Software Testing

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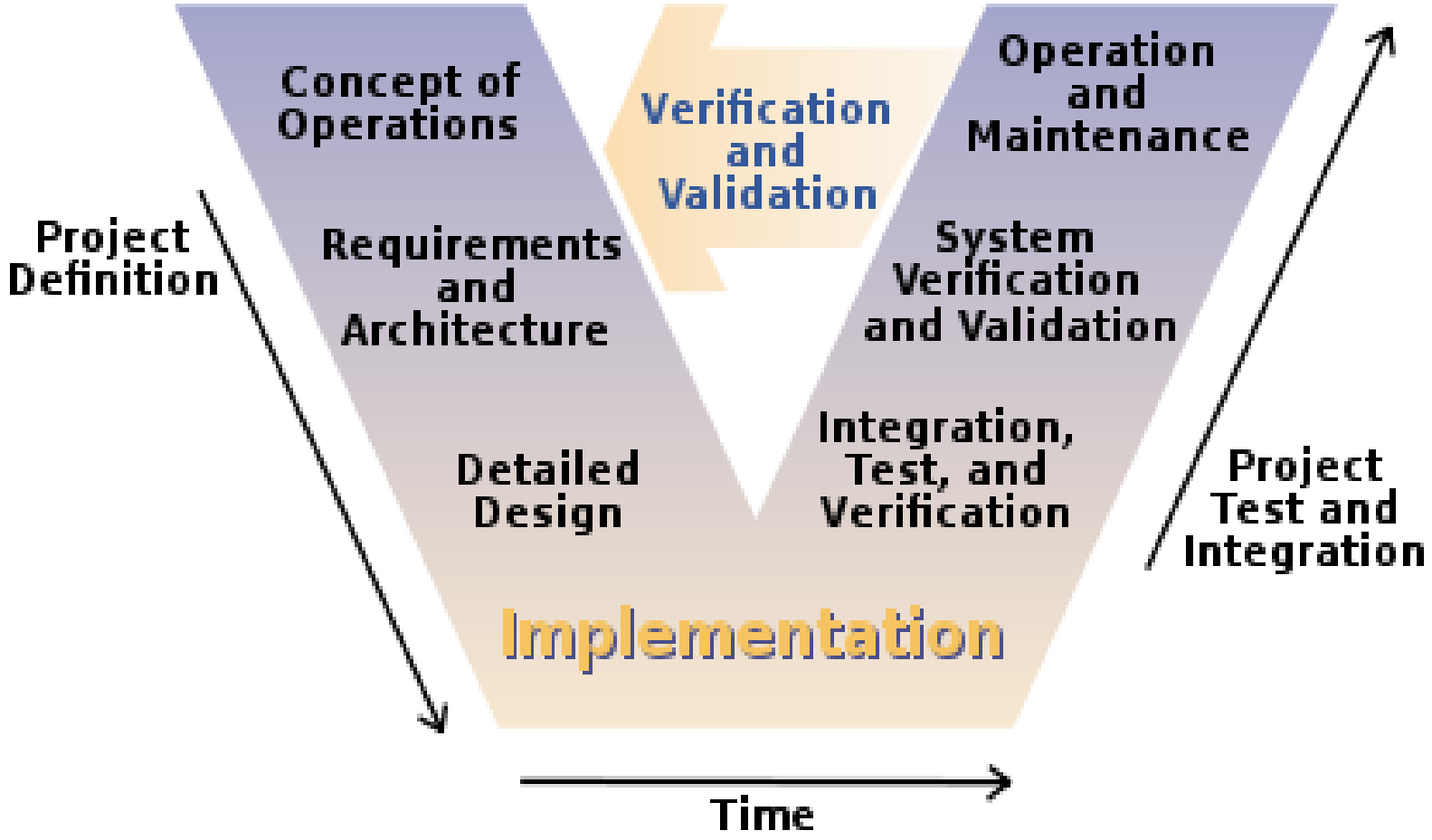
The V Model


Concept of Operations
Requirements and Architecture
Detailed Design
Implementation
Verification and Validation
Integration, Test, and Verification
System Verification and Validation
Operation and Maintenance
Project Definition
Project Test and Integration
Time

Program testing goals

- To demonstrate to the developer and the customer that the software **meets its requirements**.
  => leads to validation testing

- To discover situations in which the behavior of the software is incorrect, undesirable or does **not conform to its specification**.
  => leads to defect testing

Verification vs validation

- **Verification**: (testing)

  "Are we building the product right”.

