PR003: Testing your code

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Pre Reading Quiz

1. What are unit tests?
2. Why is it required?

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Why is software quality important?

- Software bugs are expensive
    - 1996 Ariane 5 Flight 501

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Why is software quality important?

- Software bugs are expensive
  - 1996 Ariane 5 Flight 501
  - 1998 NASA’s Mars Climate Orbiter failure due to inconsistency in units

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What are side effects ?

- Write a function which takes 2 numbers as input and add them.

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What are side effects ?

- Write a function which takes 2 numbers as input and add them.

```
# Function to add 2 numbers, print the sum and return none
def sum(var_a, var_b):
    sum = var_a + var_b
    print(sum)
```

```
# Function to add 2 numbers, print the sum and return it.
def sum(var_a, var_b):
    sum = var_a + var_b
    print(sum)
    return sum
```

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What is a good function?

- Intent of the function is clear from it's name.
- Contract of the function is well defined.
- Function is readable and well documented.
- **Is testable**

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What are unit tests

- System and their building blocks aka functions.
- Assumptions
- Proof

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What are unit tests

- Write a function to return factorial of a number
    - Input - Non-negative

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What are unit tests

- Write a function to return factorial of a number
    - Input - Non-negative
- f(x) = 1 for x = 0;
- f(x) = f(x-1) * x for x>0;

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What are unit tests

- Write a function to return factorial of a number
    - Input - Non-negative

```
#Function to return factorial of a number
#Only non-negative input expected
def factorial(integer):
    if integer == 0:
        return 1;
    return integer * factorial(integer - 1)
```

What are unit tests

- Test Case
  - ```
    if factorial(0) == 1:
        "Success"
    ```
    ```

What are unit tests

- Test Case
  - ```
    if factorial(0) == 1:
        "Success"
    ```
  - ```
    if factorial(5) == 120:
        "Success"
    ```

(Assumption)

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What are unit tests

- Test Case
  - ```
    if factorial(0) == 1:
        "Success"
    ```
  - ```
    if factorial(5) == 120:
        "Success"
    ```
    (Assumption)
  - ```
    if factorial(6) == 720:
        "Success"
    ```
    (Proof)

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    ```

What are unit tests

- Optimize the function

```
#Function to get factorial of a number
def factorial(integer):
    if integer == 0:
        return 1;
    return integer * factorial(integer - 1)
```

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What are unit tests

- Optimize the function

```
#Function to return factorial of a number
#Only non-negative input expected
def factorial(integer):
    if (integer == 0):
        return 1
    return integer * factorial(integer - 1)

                                Text

def factorial_optimised(integer, accumulator):
    if (integer == 0):
        return accumulator
    else:
        return factorial_optimised(integer-1, accumulator*integer)
```

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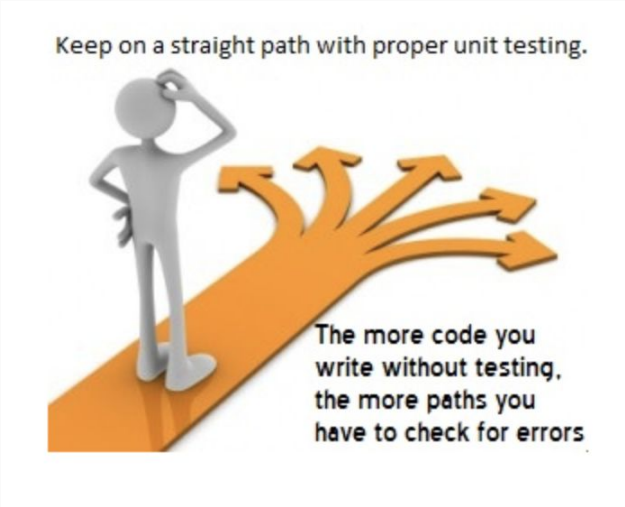
Test Driven Development (TDD)

- What is system design and architecture and when to do it.
- What is API documentation and when to do it
- What is Test Driven Development



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Why unit tests?

