

1. Software Testing:

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

Software testing also helps to identify errors, gaps or missing requirements in contrary to the actual requirements. It can be either done manually or using automated tools. Some prefer saying Software testing as a white box and Black Box Testing.

1.1 Why is Software Testing Important?

Testing is important because software bugs could be expensive or even dangerous. Software bugs can potentially cause monetary and human loss history is full of such examples.

- In April 2015, Bloomberg terminal in London crashed due to software glitch affected more than 300,000 traders on financial markets. It forced the government to postpone a 3bn pound debt sale.
- Nissan cars have to recall over 1 million cars from the market due to software failure in the airbag sensory detectors. There has been reported two accidents due to this software failure.
- Starbucks was forced to close about 60 percent of stores in the U.S and Canada due to software failure in its POS system. At one-point store served coffee for free as they unable to process the transaction.
- Some of the Amazon's third-party retailers saw their product price is reduced to 1p due to software glitch. They were left with heavy losses.
- Vulnerability in Window 10. This bug enables users to escape from security sandboxes through a flaw in the win32k system.
- In 2015 fighter plane F-35 fell victim to a software bug, making it unable to detect targets correctly.
- China Airlines Airbus A300 crashed due to a software bug on April 26, 1994, killing 264 innocents live.
- In 1985, Canada's Therac-25 radiation therapy machine malfunctioned due to software bug and delivered lethal radiation doses to patients, leaving 3 people dead and critically injuring 3 others.
- In April of 1999, a software bug caused the failure of a \$1.2 billion military satellite launch, the costliest accident in history.
- In May of 1996, a software bug caused the bank accounts of 823 customers of a major U.S. bank to be credited with 920 million US dollars.

1.2 Types of Software Testing:

Typically Testing is classified into three categories.

- Functional Testing
- Non-Functional Testing or Performance Testing
- Maintenance (Regression and Maintenance)

Testing Category	Types of Testing
Functional Testing	<input type="checkbox"/> Unit Testing <input type="checkbox"/> Integration Testing <input type="checkbox"/> Smoke <input type="checkbox"/> UAT (User Acceptance Testing) <input type="checkbox"/> Localization <input type="checkbox"/> Globalization <input type="checkbox"/> Interoperability
Non-Functional Testing	<input type="checkbox"/> Performance <input type="checkbox"/> Endurance <input type="checkbox"/> Load <input type="checkbox"/> Volume <input type="checkbox"/> Scalability <input type="checkbox"/> Usability
Maintenance	<input type="checkbox"/> Regression <input type="checkbox"/> Maintenance

2.Manual testing:

Manual Testing is a type of Software Testing where Testers manually execute test cases without using any automation tools.

Any new application must be manually tested before its testing can be automated. Manual Testing requires more effort, but is necessary to check automation feasibility.

Manual Testing does not require knowledge of any testing tool.

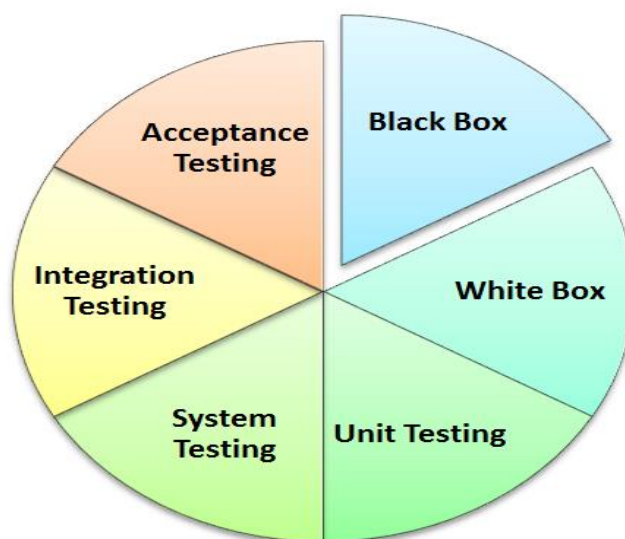
One of the Software Testing Fundamental is "**100% Automation is not possible**".

2.1 Goal of Manual Testing:

- i. The key concept of manual testing is to ensure that the application is error free and it is working in conformance to the specified functional requirements.
- ii. Test Suites or cases, are designed during the testing phase and should have 100% test coverage.
- iii. It also makes sure that reported defects are fixed by developers and re-testing has been performed by testers on the fixed defects.
- iv. Basically, this testing checks the quality of the system and delivers bug-free product to the customer.

