合肥大學
HEFEI UNIVERSITY

Programming with Python

Getting Started

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中国安徽省合肥市

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Programming with Python

This is a course on programming with the Python language at Hefei University (合肥大学).

The website with the teaching material of this course is https://thomasweise.github.io/programmingWithPython (see also the QR-code at the bottom right). There, you can find the course book and these slides. The repository with the example Python programs can be found at https://github.com/thomasWeise/programmingWithPythonCode.

Outline

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- So, finally, we will also check how you can download these example programs.

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- I will provide examples and instructions for both Ubuntu and Microsoft Windows[2].

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Installing Python under Windows

- Under Windows, Python might not be installed by default.

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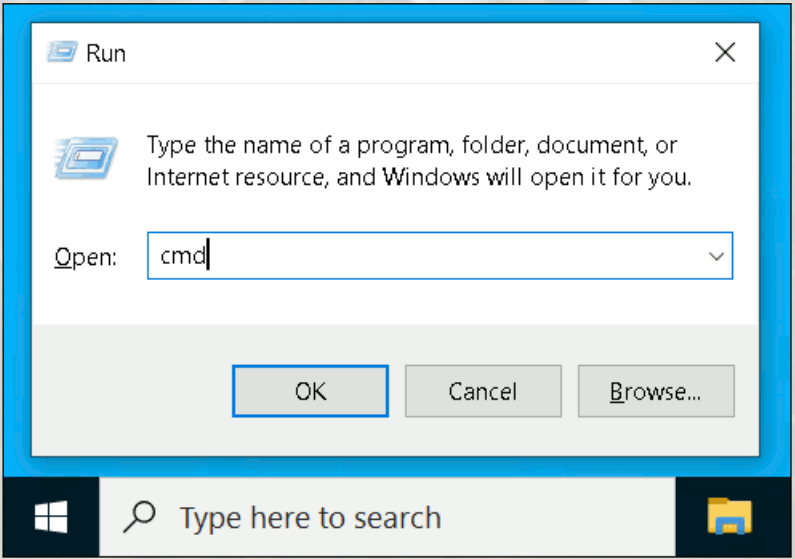

to open a Windows terminal, press ⊞ + R, type in `cmd`, and hit ↵

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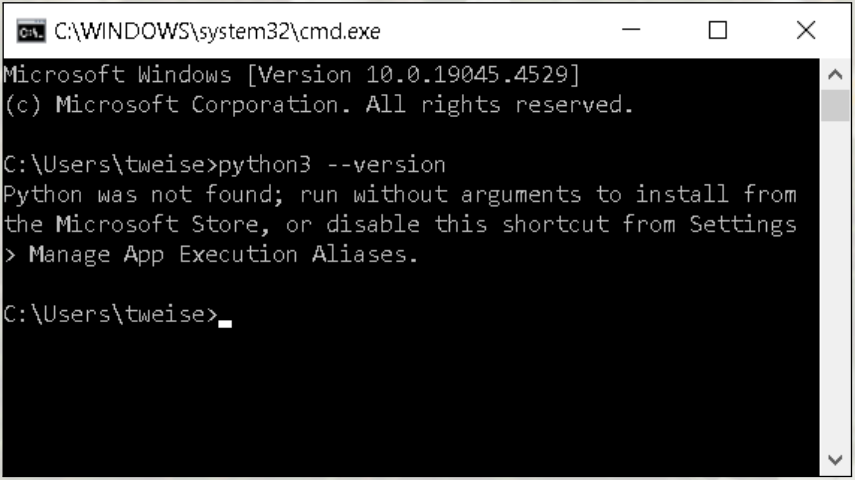

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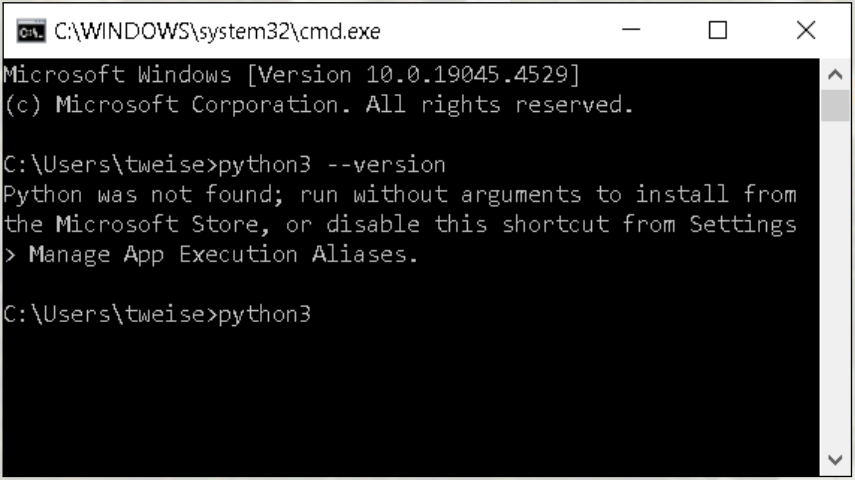

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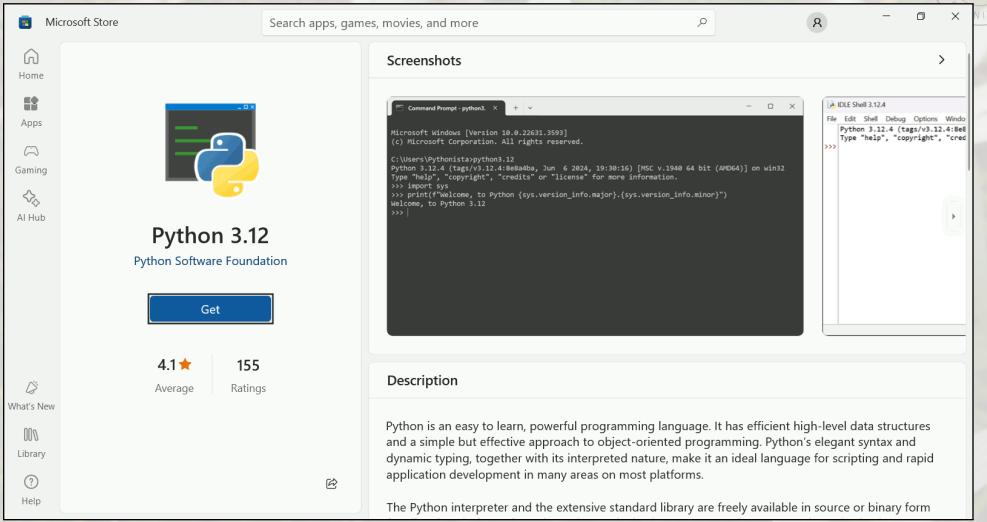

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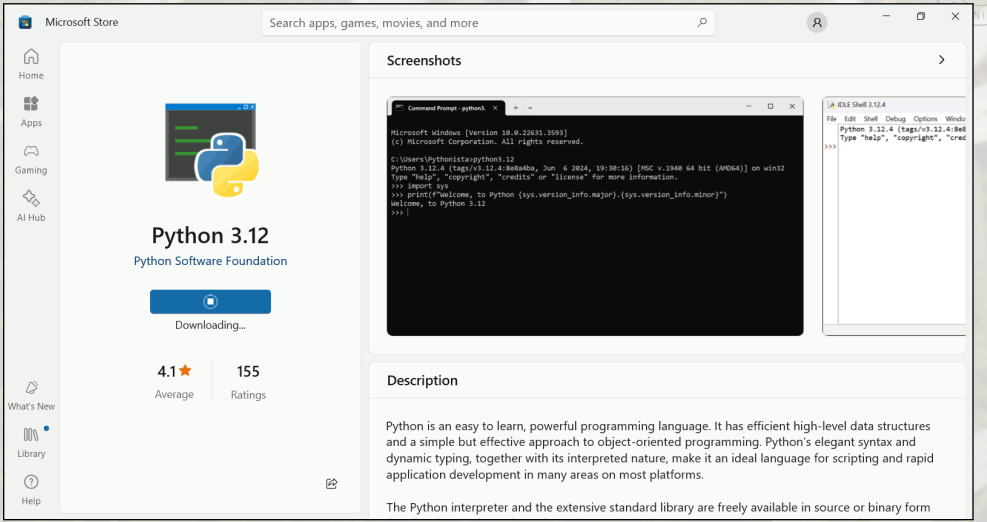

