Introduction to fixtures

INTRODUCTION TO TESTING IN PYTHON

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What is a fixture

- Fixture - a prepared environment that can be used for a test execution
- Fixture Setup - a process of preparing the environment and setting up resources that are required by one or more tests

Imagine preparation for a picnic:

1. **Invite our friends and prepare the food** (that's what **fixtures** do)
2. Have fun!
3. Clean up

Why do we need fixture

Fixtures help:

- To make test setup easier
- To isolate the test of the environmental preparation
- To make the fixture code reusable

Fixture example: overview

Assume we have:

- a Python `list` variable named `data`
- `data = [0, 1, 1, 2, 3, 5, 8, 13, 21]`

And we want to test, that:

- It contains 9 elements
- It contains the elements `5` and `21`

Fixture example: code

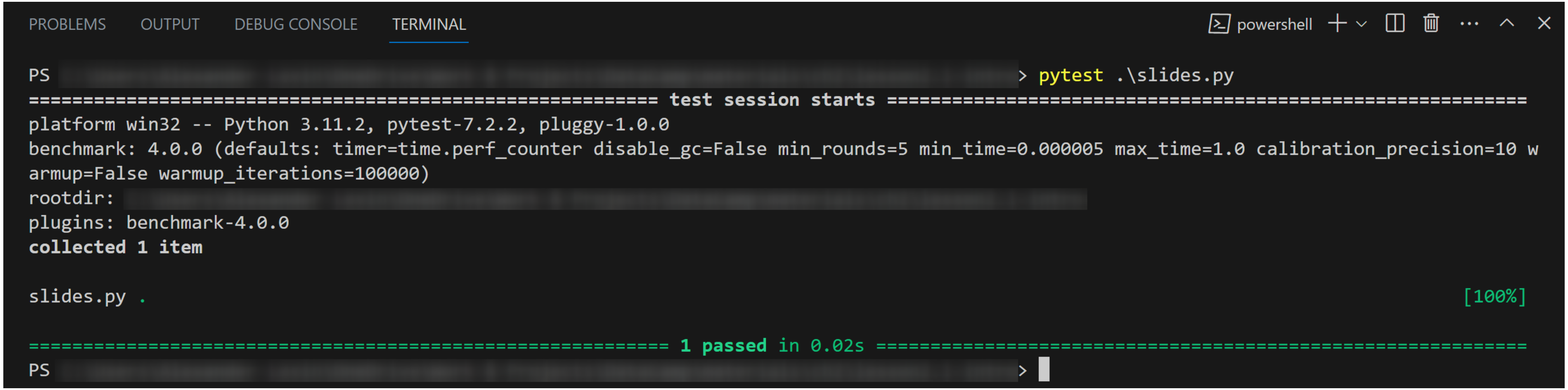
```python
import pytest

# Fixture decorator
@pytest.fixture
# Fixture for data initialization
def data():
    return [0, 1, 1, 2, 3, 5, 8, 13, 21]

def test_list(data):
    assert len(data) == 9
    assert 5 in data
    assert 21 in data
```

Fixture example: output

Output of the example:



```
PS [redacted]> pytest .\slides.py
========================================================== test session starts ===========================================================
platform win32 -- Python 3.11.2, pytest-7.2.2, pluggy-1.0.0
benchmark: 4.0.0 (defaults: timer=time.perf_counter disable_gc=False min_rounds=5 min_time=0.000005 max_time=1.0 calibration_precision=10 w
armup=False warmup_iterations=100000)
rootdir: [redacted]
plugins: benchmark-4.0.0
collected 1 item

slides.py .                                                                                                                          [100%]

=========================================================== 1 passed in 0.02s ============================================================
PS [redacted]>
```

How to use fixtures

To use the fixture we have to do the following:

1. Prepare software and tests
2. Find "environment preparation"
3. Create a fixture:
   - Declare the `@pytest.fixture` decorator
   - Implement the fixture function
4. Use the created fixture:
   - Pass the fixture name to the test function
   - Run the tests!

Summary

We learned about testing fixtures:

- Fixture - a prepared environment that can be used for a test execution
- We use fixtures to make test setup easier and isolated from the test functions
- Simple example: preparation of a Python `list`
- Define a `pytest` fixture by declaring `@pytest.fixture`
  - followed by a fixture function
- Fixture names are used in the tests as variables

Let's practice!

