

Python Summer Course

Course 3: Files, Data & Practice

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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 !)

Importing a Package or Module

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

Python Code

↺ Start Over

▶ Run Code

```
1 import math
2
3 print(math.sqrt(16))
```



Import with Alias

Python Code

[↺ Start Over](#)[▶ Run Code](#)

```
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

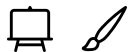
Python can read from and write to files using the built-in `open()` function.

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](#)

```
1 ✓ with open("example.txt", "r") as f:  
2     content = f.read()  
3     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 specific formats here



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

```
1 import json
2
3 # this is our dict
4
5 data = {"name": "Alice", "age": 30, "skills": ["Python", "Data"]}
```


Save to JSON File

Python Code

[↺ Start Over](#)[▶ Run Code](#)

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

Load JSON File

Python Code

[↺ Start Over](#)[▶ Run Code](#)

```
1 ✓ with open("data.json", "r") as f:  
2     loaded = json.load(f)  
3  
4 print(loaded["skills"])
```



JSON ↔ Dictionary

- `json.dump()` → save to file
- `json.load()` → read from file
- `json.dumps()` / `json.loads()` → convert to/from string

⚠ JSON uses:

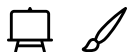
- `{ }` for objects (dicts)
- `[]` for arrays (lists)
- Keys must be strings

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



Step 2: Define a Colonie

Attributes:

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

Method

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

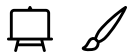
Using formula:

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

Solution

Show Solution

Enter code



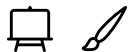
Step 3: Create Objects and Compare Predictions

- 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

Solution

Show Solution

Enter code



More references

[Python course for data analysis](#)

[The Python tutorial](#)