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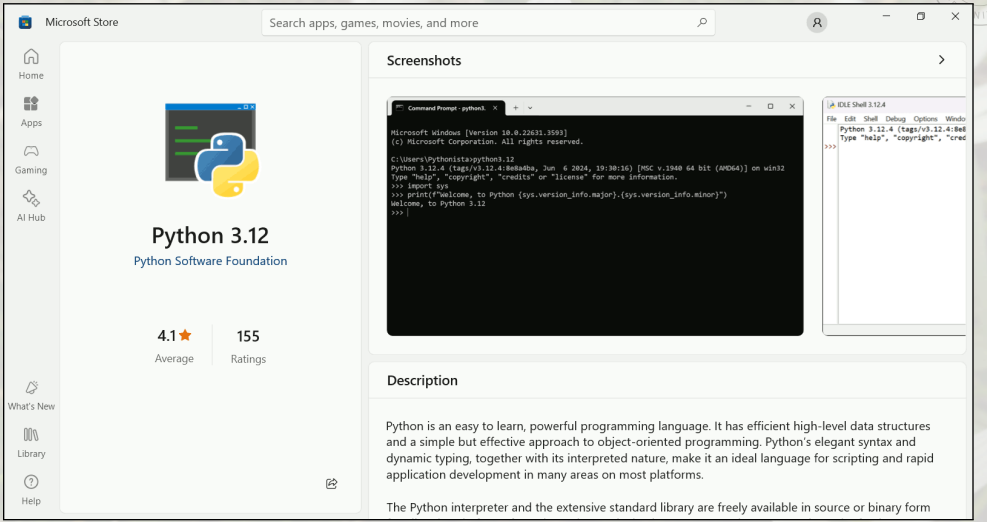

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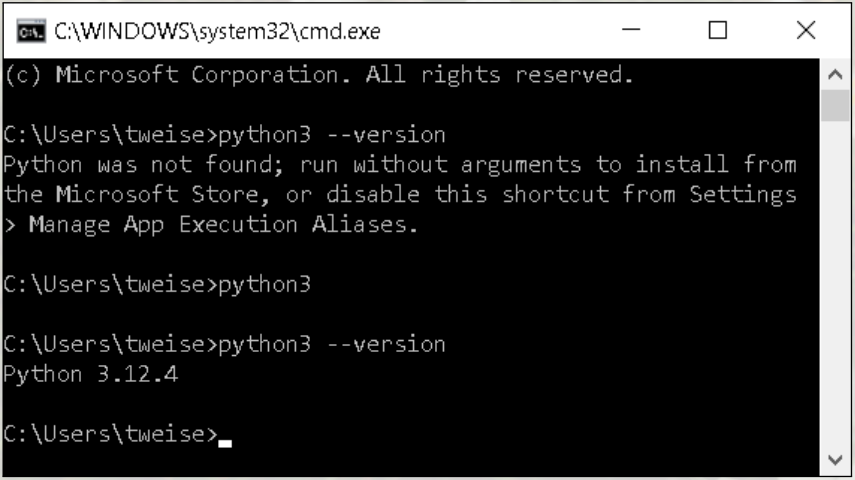

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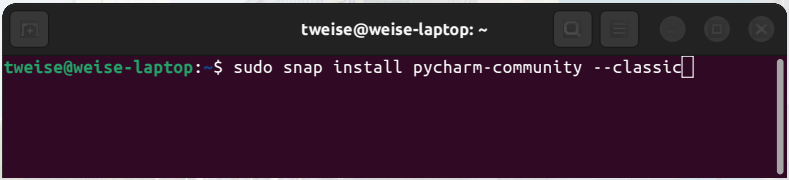

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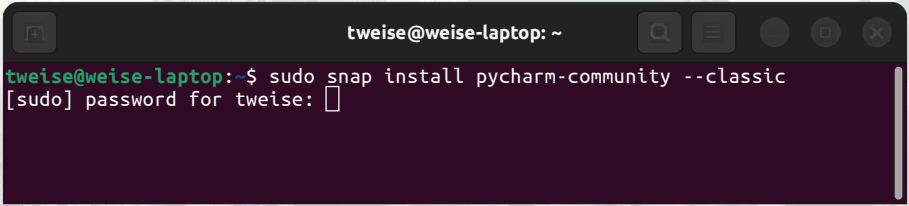

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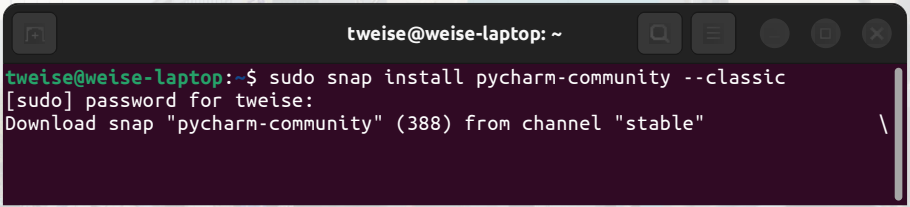

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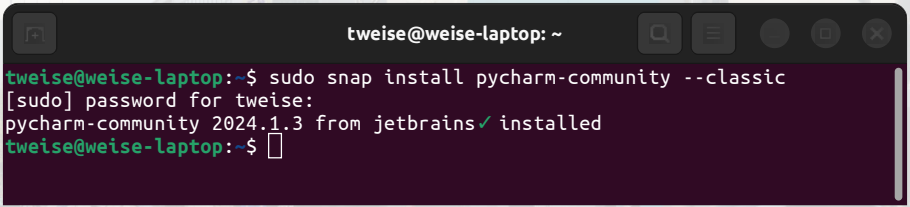

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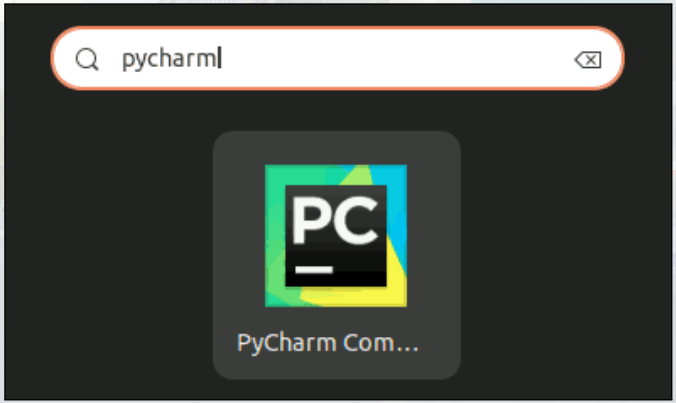

Open the launcher by pressing ⊞ and type in `pycharm`

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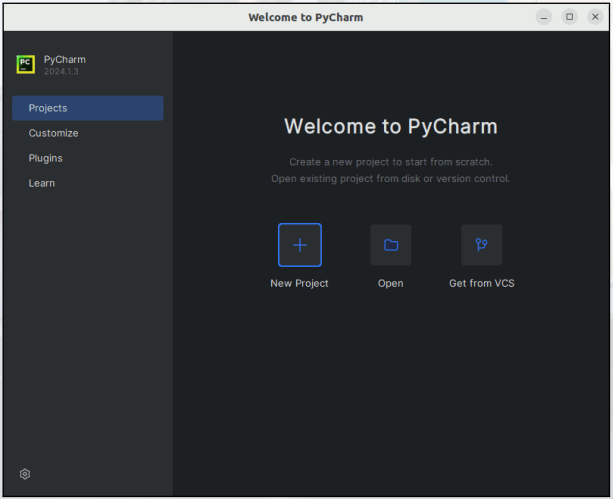

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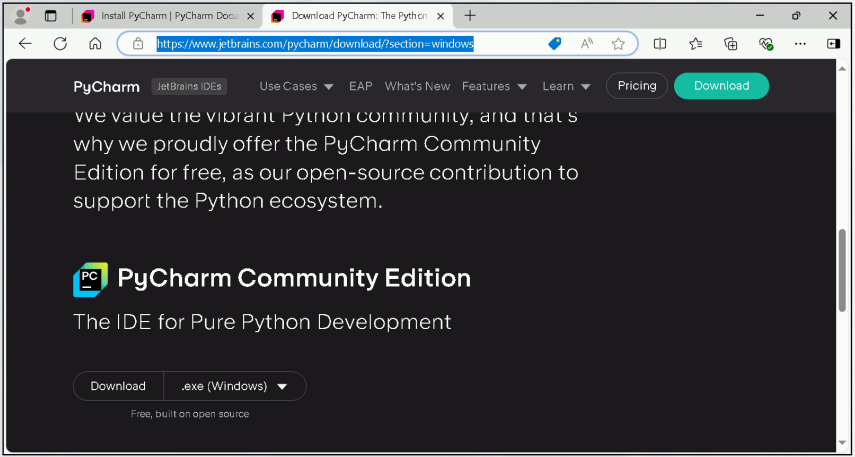

