Bachelor of Science in Computer Science (BSc in CS)

SCS1303: Introduction to Software Engineering

Software Testing

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Sub-topics

- Development Testing
- Test-driven Development
- Release Testing
- User Testing

Learning Outcomes

- Understand what is software testing and why it is important.
- Understand the stages of testing /   testing process.
- Identify how to select test cases that will geared to discover program defects.
- Understand test-first development
- Compare and contrast different testing techniques.

What is Software Testing

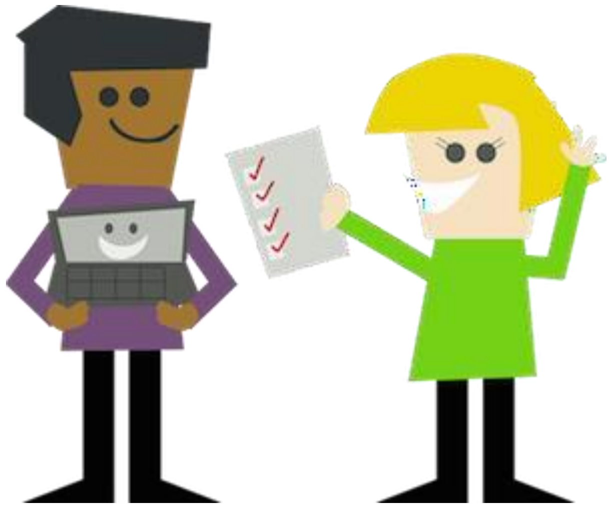
- **Software testing** is a process of executing a program or application with the intent of finding the **software bugs**.

A **software bug**- an error, flaw, failure or fault in a computer **program** or system that causes it to produce an incorrect or unexpected result, or to behave in unintended ways.

WHY SOFTWARE TESTING SOOOOO IMPORTANT?

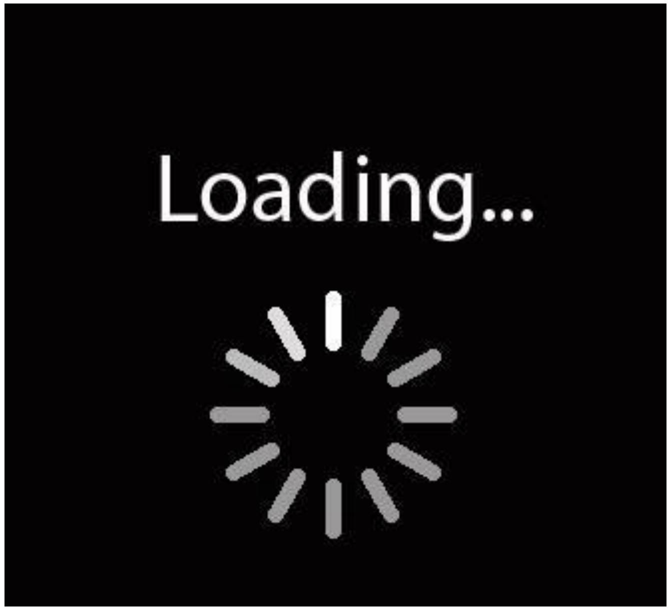
Why Software Testing is Important?

- To ensure it does what it's supposed to do.



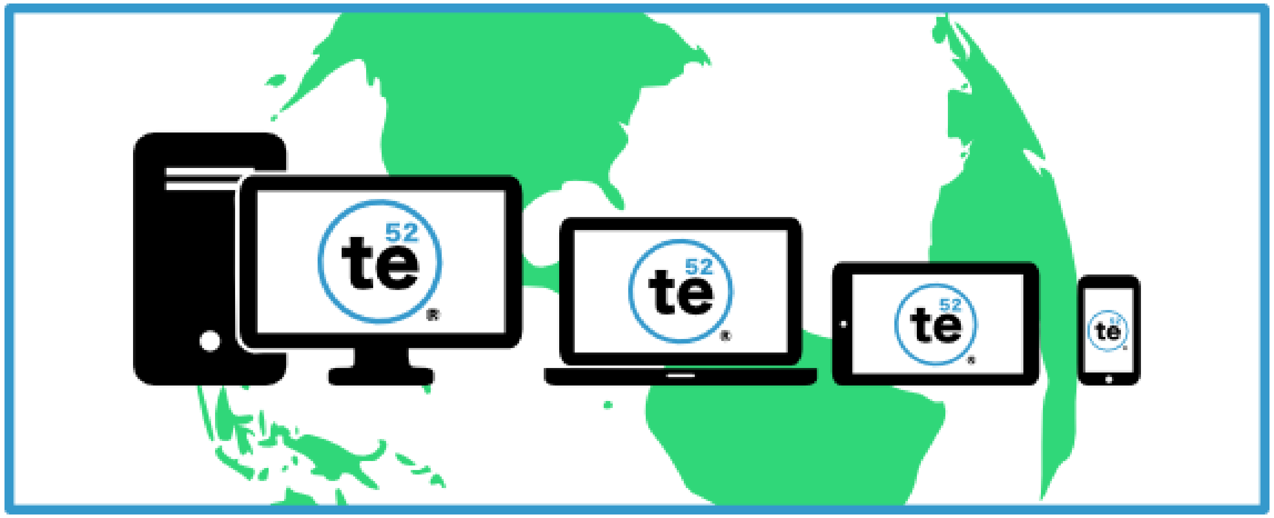
Why Software Testing is Important?

- Something that works when one person is using it, may not work when hundreds of people are using it.



Why Software Testing is Important?

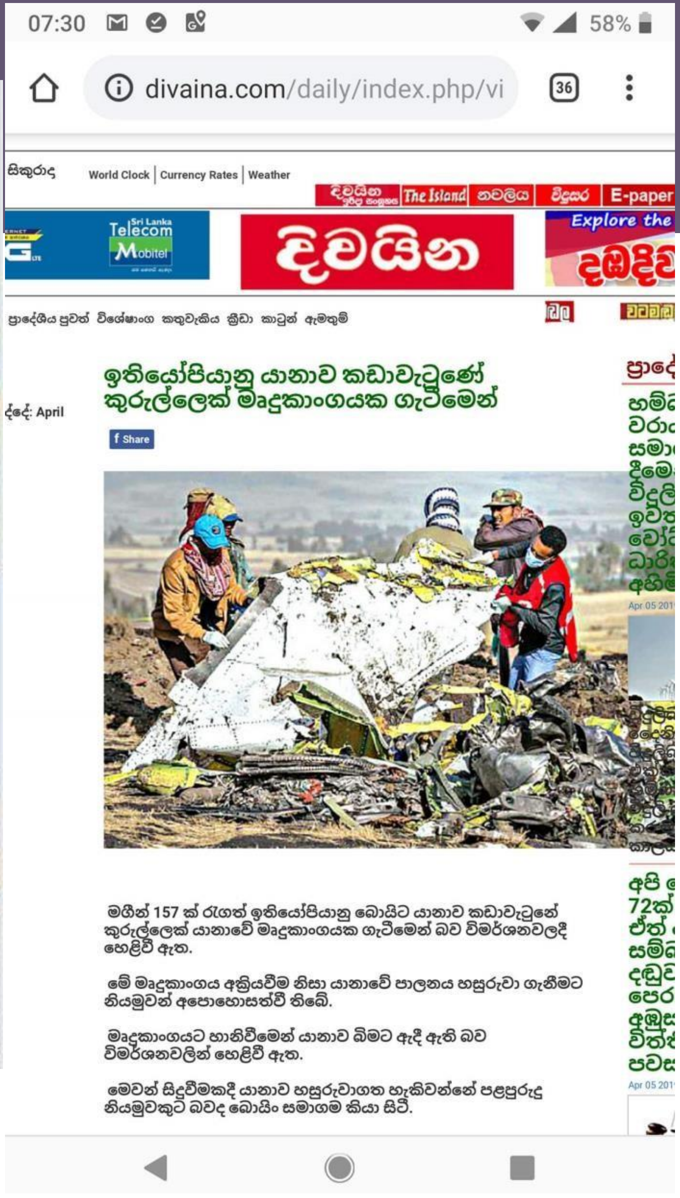
- There are lots of different devices, browsers, and operating systems out there.



Why Software Testing is Important?

- Many More!
  - lower maintenance cost
  - Increase accuracy, consistency, and reliability.
  - Increase customer confidence/satisfaction.
  - Loss of money
  - Loss of time
  - Business Reputation
  - Injury or death
    - some safety-critical systems could result in injuries or deaths if
      they don't work properly
      - e.g. flight traffic control software

https://www.ndtv.com/world-news/how-flawed-software-high-speed-doomed-ethiopian-airlines-boeing-jet-2020018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36
සිකුරාද
World Clock | Currency Rates | Weather
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Explore the
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දේ: April

ඉතියෝපියානු යානාව කඩාවැටුණේ කුරුල්ලෙක් මෘදුකාංගයක ගැටීමෙන්

මගීන් 157 ක් රැගත් ඉතියෝපියානු බෝයිට යානාව කඩාවැටුනේ කුරුල්ලෙක් යානාවේ මෘදුකාංගයක ගැටීමෙන් බව විමර්ශනවලදී හෙළිවී ඇත.

මේ මෘදුකාංගය අක්‍රියවීම නිසා යානාවේ පාලනය හසුරුවා ගැනීමට නියමුවන් අපොහොසත්වී තිබේ.

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CLEVER SOFTWARE CAN MAKE OUR LIVES EASIER BUT A GLITCH CAN HAVE DISASTROUS CONSEQUENCES

Software Testing

- Intendent to show that a program does what it is intended to do and to discover program defects before it is put into use.
- Execute a program using artificial / actual data.
- Check the results of the test run for errors, anomalies or information about the program's non-functional attributes.
- Can reveal the presence of errors NOT their absence.

Software Testing

YOU **CAN NOT** CLAIM THAT YOUR SYSTEM IS BUG FREE

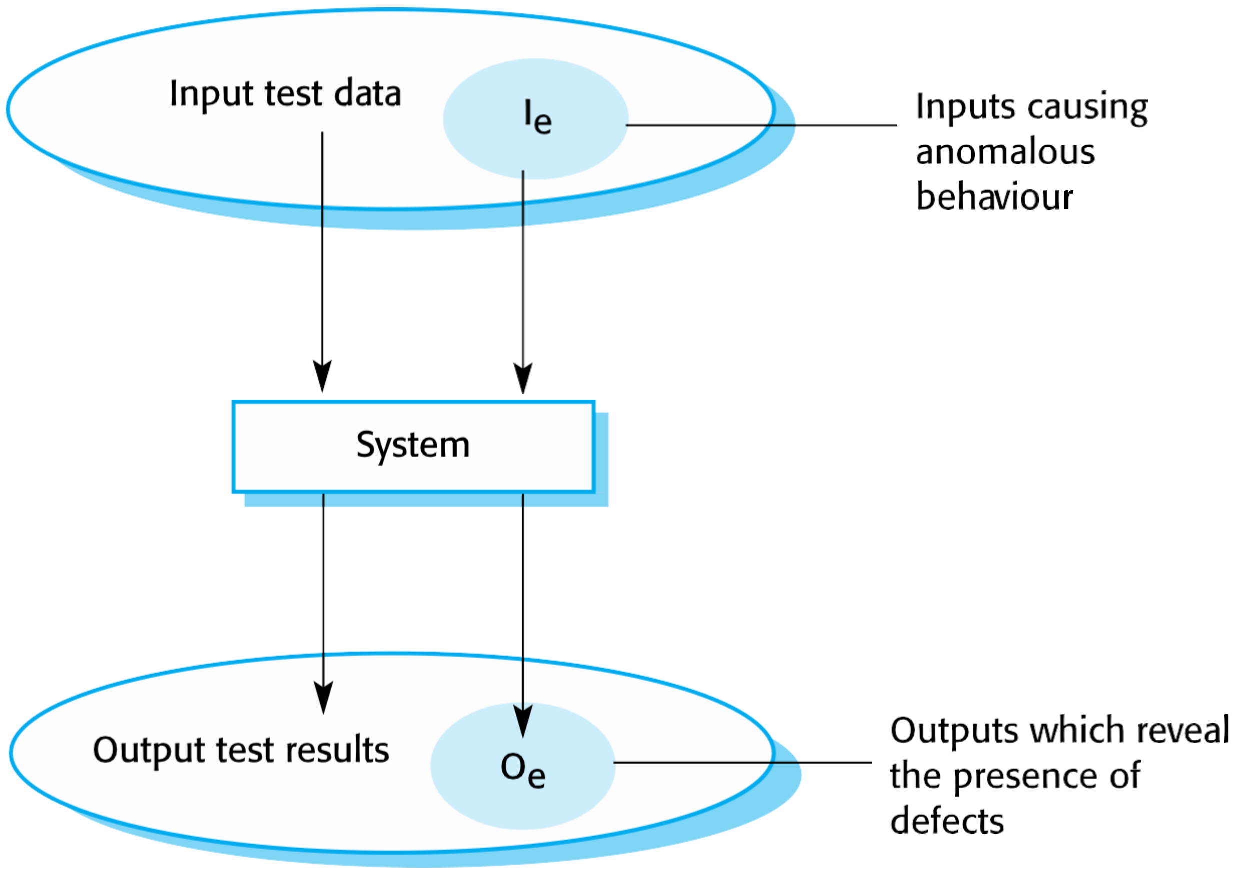
Software Testing

99% Bug Free

Main Goals - Software Testing

1. To demonstrate to the developer and the customer that the software meets its requirements.
   - A successful test shows that the system operates as intended.
   - expect the system to perform correctly using a given set of test cases
     that reflect the system's expected use.
2. To discover situations in which the behavior of the software is incorrect, undesirable or does not confirm to its specification (Identify Defects)
   - A successful test makes the system perform incorrectly.
   - The test cases are designed to expose defects.