2.2 Types of Manual Testing:

Below given diagram depicts Manual Testing Types. In fact, any type of software testing type can be executed both manually as well using an automation tool.



2.3 Tools to Automate Manual Testing:

2.3.1 Selenium

2.3.2 QTP

2.3.3 JMeter

2.3.4 Loadrunner

2.3.5 TestLink

2.3.6 Quality Center (ALM)

3.Automation Testing:

Manual Testing is performed by a human sitting in front of a computer carefully executing the test steps.

Automation Testing means using an automation tool to execute your test case suite.

The automation software can enter test data into the System Under Test, compare expected and actual results and generate detailed test reports. Test Automation demands considerable investments of money and resources.

Successive development cycles will require execution of same test suite repeatedly. Using a test automation tool, it's possible to record this test suite and re-play it as required. Once the test suite is automated, no human intervention is required. This improved ROI of Test Automation. The goal of Automation is to reduce the number of test cases to be run manually and not to eliminate Manual Testing altogether.

3.1 Why Automated Testing?

Automated software testing is important due to following reasons:

Manual Testing of all workflows, all fields, all negative scenarios is time and money consuming

It is difficult to test for multilingual sites manually

Automation does not require Human intervention. You can run automated test unattended (overnight)

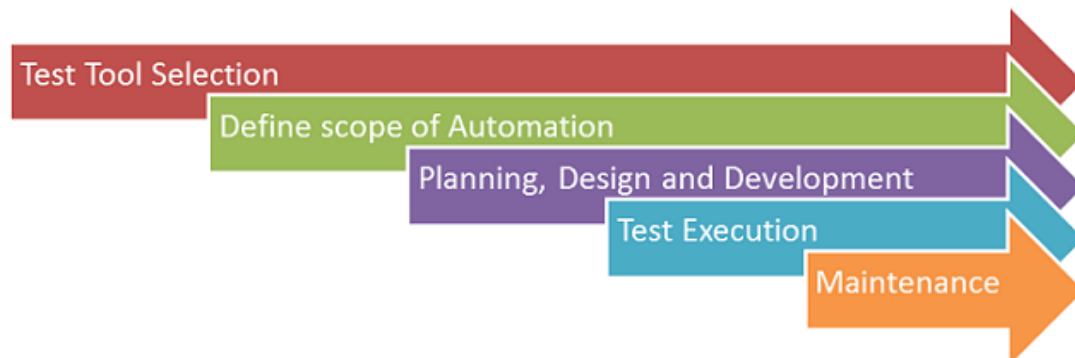
Automation increases the speed of test execution

Automation helps increase Test Coverage

Manual Testing can become boring and hence error-prone.

3.2 Automated Testing Process:

Following steps are followed in an Automation Process



○ Test tool selection

Test Tool selection largely depends on the technology the Application Under Test is built on. For instance, QTP does not support Informatics. So QTP cannot be used for testing Informatics applications. **It's a good idea to conduct Proof of Concept of Tool on AUT.**

○ Define the scope of Automation

The scope of automation is the area of your Application Under Test which will be automated. Following points help determine scope:

- The features that are important for the business
- Scenarios which have **a large amount of data**
- **Common functionalities** across applications
- Technical feasibility
- The extent to which business components are reused
- **The complexity** of test cases
- Ability to use the same test cases for cross-browser testing

○ Planning, Design, and Development

During this phase, you create Automation strategy & plan, which contains following details-

- Automation tools selected
- Framework design and its features
- In-Scope and Out-of-scope items of automation
- Automation testbed preparation
- Schedule and Timeline of scripting and execution
- Deliverables of Automation Testing

- Test Execution

Automation Scripts are executed during this phase. The scripts need input test data before there are set to run. Once executed they provide detailed test reports.

Execution can be performed using the automation tool directly or through the Test Management tool which will invoke the automation tool.

Example: Quality center is the Test Management tool which in turn it will invoke QTP for execution of automation scripts. Scripts can be executed in a single machine or a group of machines. The execution can be done during the night, to save time.