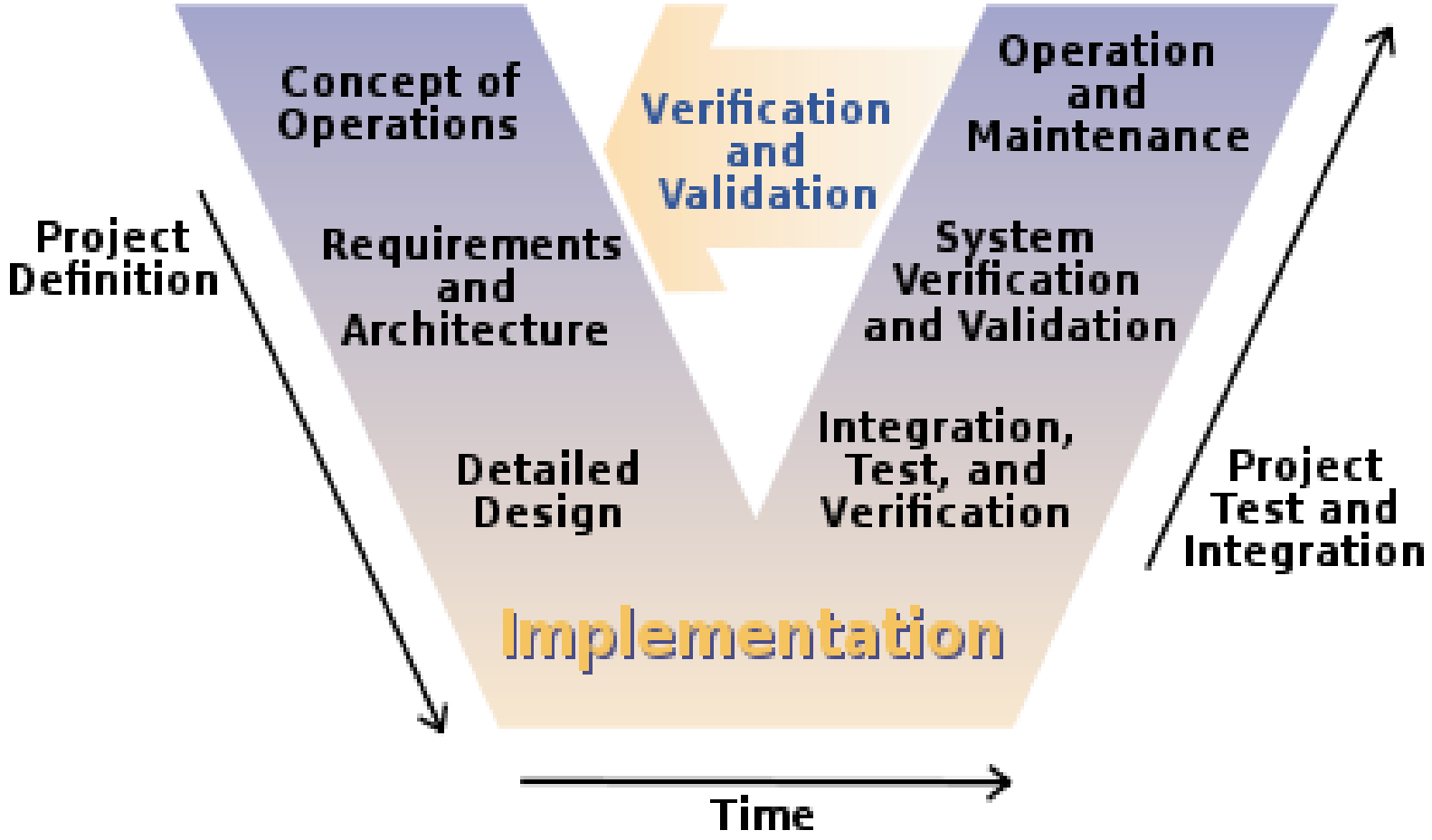
  - The software should conform to its specification.

