# Part 2: Lecture 1

## TECH2: Introduction to Programming, Data, and Information Technology

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# Contents

# About me

- Undergraduate studies in software engineering (& economics), PhD in Economics
- Research fields: Quantitative Macroeconomics & Household Finance
- 20+ years of programming experience:
  - Previously (and mostly forgotten): C/C++, Visual Basic, Java, Java Script, PHP, Perl, SQL, Matlab, R
  - These days: Python, Fortran, Unix shell scripts, Stata

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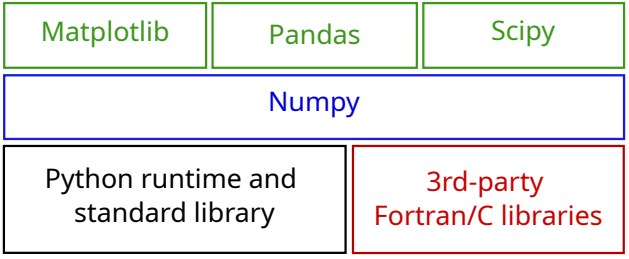
# Python ecosystem

# Python software stack

## How things fit together

- "Python" is the language & standard library supported by the Python Software Foundation
- For numerical applications, we need additional 3rd-party packages such as NumPy, SciPy, etc.
- For working with data, we use additional packages such as Pandas



# Python software stack for quantitative work

**Used in this course**

- Python language, runtime and standard libraries ("Python")
- NumPy: implements $n$-dimensional arrays, linear algebra routines, random number generators
- Matplotlib: High-level plotting routines for visualization
- Pandas: Containers to handle heterogeneous data & routines for data analysis
- Jupyter notebooks: Interactive documents that contain code, figures, and text

**Not used in this course (but useful for future work)**

- SciPy: Optimization routines, sparse matrices, integration, interpolation, linear algebra, statistics
- statsmodels: Estimation of (mostly linear) econometric & statistical models
- scikit-learn: Routines used for machine learning (Ridge regression, Lasso, elastic net, etc.)

# Outline of part 2

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**Week 39: Version control & Visual Studio Code**

- Working with the git version control system
- Working with the Visual Studio Code editor
- Application: Write and benchmark `argmax()` function

**Week 40: Introduction to pandas**

- Creating/importing data
- Data cleaning
- Summary statistics
- Indexing
- Time series data

# Outline of part 2 (continued)

**Week 41: Plotting**

- Creating line plots, bar charts, etc.
- Plotting data with pandas

**Week 42: Data wrangling I**

- Aggregation and reduction
- Transformations
- Resampling of time series data

**Week 43: Data wrangling II**

- Concatenating data
- Merging & joining data

# Goals for today

**git & GitHub**

- Create your own fork of repository at https://github.com/richardfoltyn/TECH2-H25
- Create local clone of your fork on your computer

**Visual Studio Code**

- Open repository in VS Code and familiarize yourself with the environment
- Explore using VS Code by implementing a function `argmax()` and benchmarking it against NumPy's implementation.

  This is a good opportunity to practice working with NumPy!
- Integrate git into your programming workflow: add commits as you finish individual tasks

# Tools:
# Git, GitHub, and VS Code

# Software & tools

**Goal:** learn to use industry-standard tools for programming in Python

- Python distribution: Anaconda
- Version control: git
- Code hosting: GitHub
- Editor: Visual Studio Code

**Why git? (and GitHub)**

- Because everyone uses it: almost completely replaced all other version control systems over the last 19 years

  Examples:

  - Python: https://github.com/python/cpython
  - NumPy: https://github.com/numpy/numpy
  - SciPy: https://github.com/scipy/scipy
  - Pandas: https://github.com/pandas-dev/pandas
  - Matplotlib: https://github.com/matplotlib/matplotlib
  - PyTorch (Meta's ML library): https://github.com/pytorch/pytorch
  - TensorFlow (Google's ML library): https://github.com/tensorflow/tensorflow
- Keeps history of **your** code changes (and can restore previous versions)
- Keeps history of **other's** code changes
- Allows for decentralized coding in teams
- Allows synchronizing of code across devices

# GitHub

**Why GitHub?**

- Everyone uses it!
- Alternatives (less popular):
  - GitLab
  - BitBucket
- Offers many other services besides version control (issue tracking, Wiki, etc.)
- Register for free at https://github.com/signup

# Visual Studio Code

**Why Visual Studio Code?**

- Has become the most widely used editor for most languages (see StackOverflow Developer Survey 2024)
- Free & open source
- Good support for almost any programming language and file format (e.g., Jupyter Notebooks) via extensions
- Natively supports git & GitHub (unlike older editors)

- Alternative: PyCharm by JetBrains (free community edition is available, free professional edition for students)

- Note: Visual Studio Code completely independent of Visual Studio, a commercial IDE from Microsoft for Windows development

# VS Code is the most popular editor

*"Which development environments did you use regularly over the past year?"*

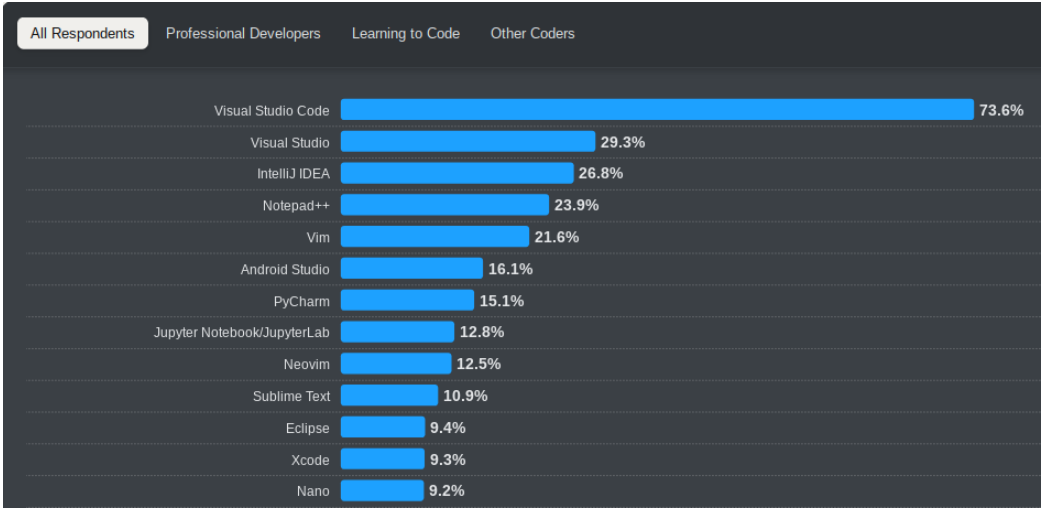


**Figure 1:** Source: StackOverflow Developer Survey 2024

# Additional Resources

# Additional resources — Videos

**Introduction to the command line / terminal:**

- Absolute BEGINNER Guide to the **Mac OS** Terminal [17 min]
  https://youtu.be/aKRYQsKR46I
- Git Bash - Simplest command line program for **Windows** [7 min]
  https://youtu.be/yoZ910JQzrg

**Introduction to using git**

- Git for dummies [20 min] https://youtu.be/mJ-qvsxPHpY
- Git and GitHub Tutorial for Beginners [46 min] https://youtu.be/tRZGeaHPoaw
- Git Essentials in VS Code [30 min] https://youtu.be/twsYxYaQikI
  Focuses on interacting with git and GitHub through VS Code