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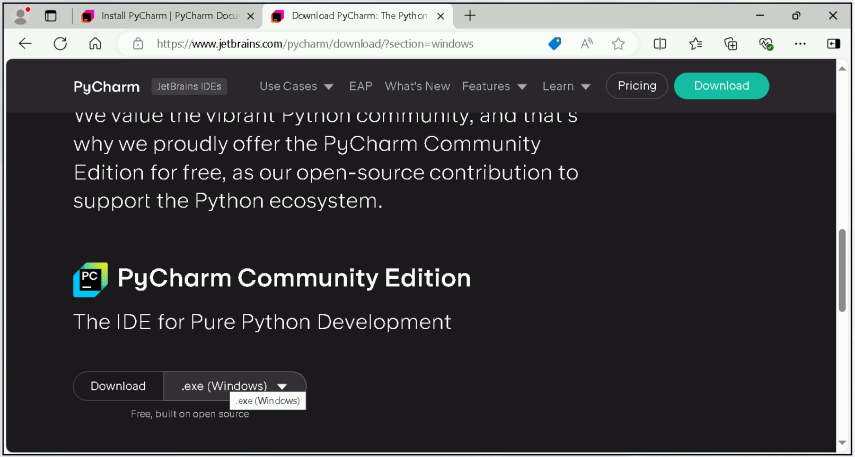

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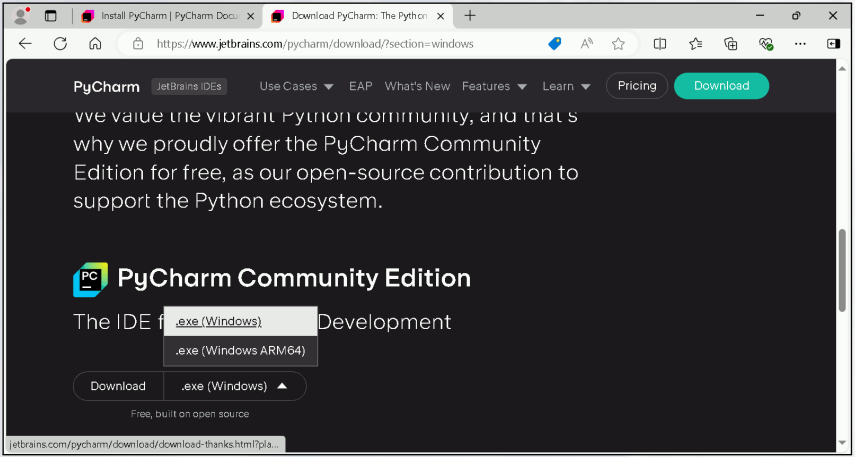

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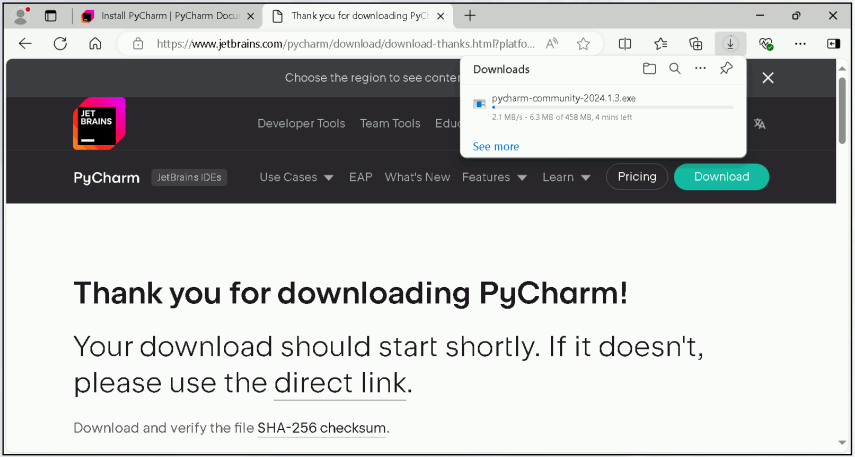

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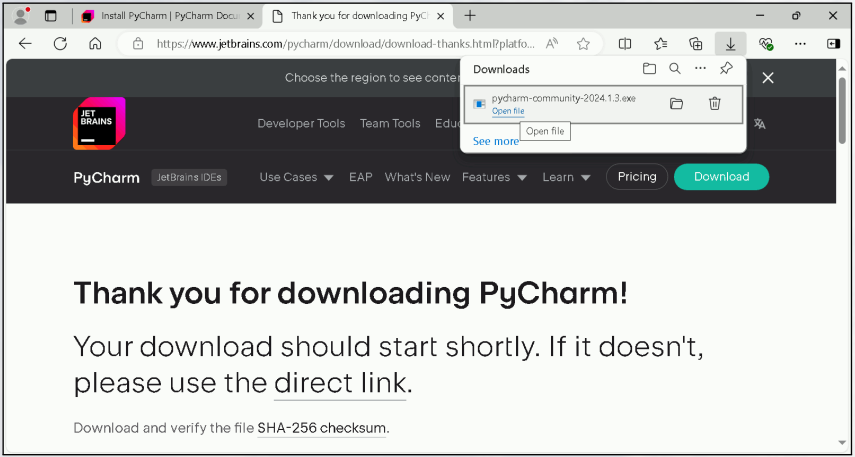

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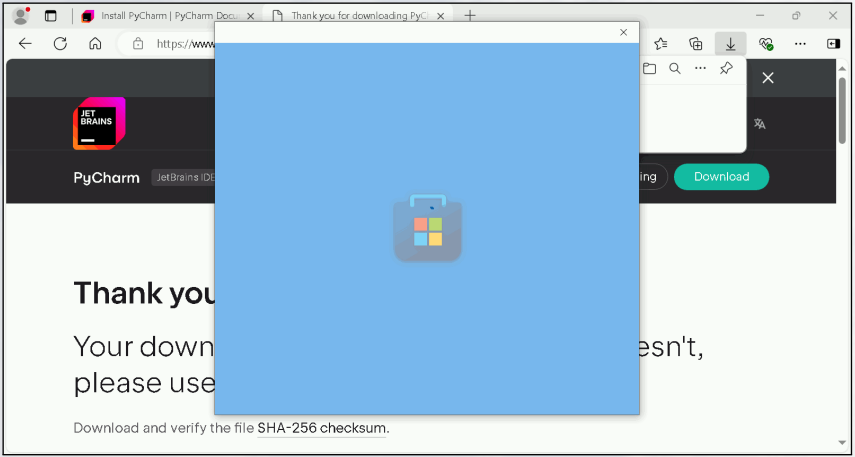

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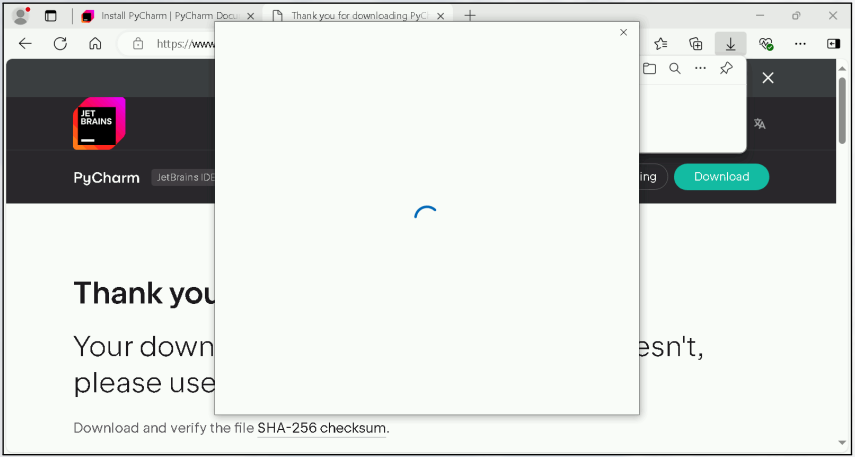