- **Validation**: (checking)

  "Are we building the right product”.

  - The software should do what the user really requires.

The V Model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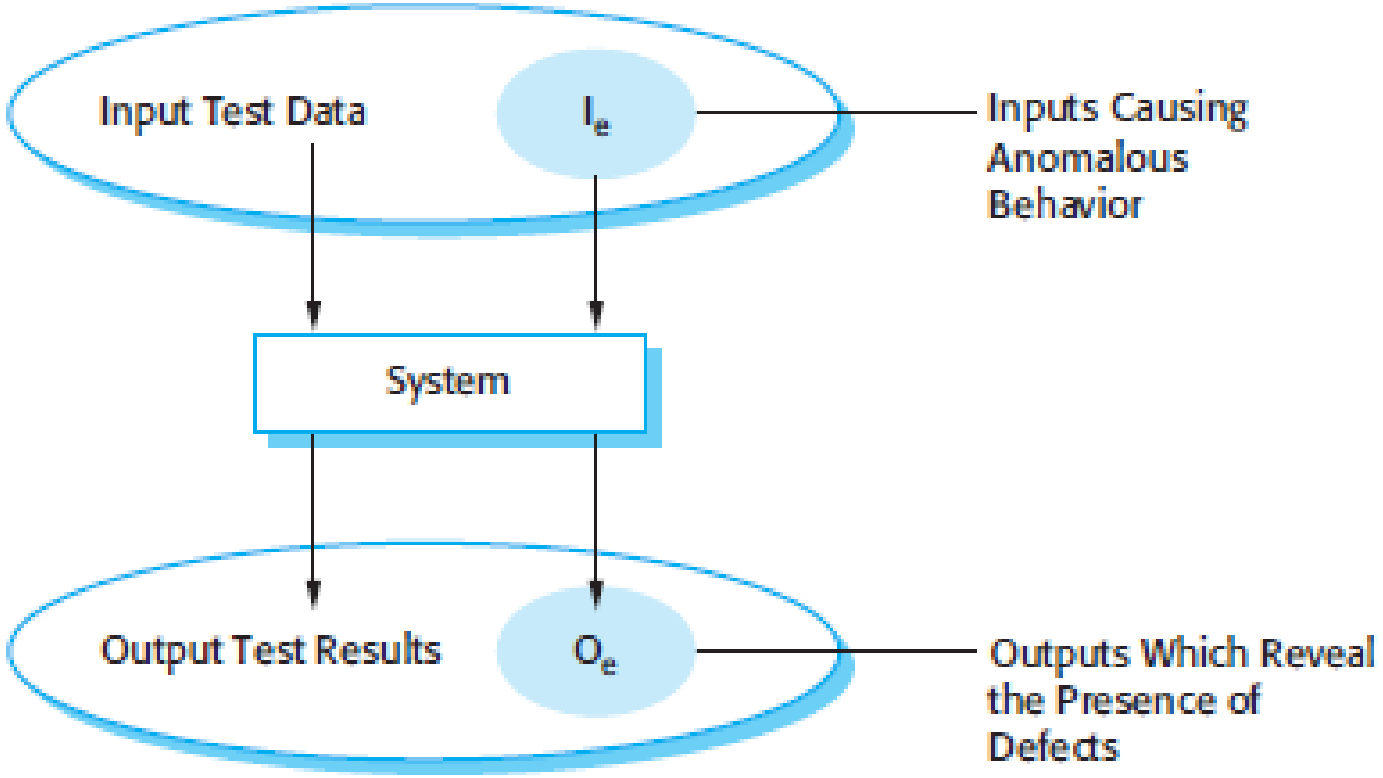
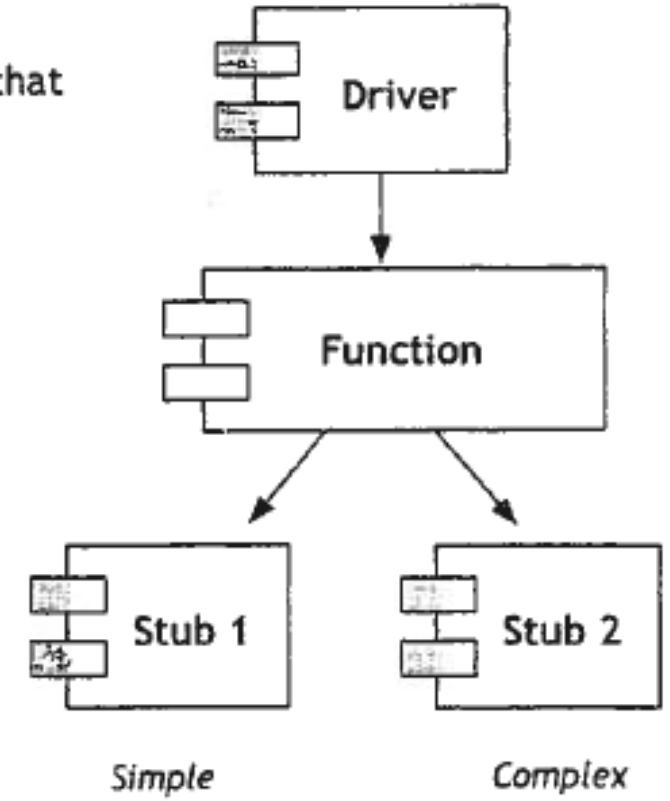
Testing - principles