An Input-Output Model of Software Testing


Input test data
I_e
Inputs causing anomalous behaviour
System
Output test results
O_e
Outputs which reveal the presence of defects

Software Testing

- A broader process of Validation and Verification.
- The process of **Validating** and **Verifying** that a software program or application or product meets the business and technical requirements that guided it's design and development.

Software Testing

- Validation:

"Are we building the right product"

- The software should do what the user really requires (Requirement Specification.

- Verification:

"Are we building the product right"

- The software should conform to its design specifications

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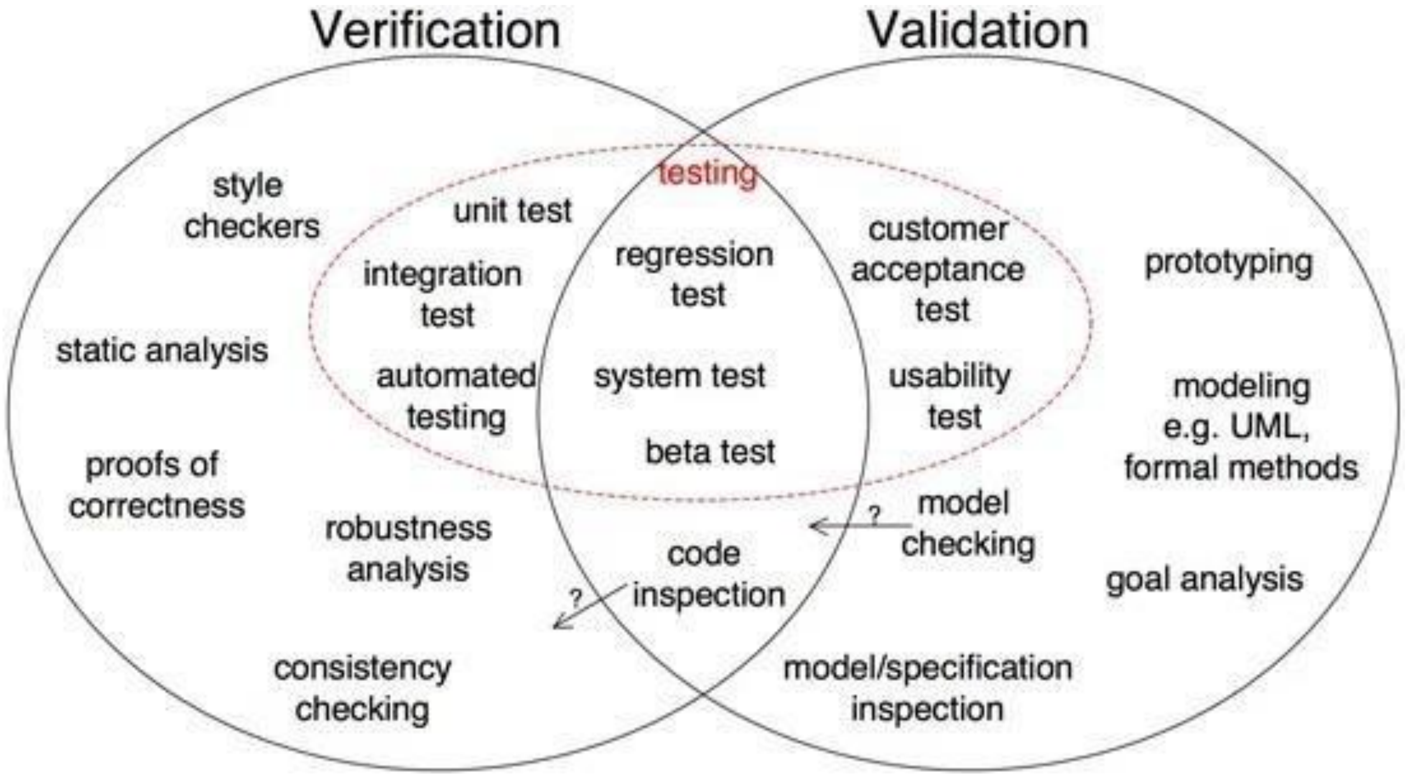
V & V Goals

- Confidence: system is ‘fit for purpose’.
- Start as soon as requirements become available.
- Continue through all stages of the development process.
- Depends on
  - **Software purpose:** The level of confidence depends on how critical the software is to an organisation.
  - **User expectations:** Users may have low expectations of certain kinds of software.
  - **Marketing environment:** Getting a product to market early may be more important than finding defects in the program.

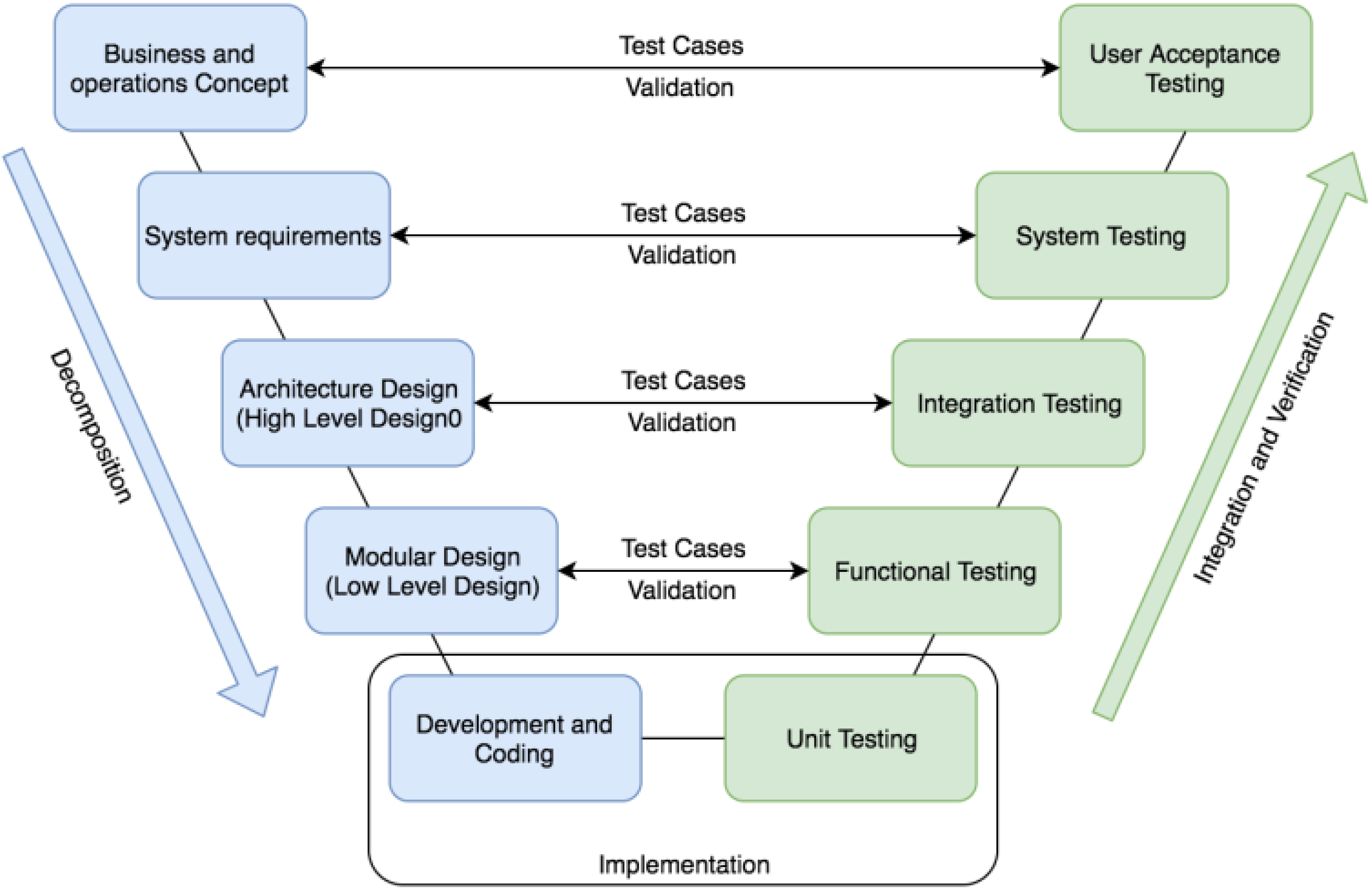
V & V Techniques



Ref: http://www.easterbrook.ca/steve/2010/11/the-difference-between-verification-and-validation/

V & V Techniques

- **Static** -Software Inspections & Review
  - Concerned with analysis of the static system representation to discover problems.
- **Dynamic** - Defect Testing
  - Concerned with exercising and observing product behavior
  - The system is executed with test data and its operational behavior is observed.


Business and operations Concept
Test Cases
Validation
User Acceptance Testing
System requirements
Test Cases
Validation
System Testing
Architecture Design (High Level Design0
Test Cases
Validation
Integration Testing
Modular Design (Low Level Design)
Test Cases
Validation
Functional Testing
Development and Coding
Unit Testing
Implementation
Decomposition
Integration and Verification

Software Inspections & Reviews

- Applicable to any representation of the system (requirements, design, configuration data, test data, etc.).
- Does not require execution of a system.
- Can be used before implementation.
- An effective technique for discovering program errors.
- Examine the source representation with the aim of discovering anomalies and defects.

Advantages of Inspections

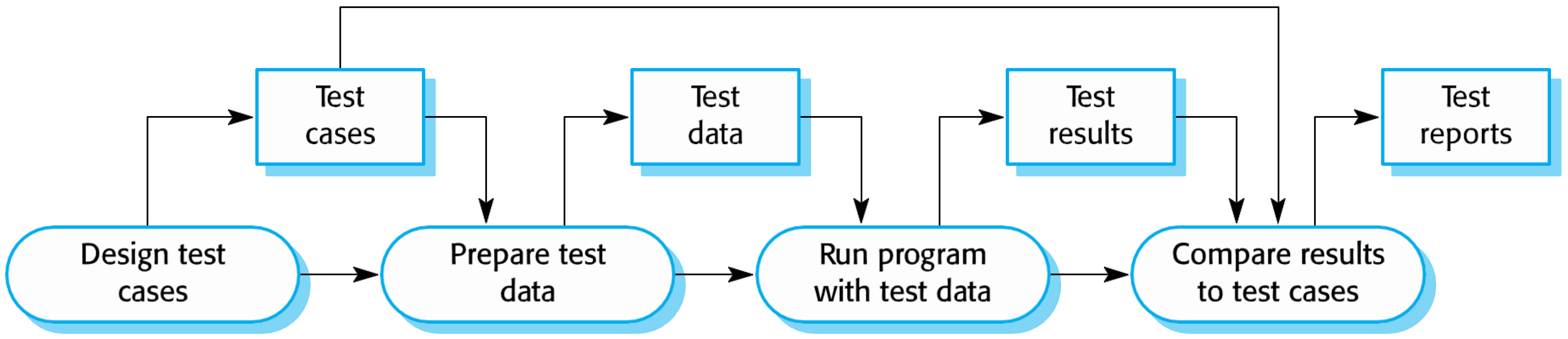
- Errors may mask (hide) other errors. No need to be concerned with interactions between errors.
- Incomplete versions of a system can be inspected without additional costs.
- Can consider broader quality attributes of a program, such as compliance with standards, portability and maintainability.
- Can look for inefficiencies, inappropriate algorithms and poor programing styles that could make the system difficult to maintain and update.

