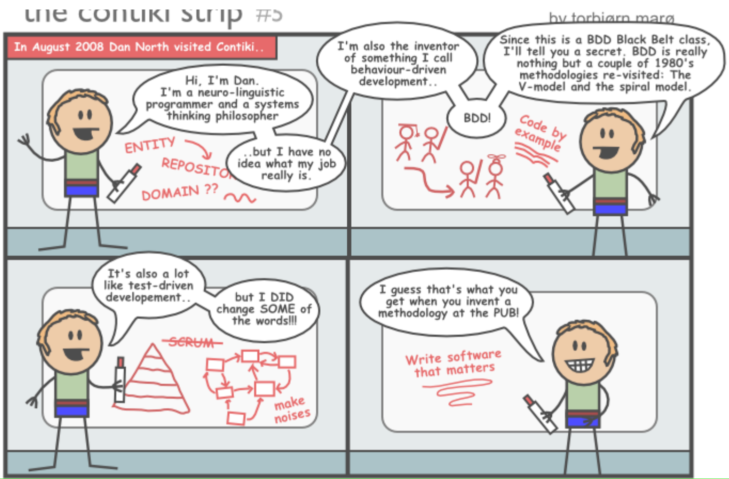
Code testing philosophies

Examples in python



the contiki strip #5
by torbjørn marø
In August 2008 Dan North visited Contiki..
Hi, I'm Dan. I'm a neuro-linguistic programmer and a systems thinking philosopher
ENTITY
REPOSITO
DOMAIN ??
..but I have no idea what my job really is.
I'm also the inventor of something I call behaviour-driven development..
BDD!
Since this is a BDD Black Belt class, I'll tell you a secret. BDD is really nothing but a couple of 1980's methodologies re-visited: The V-model and the spiral model.
Code by example
It's also a lot like test-driven developement..
but I DID change SOME of the words!!!
~~SCRUM~~
make noises
I guess that's what you get when you invent a methodology at the PUB!
Write software that matters

Bas Rustenburg, Chodera Lab @MSKCC

Hot Topics Tuesday , January 20 2015

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Why do we write tests for code?

Writing tests for code can prevent mistakes, and guide development of software.

Common reasons for writing tests

- Catch bugs introduced during development
- Maintain backwards compatibility
- Verify output of newly implemented function
- Introduction to new developers
- Provide a scaffold for code design

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Development-Driven Development
Developing code, write tests later

Strategy

“My objective is to produce code, not write tests. As long as users follow my example, the code should work fine.”

- Write the code first
- Make sure it produces the output you expect
- Finally, write tests to maintain the code in further development, if time allows it.

Development-Driven Development
Developing code, write tests later

The idea: “My objective is to produce code, not write tests.”

Advantages

- Spend your development time of the part of the software that ultimately matters most
- Programmer is not burdened with maintaining strict software management methodologies

Disadvantages

- Lack of code design and structure
- Inexperienced developers introducing bugs
- Code becomes hard to inherit

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How does it work?

The emphasis is on the structure of the code.

- Instead of units of code, one first writes tests of the unit
- Then, you write a minimal amount of code to make the test pass
- Finally, verify that all tests succeed.
- Connect all the units and you will have the complete program.

Test-Driven Development
Developing code starting with tests

What are the advantages?

- Keeps code concise
- Clear purpose for implemented code
- Tests don't cost extra time to write
- **Y**ou **A**ren't **G**onna **N**eed **I**t.
  - No code written besides the essentials
  - Code stays simple and modular

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Behavior-Driven Development
Developing from the end-users perspective.

What are the key ideas?

- The intended behavior of a program determines the development strategy
- From the start, you decide *what* should be tested.
- Using domain specific language to describe behavior
    - Often close to natural language, with some object-oriented elements
- Allow non-experts to design software and tests
- Have programmers implement them

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Good testing practices

Some things to keep in mind when writing tests.