Set up Test

Driver:
An upstream software or interface that provides access to the function

Stub:
Software that simulates a downstream process



Different levels of testing

related to the V-model

- Validation of the concepts and requirements
  e.g. Are the domain model right? The use stories? (the users)
- Validation of the design
  e.g. design class diagrams and design sequence diagrams
  (Reviews, Technical walkthrough by the project team)
- Component Verification
  e.g. **unit test** and test cases (implementer)
- System and integration validation
  e.g. system/integration test
- Operation Verification
  e.g. acceptance test

Black Box & White Box test

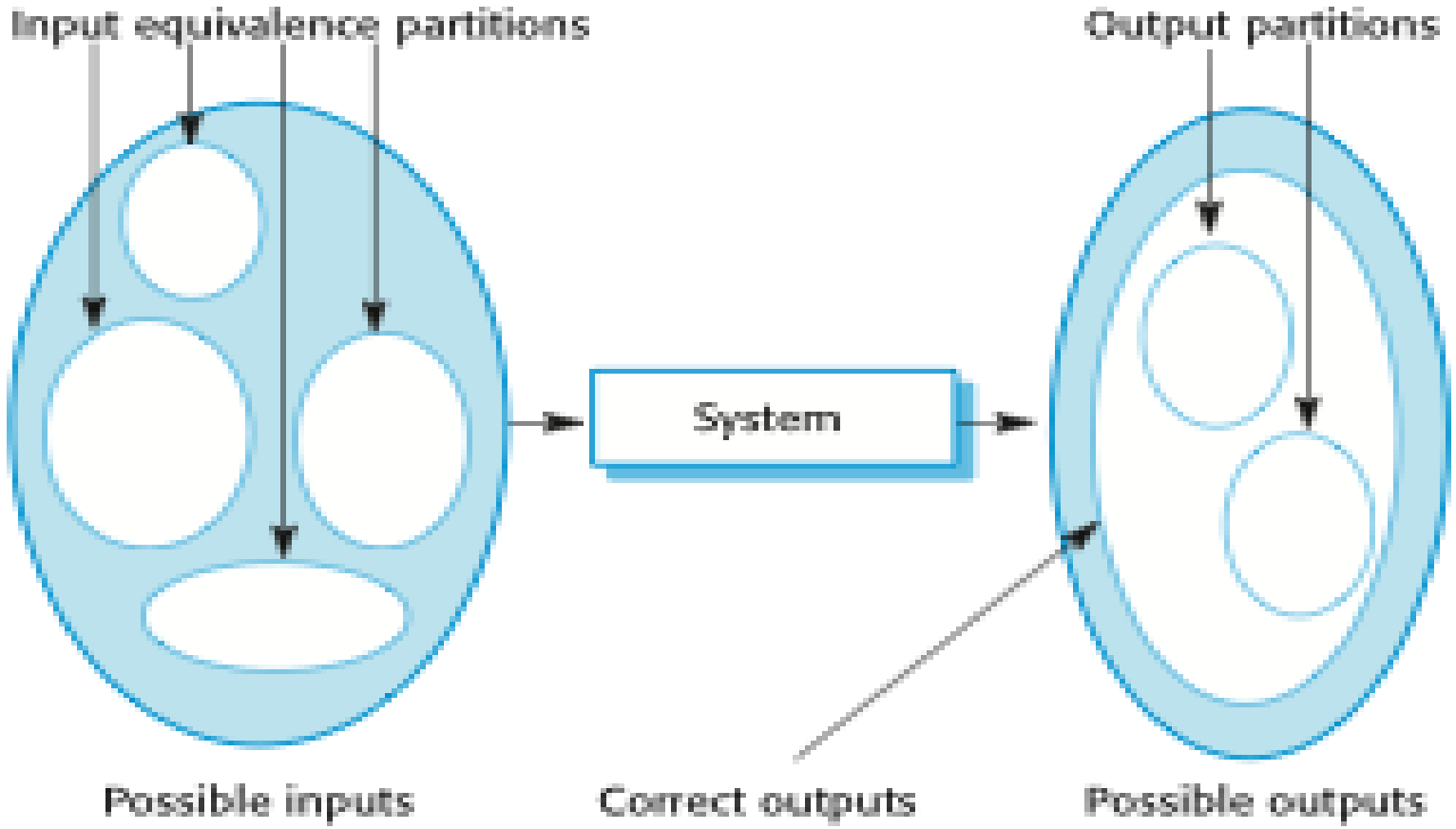
- Black box
  - Look at methods (system part) as a closed box
  - Know only interface

- White box
  - Look inside the methods (system part)
  - Look at all possible path through the methods