Inspections vs Defect Testing

- Complementary but not opposing.
- Can be used during the V & V process.
- Inspections can check conformance with a specification but not conformance with the customer's real requirements.
- Inspections cannot check non-functional characteristics such as performance, usability, etc.
- Inspections are NOT good for discovering defects that arise due to unexpected interaction (different parts of a program/ Timing errors / system performance)

DEFECT TESTING

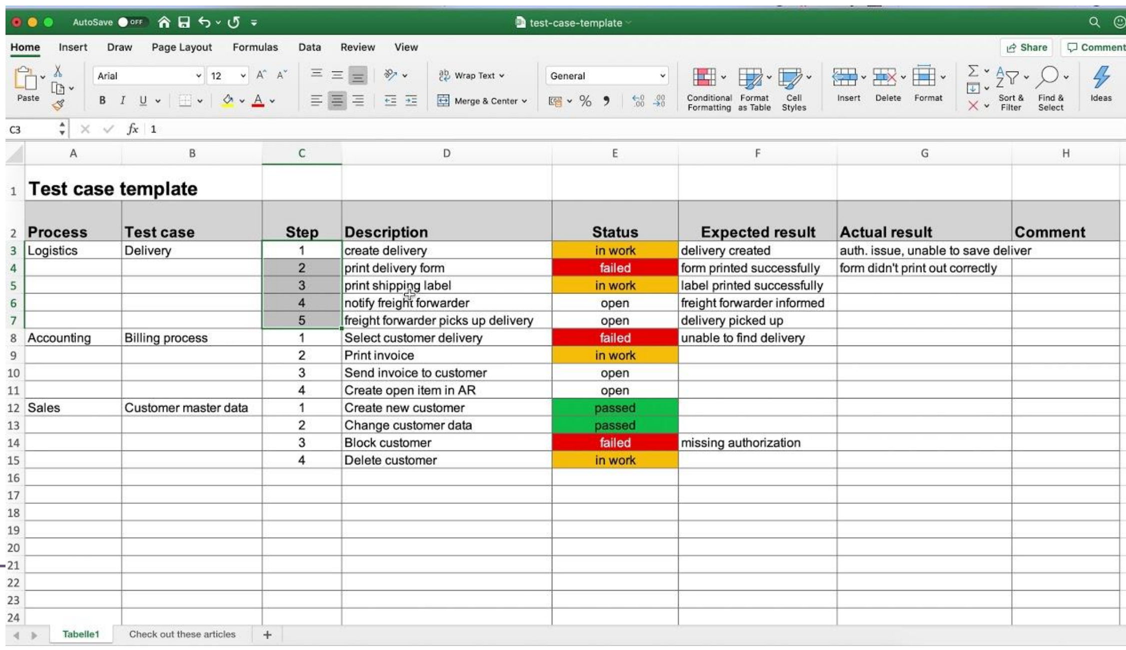
Software Defect Testing Process



What is a Test Case?

- Set of conditions or variables under which a tester will determine whether the system is working correctly or not.
- Corresponds to a use-case.
- Test case comprised of
  - ID
  - Description
  - Input
  - Expected output
- A test case

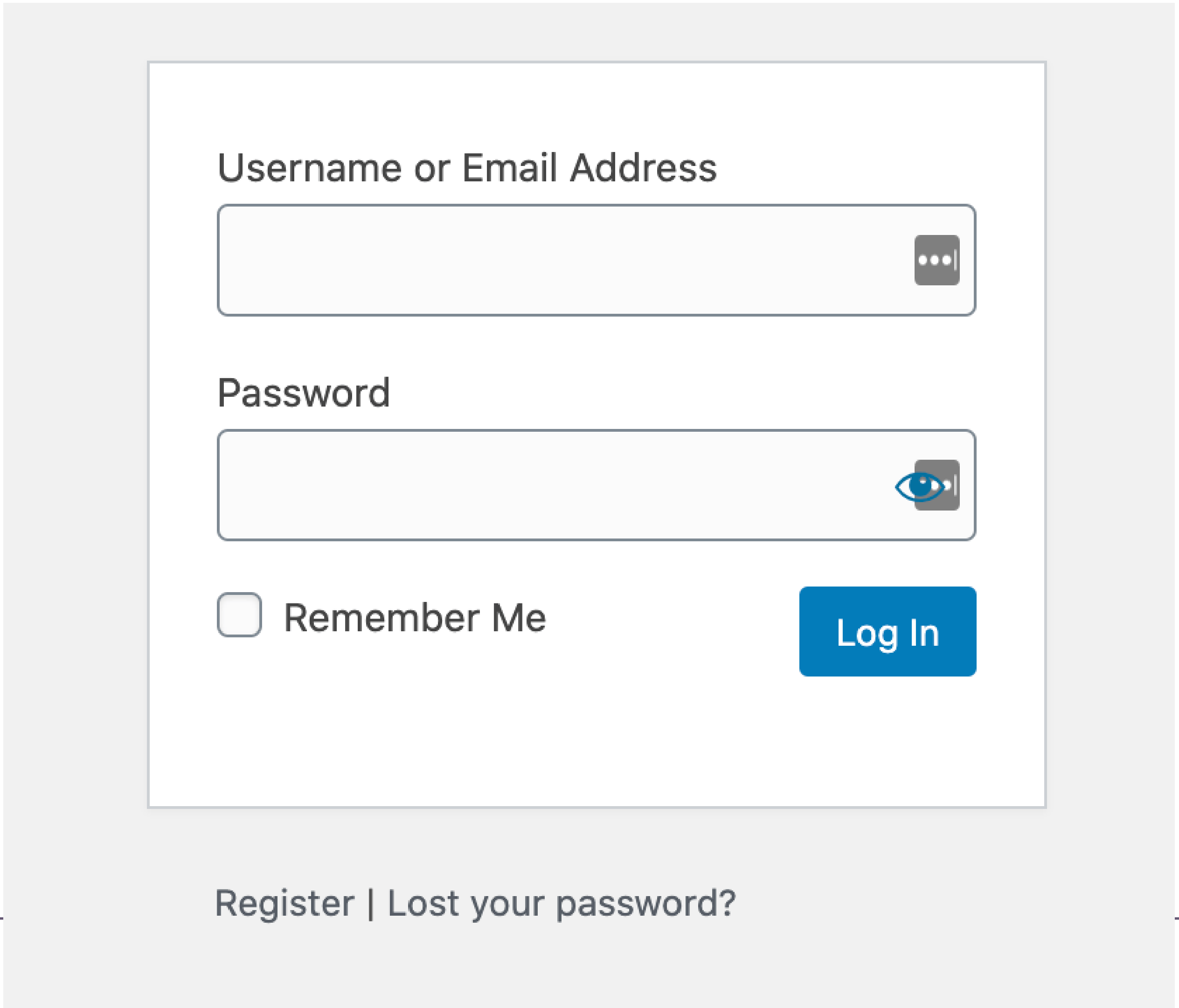
either “Passes” or “Fail”.



Test case template

Process	Test case	Step	Description	Status	Expected result	Actual result	Comment
Logistics	Delivery	1	create delivery	in work	delivery created	auth. issue, unable to save deliver	
		2	print delivery form	failed	form printed successfully	form didn't print out correctly	
		3	print shipping label	in work	label printed successfully		
		4	notify freight forwarder	open	freight forwarder informed		
		5	freight forwarder picks up delivery	open	delivery picked up		
Accounting	Billing process	1	Select customer delivery	failed	unable to find delivery		
		2	Print invoice	in work			
		3	Send invoice to customer	open			
		4	Create open item in AR	open			
Sales	Customer master data	1	Create new customer	passed			
		2	Change customer data	passed			
		3	Block customer	failed	missing authorization		
		4	Delete customer	in work			

Exercise



Username or Email Address

Password

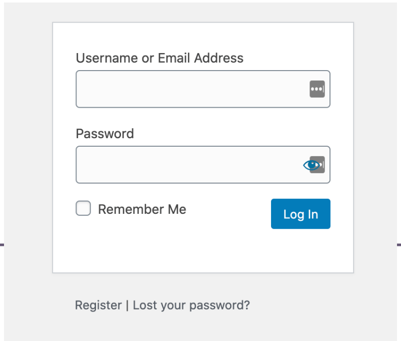
Remember Me

Log In

Register | Lost your password?

Test cases for Login page : UI Scenarios

1. Verify that the login screen contains elements such as Username, Password, Sign in button, Remember password check box, Forgot password link, and create an account link.
2. Verify that all the fields such as Username, Password has a valid placeholder
3. Verify whether all the text boxes have a minimum and maximum length.
4. Verify that the labels float upward when the text field is in focus or filled (In case of the floating label)
5. Verify to see if the font style and size of the labels, as well as the text on each object, are clearly visible.
6. Verify that the application's user interface (UI) is responsive, so it will adapt to different screen resolutions and devices.
7. Verify the login page and all the fields in the login page are displaying without any break in different browsers



Test cases for Login page : Functional

1.Verify that cursor is focused on the “Username” text box on the page load (login page)

2.Verify that tab functionality is working properly or not

3.Verify that Enter/Tab key works as a substitute for the Sign-in button

4.Verify that the User is able to Login with Valid Credentials

5.Verify that the User is not able to Login with an invalid Username and invalid Password

6.Verify that the User is not able to Login with a Valid Username and invalid Password

7.Verify that the User is not able to log in with an invalid Username and Valid Password

8.Verify that the User is not able to log in with a blank Username or Password

9.Verify that the User is not able to Login with inactive credentials

10.Verify that the reset button clears the data from all the text boxes in the login form

Test cases for Login page : Functional

11. Verify that the login credentials, mainly password stores in a database in an encrypted format
12. Verify that clicking on the browser back button after successful login should not take the User to log out mode
13. Verify that validation message is displayed in the case when User leaves Username or Password as blank
14. Verify that validation message is displayed in case of exceeding the character limit of the Username and Password fields
15. Verify that validation message is displayed in case of entering special character in the Username and password fields
16. Verify that the “Keep me logged in” checkbox is unselected by default
17. Verify that the timeout of the login session (Session Timeout)
18. Verify that the logout link is redirected to login/home page
19. Verify that User is redirected to appropriate page after successful login
20. Verify that the User is redirected to the Forgot password page when clicking on the Forgot Password link

Test cases for Login page : Functional

21. Verify that the User is redirected to the Create an account page when clicking on the Signup / Create an account link
22. Verify that the User should be able to login with the new password after changing the password
23. Verify that the user should not be able to login with the old password after changing the password
24. Verify that spaces should not be allowed before any password characters attempted
25. Verify whether the user is still logged in after a series of actions such as sign-in, close the browser, and reopen the application.
26. Verify that the ways to retrieve the password if the user forgets the password

Test cases for Login page : Quality Attributes

1. Verify that clicking on the browser back button after successful logout should not take the User to a logged-in mode
2. Verify that there is a limit on the total number of unsuccessful login attempts
3. Verify that the password is in encrypted form when entered in the password field.
4. Verify the password can be copy-pasted. System shouldn’t allow users to copy paste password.
5. Verify that encrypted characters in the “Password” field should not allow deciphering if copied
6. Verify that the “Remember password” checkbox is unselected by default
7. Verify whether the login form is revealing any security information by viewing the page source
8. Verify that the login page is vulnerable to SQL injection (HW).

Software Defect Testing Stages

- **Development testing:** The system is tested during development to discover bugs and defects.
- **Release testing:** A separate testing team test a complete version of the system before it is released to users.
- **User testing:** Users or potential users of a system, test the system in their own environment.

DEVELOPMENT TESTING

Development Testing

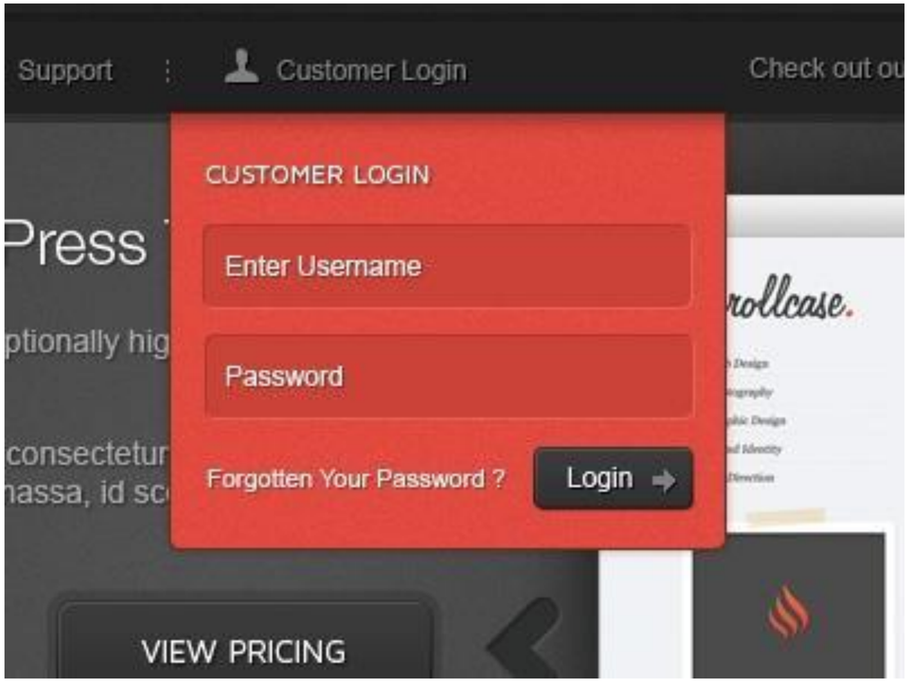
- Includes all testing activities that are carried out by the team developing the system.
  - Unit testing
  - Component testing
  - System testing

UNIT TESTING

What is Unit Testing

- Isolate each part of the system and show that the individual parts are correct.
  - i.e. Testing individual components in isolation.
- Units may be:
  - Individual functions or methods within an object
  - Object classes with several attributes and methods
  - Composite components with defined interfaces used to access their functionality.