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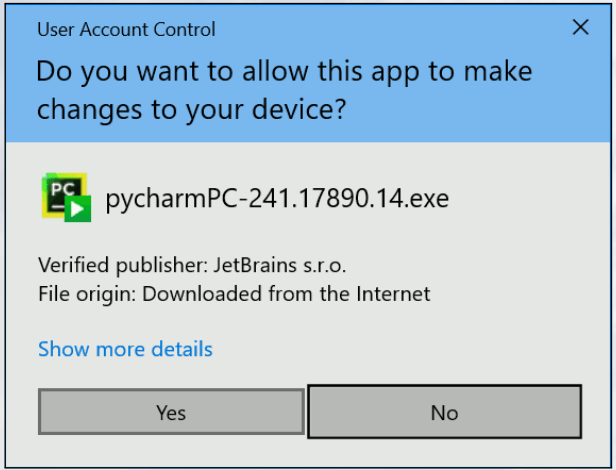

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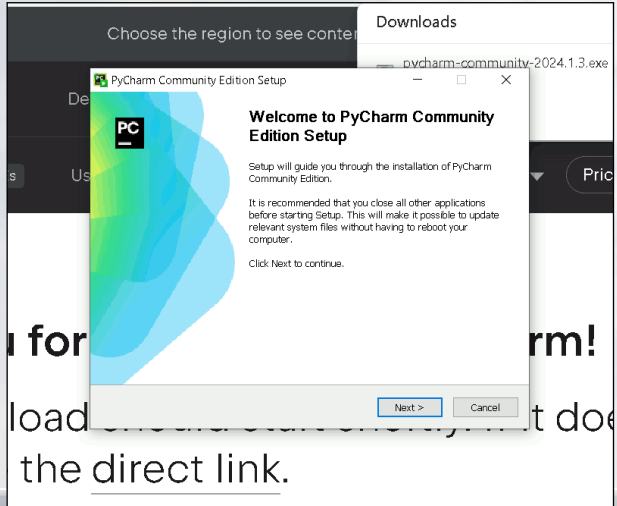

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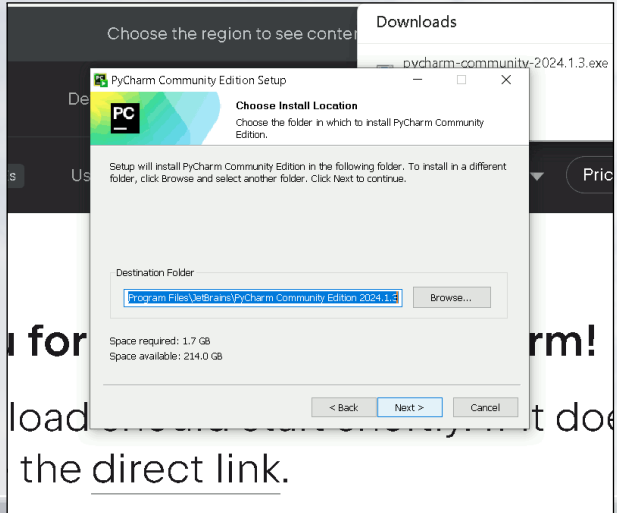

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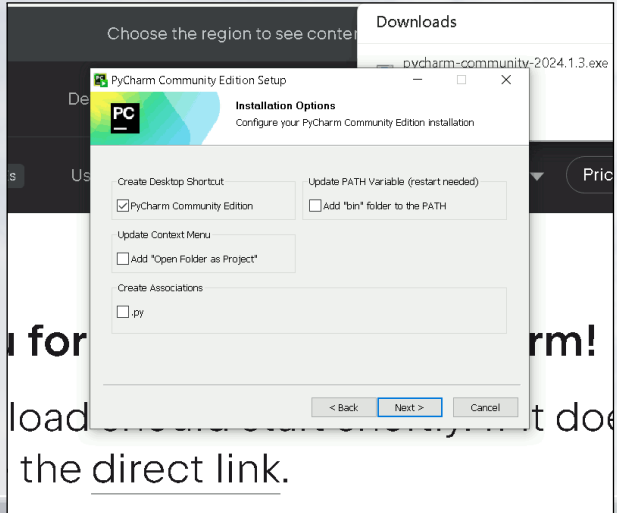

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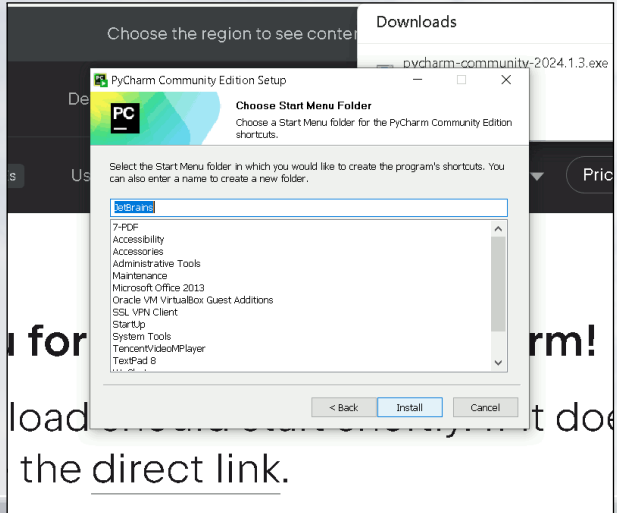

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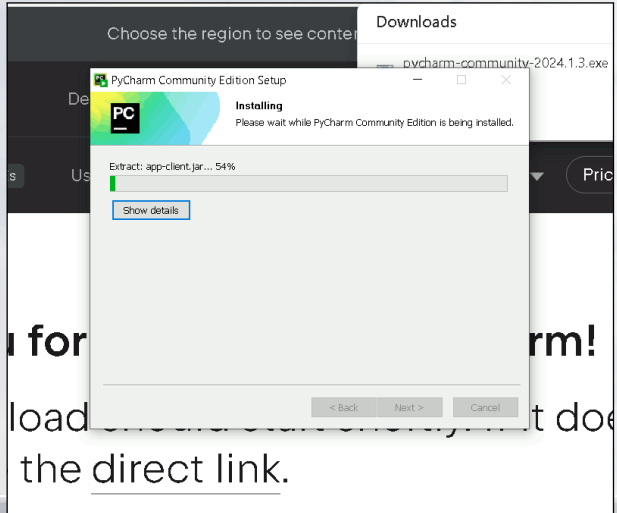

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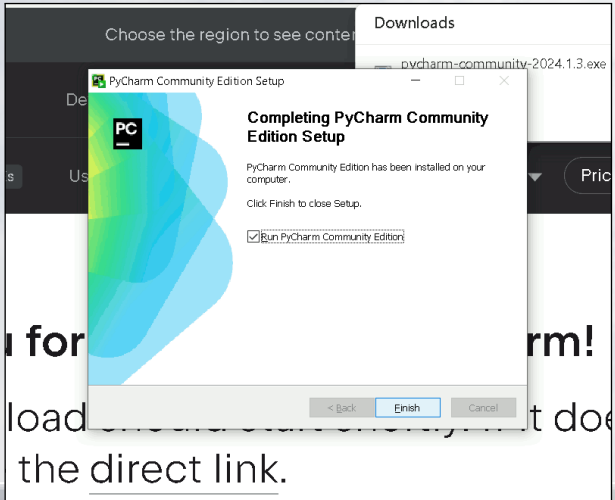

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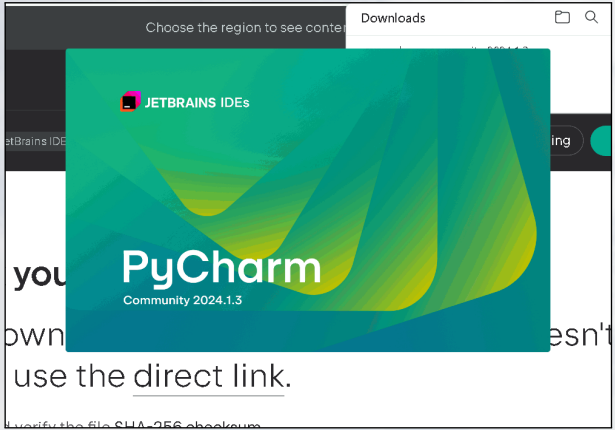