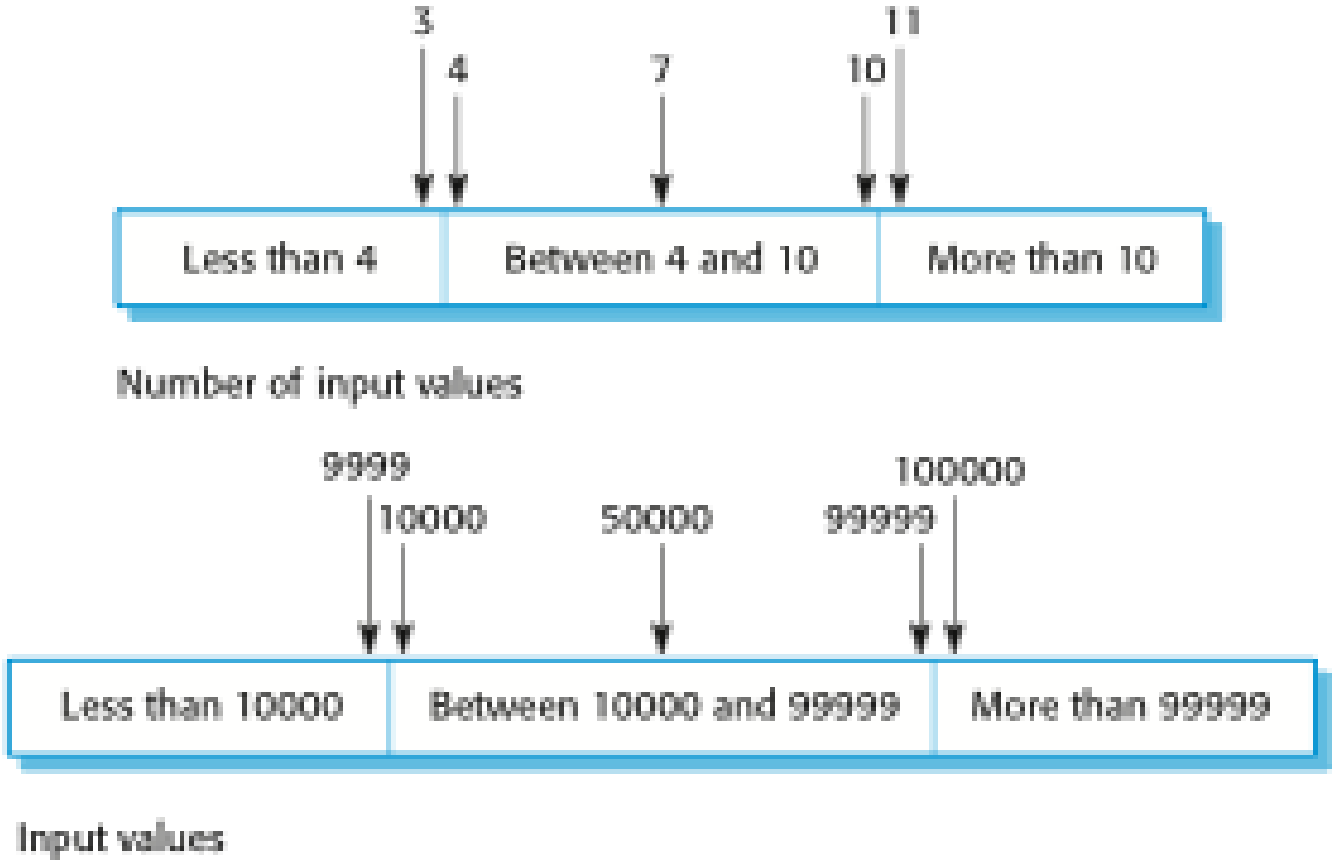
Black box testing

- The system code is ‘unknown’ -> a black box
- Look only at the methods signatures
- **Testing all kind of possible input and output**
- In C# create a Unit Test

Equivalence partitioning



Equivalence partitions



Unit test in C# - Visual Studio

- Console Programs
  - Create a test unit project,
  - Add reference to the project,
  - Remember to have the class to be tested **public.**
  - Make a test method for each test case

- App Programs
  - Create a unit test app (universal windows),
  - Add reference to the project,
  - Remember to have the class to be tested **public.**
    (in resharper set cursor at the class – right click choose generate unit test)
  - Make a test method for each test case

What can we do in in a test unit

- **Annotations**
- [TestClass] : set up the test
- [TestMethod] : This is a test method to be run
- [TestInitialize] : Run this before each test method
- [ClassInitialize] : Run this before the test starts

- **Testing verification**
- Assert.AreEqual(expected, actual)
- Assert.IsTrue(actual)
- Assert.ThrowsException<XXException>(()=> -- act --)

Practice - Test case in UNIT test

- **Arrange**
  - Set up the test (part could be in test TestInitialize)
  - Give all input the testing data
  - Give expected data the expected values

- **Act**
  - Run the method

- **Assert**
  - Check if the test have succeed

Example

```
[TestMethod]
public void TestMethod1()
{
     // Arrange
     Person p = new Person(”SomeName”, ”SomePhone”, ”SomeAddress”);
     String expectedPhone = ”SomePhone”;

     //Act
     String actualPhone = p.Phone; // do the action – here just read a property

     //Assert
      Assert.AreEqual(expectedPhone, actualPhone);
 }
```