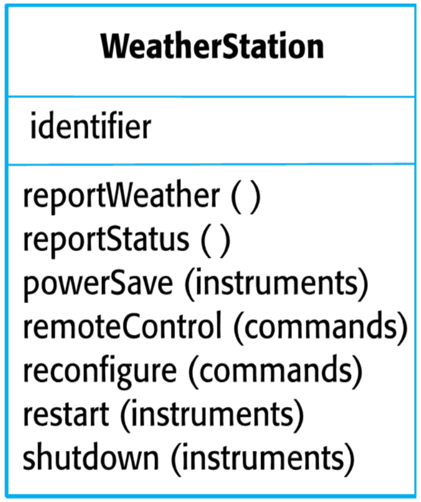
Individual Functions / Methods



Login

Object Class Testing

- Testing all operations associated with an object
- Setting and interrogating all object attributes
- Exercising the object in all possible states.



Automated Testing

- Whenever possible, unit testing should be automated so that tests are run and checked without manual intervention.
- In automated unit testing, you make use of a test automation framework (such as JUnit) to write and run your program tests.

Choosing Unit Test Cases

- The test cases should show
  - when used as expected, the component that you are testing does what it is supposed to do.
  - If there are defects in the component, these should be revealed by test cases.
- Two types of unit test cases
  - normal operation of a program and should show that the component works as expected.
  - abnormal inputs to check that these are properly processed and do not crash the component.

Test Cases Selection Strategies

- Partition testing
  - identify groups of inputs that have common characteristics and should be processed in the same way.
  - You should choose tests from within each of these groups.

- Guideline-based testing
  - Use testing guidelines to choose test cases.
  - Guidelines reflect previous experience of the kinds of errors that programmers often make when developing components.

Partition Testing

- Divide input test data into partitions.
  - Input data and output results often fall into different classes where all members of a class are related
- Assumption: any input within the partition is equivalent - the program behaves in an equivalent way for each class member.
- Test cases should be chosen from each partition.
- Test each partition.
- Equivalent partitioning.

Percentage ☐ *Accepts Percentage value between 50 to 90

Equivalence Partitioning		
Invalid	Valid	Invalid
<=50	50-90	>=90

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Equivalence Partitioning: Example 1

- Date Field (Integer values 1 to 31 is accepted)
- Identify the equivalence partitioning.

Invalid

- 0
- -1
- -2
- .
- .
- .

Valid

- 1
- 2
- 3
- …
- 31

Invalid

- 32
- 33
- ..

Equivalence Partitioning: Example 2

- User Name (6 – 10 Characters)
- Identify the equivalence partitioning.

Invalid

- 0 char
- 1 char
- 2 char
- 3 char
- 4 char
- 5 char

Valid

- 6 char
- 7 char
- 8 char
- 9 char
- 10 char

Invalid

- 11 char
- 12 char
- 13 char
- …

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Equivalence Partitioning: Example 3

- Age (18 – 80 Years except 60 – 65 Years)
- Identify the equivalence partitioning.

Invalid

- .....
- 0 Y
- 1 Y
- ......
- 17 Y

Valid

- 18 Y
- 19 Y
- ....
- 59 Y

Invalid

- 60 Y
- 61 Y
- 62 Y
- 63 Y
- 64 Y
- 65 Y

Valid

- 66 Y
- 67 Y
- ....
- 80 Y

Invalid

- 81 Y
- ......

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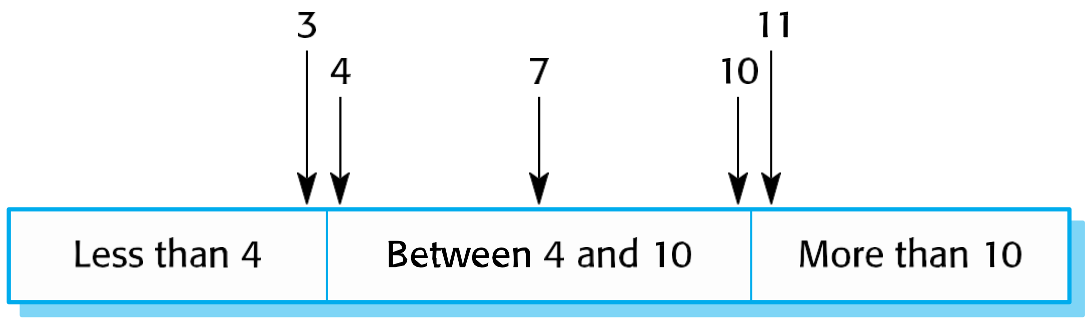
Exercise

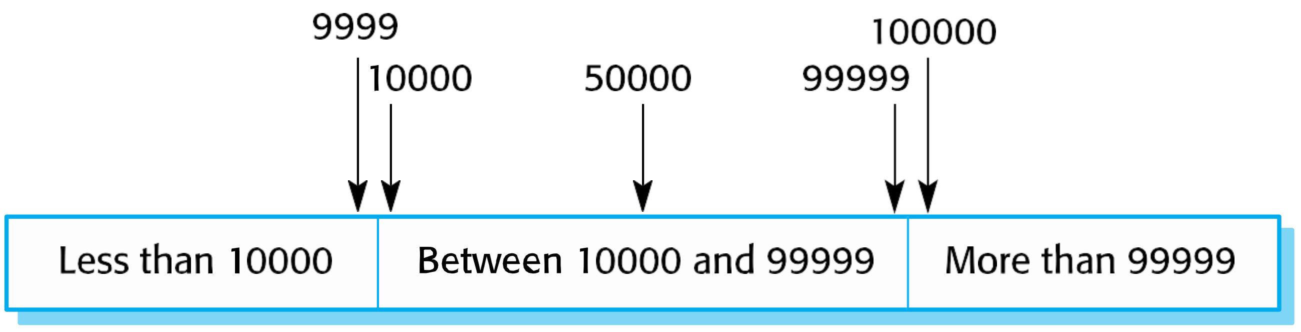
Suppose a program specification states that the program accepts 4 to 10 inputs which are five-digit integers greater than ten thousand (10,000)

Identify the input partitions and possible test input values.

Equivalence Partitions



Number of input values



Input values

Testing Guidelines (sequences)

- Using only a single value
- Use different sizes in different tests.
- Derive tests so that the first, middle and last elements of the sequence are accessed.
- Sequences of zero length.

General Testing Guidelines

- Choose inputs that force the system to generate all error messages
- Design inputs that cause input buffers to overflow
- Repeat the same input or series of inputs numerous times
- Force invalid outputs to be generated
- Force computation results to be too large or too small.

Exercise

You have been asked to test a method called ‘catWhiteSpace’ in a ‘Paragraph’ object that, with in the paragraph, replace sequences of blank characters with a single blank character. Identify testing partitions for this example and derive a set of tests for the ‘catWhiteSpace’ method.

“The quick brown fox jumped over the lazy dog”

Answer

- **Testing partitions are:**
  - Strings with only single blank characters.
  - Strings with sequences of blank characters in the middle of the string
  - Strings with sequences of blank characters at the beginning/end of string

Answer

- The quick brown fox jumped over the lazy dog(only single blanks)
- The quick brown   fox jumped over the   lazy dog(different numbers of blanks in the sequence)
- The quick brown fox jumped over the lazy dog(1st blank is a sequence)
- The quick brown fox jumped over the lazy dog (Last blank is a sequence)
-   The quick brown fox jumped over the lazy dog(2 blanks at beginning)
-         The quick brown fox jumped over the lazy dog (several blanks at beginning)
- The quick brown fox jumped over the lazy dog   (2 blanks at end)
- The quick brown fox jumped over the lazy dog   (several blanks at end)

MCQs

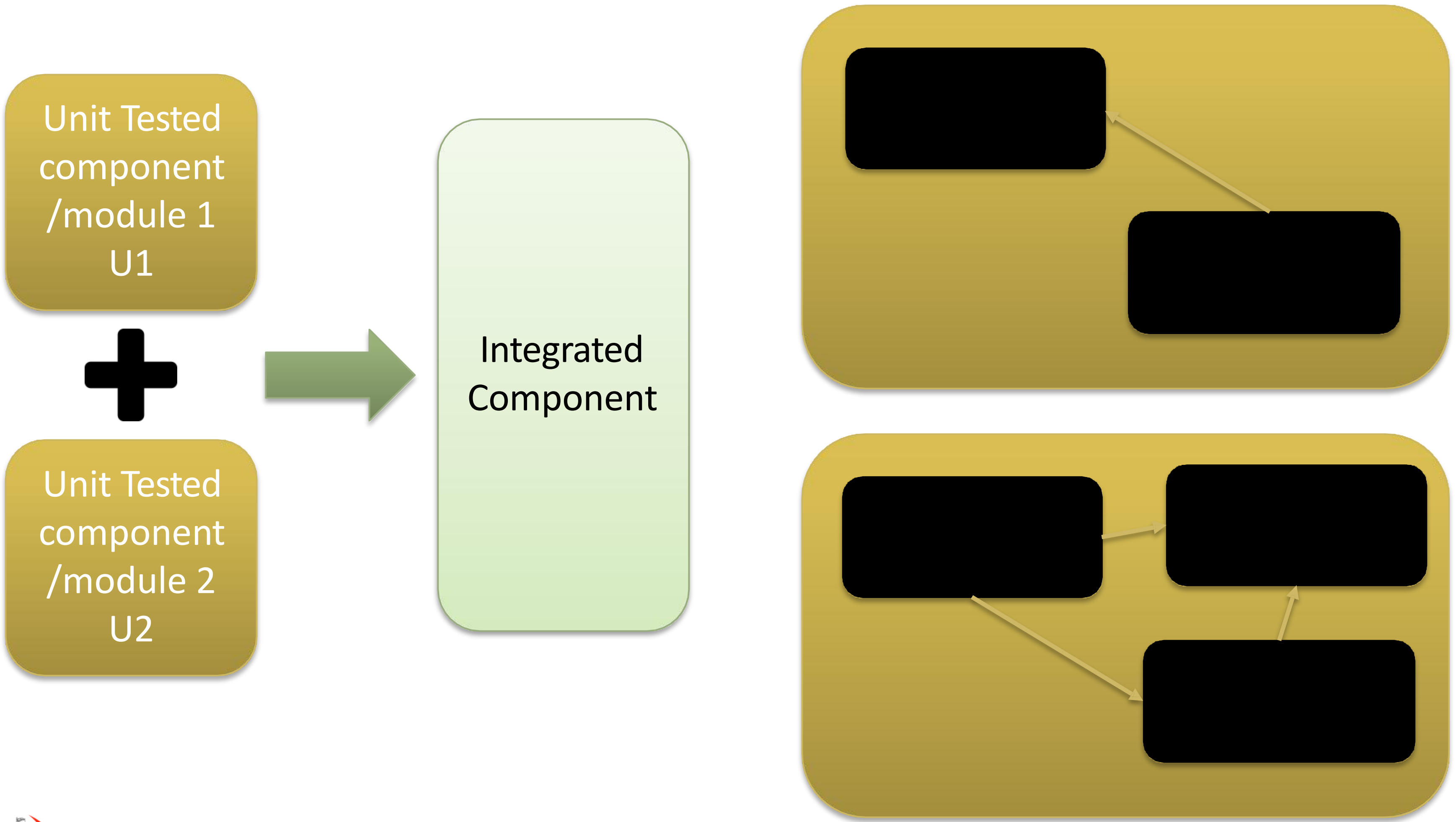
- Identify the correct statement(s) from among the following statements which are related to testing.
  a) Testing can demonstrate the presence of errors.
  b) Testing can show that there are no errors in a program.
  c) Testing is part of a broader process of software verification and validation.
  d) Testing always involves execution of a program.
  e) Static testing techniques can be used in both verification and validation processes.

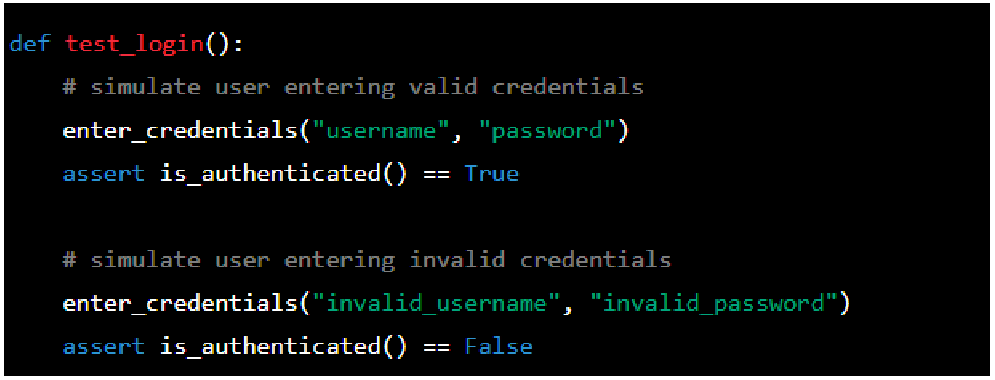
MCQs

- Identify the correct statement(s) from among the following statements which are related to testing.
  a) **Testing can demonstrate the presence of errors.**
  b) Testing can show that there are no errors in a program.
  c) **Defect testing is part of a broader process of software verification and validation.**
  d) Testing always involves execution of a program.
  e) **Static testing techniques can be used in both verification and validation processes.**

COMPONENT TESTING

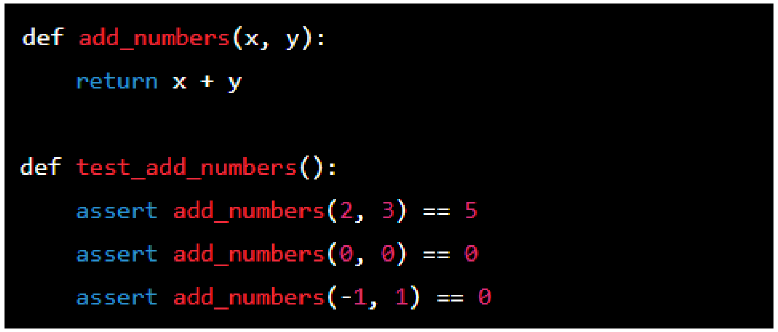
What is a Component?


