

Best Practices

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September 4, 2017

Based on talk by Valentin Haenel <https://github.com/esc/best-practices-talk>



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Introduction

- ▶ We write code regularly
- ▶ We have not been formally trained

Best Practices

- ▶ evolved from experience
- ▶ increase productivity
- ▶ decrease stress
- ▶ still evolve with tools and languages

Development Methodologies

- ▶ e.g. Agile Programming or Test Driven Development
- ▶ lots of buzzwords
- ▶ still many helpful ideas

Outline

Introduction

Style and Documentation

Special Python Statements

KIS(S) & DRY

Refactoring

Development Methodologies

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Coding Style

- ▶ readability counts
- ▶ give things *intention revealing* names
 - ▶ For example: `numbers` instead of `n`
 - ▶ For example: `numbers` instead of `list_of_float_numbers`
 - ▶ See also: [Ottinger's Rules for Naming](#)

Example

```
def fun(n):  
    """ no comment """  
    r = 1  
    for i in n:  
        r *= i  
    return r
```

Coding Style

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 - ▶ See also: [Ottinger's Rules for Naming](#)

Example

```
def my_product(numbers):  
    """ Compute the product of a sequence of numbers. """  
    total = 1  
    for item in numbers:  
        total *= item  
    return total
```

Formatting Code

- ▶ use coding conventions, e.g: [PEP-8](#)
- ▶ conventions specify
 - ▶ layout
 - ▶ whitespace
 - ▶ comments
 - ▶ naming
 - ▶ ...
- ▶ OR use a consistent style (especially when collaborating)

Formatting Code: Tools

Checker

- ▶ `pylint` (e.g. `pylint3 my_product.py`)
- ▶ `pycodestyle` (e.g. `python3 -m pycodestyle my_product.py`)
- ▶ `pydocstyle` (e.g. `python3 -m pydocstyle my_product.py`)
- ▶ `flake8` (e.g. `python3 -m flake8 my_product.py`)

Formatter

- ▶ `autopep8` (e.g. `autopep8 --in-place my_product.py`)
- ▶ `yapf3` (e.g. `yapf3 --in-place my_product.py`)

Documenting Code: Docstrings

Example

```
def my_product(numbers):  
    """ Compute the product of a sequence of numbers. """
```

- ▶ at least a single line
- ▶ also for yourself
- ▶ is on-line help too

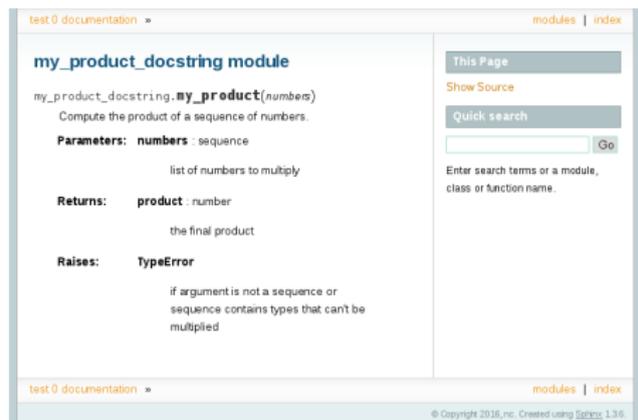
- ▶ Document arguments and return objects, including types
- ▶ For complex algorithms, document every line, and include equations in docstring
- ▶ Use docstring conventions: [PEP257](#) and/or [numpy](#)

Example Docstring

```
def my_product(numbers):  
    """ Compute the product of a sequence of numbers.  
  
    Parameters  
    -----  
    numbers : sequence  
        list of numbers to multiply  
  
    Returns  
    -----  
    product : number  
        the final product  
  
    Raises  
    -----  
    TypeError  
        if argument is not a sequence or sequence contains  
        types that can't be multiplied  
    """
```

Documenting Your Project

- ▶ tools generate website from docstrings
 - ▶ `pydoc`
 - ▶ `sphinx`
 - ▶ [Overview List](#)
- ▶ when project gets bigger
 - ▶ how-to
 - ▶ FAQ
 - ▶ quick-start



The screenshot shows a web browser displaying a Sphinx-generated documentation page. The page title is "my_product_docstring module". Below the title, the function signature is shown: `my_product_docstring.my_product(numbers)`. The description states: "Compute the product of a sequence of numbers." The page lists the following details:

- Parameters:** `numbers`: sequence
list of numbers to multiply
- Returns:** `product`: number
the final product
- Raises:** `TypeError`
if argument is not a sequence or sequence contains types that can't be multiplied

On the right side of the page, there is a sidebar with a search box and a "Go" button. The footer of the page indicates "© Copyright 2016, inc. Created using Sphinx 1.3.6."