- Maintenance

As new functionalities are added to the System Under Test with successive cycles, Automation Scripts need to be added, reviewed and maintained for each release cycle. **Maintenance becomes necessary to improve the effectiveness of Automation Scripts.**

3.3 Framework for Automation:

A framework is set of automation guidelines which help in

- Maintaining consistency of Testing
- Improves test structuring
- Minimum usage of code
- Less Maintenance of code
- Improve re-usability
- Non-Technical testers can be involved in code
- The training period of using the tool can be reduced
- Involves Data wherever appropriate

There are four types of frameworks used in automation software testing:

1. Data Driven Automation Framework
2. Keyword Driven Automation Framework
3. Modular Automation Framework
4. Hybrid Automation Framework

3.4 Benefits of Automation Testing:

Following are benefits of automated testing:

- 70% faster than the manual testing
- Wider test coverage of application features
- Reliable in results

- Ensure Consistency and improves accuracy
- Saves Time and Cost
- Human Intervention is not required while execution
- Increases Efficiency and speed in executing tests
- Re-usable test scripts
- Test Frequently and thoroughly

3.5 Different types of software testing that can be automated

- Smoke Testing
- Unit Testing
- Integration Testing
- Functional Testing
- Keyword Testing
- Regression Testing
- Data Driven Testing
- Black Box Testing

3.6 Automation Testing Tools:

1. Tricentis
2. Mabl
3. TestIM
4. Selenium
5. QTP
6. SkillTest
7. WATIR
8. Relationar Functional Tester

4. Test Plan:

A test plan is a detailed document that outlines the test strategy, Testing objectives, resources (manpower, software, hardware) required for testing, test schedule, Test Estimation and test deliverables.

The test plan serves as a blueprint to conduct software testing activities as a defined process which is minutely monitored and controlled by the test manager.

4.1 Importance of Test Plan:

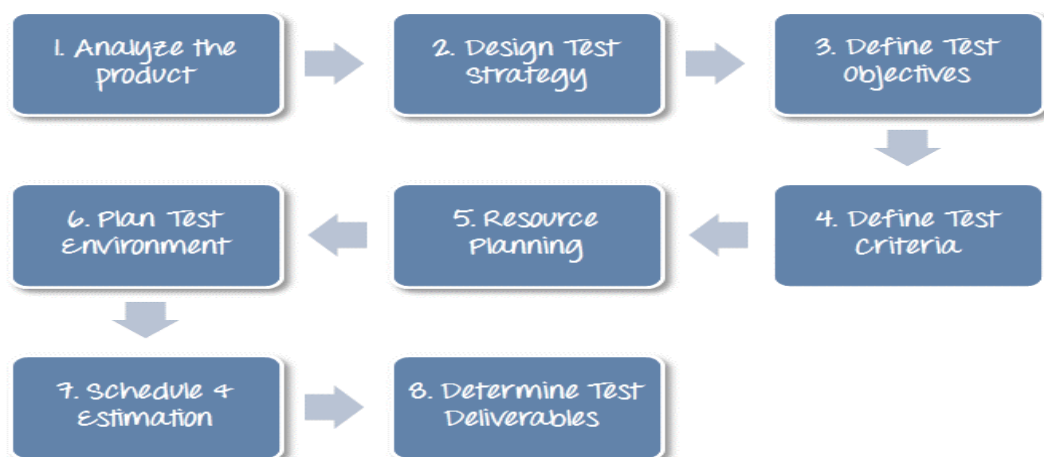
Making Test Plan has multiple benefits

- Test Plan helps us determine the **effort** needed to validate the quality of the application under test
- Help people outside the test team such as developers, business managers, customers **understand** the details of testing.
- Test Plan **guides** our thinking. It is like a rule book, which needs to be followed.
- Important aspects like test estimation, test scope, Test Strategy are **documented** in Test Plan, so it can be reviewed by Management Team and re-used for other projects.

4.2 How to write a Test Plan:

You already know that making a **Test Plan** is the most important task of Test Management Process. Follow the seven steps below to create a test plan as per IEEE 829

1. Analyze the product
2. Design the Test Strategy
3. Define the Test Objectives
4. Define Test Criteria
5. Resource Planning
6. Plan Test Environment
7. Schedule & Estimation
8. Determine Test Deliverables



Step 1) Analyze the product

How can you test a product **without** any information about it? The answer is **Impossible**. You must learn a product **thoroughly** before testing it.

