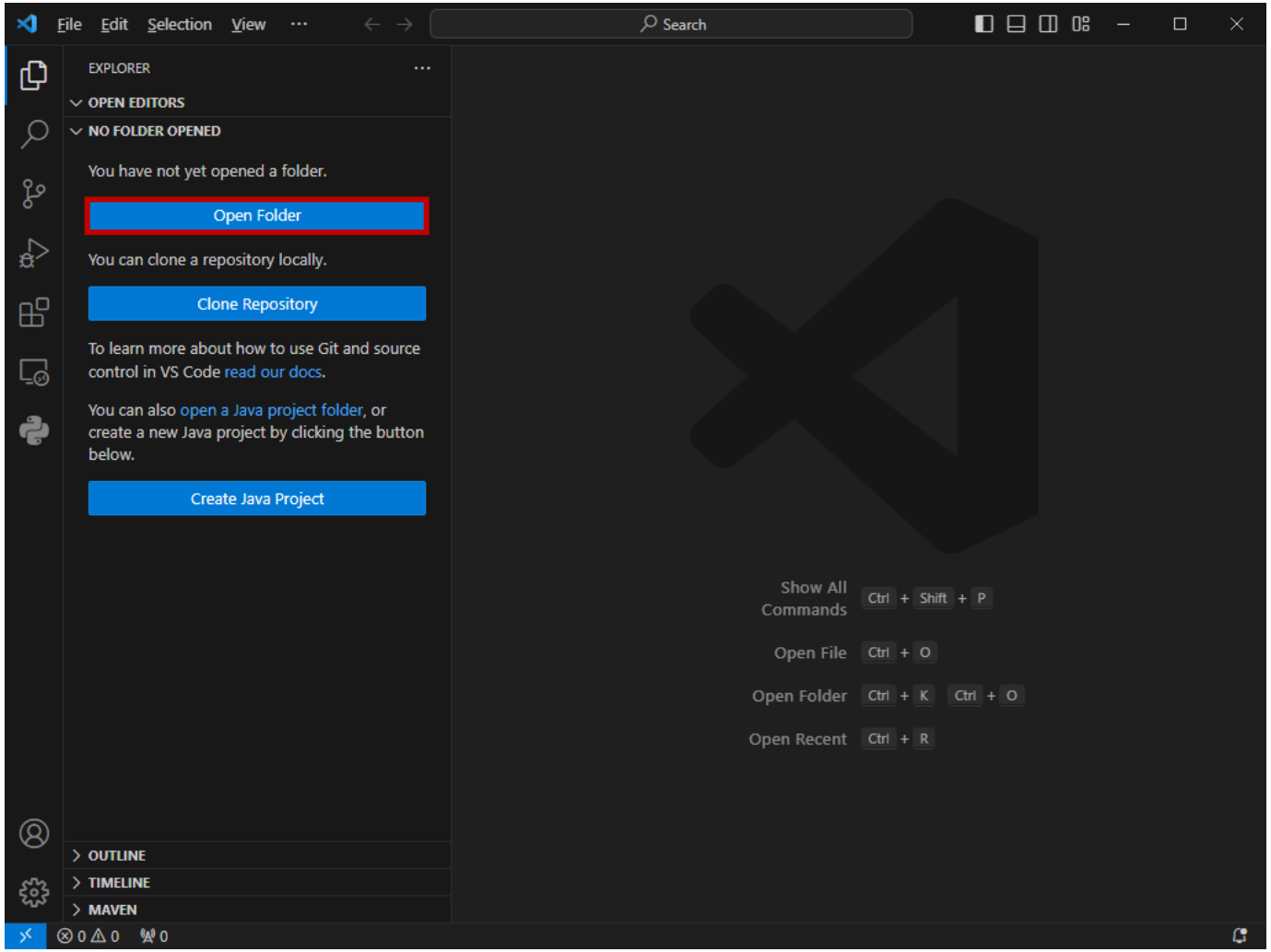






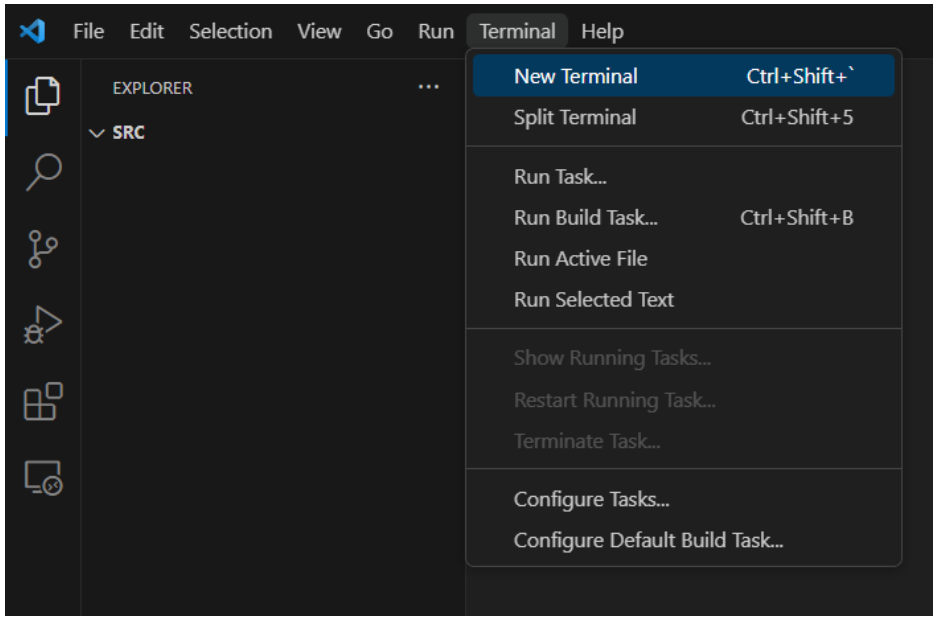
Python installation and setting

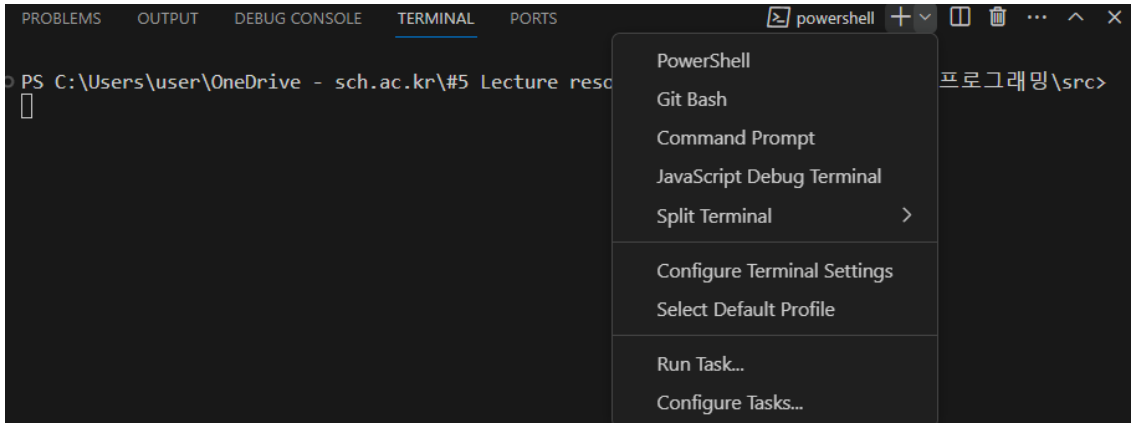
- “Open Folder” ➔ “Add Folder to Workspace…” (Space for handling your source code)