- Write once, run a hundred times
- Supports code reviews.
- Find bugs early
- Confidence when making additional changes

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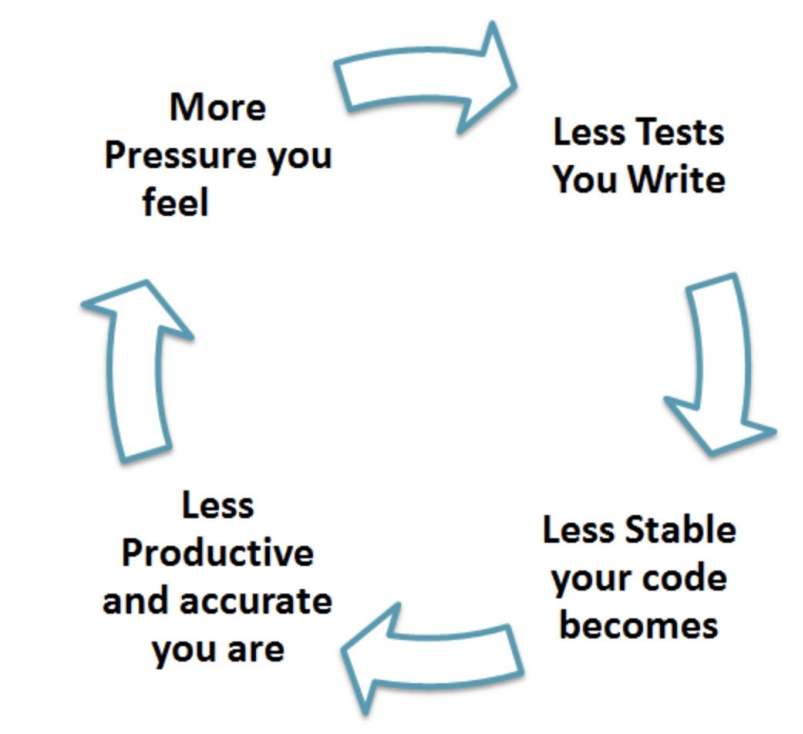
Unit Testing Tools

- **Junit:** Junit is a free to use testing tool used for **Java** programming language. It provides assertions to identify test method. This tool test data first and then inserted in the piece of code.
- **Nunit:** NUnit is widely used unit-testing framework use for all **.net** languages. It is an open source tool which allows writing scripts manually. It supports data-driven tests which can run in parallel.
- **JMockit:** JMockit is open source Unit testing tool. It is a code coverage tool with line and path metrics. It allows mocking API with recording and verification syntax. This tool offers Line coverage, Path Coverage, and Data Coverage.
- **PHPUnit:** PHPUnit is a unit testing tool for **PHP** programmer. It takes small portions of code which is called units and test each of them separately. The tool also allows developers to use pre-define assertion methods to assert that a system behave in a certain manner.

Unit Testing Myth



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Unit Testing Advantage

- Developers looking to learn what functionality is provided by a unit and how to use it can look at the unit tests to gain a **basic understanding of the unit API**.
- Unit testing allows the programmer to **refactor code at a later date**, and make sure the module still works correctly (i.e. Regression testing). The procedure is to write test cases for all functions and methods so that whenever a change causes a fault, it can be quickly identified and fixed.
- Due to the **modular nature of the unit testing**, we can test parts of the project without waiting for others to be completed.

Unit Testing Disadvantage

- Unit testing can't be expected to **catch every error** in a program. It is not possible to evaluate all execution paths even in the most trivial programs
- Unit testing by its very nature focuses on a unit of code. Hence it **can't catch integration errors or broad system level errors**.

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How is it done in Practo?

