Lesson 01: Python Setup

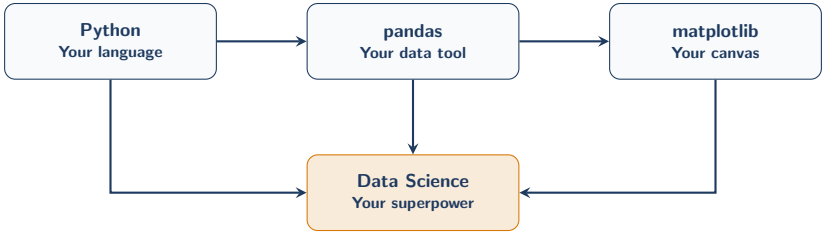
Data Science with Python – BSc Course

Data Science Program

BSc Course

45 Minutes

Welcome to Data Science!



This semester: 48 lessons from zero Python to deploying ML models.
Today we start with the absolute basics – Python as your new calculator.

No prior programming experience required

Learning Objectives

After this lesson, you will be able to:

- **Explain** Python's role in the data science ecosystem
- **Navigate** the Jupyter Notebook environment
- **Create** variables and assign values of different types
- **Perform** arithmetic operations on numeric data
- **Manipulate** strings using methods and f-strings

Finance Application: Store and compute stock prices, returns, and portfolio values.

Bloom's levels: Explain, Navigate, Create, Perform, Manipulate

What You Need to Get Started

What you bring:

- Curiosity about data
- A laptop with internet
- Willingness to make mistakes

No experience needed.
If you can use a calculator, you can write Python.

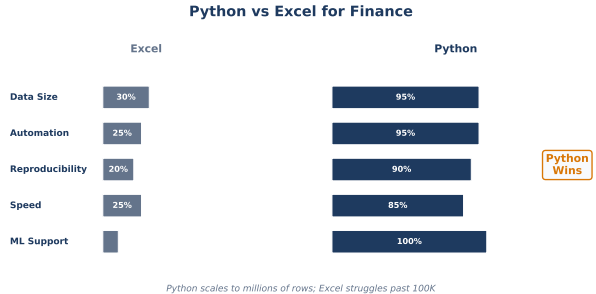
What you'll gain:

- Analyze thousands of data points
- Automate repetitive calculations
- Create publication-quality charts
- Build predictive models

By lesson 48: You deploy a machine learning app to the cloud.

Python is the #1 language for data science (Stack Overflow 2024)

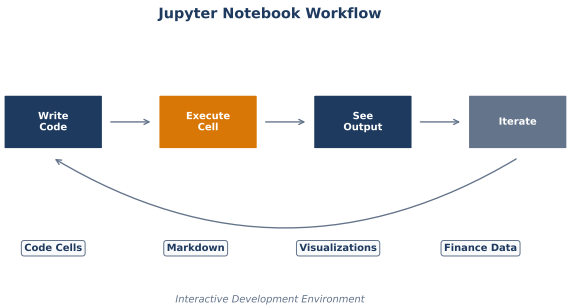
The Python Data Science Ecosystem



Why Python? Millions of rows, reproducible scripts, free and open-source.

Python: millions of rows, full automation. Excel: manual, limited.

The Jupyter Notebook Environment



Key elements: Cells (code or text) — Run button (Shift+Enter) — Kernel status

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Jupyter = Julia + Python + R – interactive development for data science

Working in Jupyter

Cell Types:

- **Code cells** – run Python
- **Markdown cells** – formatted text
- **Output** – appears below code

Essential Shortcuts:

`Shift+Enter` – run cell
`Esc+A` – insert cell above
`Esc+B` – insert cell below
`Esc+DD` – delete cell

Best Practices:

1. One idea per cell
2. Add markdown explanations
3. Run cells top to bottom
4. Restart kernel if confused

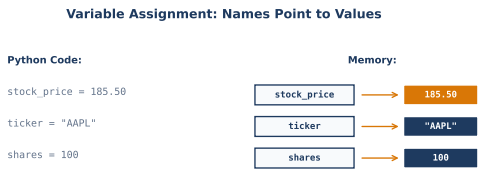
Common Pitfall:

Running cells out of order causes errors. When in doubt:
`Kernel > Restart & Run All`

Treat notebooks like lab journals – document as you go

Variables: Named Containers

A variable is a name that points to a value in memory



Assignment: `price = 185.50` creates a label "price" pointing to the value 185.50

Python uses dynamic typing – no need to declare types

Variable Naming Rules

Valid Names:
`stock_price` – descriptive
`dailyReturn` – camelCase OK
`_private` – underscore prefix
`price2` – numbers OK (not first)