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import

- ▶ Don't use the *star import*: `from module import *`
 - ▶ not obvious what you need
 - ▶ modules may overwrite each other
 - ▶ Where does this function come from?
 - ▶ will import *everything* in a module
 - ▶ ...unless you have a very good reason: e.g. `pylab`, `interactive`
- ▶ Put all imports at the beginning of the file...
- ▶ ...unless you have a very good reason

Example

```
import my_product as mp
mp.my_product([1,2,3])

from my_product import my_product
my_product([1,2,3])
```

import: Pitfalls

Python evaluates the imported code at import time.

```
""" Bad Things happen here. """

def append_one(list_=[]):
    """ Do not use mutable default values """
    list_.append(1)
    return list_

def default_arg(bad=1/0):
    """ Do not trigger exceptions in keyword-arguments """
    return bad

def constants():
    """ You will not be able to import this """
    return 9999999 ** 9999999
```

Exceptions

- ▶ use `try`, `except` and `raise`
- ▶ often better than `if` (e.g. `IndexError`)

Example

```
try:
    my_product(1, 2, 3)
except TypeError:
    print("'my_product' expects a sequence")
    raise TypeError
```

- ▶ don't use *special* return values:
1, 0, False, None
- ▶ Fail early, fail often
- ▶ use **built-in Exceptions**

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Keep it Simple (Stupid) – KIS(S) Principle

Keep it Simple

Debugging is twice as hard as writing the code in the first place.
Therefore, if you write the code as cleverly as possible,
you are, by definition, not smart enough to debug it.

– Brian W. Kernighan

Don't Repeat Yourself (DRY)

- ▶ No copy & paste!
- ▶ Not just lines code, but knowledge of all sorts
- ▶ Do not express the same piece of knowledge in two places. . .
- ▶ . . . or you will have to update it everywhere
- ▶ It is not a question of *if* this may fail, but *when*

Don't Repeat Yourself (DRY): Types

Example

- ▶ Copy-and-paste a snippet, instead of refactoring it into a function
 - ▶ Repeated implementation of utility methods
 - ▶ because you don't remember
 - ▶ because you don't know the libraries

```
numpy.prod([1,2,3])
```

 - ▶ because developers don't talk to each other
 - ▶ Version number in source code, website, readme, package filename
-
- ▶ If you detect duplication: refactor!

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Refactoring

- ▶ re-organise your code without changing its functionality
- ▶ rethink earlier design decisions
- ▶ break large code blocks apart
- ▶ rename and restructure code

- ▶ will improve the readability and modularity
- ▶ will usually reduce the lines of code

Common Refactoring Operations

- ▶ Rename class/method/module/package/function
- ▶ Move class/method/module/package/function
- ▶ Encapsulate code in method/function
- ▶ Change method/function signature
- ▶ Organise imports (remove unused and sort)

- ▶ Always refactor one step at a time, and ensure code still works
 - ▶ version control
 - ▶ unit tests

Refactoring Example

```
def my_func(numbers):  
    """ Subtract sum of numbers from product of numbers. """  
    total = 0  
    for item in numbers:  
        total += item  
    total2 = 1  
    for item in numbers:  
        total2 *= item  
    return total - total2
```

- ▶ split into functions
- ▶ use libraries/built-ins
- ▶ fix bug

Refactoring Example

```
from my_math import my_product, my_sum

def my_func(numbers):
    """ Subtract sum of numbers from product of numbers. """
    sum_value = my_sum(numbers)
    product_value = my_product(numbers)
    return sum_value - product_value
```