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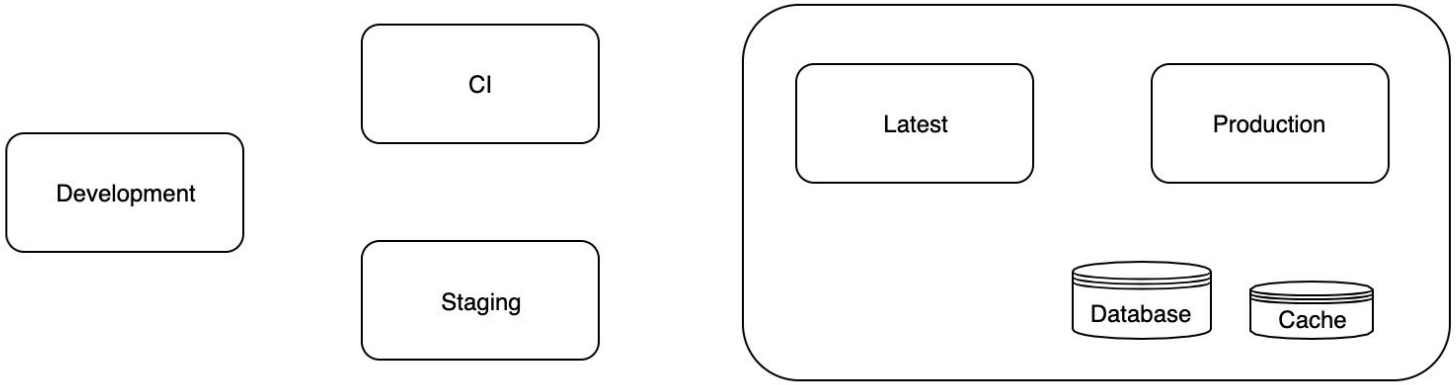
Different environments

Write unit, integration test

Run unit, integration test
Calculate code coverage
Static code checking
for security vulnerabilities
(ex: Snyk, bandit, safety check)



Manual testing of functionality
Session based tests
Benchmarking
Load testing

Testing for regression
Benchmarking
Optional load testing

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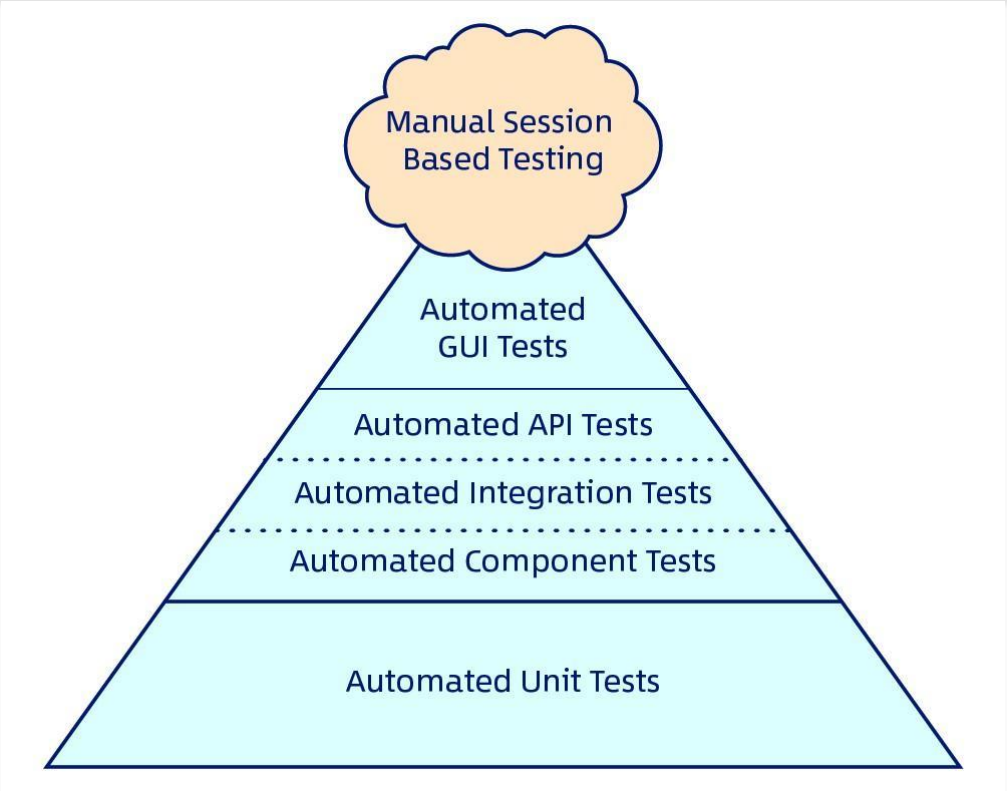
Testing pyramid



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Assignment

Part 1 of 2

1. Write a module which does credit card validation
2. Unit test the module, add travis-ci integration, run unit tests in travis
3. Add coveralls.io integration

Reference Links

1. Luhn's algorithm
2. Travis CI
3. Coveralls

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“Quality means doing it right when no one is looking.”

- Henry Ford

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Questions?

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Thanks

#dogreat

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