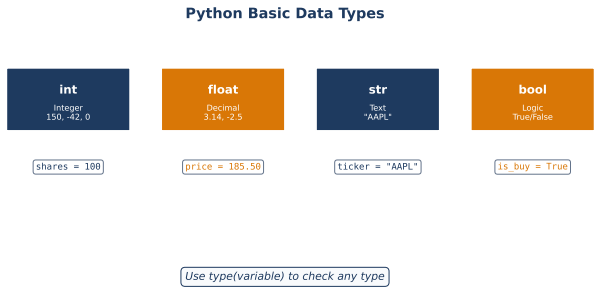
Python Convention:
Use `snake_case` for variables:
`buy_price`, `total_value`

Invalid Names:
`2price` – starts with number
`my-var` – hyphen not allowed
`class` – reserved keyword
`for` – reserved keyword

Good vs Bad:
`stock_price` Y descriptive
`sp` N cryptic
`x` N meaningless

Descriptive names make code self-documenting

Python Data Types



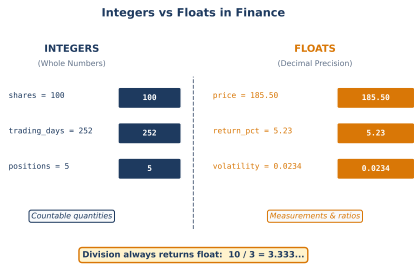
Four fundamental types: `int` (whole numbers), `float` (decimals), `str` (text), `bool` (True/False)

Use type(variable) to check any variable's type

Integers vs Floats in Finance

Integers (`int`):

- Shares owned: `shares = 100`
- Trading days: `days = 252`
- Position count: `n = 5`



Floats (`float`):

- Price: `price = 185.50`
- Return: `ret = 0.0523`
- Percentage: `pct = 5.23`

Key Rule:
Division always returns float:
`10 / 3` → `3.333...`
`10 // 3` → `3` (floor division)

Use int for counts, float for prices and returns

Arithmetic Operations

Basic Operators:

Op	Symbol	Example
Add	`+`	`100 + 50 = 150`
Subtract	`-`	`185 - 150 = 35`
Multiply	`*`	`50 * 185 = 9250`
Divide	`/`	`35 / 150 = 0.233`
Power	`**`	`2 ** 3 = 8`
Floor div	`//`	`7 // 2 = 3`
Modulo	`%`	`7 % 2 = 1`

Order of Operations (PEMDAS):

1. Parentheses `( )`
2. Exponents `**`
3. Multiply / Divide `* / // %`
4. Add / Subtract `+ -`

Example:

`2 + 3 * 4` → 14
`(2 + 3) * 4` → 20

When in doubt, use parentheses to make order explicit

Finance: Computing Returns

Portfolio Calculation:

```
buy_price = 150.25
current_price = 185.50
shares = 50

investment = shares * buy_price
# 7512.50

current_value = shares * current_price
# 9275.00

profit = current_value - investment
# 1762.50

return_pct = (profit / investment) * 100
# 23.46%
```

Compound Interest:

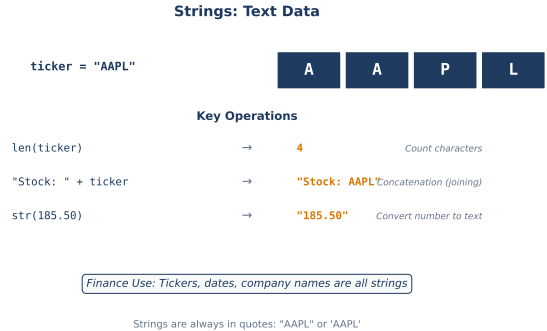
```
principal = 10000
rate = 0.07  # 7% annual
years = 5

future = principal * (1 + rate) ** years
# 14,025.52
```

Formula: $FV = PV \times (1 + r)^n$

Python computes this instantly.
Excel needs a formula per cell.

Python turns financial formulas into one-line calculations

String Operations



Strings store text: ticker symbols, company names, dates, log messages

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Strings are immutable – methods return new strings, originals unchanged

Working with Strings

String Methods:

```
ticker = "aapl"
ticker.upper() → "AAPL"
"AAPL".lower() → "aapl"
len("AAPL") → 4
```

Concatenation:

```
"NASDAQ:" + "AAPL"
→ "NASDAQ:AAPL"
```

Indexing:

```
ticker[0] → "A"
ticker[-1] → "L"
```

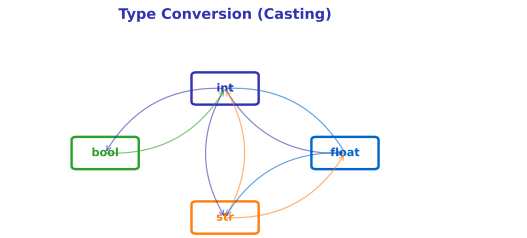
F-strings (Recommended):

```
price = 185.50
shares = 50
msg = f"Price: ${price}"
# "Price: $185.5"
msg = f"{shares} shares"
# "50 shares"
msg = f"Return: {23.46:.1f}%"
# "Return: 23.5%"
```