- ▶ split into functions
- ▶ use libraries/built-ins
- ▶ fix bug

Refactoring Example

```
from numpy import prod, sum

def my_func(numbers):
    """ Subtract sum of numbers from product of numbers. """
    sum_value = sum(numbers)
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Refactoring Example

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    """ Subtract sum of numbers from product of numbers. """
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```

- ▶ split into functions
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What is a Development Methodology?

Consists of:

- ▶ approach towards development
- ▶ tools and models to support approach

Help answer questions like:

- ▶ How far ahead should I plan?
- ▶ What should I prioritise?
- ▶ When do I write tests and documentation?

Right methodology depends on scenario.

What is a Development Methodology?

Consists of:

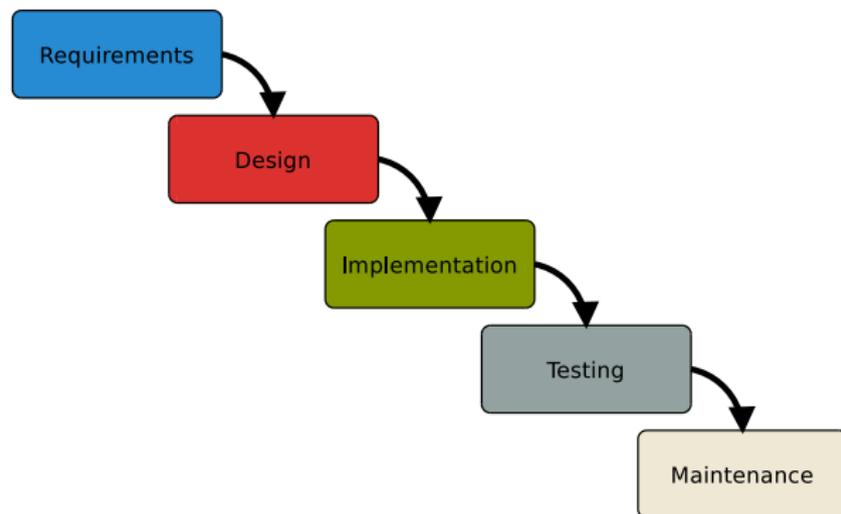
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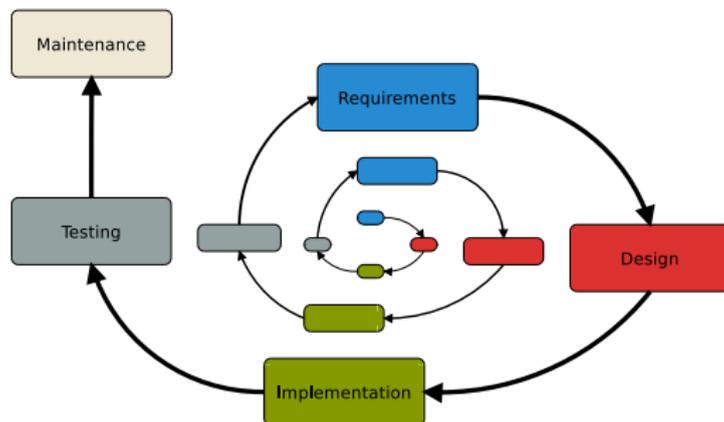
The Waterfall Model, Royce 1970



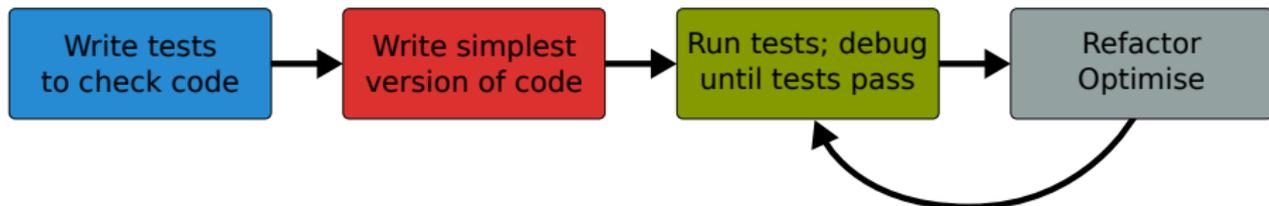
- ▶ sequential
- ▶ from manufacturing and construction

Agile Methods (late 90's)

- ▶ minimal planning, small development iterations
- ▶ design/implement/test on a modular level
- ▶ frequent input from team/customer/boss/professor
- ▶ very adaptive, since nothing is set in stone



Test Driven Development (TDD)



- ▶ Define unit tests first!
- ▶ Develop one unit at a time!
- ▶ more tomorrow

Using VirtualEnv

The Problem

- ▶ different tools need different versions of a module
- ▶ your Linux distribution does not include a module

The Solution: `virtualenv`

- ▶ initialise folder `venv` to store modules of this project

```
virtualenv --system-site-packages -p python3 --prompt="ve " venv
```

- ▶ update the search-paths to include folders in `venv`

```
. venv/bin/activate
```

- ▶ run your code or install libraries with `pip`
- ▶ undo changes to search-paths

```
deactivate
```