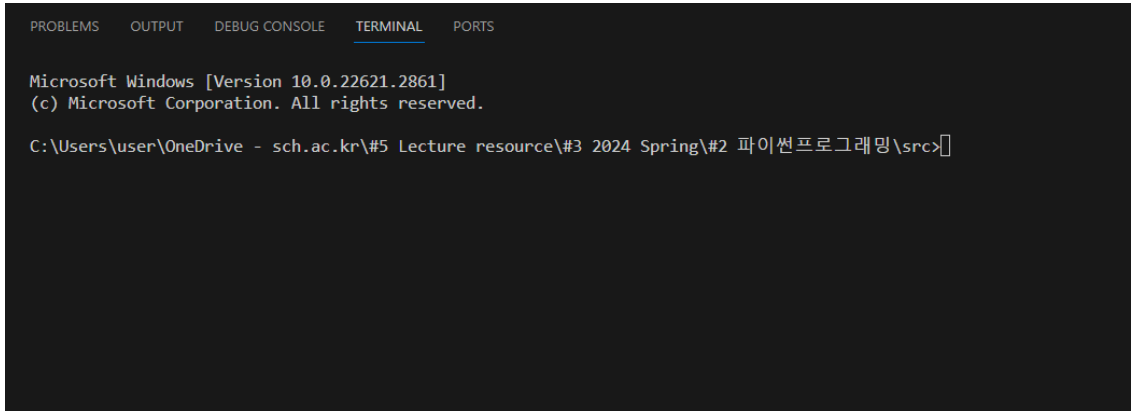


Connecting to Anaconda in VSCode

- Open “Command Prompt”: “Terminal” tab ➔ New terminal
  - Provides the various terminal options
    - PowerShell (PS), Git bash, Command Prompt