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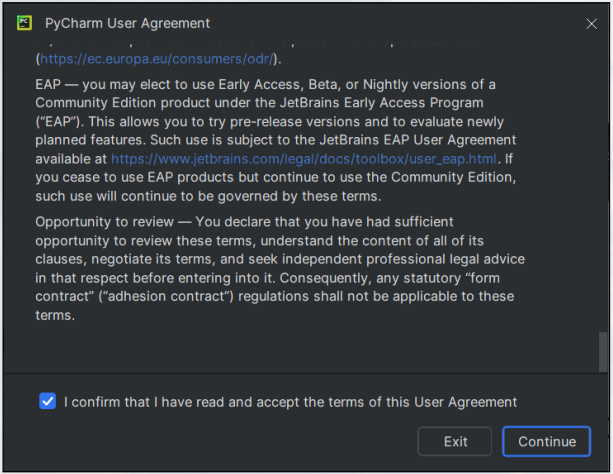

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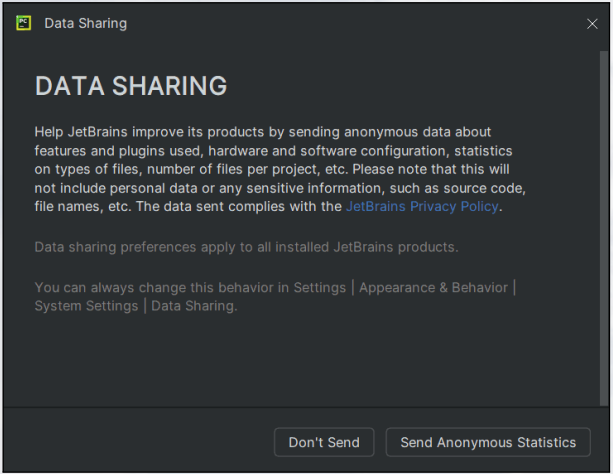

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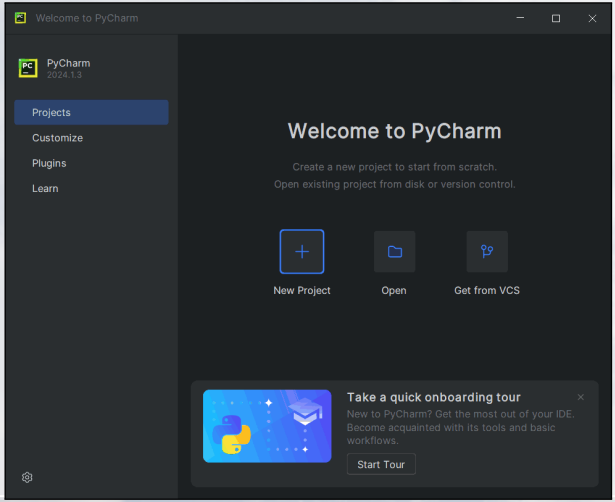

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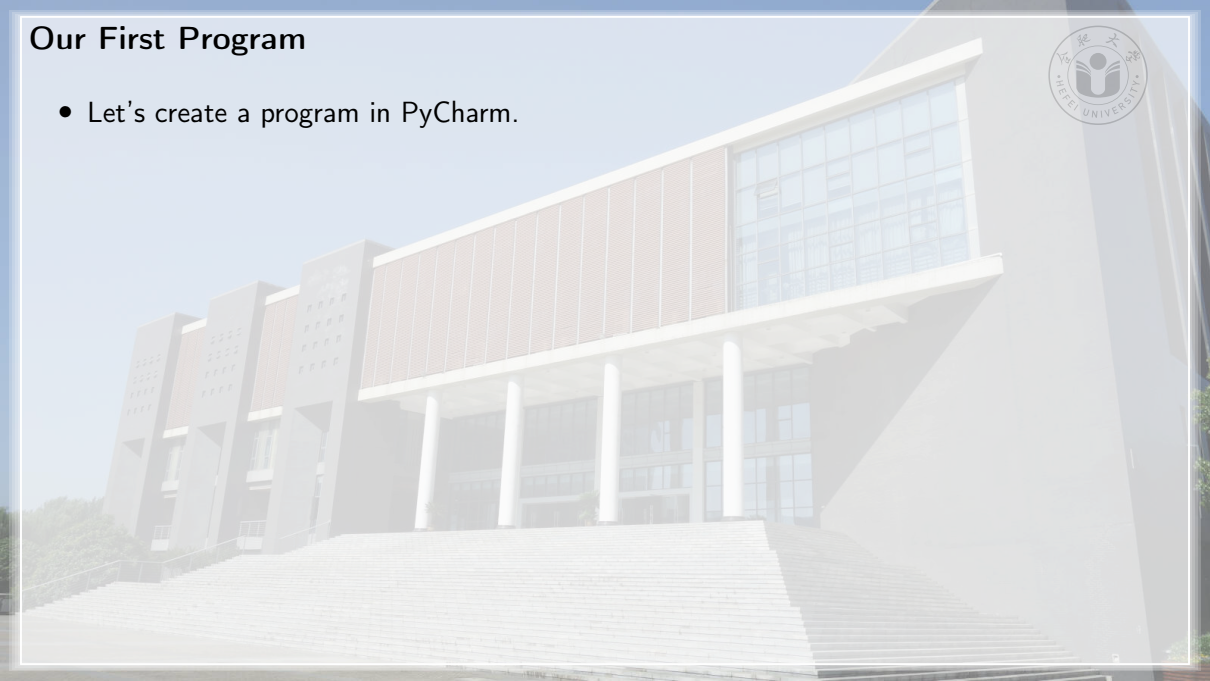

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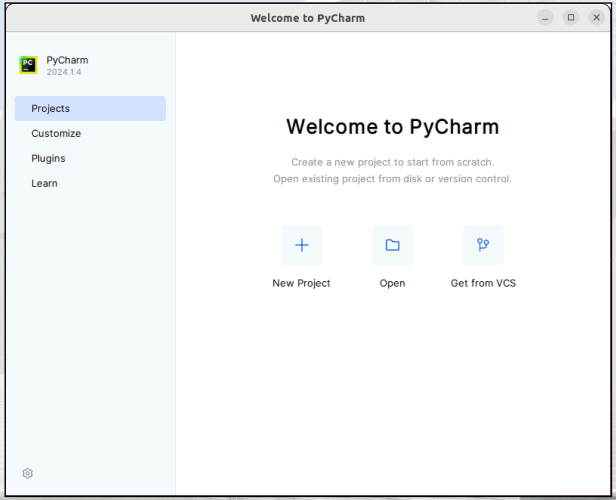

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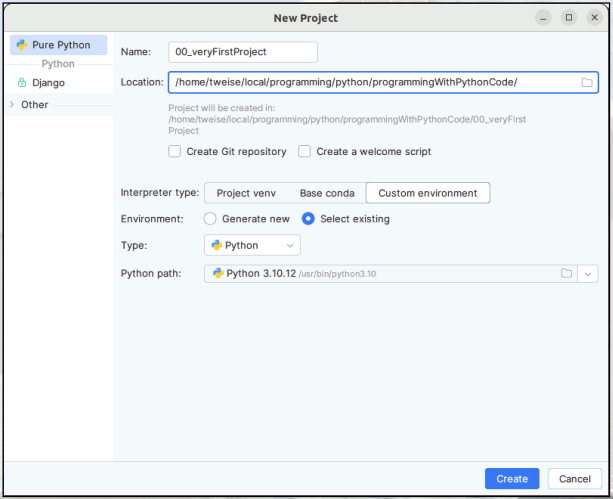

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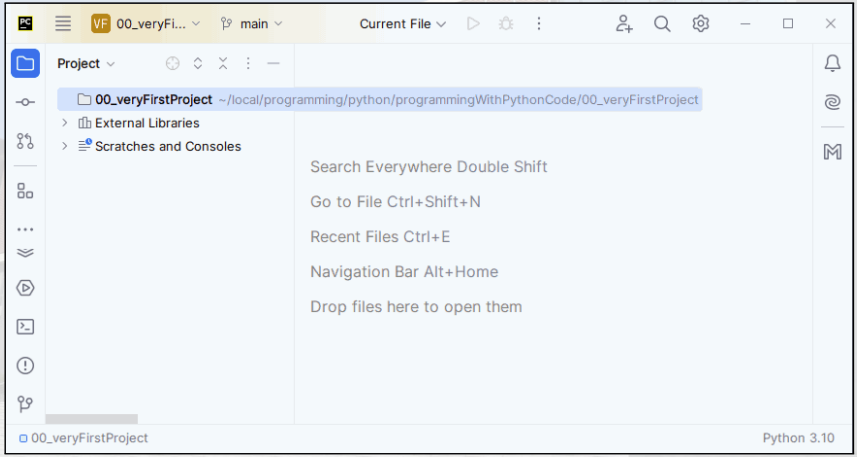

