# Effective Programming Practices for Economists

# Reproducible Research

## Testing code that should raise errors

Janoś Gabler and Hans-Martin von Gaudecker

# Reminder of the example

```
>>> raw = pd.read_csv("survey.csv")
>>> raw
```

| | Q001 | Q002 | Q003 |
|---|---|---|---|
| 0 | strongly disagree | agree | python |
| 1 | strongly agree | strongly agree | Python |
| 2 | -77 | disagree | R |
| 3 | agree | -77 | Python |
| 4 | -99 | -99 | Python |
| 5 | nan | strongly agree | Python |
| 6 | neutral | strongly agree | Python |
| 7 | disagree | agree | python |
| 8 | strongly disagree | -99 | PYTHON |
| 9 | -77 | -99 | Ypthon |

From the metadata you know

- Q001: I am a coding genius
- Q001: I learned a lot
- Q003: What is your favourite language

- -77 not readable
- -99 no reply

# What will happen for invalid data?

```
def _clean_agreement_scale(sr):
    sr = sr.replace(
        {
            "-77": pd.NA,
            "-99": pd.NA
        }
    )
    categories = [
      "strongly disagree",
      "disagree",
      "neutral",
      "agree",
      "strongly agree"
    ]
    dtype = pd.CategoricalDtype(
      categories=categories,
      ordered=True
    )
    return sr.astype(dtype)
```

- What if next year the survey tool changed the representation of missings?
- What if categories were changed?

- What do you actually expect the function to do?

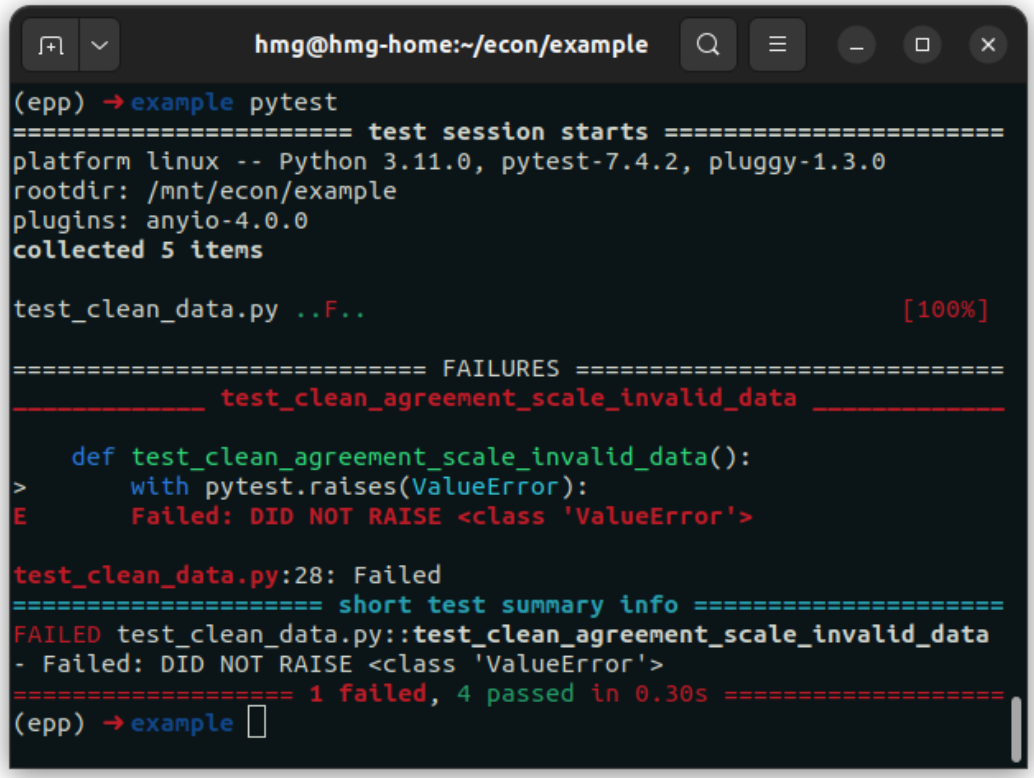
# Tests pin down desired behaviour

```
import pytest


def test_clean_agreement_scale_invalid_data():
    with pytest.raises(ValueError):
        _clean_agreement_scale(pd.Series([-77, "typo"]))
```

- Passing two codes that should not work
- We expect a `ValueError` to be raised
- Test will fail if
  - no error is being raised
  - a different error is being raised

# Run pytest


hmg@hmg-home:~/econ/example
(epp) ➜ example pytest
========== test session starts ==========
platform linux -- Python 3.11.0, pytest-7.4.2, pluggy-1.3.0
rootdir: /mnt/econ/example
plugins: anyio-4.0.0
collected 5 items
test_clean_data.py ..F.. [100%]
========== FAILURES ==========
_____ test_clean_agreement_scale_invalid_data _____
def test_clean_agreement_scale_invalid_data():
> with pytest.raises(ValueError):
E Failed: DID NOT RAISE <class 'ValueError'>
test_clean_data.py:28: Failed
========== short test summary info ==========
FAILED test_clean_data.py::test_clean_agreement_scale_invalid_data
- Failed: DID NOT RAISE <class 'ValueError'>
========== 1 failed, 4 passed in 0.30s ==========
(epp) ➜ example

# Tests teach you programmes' behaviour

- This is how I learned that `.astype(pd.CategoricalDtype())` sets values that are not among the categories to missing!
- Small examples are exactly the right level to learn
- Imagine this would have happened in a large project, where you would have noticed only when only 5% of the expected sample size is left in regression tables!
- "Fail early, fail often"

# For the record: Solution

```
def _clean_agreement_scale(sr):
    known_missings = {"-77", "-99"}
    categories = ["strongly disagree", "disagree", "neutral", "agree", "strongly agree"]
    if invalid_values := set(sr.unique()) - set(categories) - known_missings:
        msg = f"Unexpected values in agreement scale: {invalid_values}"
        raise ValueError(msg)
    dtype = pd.CategoricalDtype(categories=categories, ordered=True)
    return sr.replace({m: pd.NA for m in known_missings}).astype(dtype)
```

# Run pytest, again