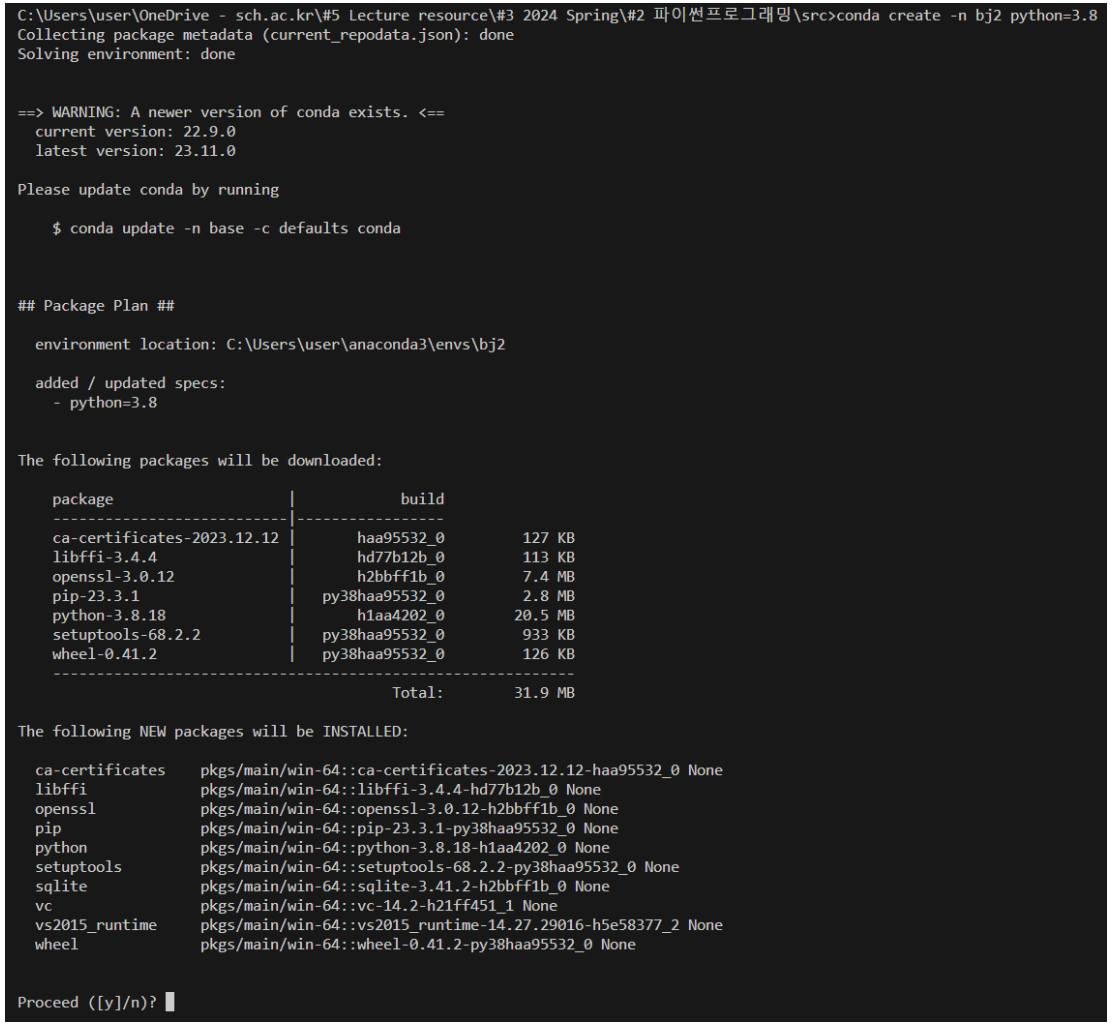






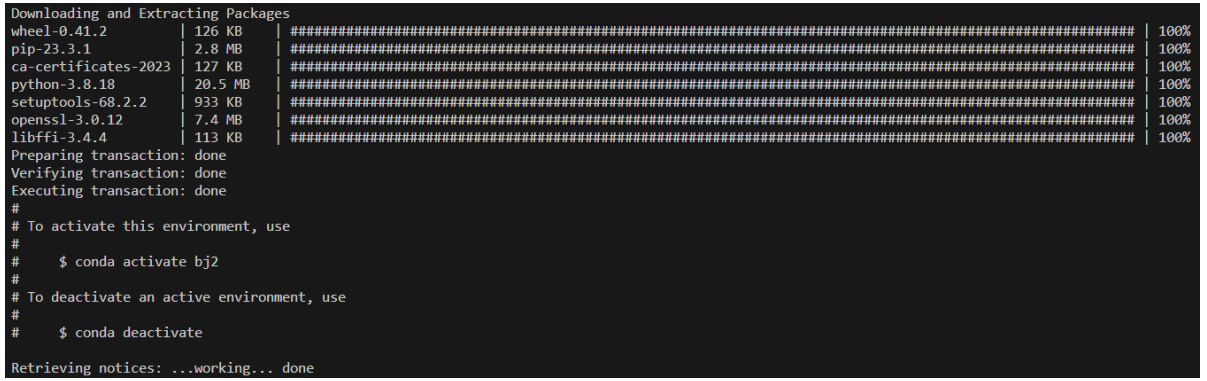
Connecting to Anaconda in VSCode

- How to create your virtual env. on command prompt
  - conda create –n [ENV_NAME] [OPTS]
    - Set your virtual env. name with options
    - Ex) conda create –n bj2 python=3.8
  - Proceed ([y]/n)? ➔ ENTER or ENTER after typing y

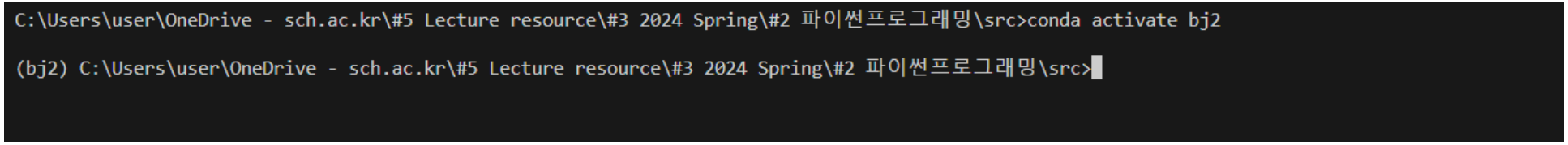


Connecting to Anaconda in VSCode

- How to connect to virtual env. on command prompt (Cont'd)
  - Check your virtual env. as follows:



  - conda activate [ENV_NAME]
    - Ex) conda activate bj2
  - Check appearing [ENV_NAME] at leftmost command line
    - Ex) (bj2) C:₩....



Check Python installation

- Check your Python version
  - Enter python --version on command prompt
    - Current version (for me): Python 3.8.18

```
(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python --version
Python 3.8.18
```

- *Caution
  - It is a version installed on Anaconda virtual environment
    - Might have different versions if you command in other space (e.g. local)
      - Might be version conflict when running your program out of the virtual env.

```
C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python --version
Python 3.9.13
```

Installing packages in Anaconda

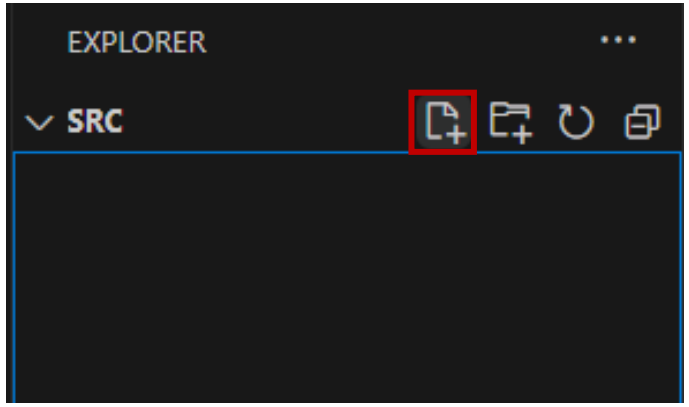
- How to install packages in Anaconda virtual environment
  - Use “pip” or “conda” command
    - pip install [PKG_NAME] or conda install [PKG_NAME]
    - Ex) pip install jupyter