Chain Fixtures Requests

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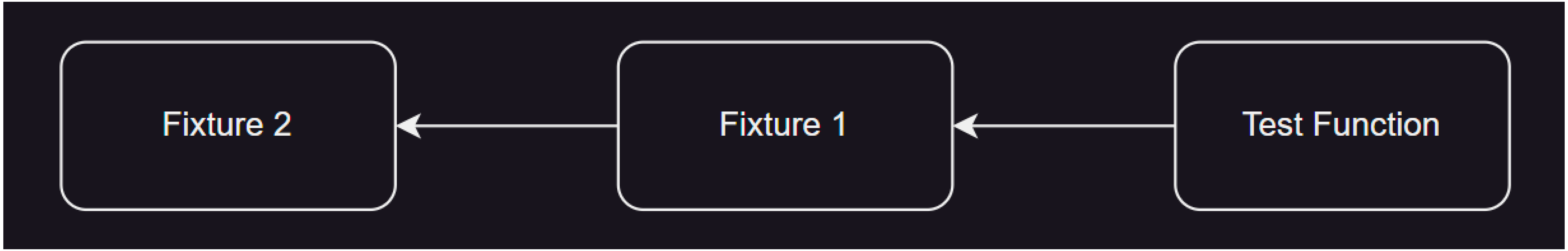
What is a chain request

- **Chain fixtures requests** - a pytest feature, that allows a fixture to use another fixture
- Creates a composition of fixtures



Why and when to use

Chain fixtures requests help to:

- **Establish dependencies** between fixtures
- Keep the code **modular**

When it can be useful:

- When we have several fixtures that **depend on each other**

Example of chain requests

```python
# Fixture that is requested by the other fixture
@pytest.fixture
def setup_data():
    return "I am a fixture!"
```

```python
# Fixture that is requested by the test function
@pytest.fixture
def process_data(setup_data):
    return setup_data.upper()
```

```python
# The test function
def test_process_data(process_data):
    assert process_data == "I AM A FIXTURE!"
```

How to use chain requests

1. Prepare the program we want to test
2. Prepare the testing functions
3. Prepare the `pytest` fixtures
4. Pass the fixture name to the other fixture signature

```python
# Fixture requesting other fixture
@pytest.fixture
def process_data(setup_data):
    return setup_data.upper()
```

Summary

- Chain fixture requests - is a feature that allows a fixture to use another fixture (creating fixture compositions)
- It helps to divide the code by functions and keep it modular
- Example use case: the steps of data pipeline
- To use chain fixture requests pass the fixture name to the other fixture signature

Let's practice!

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Fixtures autouse

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Autouse argument

- An optional boolean argument of a fixture
- Can be passed to the fixture decorator
- When `autouse=True` the fixture function is executing regardless of a request
- Helps to reduce the amount of redundant fixture calls

When to use

In case we need to apply certain environment preparations or modifications **for all tests.**

For example, when we want to guarantee, that all tests:

- Have the same data
- Have the same connections (data, API, etc.)
- Have the same environment configuration
- Have a monitor, logging, or profiling

All such cases should be addressed with an **"autouse" argument.**

Autouse example

Example of an "autoused" fixture:

```
import pytest
import pandas as pd

# Autoused fixture
@pytest.fixture(autouse=True)
def set_pd_options():
    pd.set_option('display.max_columns', 5000)

# Test function
def test_pd_options():
    assert pd.get_option('display.max_columns') == 5000
```

Autouse incorrect example

Incorrect example of an "autoused" fixture:

```python
import pytest
import pandas as pd

# Wrong autoused fixture
@pytest.fixture(autouse=True)
def wrong_fixture():
    return [1,2,3,4,5]

# Test function
def test_type():
    assert type(wrong_fixture) == list
```

Corrected example of the fixture:

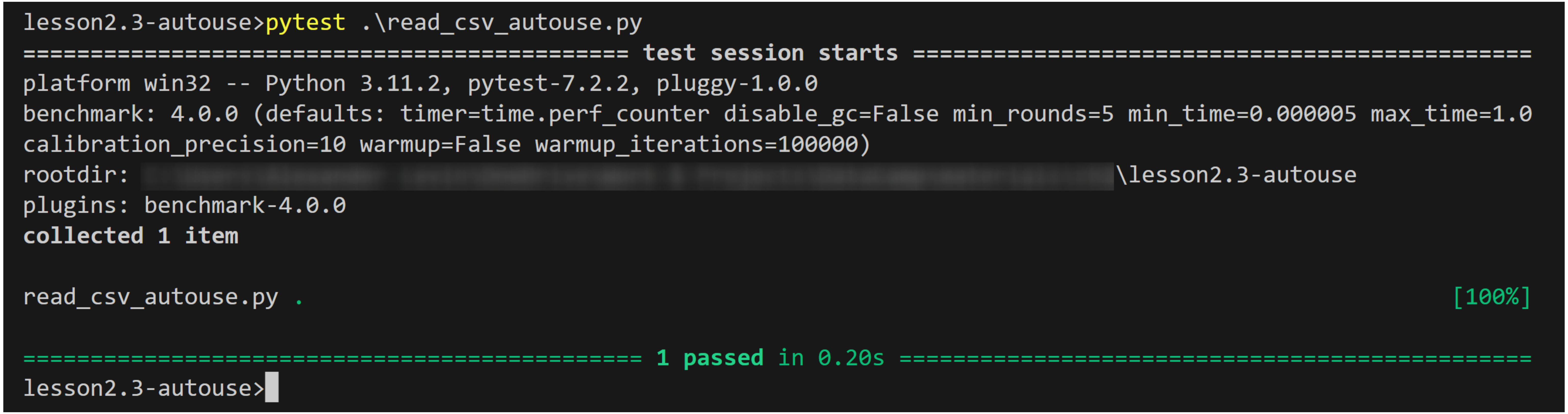
```python
import pytest
import pandas as pd

# Wrong autoused fixture
@pytest.fixture
def correct_fixture():
    return [1,2,3,4,5]

# Test function
def test_type(correct_fixture):
    assert type(correct_fixture) == list
```

Autouse example: output

Output of the example:



```
lesson2.3-autouse>pytest .\read_csv_autouse.py
============================================= test session starts ==============================================
platform win32 -- Python 3.11.2, pytest-7.2.2, pluggy-1.0.0
benchmark: 4.0.0 (defaults: timer=time.perf_counter disable_gc=False min_rounds=5 min_time=0.000005 max_time=1.0
calibration_precision=10 warmup=False warmup_iterations=100000)
rootdir: [redacted]\lesson2.3-autouse
plugins: benchmark-4.0.0
collected 1 item

read_csv_autouse.py .                                                                                     [100%]

============================================== 1 passed in 0.20s ===============================================
lesson2.3-autouse>
```

Summary

- **Definition of `autouse`** : An optional boolean argument of a fixture decorator
- **Usage:** `@pytest.fixture(autouse=True)`
- **Advantage:** Helps to reduce the number of redundant fixture calls, thus makes the code simpler
- **Feature:** `autouse=True` the fixture function is executing regardless of a request
- **When to use:** in case we need to apply certain environment preparations or modifications
- **Use cases examples:**
  - Reading and preparing data for all tests
  - Configuring connections and environment parameters
  - Implementing a monitor, a logger, or a profiler

Let's practice!

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Fixtures Teardowns

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What is a fixture teardown

- **Fixture Teardown** - a process of cleaning up ("tearing down") resources that were allocated or created during the setup of a testing environment.

Recall the "picnic" analogy:

1. Invite our friends and prepare the food
2. Have fun!
3. **Clean up** - that's the teardown

Why to use teardowns

It is important to **clean the environment** at the end of a test. If one does not use **teardown,** it can lead to significant issues:

- Memory leaks
- Low speed of execution and performance issues
- Invalid test results
- Pipeline failures and errors

When to use

When to use:

- Big objects
- More than one test
- Usage of `autouse`

When it is not necessary to use:

- One simple script with one test

Lazy evaluation in Python

- `yield` - is a Python keyword, which allows to create generators

```python
# Example of generator function
def lazy_increment(n):
    for i in range(n):
        yield i
f = lazy_increment(5)
next(f) # 0
next(f) # 1
next(f) # 2
```

How to use

How to use:

- Replace `return` by `yield`
- Place the teardown code after `yield`
- Make sure that the setup code is only before `yield`

Teardown example

```python
@pytest.fixture
def init_list():
    return []

@pytest.fixture(autouse=True)
def add_numbers_to_list(init_list):
    # Fixture Setup
    init_list.extend([i for i in range(10)])
    # Fixture output
    yield init_list
    # Teardown statement
    init_list.clear()

def test_9(init_list):
    assert 9 in init_list
```

Summary

- **Definition:** Fixture Teardown - is a process of cleaning up resources that were allocated during the setup.
- **Usage:**
  - The `yield` keyword instead of `return`
  - Teardown code after `yield`
- **Advantages:**
  - Prevents software failures
  - Prevents potential drops of performance
- **When to use:** Always, when you have more than one test!

Let's practice!

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