Python Summer Course

Course 3: Files, Data & Practice

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August 4, 2025

Downloading Pyodide

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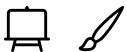
Installing Python Packages

Most functionality in Python comes from external packages (libraries).

⚠️ Install with `pip` (Python's package installer)

```
1   !pip install numpy
```

Run this in:

- Jupyter notebooks (with `!`)

- Google Colab

- Terminal/command line (without `!`)

Downloading package: ipython

📥 main

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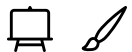
Importing a Package or Module

Once installed, use `import` to load the package in your code.

| Python Code   ⟳ Start Over | ▷ Run Code |

```python
import math

print(math.sqrt(16))
```

Import with Alias

| Python Code | ↻ Start Over | ▷ Run Code |

```python
1  import numpy as np
2
3  # We will see this next course!
4  print(np.array([1, 2, 3]) * 2)
```

Import Specific Functions

Python Code ⟳ Start Over   ▷ Run Code

```
1  from math import pi, sin
2
3  print(sin(pi / 2))  # 1.0
```

Best Practice:

- Use standard aliases: `np` for numpy, `pd` for pandas, `plt` for matplotlib

- Only import what you need to keep code clean
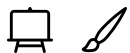
Reading and Writing Files in Python

Python can read from and write to files using the built-in `open()` function.

```
Python Code    ⟳ Start Over                          ▷ Run Code
1 ∨  with open("example.txt", "w") as f:
2        f.write("Hello, file!\n")
```

Reading from a Text File

Python Code | ↻ Start Over | ▷ Run Code

```python
with open("example.txt", "r") as f:
    content = f.read()
print(content)
```

⚠️ Notes:

- `"w"` mode = write (overwrites file)

- `"r"` mode = read

- `"a"` mode = append

- Always use `with` so auto closes the file

- More functionalities (e.g. line by line) but we focus on specifc formats here

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JSON: Storing Structured Data

JSON (JavaScript Object Notation) is a text format for storing **structured data** , like Python dictionaries and lists.

✅ It's widely used in APIs, configs, and data exchange.

Python Code ⟳ Start Over   ▷ Run Code

```python
import json

# this is our dict

data = {"name": "Alice", "age": 30, "skills": ["Python", "Data"]}
```

Save to JSON File

Python Code   ⟳ Start Over   ▷ Run Code

```python
with open("data.json", "w") as f:
    # Write with some option for a more redable output
    json.dump(data, f, , indent=4, sort_keys=True)
```

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Load JSON File

Python Code ⟳ Start Over   ▷ Run Code

```python
with open("data.json", "r") as f:
    loaded = json.load(f)

print(loaded["skills"])
```

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JSON ↔ Dictionary

- `json.dump()` → save to file

- `json.load()` → read from file

- `json.dumps()` / `json.loads()` → convert to/from string

⚠️ JSON uses:

- `{}` for objects (dicts)

- `[]` for arrays (lists)

- Keys must be strings

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Study Case: Modeling Bacterial Colony Growth

We will work with simulated growth data of bacterial colonies under different conditions.

Objectives:

1. Load and inspect the dataset (JSON)

2. Create a `Colonie` class to represent each colony

3. Implement a method to **predict growth at a given time**

4. Create and test colony objects from data

5. Compare predicted vs actual growth data
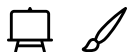
Step 1: Load Dataset from JSON

- Open and parse the JSON file using `json.load()`

- Check structure: list of colonies, each with conditions + growth

Solution

Show Solution | Enter code

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Step 2: Define a Colonie

Attributes:

- `name`, `temperature`, `ph`, `sugar`

Method

- `predict_growth(time)`
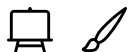
- `math` package for exp, log functions

Using formula:

$$G(t) = S \cdot e^{-\frac{(T-37)^2}{20}} \cdot (1 - 0.3 \cdot |\text{pH} - 7|) \cdot \ln(t+1)$$

S: Sugar, T: temperature, pH: pH level, t: time (h)

Solution

Show Solution | Enter code

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Step 3: Create Objects and Compare Predictions

- Loop over data entries

- Create a `Colonie` object for each

- Predict growth at fixed times (e.g. 3, 5, 8)

- Compare with actual values in the dataset

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Solution

Show Solution | Enter code

More references

[Python course for data analysis](#)

[The Python tutorial](#)