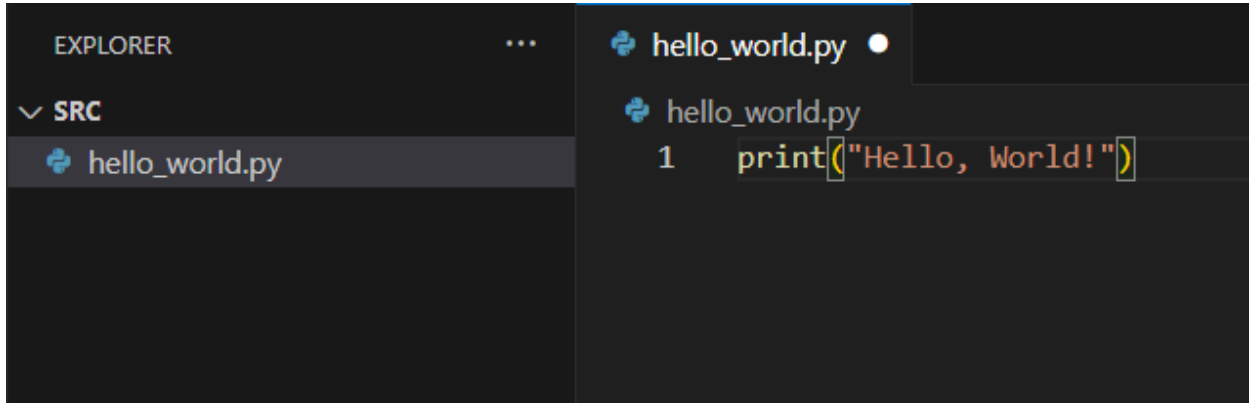
```
(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>pip install jupyter
Collecting jupyter
  Downloading jupyter-1.0.0-py2.py3-none-any.whl (2.7 kB)
Collecting notebook (from jupyter)
  Downloading notebook-7.0.6-py3-none-any.whl.metadata (10 kB)
Collecting qtconsole (from jupyter)
  Downloading qtconsole-5.5.1-py3-none-any.whl.metadata (5.1 kB)
Collecting jupyter-console (from jupyter)
  Downloading jupyter_console-6.6.3-py3-none-any.whl (24 kB)
Collecting nbconvert (from jupyter)
  Downloading nbconvert-7.14.0-py3-none-any.whl.metadata (7.7 kB)
Requirement already satisfied: ipykernel in c:\users\user\anaconda3\envs\bj2\lib\site-packages (from jupyter) (6.28.0)
```

  - pip install vs. conda install
    - pip: Package installer for Python; Official packages by Python
    - conda: Part of the Conda package management system; an open-source package management
    - Please be careful about version conflict when you use both of them

Hello, World!

- Create Python file (.py)
  - Type “hello_word.py” in Explorer
    - Please type an extension “.py”
  - Extension related with Python
    - .py : Python source file executable on command prompt
    - .ipynb : Python source code executable on iPython Notebook (Jupyter) (not execution file)
- print(“Hello, World!”)





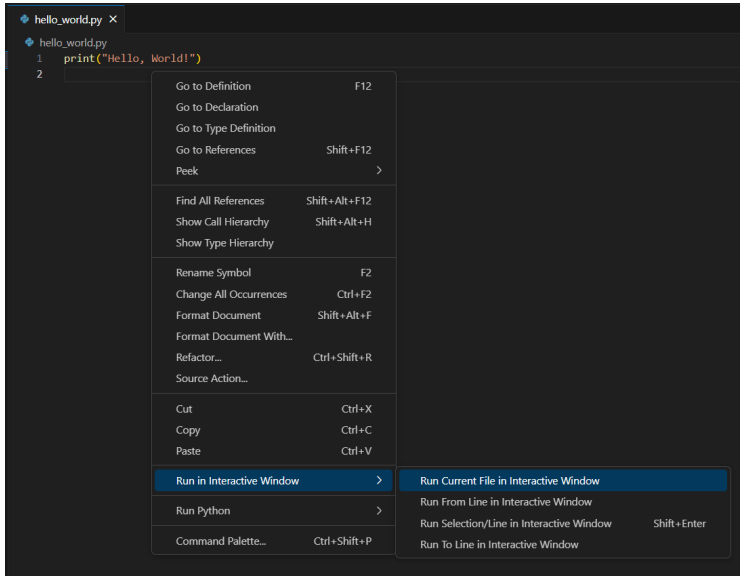
Hello, World!

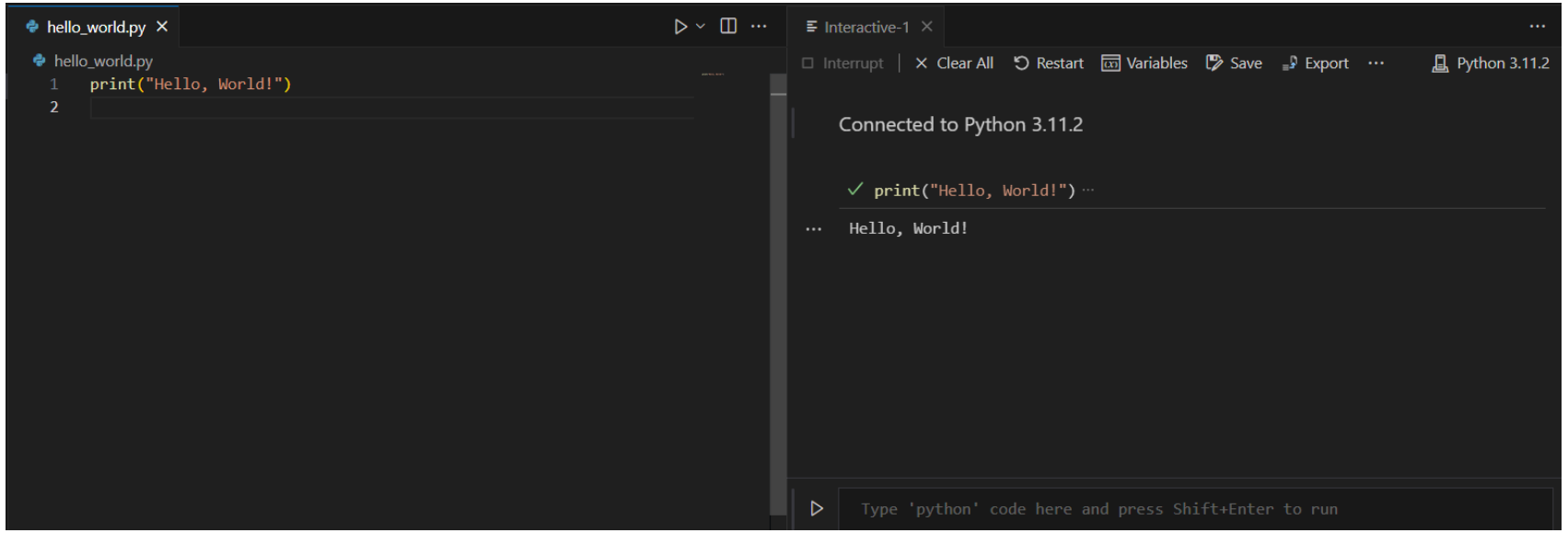
- Execute Python file (.py)
  - Enter the follows on Anaconda virtual env., command prompt
  - python [.py FILE_NAME]
    - Ex) python hello_world.py

```
(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python hello_world.py
Hello, World!
```