Attempt to at least:

- Focus on small units of functionality and ensure correctness
- Tests must be able to run independently (see Mock for help)
- Keep them fast! Slowness discourages running tests.
- Write a test for debugging.
- Keep your code clear, keep your tests clearer!

Inspired by: The Hitchhiker's Guide to Python

`https://github.com/kennethreitz/python-guide`

Mock

Making sure that a method was called:

```
# mock_example.py
from mock import Mock

class Myclass(object):
  def closer(self, something):
      something.close()

mycase = Myclass()
mock = Mock()
mycase.closer(mock)
mock.close.assert_called_with()
```

http://www.voidspace.org.uk/python/mock/index.html

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How to test code?
Example python libraries

unittest

A solid testing library that provides many functions to help you test units of code.

```python
# unittest_example.py
import unittest

def my_function(x, y):
    """Subtract y from x"""
    return x - y

class MyTest(unittest.TestCase):
    def test_subtracting(self):
        self.assertEqual(my_function(7, 4), 3)
    def test_subtracting_typerror(self):
        self.assertRaises(TypeError, my_function, [7, '4'])
if __name__ == '__main__':
    unittest.main()
```

https://docs.python.org/2/library/unittest.html

How to test code?
Example python libraries

doctest

Write test in your documentation strings.

```
# doctest_example.py
def my_function(x, y):
    """Subtract y from x
    Examples
    --------
    >>> my_function(7, 4)
    3
    >>> my_function(7, '4')
    Traceback (most recent call last):
    ...
    TypeError: unsupported operand type(s) for -: 'int' and 'str'
    """
    return x - y

if __name__ == "__main__":
    #Execute script as: python doctest_example.py -v
    import doctest
    doctest.testmod()
```

https://docs.python.org/2/library/doctest.html

How to test code?
Example python libraries

nosetests

Adds test discovery on top of available tools.

```
# test_nose_example.py
def my_function(x, y):
    """Subtract y from x"""
    return x - y

def test_my_function():
    assert my_function(7,4) == 3
```

Try commands such as:

- nosetests
- nosetests unittest_example.py
- nosetests --with-doctest

https://nose.readthedocs.org/en/latest

Cucumber and Behave
Examples of Behavior-Driven Development tools

What are they all about?

- Cucumber (Ruby), Behave(Python), Specflow (.NET) et al.
- The behavior of the program is written down in a business readable, domain specific language called *Gherkin*
- This is then parsed and matched to functions called *step functions*
- The step functions are written in actual programming languages
- They test other underlying code and take input from the Gherkin parser

`https://github.com/cucumber/cucumber/wiki/Gherkin`

Gherkin syntax

A simple example

```
# example.feature
Feature: An example of behavior driven design

Scenario: I want to subtract two integers
Given our subtractor is installed
When I subtract 4 from 7
Then the result should be 3

Scenario: I want subtract floats
Given our subtractor is installed
When I subtract 3.5 from 7.0
Then it should return 3.5 within 0.0001 error
```

Step methods
The underlying python code

A simple example

```
# Example steps
from behave import given, when, then

# Given our subtractor is installed
@given('our subtractor is installed')
def step_impl(context):
    pass
# When I subtract 4 from 7
@when('I subtract {y} from {x}')
def step_impl(context,y,x):
    if '.' in x or '.' in y:
      x = float(x)
      y = float(y)
    else:
      x = int(x)
      y = int(y)

    context.result = x - y
# Then the result should be 3
@then('the result should be {result}')
def step_impl(context, result):
    if '.' in result:
      result = float(result)
    else:
      result = int(result)
    assert (context.result - result) <= 0.0001
```

Useful sources of information
..the wiki is not enough..

Urls

- Hitchhiker's Guide to Python : `https://github.com/kennethreitz/python-guide`
- doctest, unittest: `https://docs.python.org/2/library/development.html`
- nose: `https://nose.readthedocs.org`
- mock: `http://www.voidspace.org.uk/python/mock/mock.html`
- behave: `http://pythonhosted.org/behave/`
- cucumber: `http://cukes.info`