Pytest

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METASNAKE

pytest

pytest

- Easy test creation (less boilerplate)
- Test runner
- Test selection
- Test parameterization
- Fixtures
- Plugins

Installation

Create a virtualenv

```
(venv) $ pip install pytest
```

Command line

Installs an executable called `pytest` (previously part of `py` library).

Assignment

Assignment 1

Basics

Code Layout

```
Project/
   proj/
       __init__.py
       adder.py
   tests/
       conftest.py
       test_adder.py
```

Code Layout

Notes

- If test subdirectories don't have `__init__.py`, you can't use the same filename in different directories
- If file named `testadder.py` instead of `test_adder.py`, pytest won't find it

Simple Code

Basic but fits on slides (`adder.py`)

```python
# adder.py
def adder(x, y):
    return x + y
```

Test Creation

Unittest style (`test_adder.py`)

```
# test_adder.py
from proj.adder import adder
import unittest

class TestAdder(unittest.TestCase):
    def test_simple(self):
       2res = adder(2, 3)
       3self.assertEquals(res, 5)
```

Run Tests

`$ pytest` ignores current directory. (To aid in ensuring testing installed code).

`$ python -m pytest` inserts current directory in `sys.path`.

Run Tests (2)

```
$ PYTHONPATH=. pytest tests/*.py
================ test session starts =================
platform darwin -- Python 3.6.4, pytest-3.0.6, py-
1.4.32, pluggy-0.4.0
rootdir: /Users/matt/code_samples/pytest, inifile:
plugins: asyncio-0.8.0
collected 1 items

tests/test_adder.py .

============== 1 passed in 0.01 seconds ==============
```

Output

- `.` - test passed
- `F` - test failed
- `E` - Exception
- `s` - test skipped
- `x` - expected failure (broken now but will fix)
- `X` - unexpected pass (should have failed)

Unittest style

- Non-PEP 8 compliant
- "Classy"
- Need to remember which `assert...` method to call

Test Creation

pytest style (`test_adder2.py`)

```
# test_adder2.py
from proj.adder import adder


def test_add():
  2 res = adder(2, 3)
  3 assert res == 5
```

pytest style

- Just a function that starts with "test"
- Use the `assert` statement

Assignment 2

More Test Creation

Can specify a message

```
from proj.adder import adder

def test_add():
    res = adder(2, 3)
    assert res == 5, "Value should be 5"
```

Catching Exceptions

Can specify an exception

```
import pytest
def test_exc():
    with pytest.raises(TypeError):
        adder('', 3)
```

Context

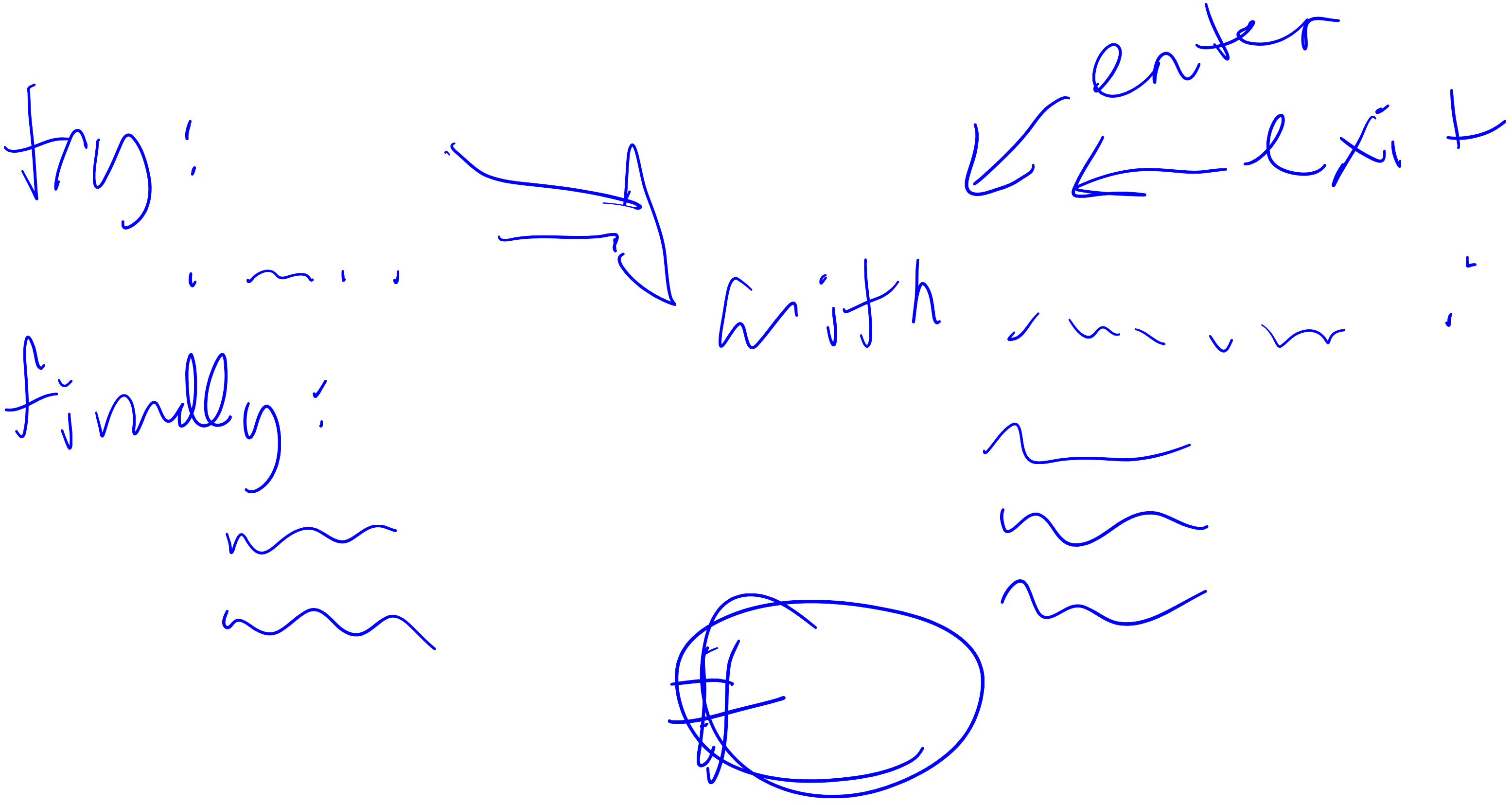
Catching Exceptions (2)