Unit Tested component /module 1 U1
Unit Tested component /module 2 U2
Integrated Component



```python
def test_login():
    # simulate user entering valid credentials
    enter_credentials("username", "password")
    assert is_authenticated() == True

    # simulate user entering invalid credentials
    enter_credentials("invalid_username", "invalid_password")
    assert is_authenticated() == False
```

Component testing, involves testing larger and more complex parts of an application that may consist of multiple units working together to achieve a specific goal or functionality.

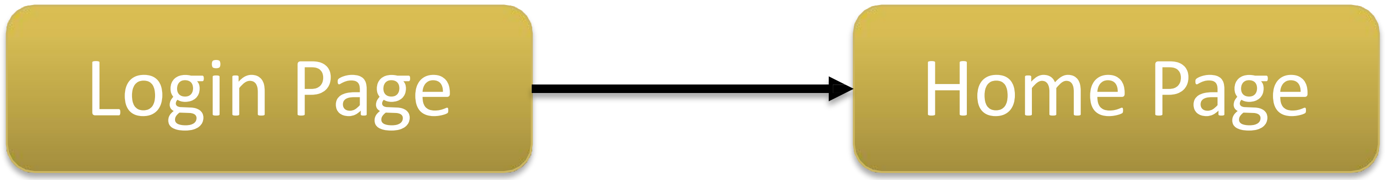


```python
def add_numbers(x, y):
    return x + y

def test_add_numbers():
    assert add_numbers(2, 3) == 5
    assert add_numbers(0, 0) == 0
    assert add_numbers(-1, 1) == 0
```

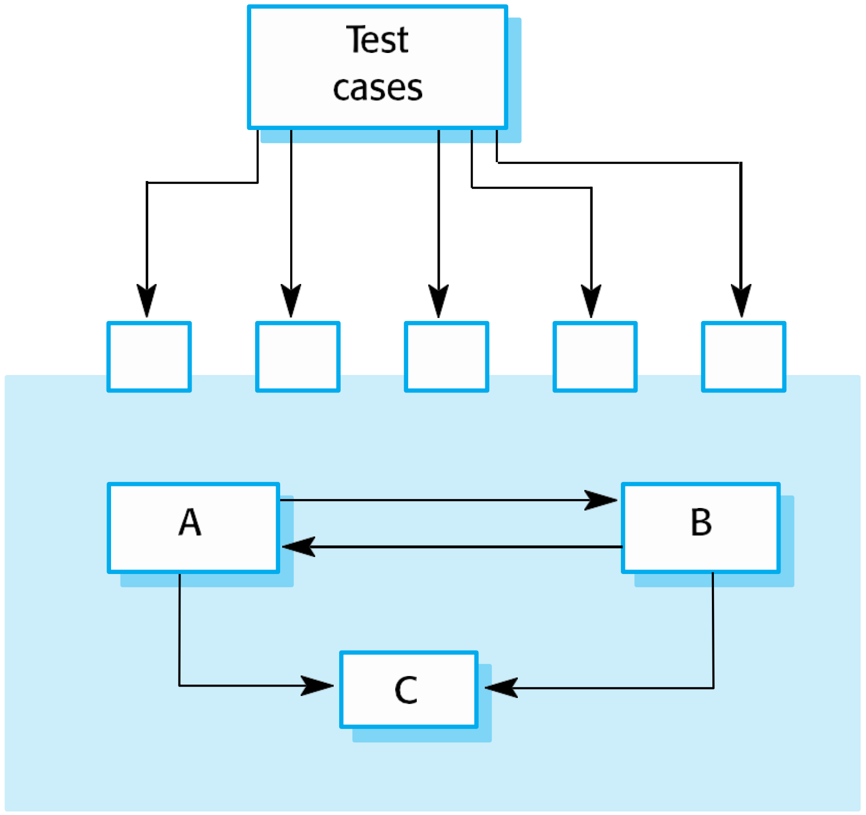
Unit testing involves testing individual units of code, such as functions or methods, in isolation from the rest of the application.

Component Testing

- Composite components are made up of several interacting objects.
- Access the functionality of these objects through the defined component interface.
- Testing composite components should focus on showing that the component interface behaves according to its specification.



Interface Testing



Interface Testing is defined as a software testing type which verifies whether the communication between two different software systems is done correctly.

A connection that integrates two components is called interface.

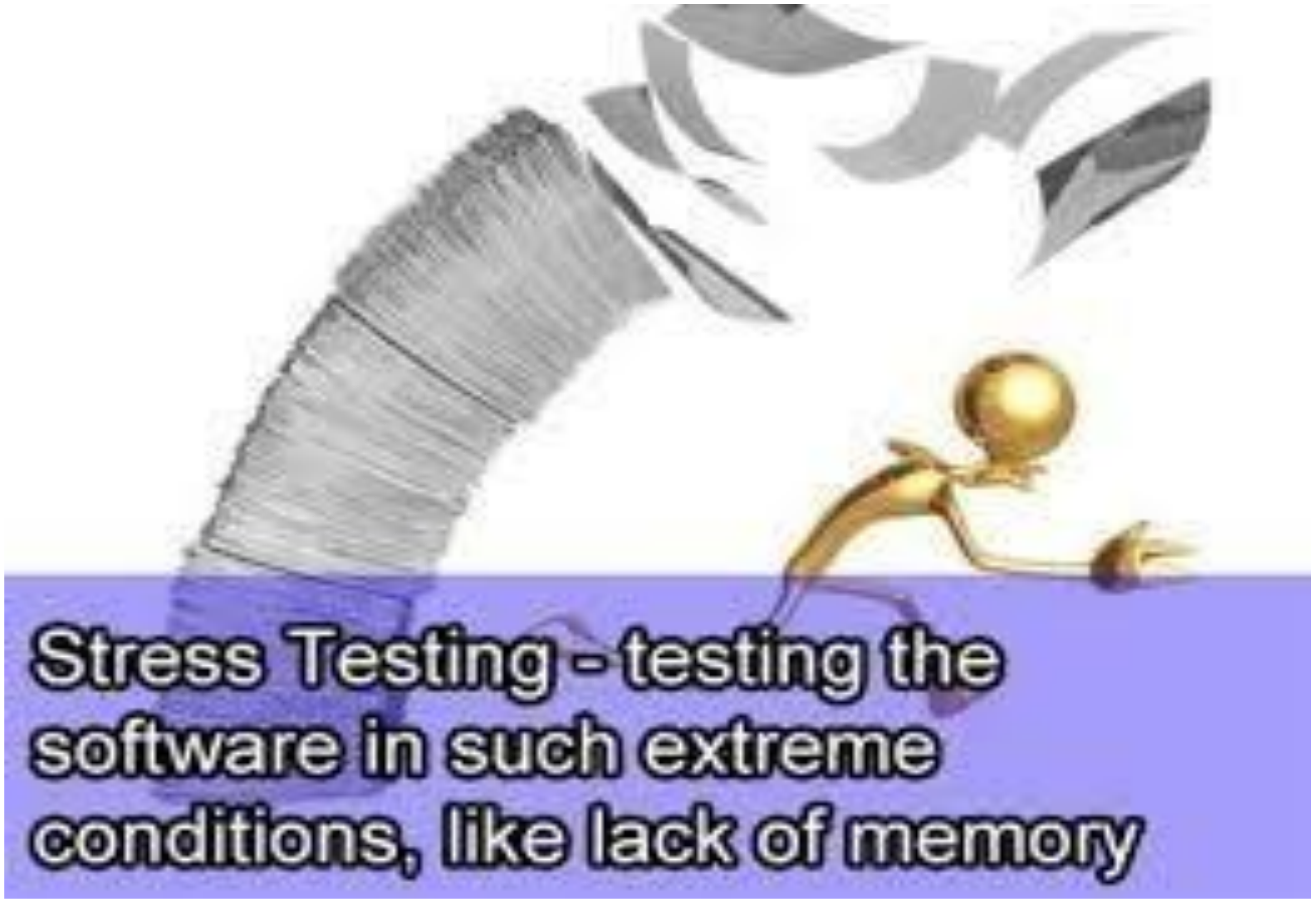
Interface Testing

- Detect faults due to interface errors or invalid assumptions about interfaces.
- Interface types
  - **Parameter interfaces:** Data / function references passed from one component to another.
  - **Shared memory interfaces:** Block of memory is shared between components. Data is placed in memory by one sub-system and retrieved from there by another sub system.
  - **Procedural interfaces:** Sub-system encapsulates a set of procedures to be called by other sub-systems.
  - **Message passing interfaces:** Sub-systems request services from other sub-systems by passing a message.

Interface Testing Guidelines

- Design tests so that parameters to a called procedure are at the extreme ends of their ranges.
- Always test pointer parameters with null pointers.
- Design tests which cause the component to fail.
- In shared memory systems, vary the order in which components are activated.
- Use **stress testing.**

What is Stress Testing?


Stress Testing - testing the software in such extreme conditions, like lack of memory

What is Stress Testing?

- It is a form of **software testing** that is used to determine the stability of a given system.
- A type of **non-functional testing**.
- It involves testing beyond normal operational capacity (breaking point), in order to observe the results.
- It put greater emphasis on robustness, availability, and error handling under a heavy load, rather than correct behavior under normal circumstances.
- The goals of such tests may be to ensure the software does not crash in conditions of insufficient computational resources (such as memory or disk space).

SYSTEM TESTING

System Testing

- Involves integrating components to create a version of the system and then testing the integrated system.
- The focus is testing the interactions between components.
- System testing checks that components are compatible, interact correctly and transfer the right data at the right time across their interfaces.
- System testing tests the emergent behavior of a system.

System Testing

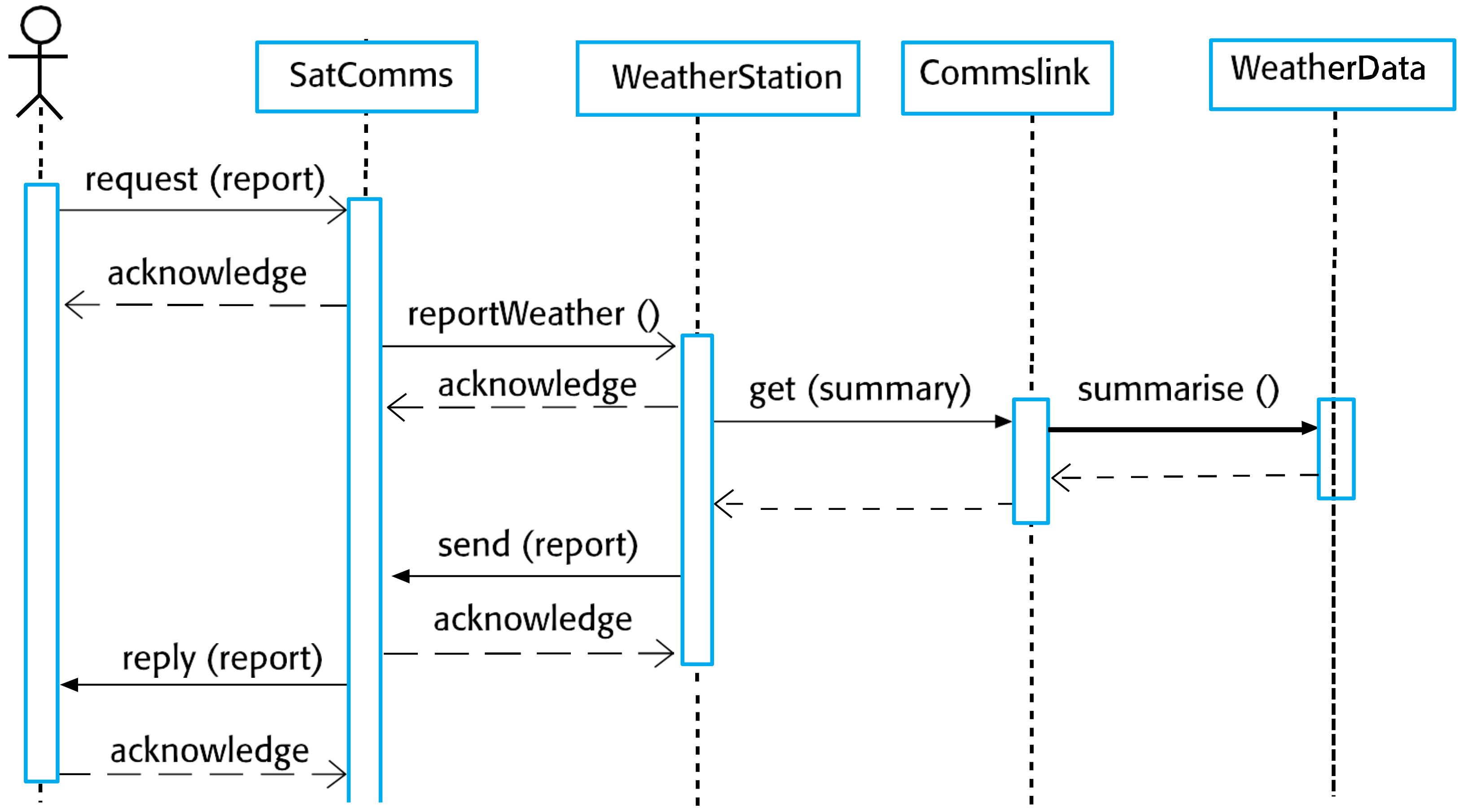
- Reusable components that have been separately developed and off-the-shelf systems may be integrated with newly developed components. The complete system is then tested.
- Components developed by different team members or sub-teams may be integrated at this stage.
- System testing is a collective rather than an individual process.
  - In some companies, system testing may involve a separate testing team with no involvement from designers and programmers.