Key: F-strings embed variables directly inside strings with `f"..."`

F-strings are the modern way to format strings (Python 3.6+)

Type Conversion



Converting Between Types:

`int("100")` → `100`
`float("185.5")` → `185.5`
`str(185.5)` → `"185.5"`
`bool(1)` → `True`

Finance Use Case:

CSV files deliver prices as strings.
You must convert before calculating.

Gotcha:

`int("185.5")` fails!
Use `int(float("185.5"))` instead.

Real-world data arrives as strings – conversion is essential

Checkpoint: Check Your Understanding

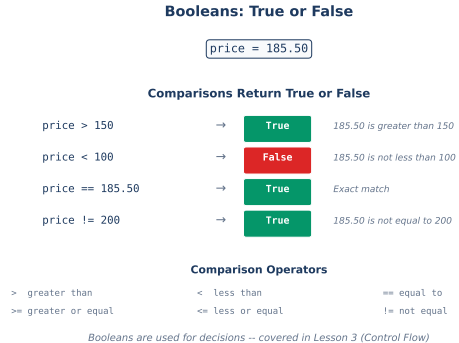
Q1: What type is `"42"`?
(a) `int` (b) `str` (c) `float` (d) `bool`

Q2: What does `type(3.14)` return?
(a) `int` (b) `str` (c) `float` (d) `pi`

Q3: What is `10 / 3`?
(a) `3` (b) `3.0` (c) `3.333...` (d) Error

Answers: Q1=b (quotes make it a string), Q2=c, Q3=c (division returns float)

Boolean Values and Logic



Booleans: Only two values – `True` or `False`. The basis of all decision-making in code.

Booleans control if-statements, filters, and trading signals

Comparison and Logical Operators

Comparison Operators:

Op	Meaning	Example
>	greater than	`185 > 150` → T
<	less than	`100 < 50` → F
>=	greater or equal	`5 >= 5` → T
<=	less or equal	`3 <= 2` → F
==	equal to	`5 == 5` → T
!=	not equal	`5 != 3` → T

Logical Operators:

`and` – both must be True
`or` – at least one True
`not` – inverts True/False

Trading Example:

```
price = 145
volume = 1200000
buy = (price < 150) and
      (volume > 1000000)
# buy = True
```

Comparisons return booleans – the foundation of trading logic

Finance: Simple Interest vs Compound Interest

Simple Interest:

```
principal = 10000
rate = 0.05
years = 3
interest = principal * rate * years
# 1500.00
total = principal + interest
# 11500.00
```

$I = P \times r \times t$

Compound Interest:

```
principal = 10000
rate = 0.05
years = 3
total = principal * (1 + rate) ** years
# 11576.25
interest = total - principal
# 1576.25
```

$FV = PV \times (1 + r)^n$

Difference: Compound earns $76.25 more – interest on interest.

Compound interest: "the eighth wonder of the world" – attributed to Einstein

Your Python Toolkit So Far

Data Types	Operations	Tools
`int`, `float`	`+ - * / ** //`	Jupyter Notebook
`str`, `bool`	`> < == != and or`	`type()`, `print()`

Variables store values: `price = 185.50`

F-strings format output: `f"Price: ${price}"`

These building blocks combine into powerful data analysis tools

Hands-on Exercise (25 min)

Create a Jupyter notebook and complete:

1. Create variables for a stock portfolio:
   - `ticker = "AAPL"`, `shares = 50`
   - `buy_price = 150.25`, `current_price = 185.50`
2. Calculate portfolio metrics:
   - Total investment: `shares * buy_price`
   - Current value: `shares * current_price`
   - Profit and return percentage
3. Create a boolean: `is_profitable = profit > 0`
4. Print results using f-strings:
   `f"{ticker}: {return_pct:.2f}% return"`

Save your notebook – we build on this next lesson

Everything from here builds on what you learned today

Lesson Summary

Key Takeaways:

- Jupyter Notebook is our interactive development environment
- Four basic types: `int`, `float`, `str`, `bool`
- Variables store values with descriptive names (`snake_case`)
- Arithmetic follows PEMDAS order of operations
- F-strings format output: `f"Price: ${price}"`
- Type conversion needed when reading external data

Next Lesson: Data Structures – lists and dictionaries to organize collections of data.

Practice: try different variable types in Jupyter tonight