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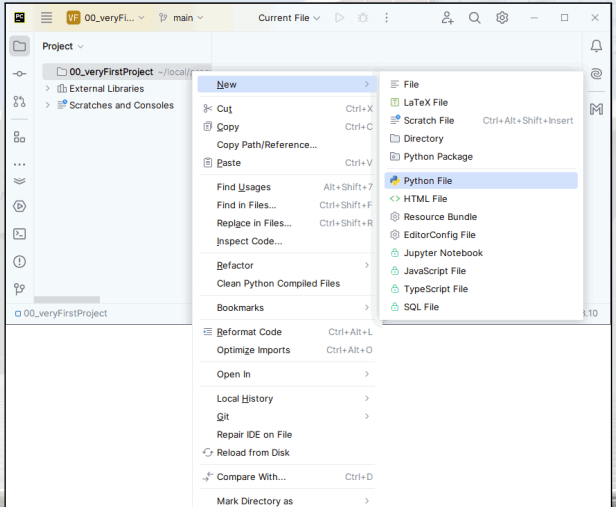

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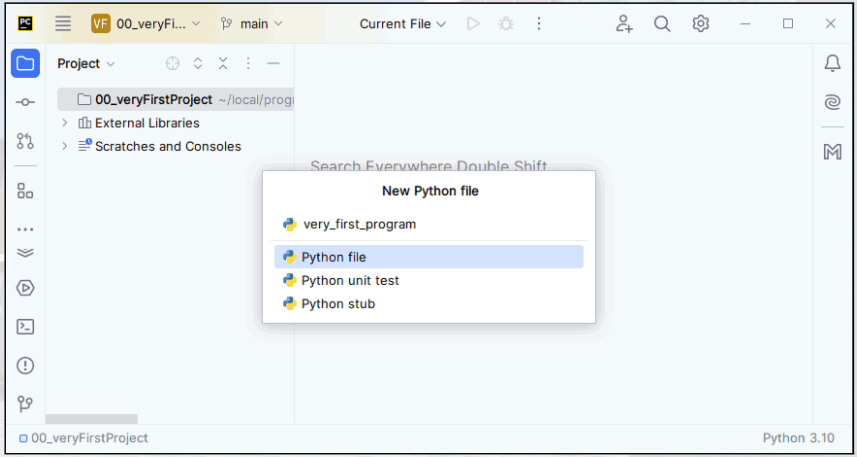

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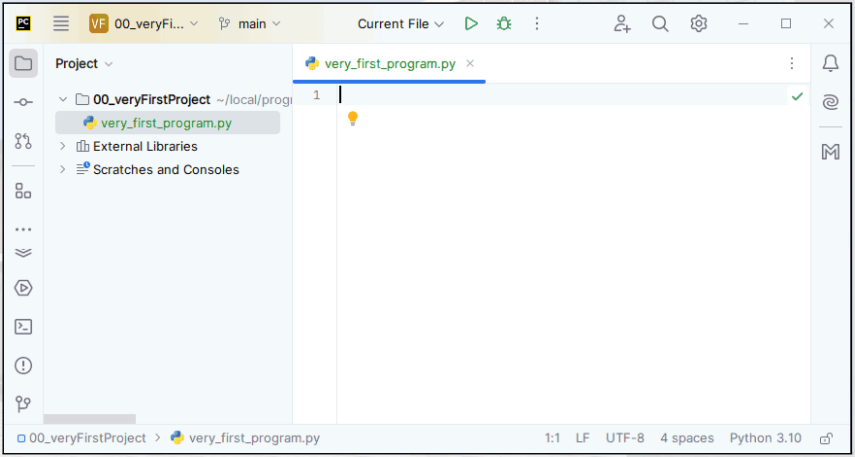

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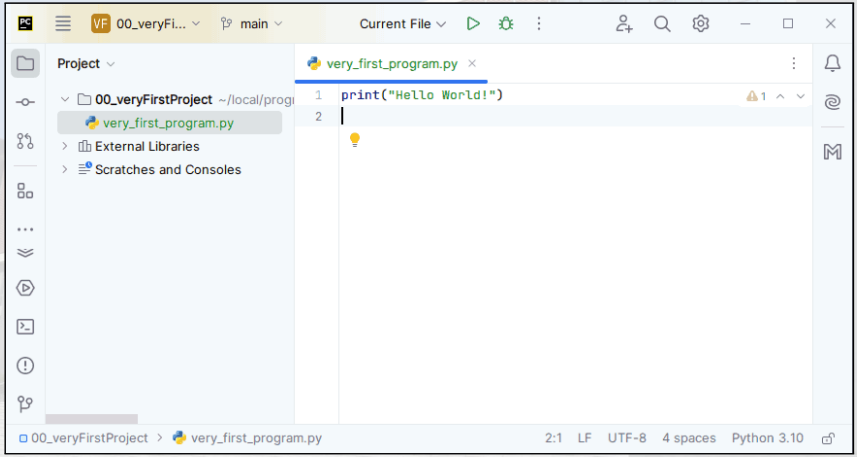

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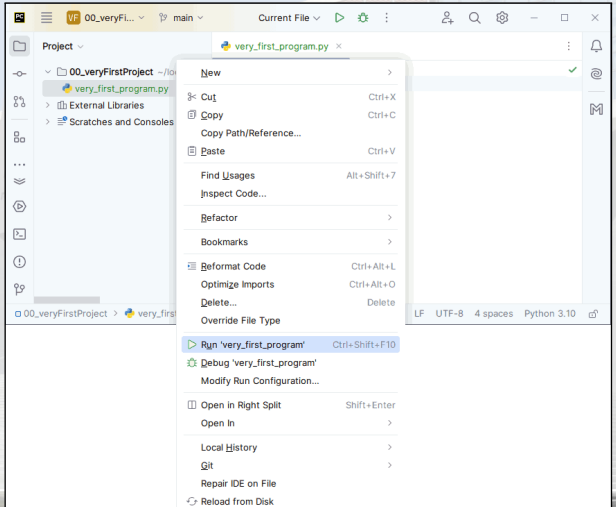

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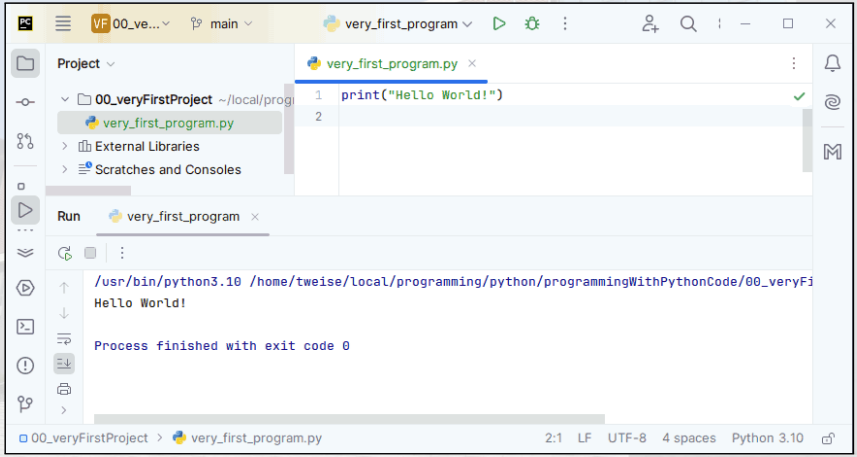

Python in the Terminal

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- We already did option 1., now let's try the others.

