Best Practices

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

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

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KIS(S) & DRY

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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

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

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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
- conventions specify:
  - variable naming
  - indentation
  - import
  - maximum line length
  - blank lines, whitespace, comments
- e.g: PEP-8
- OR use a consistent style (especially when collaborating)

Tools

- pylint (e.g. `pylint3 my_product.py`)
- pep8 (e.g. `python3 -m pep8 my_product.py`)
- flake8 (e.g. `python3 -m flake8 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

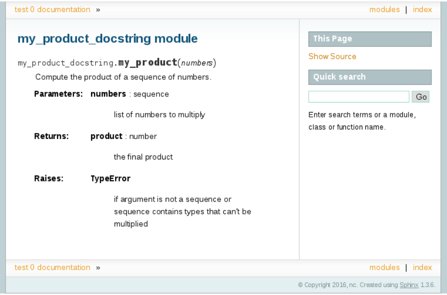
- Document arguments and return objects, including types
- For complex algorithms, document every line, and include equations in docstring
- Use docstring conventions: PEP257 and/or numpy

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



my_product_docstring module

my_product_docstring.**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

Enter search terms or a module, class or function name.

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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])
```

Exceptions

- use `try`, `except` and `raise`
- often better then `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

```python
def my_func(numbers):
    """ Difference between sum and product of sequence. """
    total = 0
    for item in numbers:
        total += item
    total2 = 1
    for item in numbers:
        total2 *= item
    return total2 - total
```

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

Refactoring Example

```python
from my_math import my_product, my_sum

def my_func(numbers):
    """ Difference between sum and product of sequence. """
    sum_value = my_sum(numbers)
    product_value = my_product(numbers)
    return product_value - sum_value
```

- split into functions
- use libraries/built-ins
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Refactoring Example

```
from numpy import prod, sum

def my_func(numbers):
    """ Difference between sum and product of sequence. """
    sum_value = sum(numbers)
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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.

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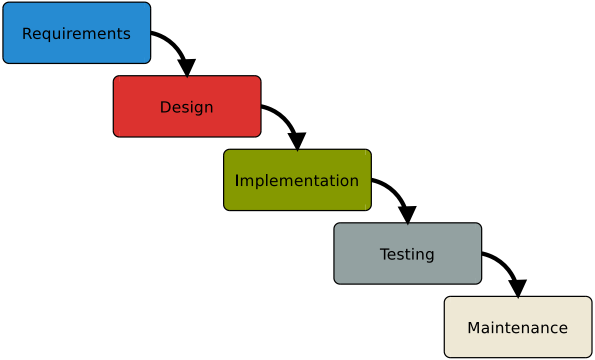
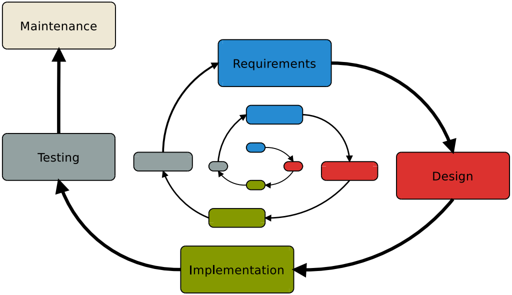
The Waterfall Model, Royce 1970



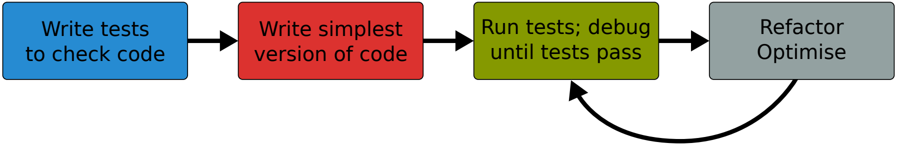
- sequential
- from manufacturing and construction

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)


Write tests to check code
Write simplest version of code
Run tests; debug until tests pass
Refactor Optimise

- Define unit tests first!
- Develop one unit at a time!

- more tomorrow