Can include a regular expression as a `match` parameter

```
import pytest
def test_exc():
    with pytest.raises(TypeError,
              match='unsupported operand'):
        adder('', 3)
```

Catching Exceptions (3)

Similar to `pytest.raises` use `pytest.warns` context manager for catching `DeprecationWarning`



Catching Exceptions (4)

Can specify an exception in decorator (status XFAIL or x)

```
@pytest.mark.xfail(raises=TypeError)
def test_exc2():
    adder('', 3)
```

Expected Fail?

Use to specify a test that should work that isn't (ie planning to implement or known bug without a fix)

Expected Fail? (2)

If an expected failure passes it will have a status of XPASS (`X`), unless you give it a `strict=True` option in the decorator. Then it will FAIL (`F`).

Failing a Test

```python
def test_missing_dep():
    try:
        import foo
    except ImportError:
        pytest.fail("No foo import")
```

Approximations

Floating point limitations:

```
>>> .7 + .6 == 1.3
False
```

Approximations (2)

`pytest.approx` dynamically adds tolerance:

```
def test_small():
    assert adder(1e-10, 2e-10) == \
        pytest.approx(3e-10)
```

Approximations (3)

`pytest.approx` works with lists, dictionary values, and numpy arrays of floats

How `assert` works

pytest uses an *import hook* (PEP 302) to rewrite assert statements by introspecting code (AST) the runner has collected.

Care needed

Don't wrap assertion in parentheses (truthy tuple):

```
def test_almost_false():
    assert (False == True, 'Should be false')
```

Care needed (2)

You will get a warning:

```
$ pytest test_adder.py
test_adder.py s..x                                 [100%]

=================== warnings summary ====================
test_adder.py:15
  assertion is always true, perhaps remove parentheses?

-- Docs: http://doc.pytest.org/en/latest/warnings.html
 2 passed, 1 skipped, 1 xfailed, 1 warnings in 0.11
seconds
```

Context-sensitive Comparisons

- Inlining function/variable results
- Diffs in similar text
- Lines in multiline texts
- List/Dict/Set diffs (`-vv` for full diff)
- In (`__contains__`) statements

Customize Assert

In `conftest.py`:

```python
def pytest_assertrepr_compare(op, left, right):
    if (isinstance(left, str) and
        isinstance(right, int) and op == '=='):
        return ['"{}" should be an int'.format(left)]
```

In `test_adder.py`:

```python
def test_custom():
    assert "1" == 1
```

Result

```
$ pytest test_adder.py
test_adder.py F.x                                  [100%]

======================= FAILURES ========================
______________________ test_custom ______________________

    def test_custom():
>       assert "1" == 1
E       assert "1" should be an int

test_adder.py:11: AssertionError
===== 1 failed, 1 passed, 1 xfailed in 0.08 seconds =====
```

Assignment

Assignment 3

Test Runner

Test Runner

For `unittest` add:

```python
if __name__ == '__main__':
    unittest.main()
```

or run:

```
$ python3 -m unittest test_adder.TestAdder
```

Test Runner

For `pytest` add:

```
if __name__ == '__main__':
    import pytest
    pytest.main()
```

or run:

```
$ pytest test_adder2.TestAdder
```

Test Discovery

- Recurse current directory or `testpaths` from `pytest.ini` (ignores the `norecursedirs` and virtual environmnets)
- Files with `test_*.py` or `*_test.py`
- Functions starting with `test*`
- Methods starting with `test*` in class named `Test*` without a `__init__` method