Introduction on various Python programming environment

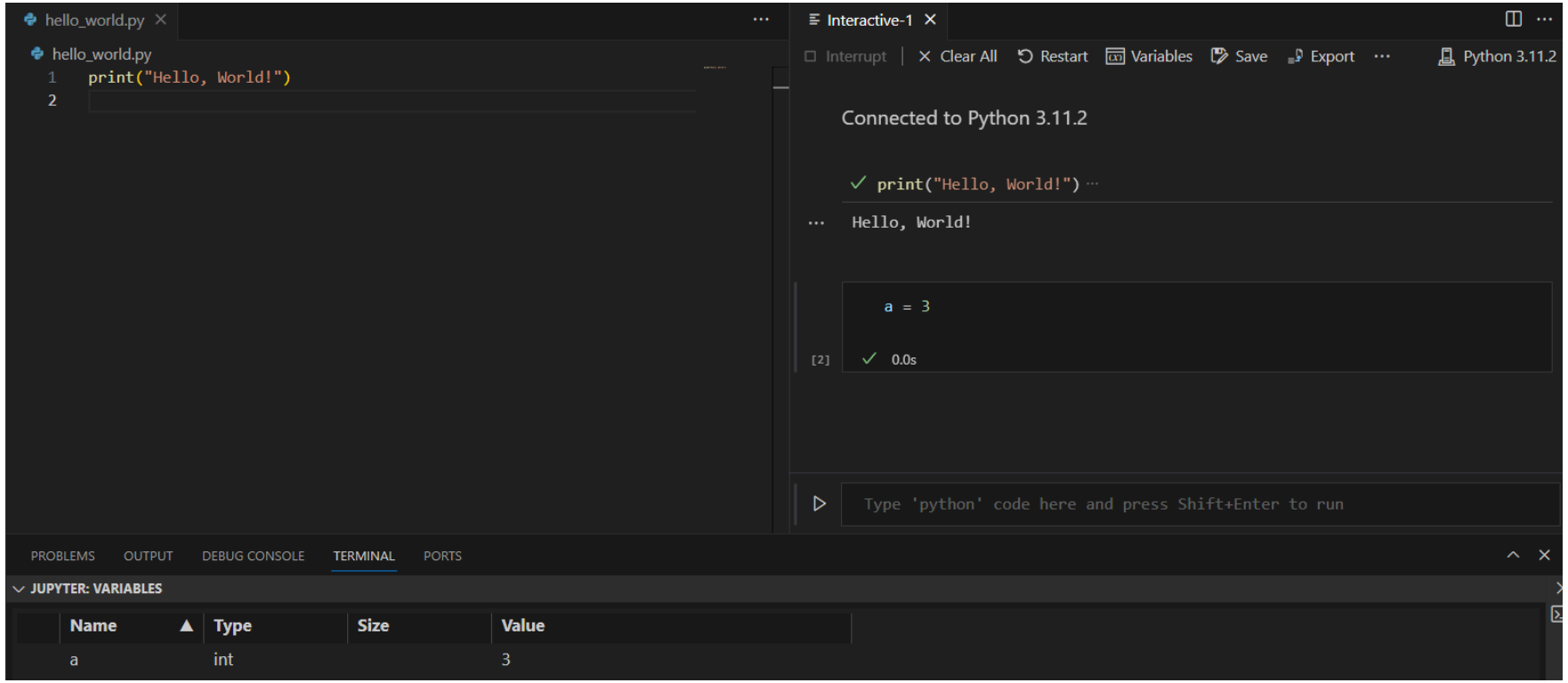
- Interactive window in VSCode
  - Right click on sour code window ➔ Run in Interactive Windows ➔ Run Current File in Interactive Windows
    - Available after Jupyter and ipykernel installation
  - Support the interactive interpreter by Jupyter Notebook (ipykernel)





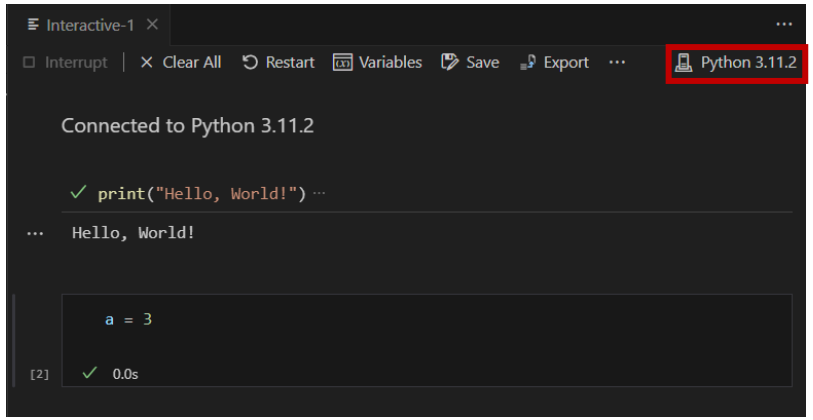
Introduction on various Python programming environment