Use-case Testing

- The use-cases developed to identify system interactions can be used as a basis for system testing.
- Each use case usually involves several system components so testing the use case forces these interactions to occur.
- The sequence diagrams associated with the use case documents the components and interactions that are being tested.

Sequence Diagram: Example

information system



Test Cases

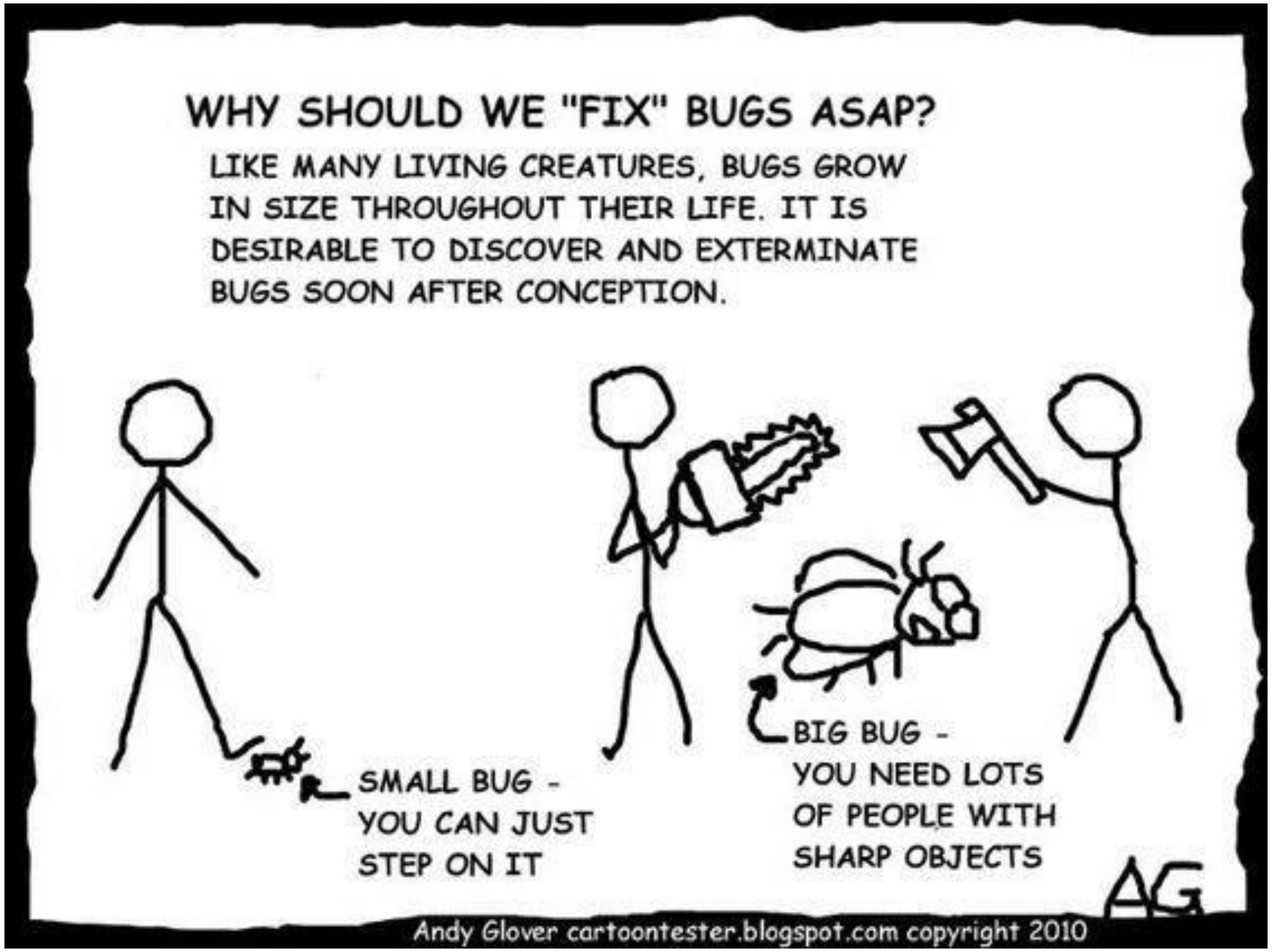
- An input of a request for a report should have an associated acknowledgement. A report should ultimately be returned from the request.
  - You should create summarized data that can be used to check that the report is correctly organized.
- An input request for a report to WeatherStation results in a summarized report being generated.
  - Can be tested by creating raw data corresponding to the summary that you have prepared for the test of SatComms and checking that the WeatherStation object correctly produces this summary. This raw data is also used to test the WeatherData object.

Testing Policies

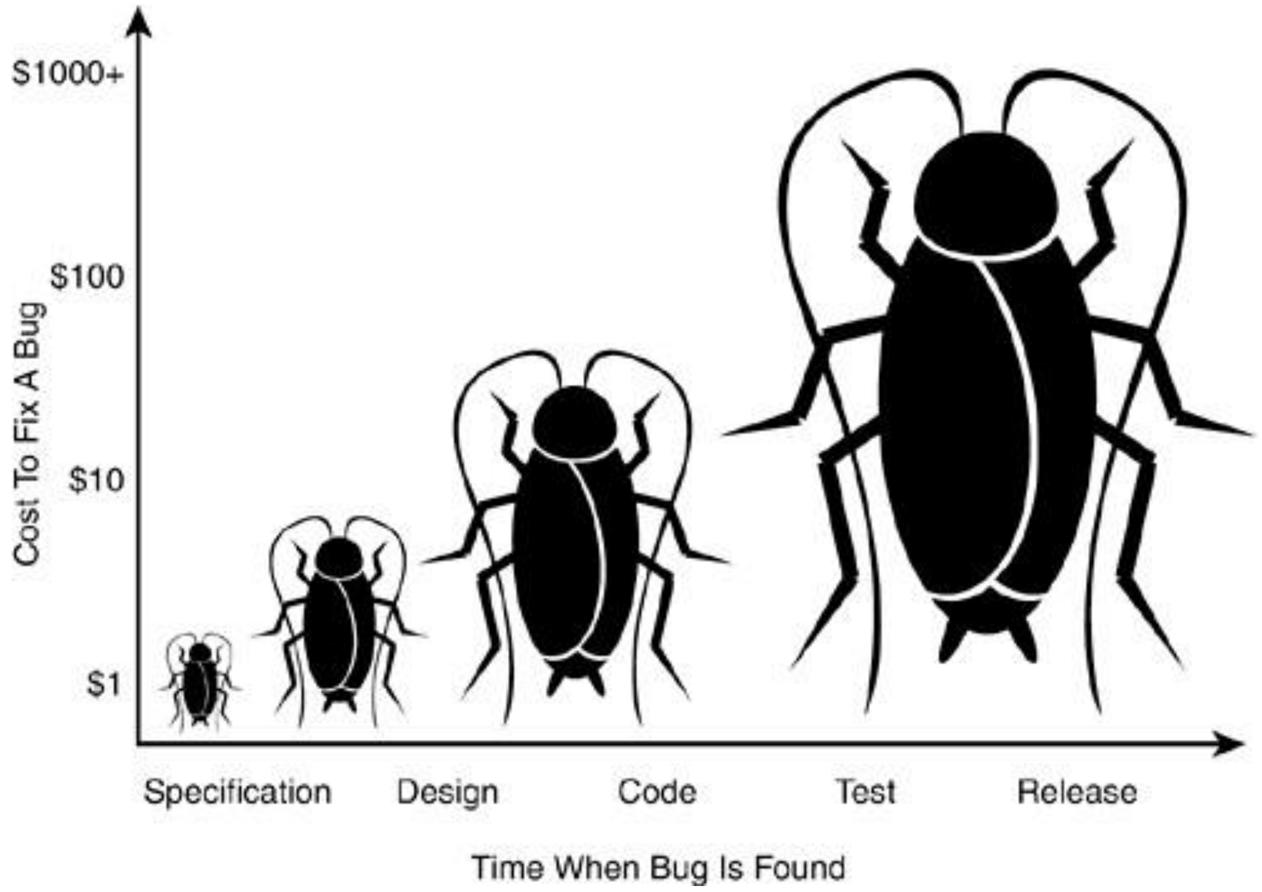
- Difficult to know how much system testing is required.
- Exhaustive system testing is impossible.
- Testing should be based on a subset of possible test cases.
- Software companies should have policies in choosing test cases. Examples of testing policies:
  - All system functions accessed through menus should be tested.
  - Combinations of functions accessed through the same menu must be tested.
  - Where user input is provided, all functions must be tested with both correct and incorrect input.

TEST FIRST DEVELOPMENT / TEST-DRIVEN DEVELOPMENT (TDD)

Why should not underestimate "Bug"?


WHY SHOULD WE "FIX" BUGS ASAP?
LIKE MANY LIVING CREATURES, BUGS GROW IN SIZE THROUGHOUT THEIR LIFE. IT IS DESIRABLE TO DISCOVER AND EXTERMINATE BUGS SOON AFTER CONCEPTION.
SMALL BUG - YOU CAN JUST STEP ON IT
BIG BUG - YOU NEED LOTS OF PEOPLE WITH SHARP OBJECTS
AG
Andy Glover cartoontester.blogspot.com copyright 2010

Lifetime of a Bug and cost of overcoming



TEST- DRIVEN DEVELOPMENT (TDD)

Start with Tests

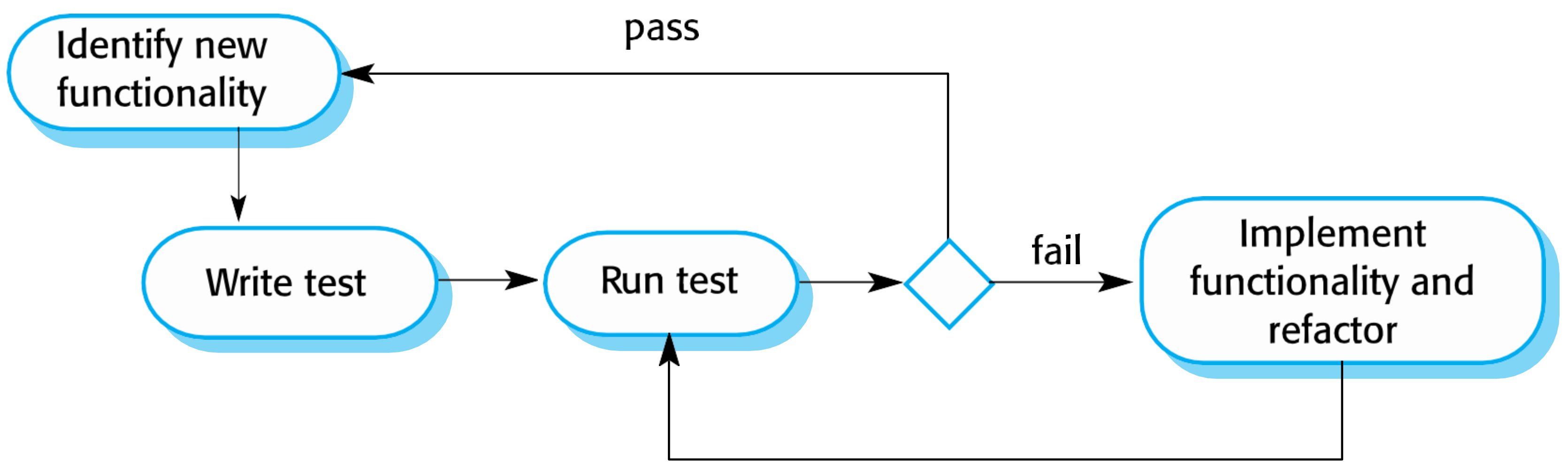
A way to prevent bugs from the beginning

UCSC

Test-Driven Development

- Tests are written before code.
- Tests should pass and it is a critical driver of development.
- You develop code incrementally, along with a test for that increment.
- You don’t move on to the next increment until the code that you have developed passes its test.
- TDD was introduced as part of agile methods such as Extreme Programming. However, it can also be used in plan-driven development processes.