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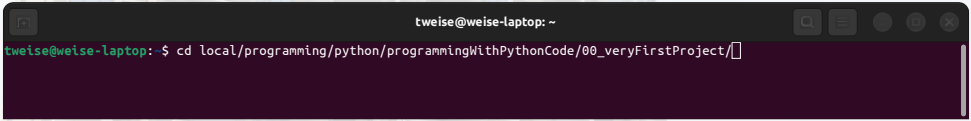

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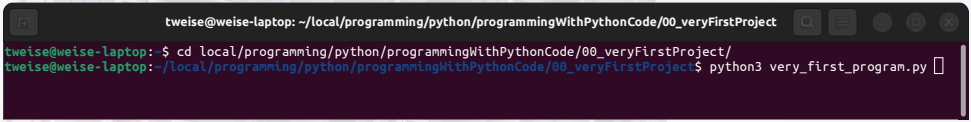

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```
tweise@weise-laptop: ~/local/programming/python/programmingWithPythonCode/00_veryFirstProject
tweise@weise-laptop:~$ cd local/programming/python/programmingWithPythonCode/00_veryFirstProject/
tweise@weise-laptop:~/local/programming/python/programmingWithPythonCode/00_veryFirstProject$ python3 very_first_program.py
Hello World!
tweise@weise-laptop:~/local/programming/python/programmingWithPythonCode/00_veryFirstProject$
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```
1 print("Hello World!")
```

↓ `python3 veryFirstProject.py` ↓

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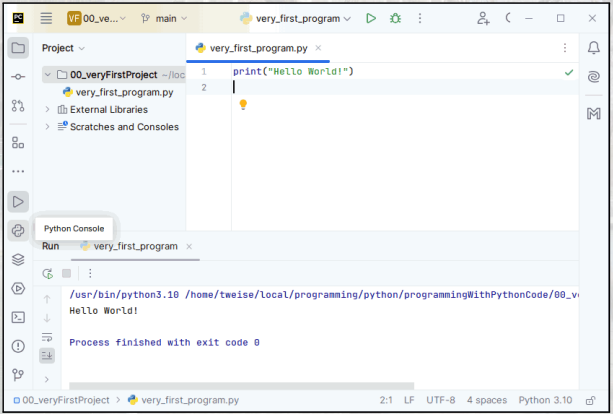

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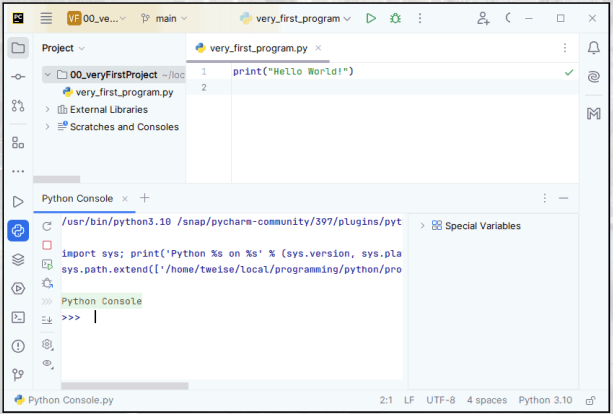

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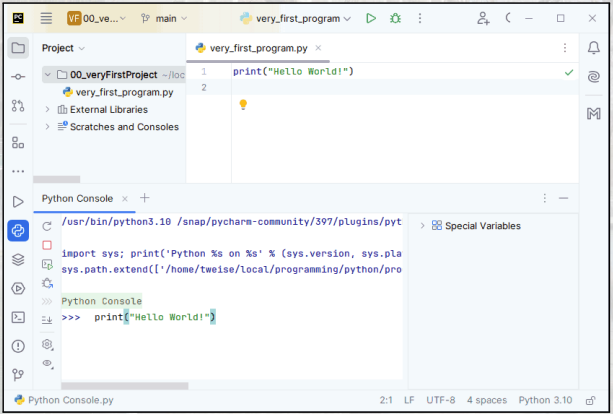

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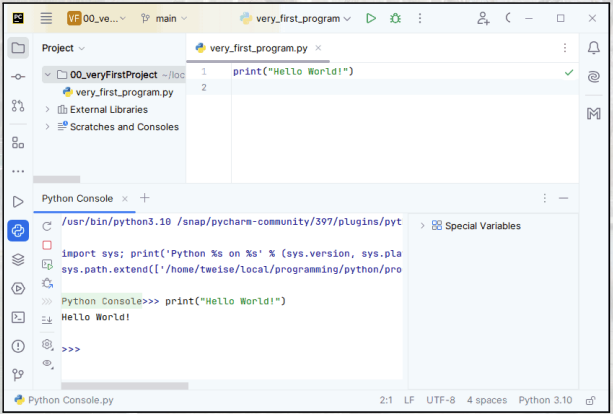

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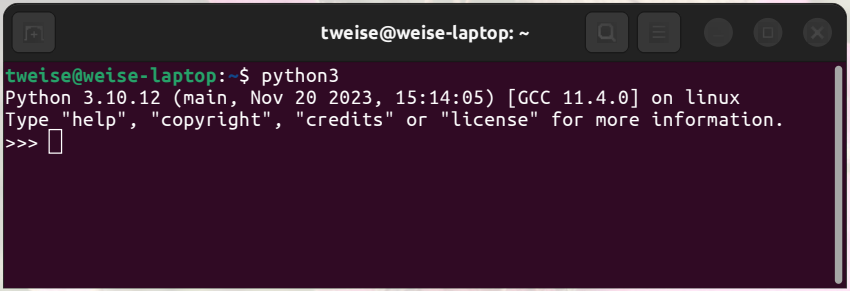

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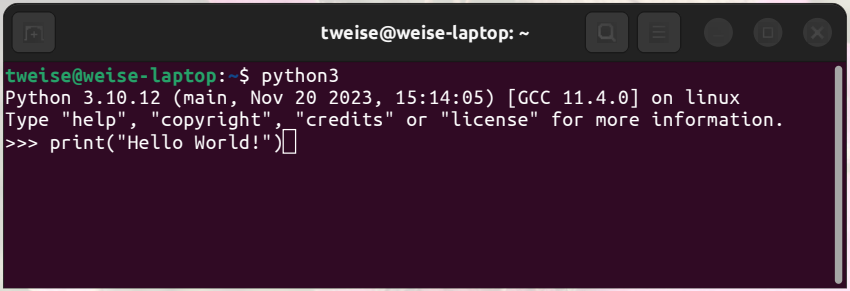

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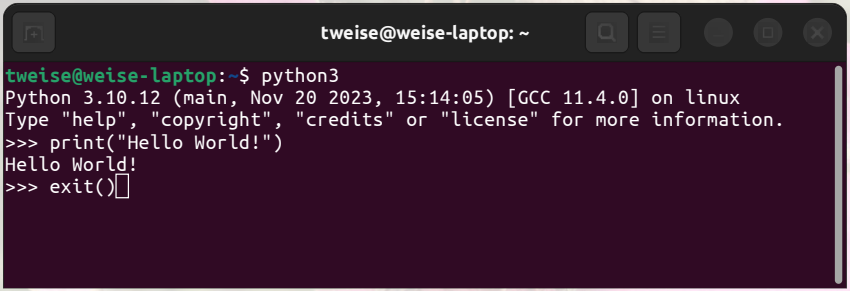

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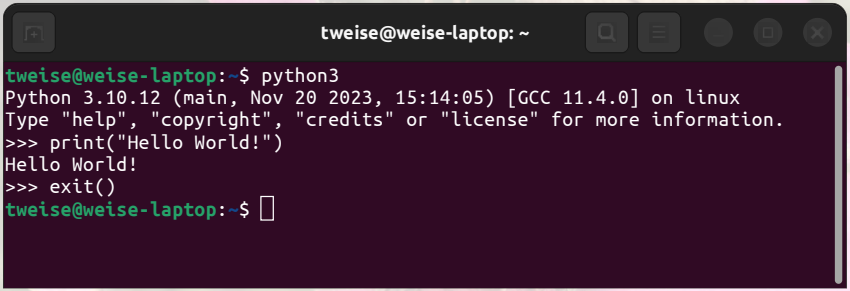

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Best Practice The only proper way to run a Python application in a productive scenario is in the terminal.

Obtaining the Examples

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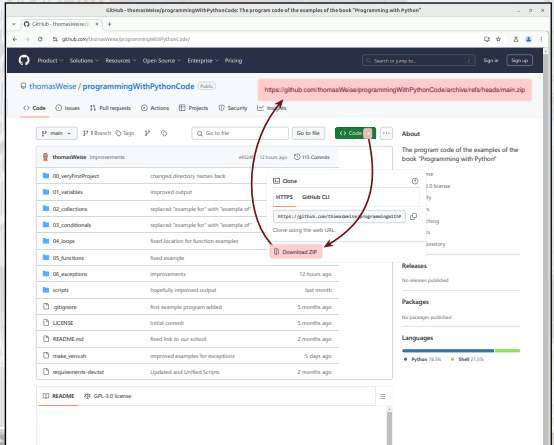

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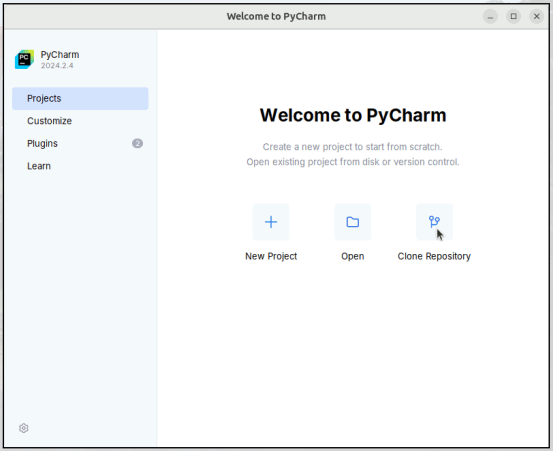

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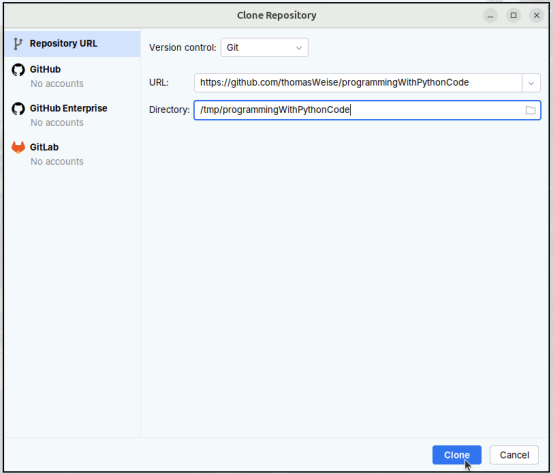

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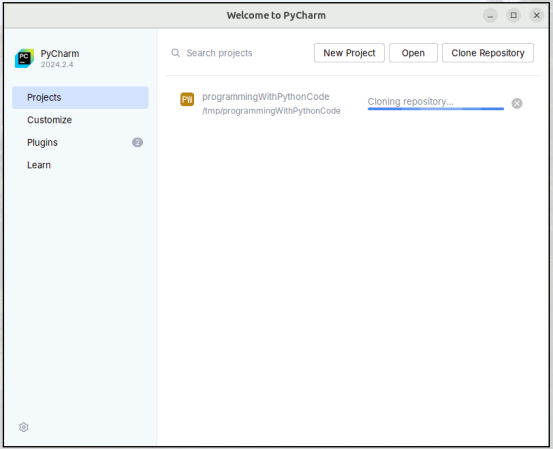

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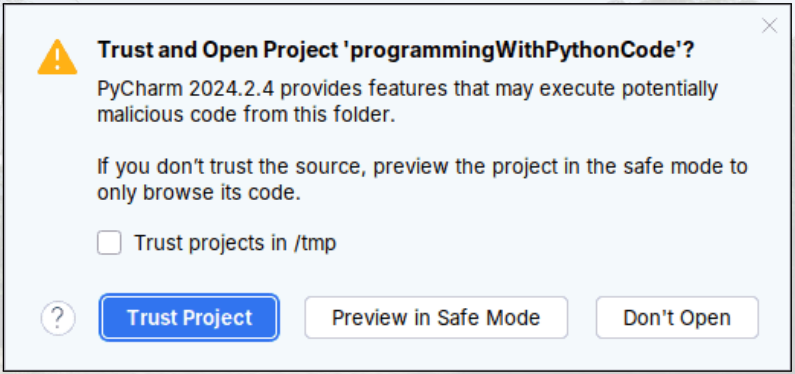

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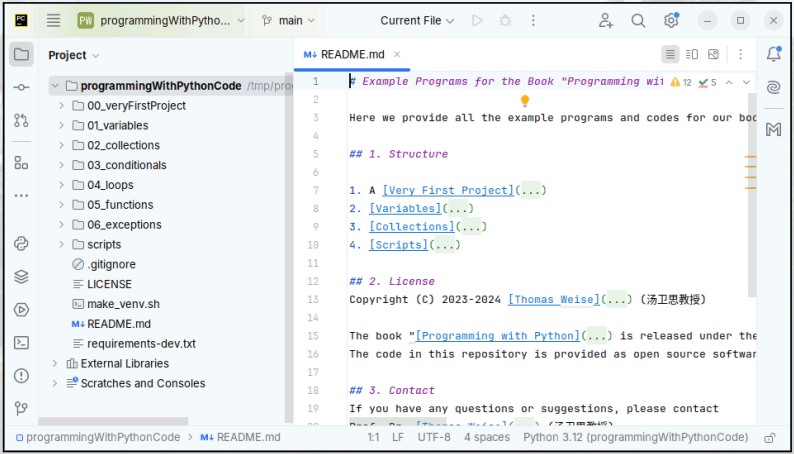

Summary

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- The optimization algorithms we consider in this lecture are randomized.