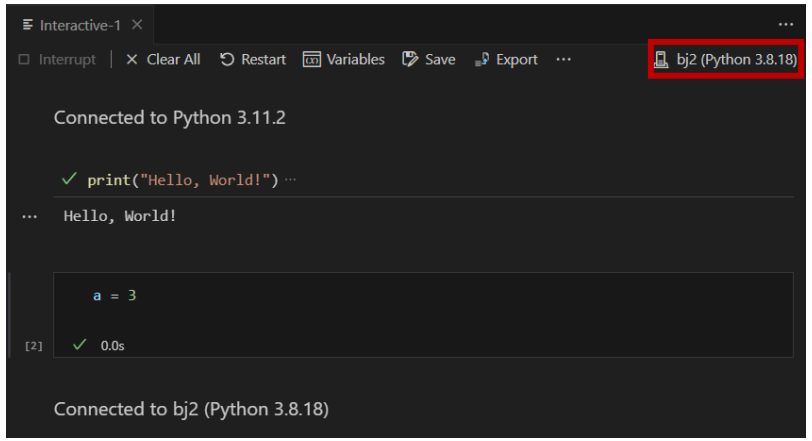
- Interactive window in VSCode
  - Good for Python newbie
    - Can see the names, types, values for variables for the current usage
  - But, not provided by programming test (기업 코딩테스트 등)

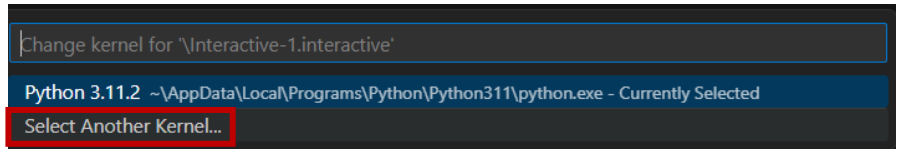


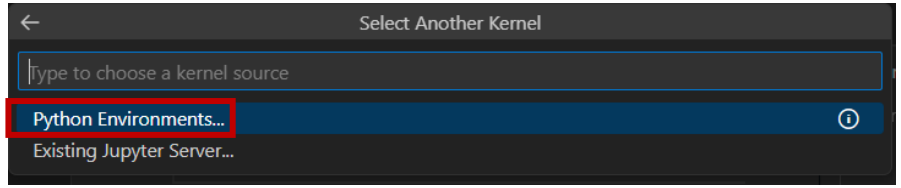
Introduction on various Python programming environment

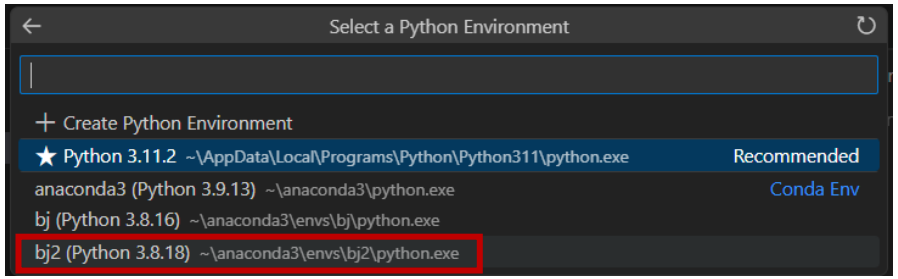
- Interactive window in VSCode
  - Note.
    - ** Setting of Python interpreter for interactive window