Test-Driven Development


pass
Identify new functionality
Write test
Run test
fail
Implement functionality and refactor

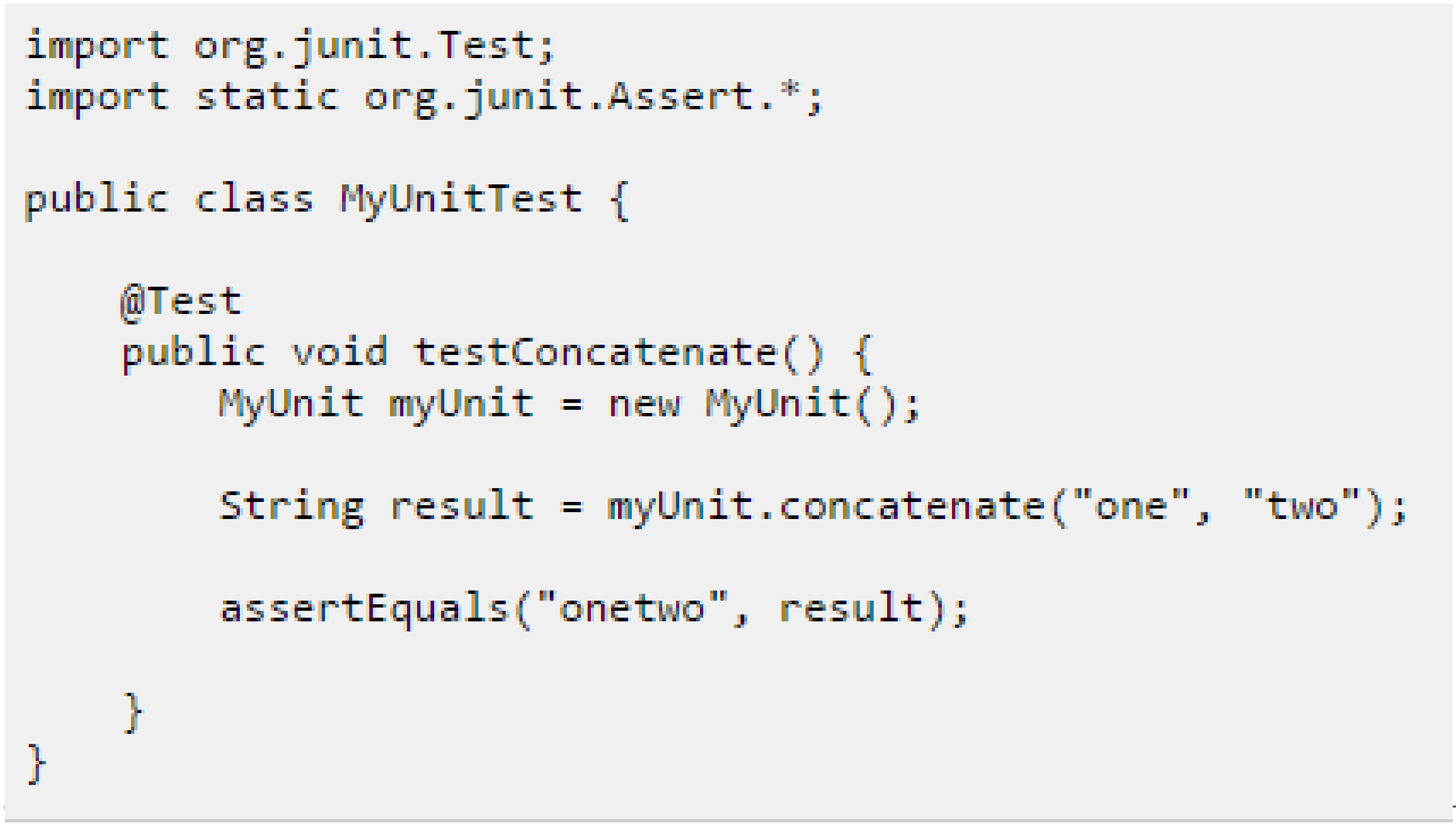
TDD Process Activities

- Start by identifying the increment of functionality that is required. This should normally be small and implementable in a few lines of code.
- Write a test for this functionality and implement this as an automated test.
- Run the test, along with all other tests that have been implemented. Initially, you have not implemented the functionality so the new test will fail.
- Implement the functionality and re-run the test.
- Once all tests run successfully, you move on to implementing the next chunk of functionality.

Example

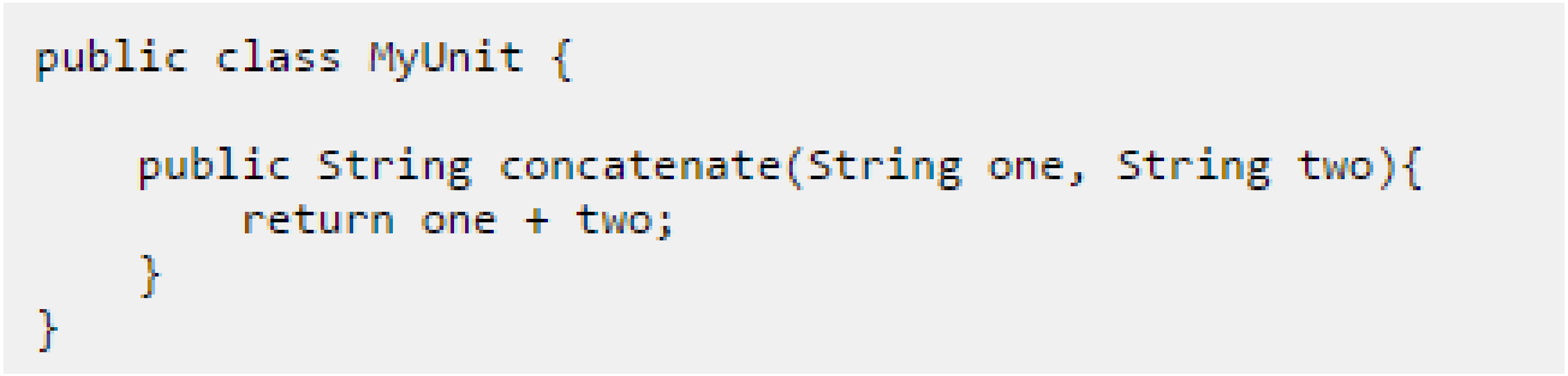
- Suppose you were asked to write a simple function to concatenate two words.
  - Input:
    - One
    - Two
  - Output:
    - OneTwo

Start with a Test



```java
import org.junit.Test;
import static org.junit.Assert.*;

public class MyUnitTest {

    @Test
    public void testConcatenate() {
        MyUnit myUnit = new MyUnit();

        String result = myUnit.concatenate("one", "two");

        assertEquals("onetwo", result);

    }
}
```

Implement Next



```
public class MyUnit {

    public String concatenate(String one, String two){
        return one + two;
    }
}
```

Benefits of Test-Driven Development

- Code coverage
  - Every code segment that you write has at least one associated test so all code written has at least one test.
- Simplified debugging
  - When a test fails, it should be obvious where the problem lies. The newly written code needs to be checked and modified.
- System documentation
  - The tests themselves are a form of documentation that describe what the code should be doing.
- **Regression testing**
  - A regression test suite is developed incrementally as a program is developed.

What is Regression Testing?

To Check Newly Added Functionality
does not affect existing Functionality

Regression Testing

- Regression testing is testing the system to check that changes have not ‘broken’ previously working code.
- In a manual testing process, regression testing is expensive but, with automated testing, it is simple and straightforward.
- All tests are re-run every time a change is made to the program.
- Tests must run ‘successfully’ before the change is committed.

RELEASE TESTING

Release Testing

- The process of testing a particular release of a system that is intended for use outside of the development team.
- The primary goal - Convince that the system is good enough for use.
  - Needs to show that the system delivers its specified functionality, performance and dependability, and that it does not fail during normal use.
- It is usually a **black-box testing** process where tests are only derived from the system specification.

Release Testing and System Testing

- Release testing is a form of system testing.
- Important differences:
  - A separate team that has not been involved in the system development, should be responsible for release testing.
  - System testing by the development team should focus on discovering bugs in the system (defect testing).
  - The objective of release testing is to check that the system meets its requirements and is good enough for external use (validation testing).

Requirements Based Testing

- Requirements-based testing involves examining each requirement and developing a test or tests for it.
- Example: Mentcare system requirements:
  - If a patient is known to be allergic to any particular medication, then prescription of that medication shall result in a warning message being issued to the system user.
  - If a prescriber chooses to ignore an allergy warning, they shall provide a reason why this has been ignored.

Example: Requirements Tests

- Set up a patient record with no known allergies. Prescribe medication for allergies that are known to exist. Check that a warning message is not issued by the system.
- Set up a patient record with a known allergy. Prescribe the medication to that the patient is allergic to, and check that the warning is issued by the system.
- Set up a patient record in which allergies to two or more drugs are recorded. Prescribe both of these drugs separately and check that the correct warning for each drug is issued.
- Prescribe two drugs that the patient is allergic to. Check that two warnings are correctly issued.
- Prescribe a drug that issues a warning and overrule that warning. Check that the system requires the user to provide information explaining why the warning was overruled.

A scenario for the Mentcare System testing

George is a nurse who specializes in mental healthcare. One of his responsibilities is to visit patients at home to check that their treatment is effective and that they are not suffering from medication side effects.

On a day for home visits, George logs into the Mentcare system and uses it to print his schedule of home visits for that day, along with summary information about the patients to be visited. He requests that the records for these patients be downloaded to his laptop. He is prompted for his key phrase to encrypt the records on the laptop.

One of the patients that he visits is Jim, who is being treated with medication for depression. Jim feels that the medication is helping him but believes that it has the side effect of keeping him awake at night. George looks up Jim's record and is prompted for his key phrase to decrypt the record. He checks the drug prescribed and queries its side effects. Sleeplessness is a known side effect so he notes the problem in Jim's record and suggests that he visits the clinic to have his medication changed. Jim agrees so George enters a prompt to call him when he gets back to the clinic to make an appointment with a physician. George ends the consultation and the system re-encrypts Jim's record.

After, finishing his consultations, George returns to the clinic and uploads the records of patients visited to the database. The system generates a call list for George of those patients who He has to contact for follow-up information and make clinic appointments.

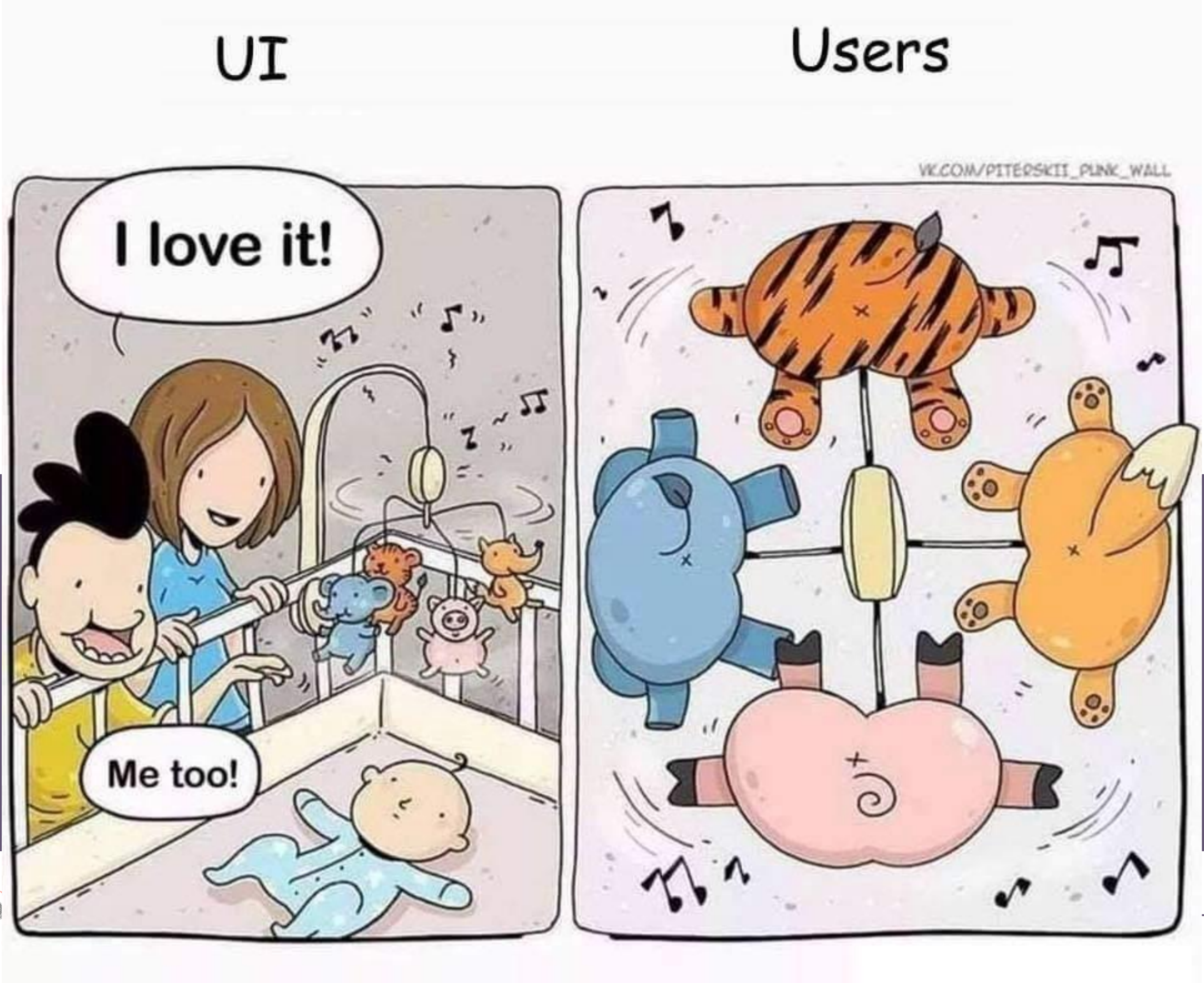
Features to be tested by the given Scenario

- Authentication by logging on to the system.
- Downloading and uploading of specified patient records to a laptop.
- Home visit scheduling.
- Encryption and decryption of patient records on a mobile device.
- Record retrieval and modification.
- Links with the drugs database that maintains side-effect information.
- The system for call prompting.