Can customize

- `--ignore path` - Tell pytest to ignore modules or paths
- `norecursedirs` - Dirs to not recurse in `pytest.ini` (default `.*`, `build`, `dist`, `CVS`, `_darcs`, `{arch}`, `*.egg`, `venv`)
- `testpaths` - Force to look in these locations
- `python_files` - Glob (`validate_*.py`) to discover in `pytest.ini`
- `python_classes`, `python_methods` - More discovery

Options

- `--doctest-modules` - Run doctests
- `--doctest-glob='*.rst'` - Capture rst files (instead of default `*.txt`)
- `--pdb` - Drop into debugger on fail
- `--collect-only` - Don't run tests, just collect
- `-v` - Verbose (show test ids)
- `-m EXPR` - Run marks
- `-k EXPR` - Run tests with names (*keyword expression*)
- `NODE_IDS` - Run tests with NODE IDS

Assignment

Assignment 4

Debugging

Debugging

Options:

- `import pdb;pdb.set_trace()`
- `assert 0` (in code) + `--pdb` (command line)
- Use `-s` to see stdout for successful tests

Command Line

- `-l` - Show local values
- `--lf` - Run *last failed* test first
- `--maxfail=N` - Stop after N failures
- `--tb=` - Control traceback (auto/long/short/no)
- `-v` - Show node ids
- `-x` - Exit after first fail (`--maxfail=1`)

Hint

Careful with `-l` (`--showlocals`) if running in CI and you have secrets you are using and don't want exposed

Hint

Consider combining `-x --lf` (exit after first fail and run with last fail first)

Hint

If you have hierarchical test directories, use `__init__.py` files (make them packages), otherwise you can't have two test files with the same name (ie `unit/test_name.py` & `reg/test_name.py`)

Doctest

Doctest

Update `pytest.ini` to permanently run doctests, with certain flags:

```
[pytest]
addopts = --doctest-modules

doctest_optionflags= NORMALIZE_WHITESPACE
IGNORE_EXCEPTION_DETAIL
```

Doctest

Can use pytest fixtures with `get_fixture`:

```
# file.py
"""
>>> req = get_fixture('request')
>>> req.cache.get('bad_key')
None
"""
```

Injecting into Namespace

Python module that we typically import with shortened name `lf`:

```python
# longfilename.py
"""
>>> lf.foo()
"""
def foo(): pass
```

pd. read_

```python
# conftest.py
import longfilename
@pytest.fixture(autouse=True)
def add_lf(doctest_namespace):
    doctest_namespace['lf'] = longfilename
```

pd

pd = pandas

Assignment

Assignment 5

Test Selection & Marking

Listing Tests

```
$ PYTHONPATH=./ pytest tests/*.py --collect-only
================ test session starts =================
platform darwin -- Python 3.6.4, pytest-3.0.6, py-
1.4.32, pluggy-0.4.0
rootdir: /Users/matt/code_samples/pytest/Project,
inifile:
plugins: asyncio-0.8.0
collected 1 items
<Module 'tests/test_adder.py'>
  <Function 'test_add'>

============ no tests ran in 0.00 seconds ============
```

Test Selection

- Marking tests
- Skip tests

Marking Tests

```
@pytest.mark.small
@pytest.mark.num
def test_ints():
    assert adder(1, 3) == 4
```

Marking Tests (2)

```
$ pytest -m num
```

or

```
$ pytest -m "not num"
```

Marking Tests (3)

Can mark a class instead of marking every method

Marking Tests (4)

Can mark a module by creating a `pytestmark` global variable:

```
pytestmark = pytest.mark.num

# or a list of marks
pytestmark = [pytest.mark.num,
              pytest.mark.other]
```

Register Markers

To avoid typos, *register* markers in `pytest.ini` with:

```
[pytest]
markers =
  small: Tests with small numbers
  num: Tests on integers
```

Register Markers

Get *registered* markers:

```
$ pytest --markers
@pytest.mark.small: Tests with small
numbers

@pytest.mark.num: Tests on integers

@pytest.mark.asyncio: mark...
```

Register Markers

If you run with `--strict` it will complain if a marker isn't registered

Named Tests

To run tests with "int" in name:

```
$ pytest -k int
```

Built-in Marks

- skipif
- xfail

Skipping tests

```
@pytest.mark.skipif(
    not os.environ.get("SLOWTEST"),
    reason="Don't run slow tests")
def test_big():
    assert adder(1e10, 3e10) == 4e10
```

Assignment

Assignment 6

Thanks

Go forth and test!

METASNAKE