谢谢您们
Thank you

References I

[1] Daniel J. Barrett. *Efficient Linux at the Command Line*. Sebastopol, CA, USA: O'Reilly Media, Inc., Feb. 2022. ISBN: 978-1-0981-1340-7 (cit. on pp. 11–23).

[2] Ed Bott. *Windows 11 Inside Out*. Hoboken, NJ, USA: Microsoft Press, Pearson Education, Inc., Feb. 2023. ISBN: 978-0-13-769132-6 (cit. on pp. 11–23).

[3] David Clinton and Christopher Negus. *Ubuntu Linux Bible*. 10th ed. Bible Series. Chichester, West Sussex, England, UK: John Wiley and Sons Ltd. Chichester, West Sussex, England, UK: John Wiley and Sons Ltd.: John Wiley and Sons Ltd., Nov. 10, 2020. ISBN: 978-1-119-72233-5 (cit. on pp. 11–23).

[4] Michael Hausenblas. *Learning Modern Linux*. Sebastopol, CA, USA: O'Reilly Media, Inc., Apr. 2022. ISBN: 978-1-0981-0894-6 (cit. on pp. 11–23).

[5] Prague, Czech Republic: JetBrains. *pycharm-community: PyCharm Community Edition*. London, England, UK: Canonical Ltd., Dec. 12, 2024. URL: https://snapcraft.io/pycharm-community (visited on 2025-01-01) (cit. on pp. 45–52).

[6] "Python Setup and Usage". In: *Python 3 Documentation*. Beaverton, OR, USA: Python Software Foundation (PSF), 2001–2024. URL: https://docs.python.org/3/using (visited on 2024-07-05) (cit. on pp. 25–30).

[7] Anna Skoulikari. *Learning Git*. Sebastopol, CA, USA: O'Reilly Media, Inc., May 2023. ISBN: 978-1-0981-3391-7 (cit. on pp. 11–23).

[8] *Snap Documentation*. London, England, UK: Canonical Ltd., 2025. URL: https://snapcraft.io/docs (visited on 2025-01-01) (cit. on pp. 45–52).

[9] Linus Torvalds. "The Linux Edge". *Communications of the ACM (CACM)* 42(4):38–39, Apr. 1999. New York, NY, USA: Association for Computing Machinery (ACM). ISSN: 0001-0782. doi:10.1145/299157.299165 (cit. on pp. 11–23).

[10] Mariot Tsitoara. *Beginning Git and GitHub: Version Control, Project Management and Teamwork for the New Developer*. New York, NY, USA: Apress Media, LLC, Mar. 2024. ISBN: 979-8-8688-0215-7 (cit. on pp. 11–23).

[11] Bruce M. Van Horn II and Quan Nguyen. *Hands-On Application Development with PyCharm*. 2nd ed. Birmingham, England, UK: Packt Publishing Ltd, Oct. 2023. ISBN: 978-1-83763-235-0 (cit. on pp. 11–23).

[12] Martin Yanev. *PyCharm Productivity and Debugging Techniques*. Birmingham, England, UK: Packt Publishing Ltd, Oct. 2022. ISBN: 978-1-83763-244-2 (cit. on pp. 11–23).