Performance Testing

- Part of release testing may involve testing the emergent properties of a system, such as performance and reliability.
- Tests should reflect the profile of use of the system.
- Performance tests usually involve planning a series of tests where the load is steadily increased until the system performance becomes unacceptable.
- <u>Stress testing</u> is a form of performance testing where the system is deliberately overloaded to test its failure behavior.

USER TESTING


UI
Users
VK.COM/PITERSKII_PUNK_WALL
I love it!
Me too!

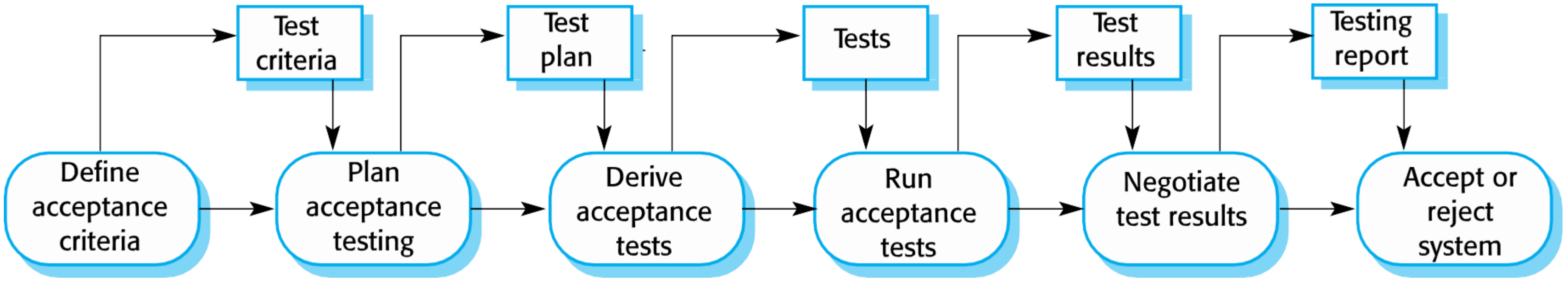
User Testing

- Users or customers provide input and test the system.
- User testing is essential, even when comprehensive system and release testing have been carried out.
    - The reason for this is that influences from the user’s working environment have a major effect on the reliability, performance, usability and robustness of a system. These cannot be replicated in a testing environment.

3 Types of User

- **Alpha testing**
  - Users of the software work with the development team to test the software at the developer's site.
- **Beta testing**
  - A release of the software is made available to users to allow them to experiment and to raise problems that they discover with the system developers.
- **Acceptance testing**
  - Customers test a system to decide whether or not it is ready to be accepted from the system developers and deployed in the customer environment.

The Acceptance Testing Process

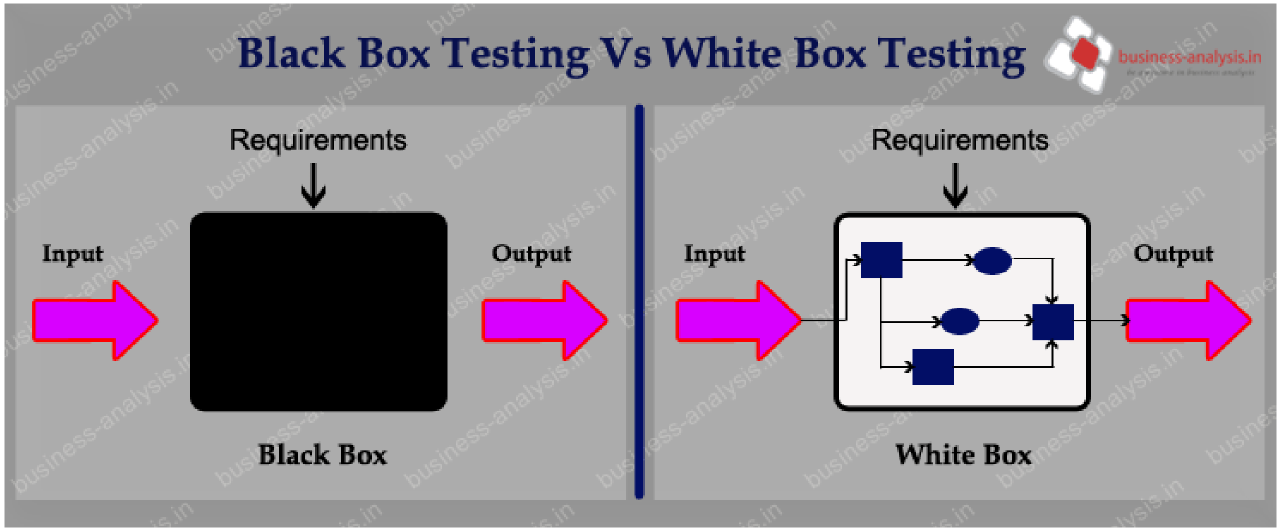


Stages in the Acceptance Testing Process

- Define acceptance criteria
- Plan acceptance testing
- Derive acceptance tests
- Run acceptance tests
- Negotiate test results
- Reject/accept system

Agile Methods and Acceptance Testing

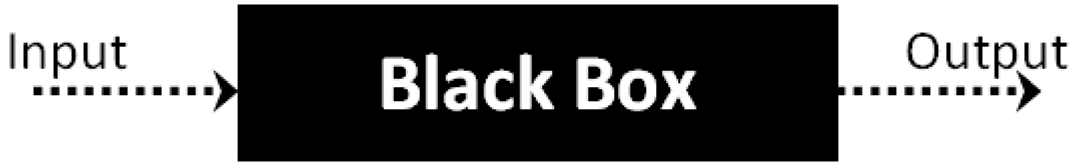
- In agile methods, the user/customer is part of the development team and is responsible for making decisions on the acceptability of the system.
- Tests are defined by the user/customer and are integrated with other tests in that they are run automatically when changes are made.
- There is no separate acceptance testing process.
- Main problem here is whether or not the embedded user is 'typical' and can represent the interests of all system stakeholders.



BLACK BOX TESTING AND WHITE BOX TESTING

What is ‘Black Box Testing’

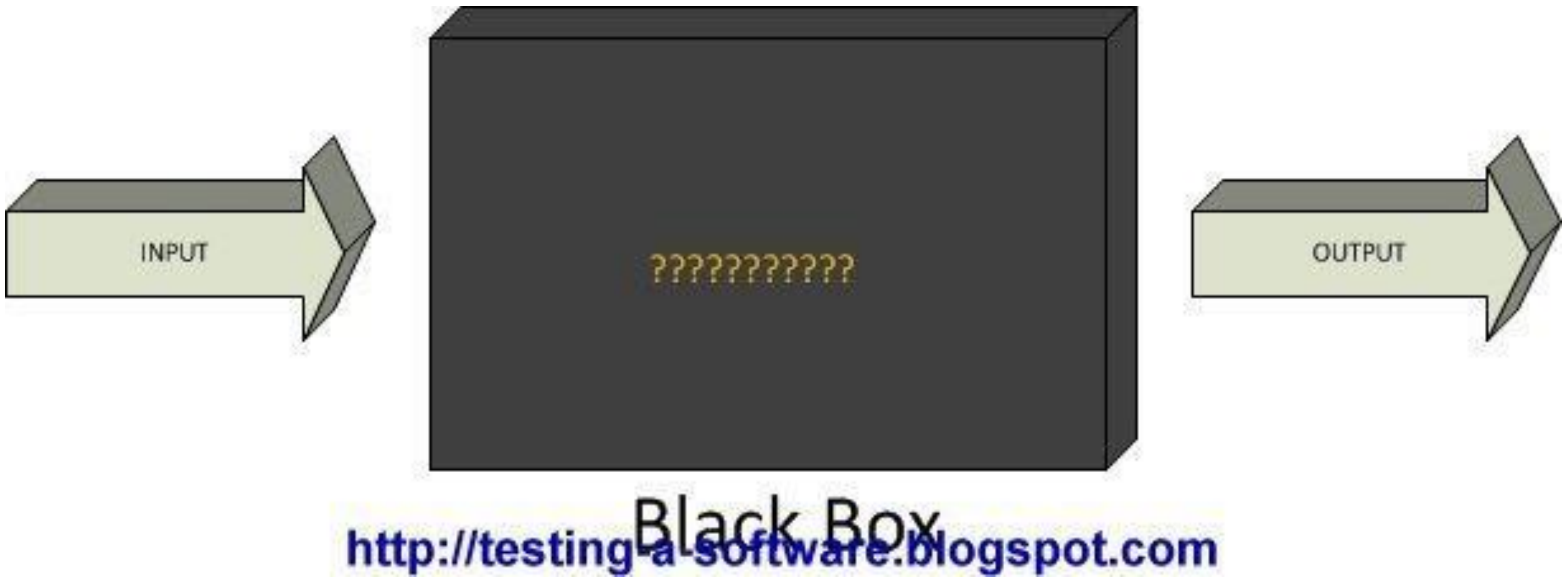
- A method of software testing.
- Examines the functionality of an application without peering into its internal structures or workings.
- Can be applied to every level of software testing:
  - Unit, Integration / Component, System and acceptance.



Black Box: Testing Procedure

- Specific knowledge of the application's code/internal structure and programming knowledge in general is not required.
- The tester is aware of *what* the software is supposed to do but is not aware of *how* it does it.
  - For instance, the tester is aware that a particular input returns a certain, invariable output but is not aware of *how* the software produces the output in the first place.

Black Box Testing

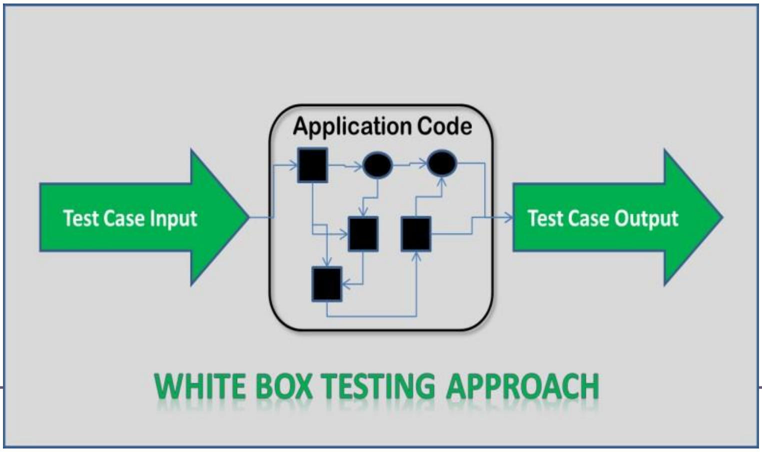


Black Box Testing: Choosing Test Cases

- Test cases are built around specifications and requirements,
- *Both functional* and *non-functional* tests can be applied.
- The test designer selects both valid and invalid inputs and determines the correct output, without any knowledge of the test object's internal structure.

What is White Box Testing

- A method of testing software that tests internal structures or workings of an application.
- Also known as **clear box testing**, **glass box testing**, **transparent box testing**, and **structural testing**
- can be applied at the unit, integration and system levels of the software testing process.



White Box Testing

- Unit testing:
  - to ensure that the code is working as intended, catches any defects early on and prevents errors that can occur later on.
- Integration testing:
  - test the interactions of each interface with each other.
- Regression testing:
  - the use of recycled white-box test cases at the unit and integration testing levels.

Activity

Compare and contrast Black box testing over White box testing.