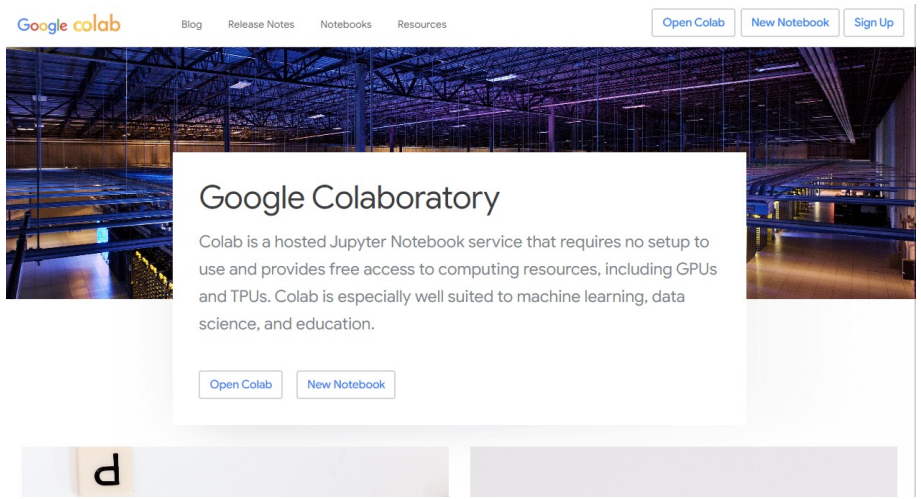


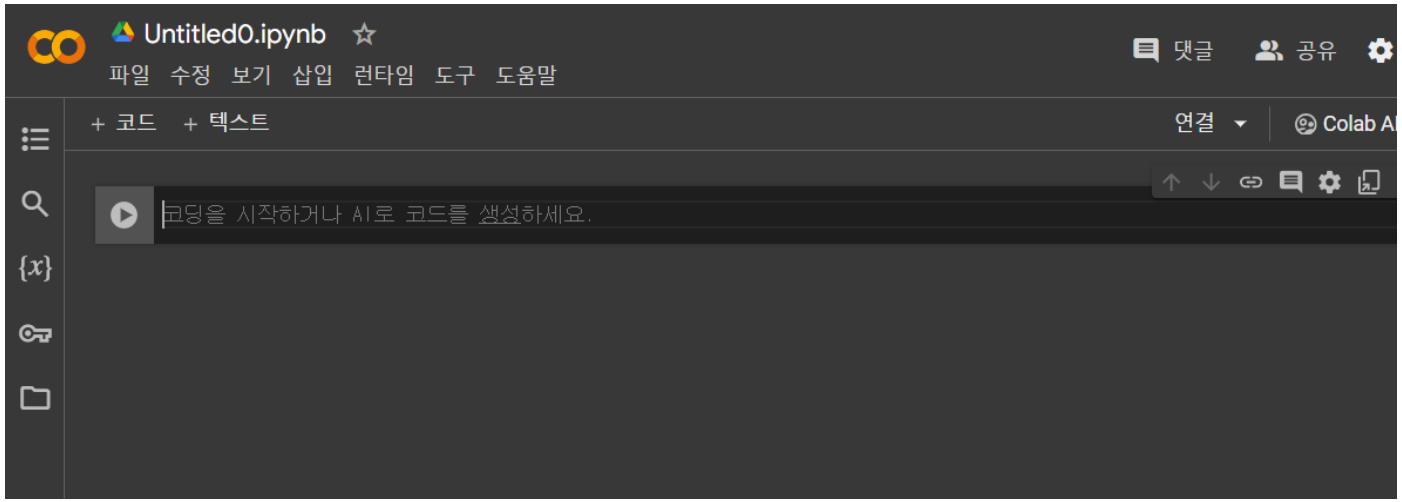




Introduction on various Python programming environment

- Google Colab
  - Access https://colab.google/ on web browser
  - Available directly from New Notebook for Python programming (no separate installation required)





Tips

- Python **quickstart** on command prompt
  - Enter “python” on command prompt (please on virtual env.)
    - Line by line execution for Python code by interpreter

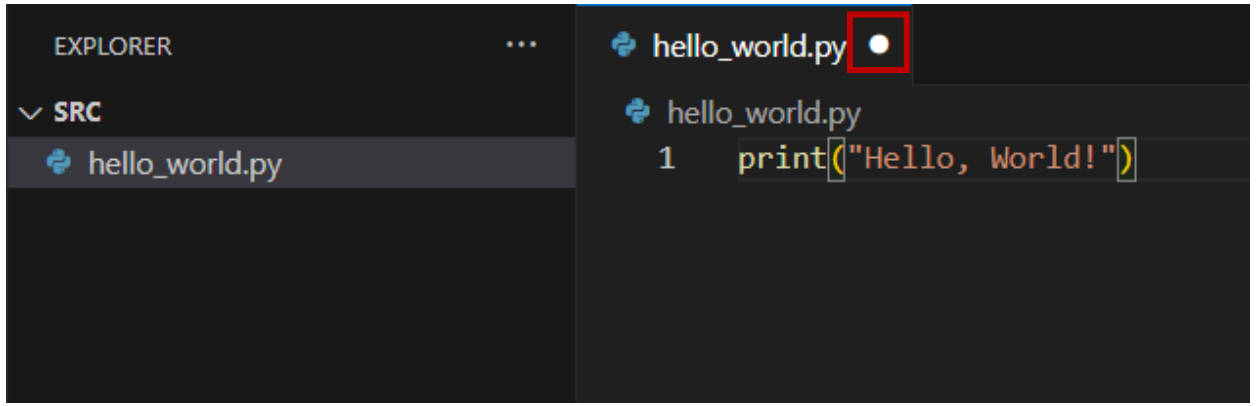
```
(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python
Python 3.8.18 (default, Sep 11 2023, 13:39:12) [MSC v.1916 64 bit (AMD64)] :: Anaconda, Inc. on win32
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

  - Write “Hello, World!” in the command line:

```
(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python
Python 3.8.18 (default, Sep 11 2023, 13:39:12) [MSC v.1916 64 bit (AMD64)] :: Anaconda, Inc. on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> print("Hello, World!")
Hello, World!
>>>
```

Tips

- Check if the current file is saved or not
  - See a “point” next to the file name
  - Let’s make file saving (Ctrl+S) a habit



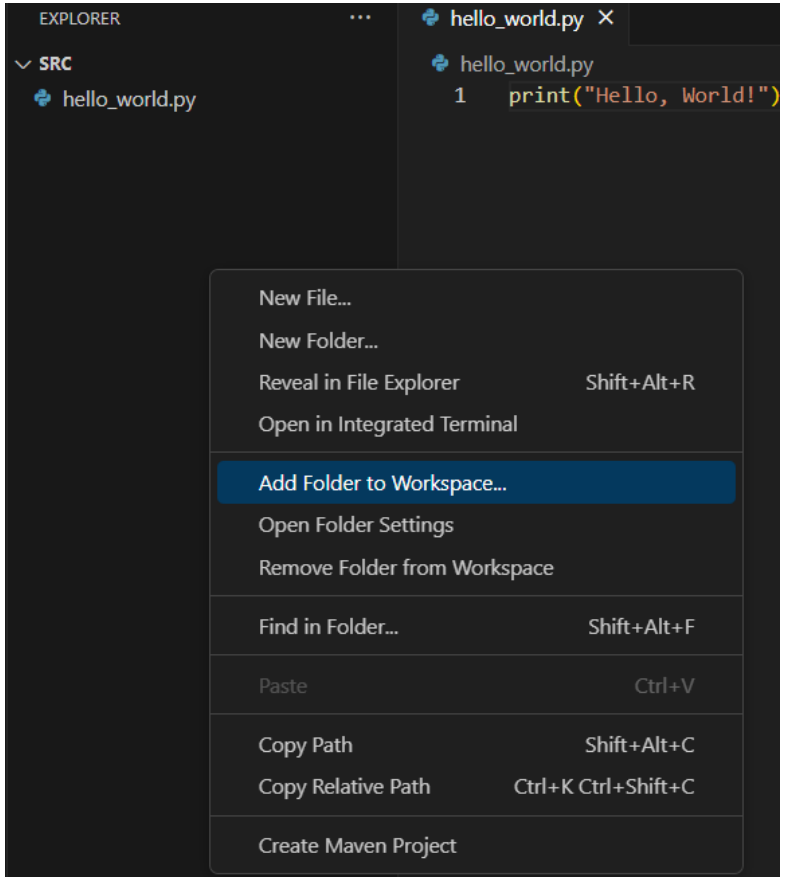
Tips

- The importance of “PATH”
  - If the location of the .py file and the location where I am trying to execute the Python file are different, it will not execute
    - My current location: C:₩Users₩user₩LectureSourceGit
    - Python file location: C:₩Users₩user₩#2 파이썬프로그래밍₩src
  - When the location of the .py file and my current path are different

    ➔ Change your current location to where the .py file is located
    - Use the “cd” command ➔ cd [FILE_PATH]
      - Ex) cd ..
        - Move to the previous directory (folder) (.. represent one level up from the current space)
      - Ex) cd C:₩Users₩user₩#2 파이썬프로그래밍₩src
        - Move to the current location of the .py file

Tips

- When the .py file you are working on does not appear in Explorer, or when you need to add a new directory for work
  - Right click in Explorer and click “Add Folder to Workspace” to add the desired directory to the workspace

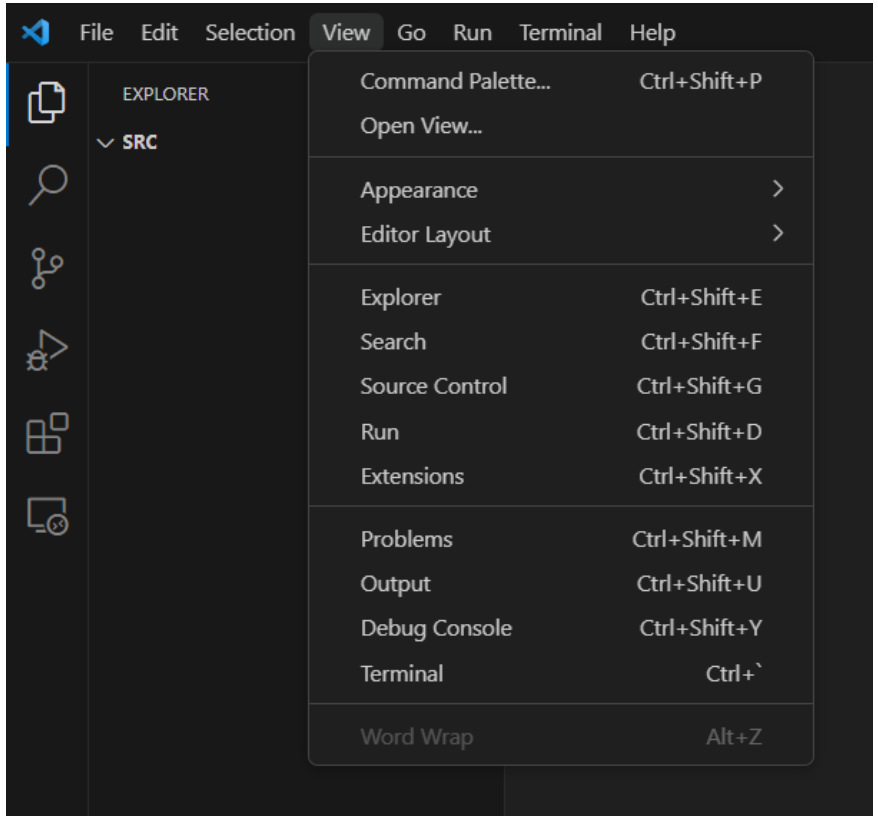


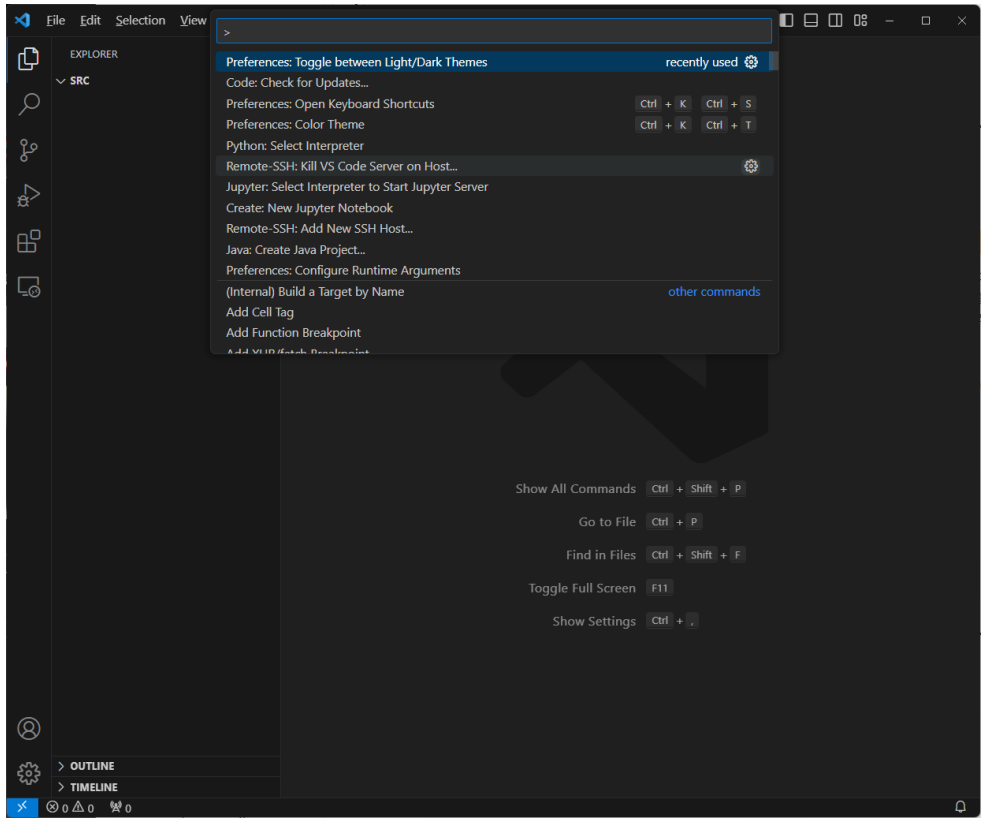
Tips

- Popular shortcuts
  - F1: command palette open
  - Alt + Shift + F: Code clearance (improves readability)

```
for i,j in range(0, 10):
    a,b=i,j+1
```

```
for i, j in range(0, 10):
    a, b = i, j+1
```





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