The product under test is Guru99 banking website. You should research clients and the end users to know their needs and expectations from the application

- Who will use the website?
- What is it used for?
- How will it work?
- What is software/ hardware the product uses?

You can use the following approach to analyze the site



Step 2) Develop Test Strategy

Test Strategy is a **critical step** in making a Test Plan. A Test Strategy document, is a high-level document, which is usually developed by Test Manager. This document defines:

- The project's **testing objectives** and the means to achieve them
- Determines testing **effort** and **costs**

Back to your project, you need to develop Test Strategy for testing that banking website. You should follow steps below



Step 2.1) Define Scope of Testing

Before the start of any test activity, scope of the testing should be known. You must think hard about it.

- The components of the system to be tested (hardware, software, middleware, etc.) are defined as "**in scope**"
- The components of the system that will not be tested also need to be clearly defined as being "**out of scope.**"

Defining the scope of your testing project is very important for all stakeholders. A precise scope helps you

- Give everyone a **confidence & accurate information** of the testing you are doing
- All project members will have a **clear** understanding about what is tested and what is not

How do you determine scope your project?

To determine scope, you must –

- Precise customer requirement
- Project Budget
- Product Specification
- Skills & talent of your test team

Step 2.2) Identify Testing Type

A **Testing Type** is a standard test procedure that gives an expected test outcome.

Each testing type is formulated to identify a specific type of product bugs. But, all Testing Types are aimed at achieving one common goal “**Early detection of** all the defects before releasing the product to the customer”

The **commonly used** testing types are described as following figure

Unit Test	<ul style="list-style-type: none"> • Test the smallest piece of verifiable software in the application
API Testing	<ul style="list-style-type: none"> • Test the API's created for the application
Integration Test	<ul style="list-style-type: none"> • Individual software modules are combined and tested as a group
System Test	<ul style="list-style-type: none"> • Conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements
Install/uninstall Testing	<ul style="list-style-type: none"> • Focuses on what customers will need to do to install /uninstall and set up/remove the new software successfully
Agile Testing	<ul style="list-style-type: none"> • Testing the system using Agile methodology

Step 2.3) Document Risk & Issues

Risk is future's **uncertain event** with a probability of **occurrence** and a **potential** for loss. When the risk actually happens, it becomes the '**issue**'.

In the article Risk Analysis and Solution, you have already learned about the 'Risk' analysis in detail and identified potential risks in the project.

In the Test Plan, you will document those risks

Risk	Mitigation
Team member lack the required skills for website testing.	Plan training course to skill up your members
The project schedule is too tight; it's hard to complete this project on time	Set Test Priority for each of the test activity.
Test Manager has poor management skill	Plan leadership training for manager
A lack of cooperation negatively affects your employees' productivity	Encourage each team member in his task, and inspire them to greater efforts.
Wrong budget estimate and cost overruns	Establish the scope before beginning work, pay a lot of attention to project planning and constantly track and measure the progress

Step 2.4) Create Test Logistics

In Test Logistics, the Test Manager should answer the following questions:

- **Who** will test?
- **When** will the test occur?

Who will test?

You may not know exact names of the tester who will test, but the **type of tester** can be defined.

To select the right member for specified task, you have to consider if his skill is qualified for the task or not, also estimate the project budget. Selecting wrong member for the task may cause the project to **fail** or **delay**.

Person having the following skills is most ideal for performing software testing:

- Ability to **understand** customers point of view
- Strong **desire** for quality
- **Attention** to detail
- Good **cooperation**

In your project, the member who will take in charge for the test execution is the **tester**. Base on the project budget, you can choose in-source or outsource member as the tester.

When will the test occur?

Test activities must be matched with associated development activities.

You will start to test when you have **all required items** shown in following figure



Step 3) Define Test Objective

Test Objective is the overall goal and achievement of the test execution. The objective of the testing is finding as many software defects as possible; ensure that the software under test is **bug free** before release.

To define the test objectives, you should do 2 following steps

1. List all the software features (functionality, performance, GUI...) which may need to test.
2. Define the **target** or the **goal** of the test based on above features

Let's apply these steps to find the test objective of your Guru99 Bank testing project

You can choose the '**TOP-DOWN**' method to find the website's features which may need to test. In this method, you break down the application under test to **component** and **sub-component**.

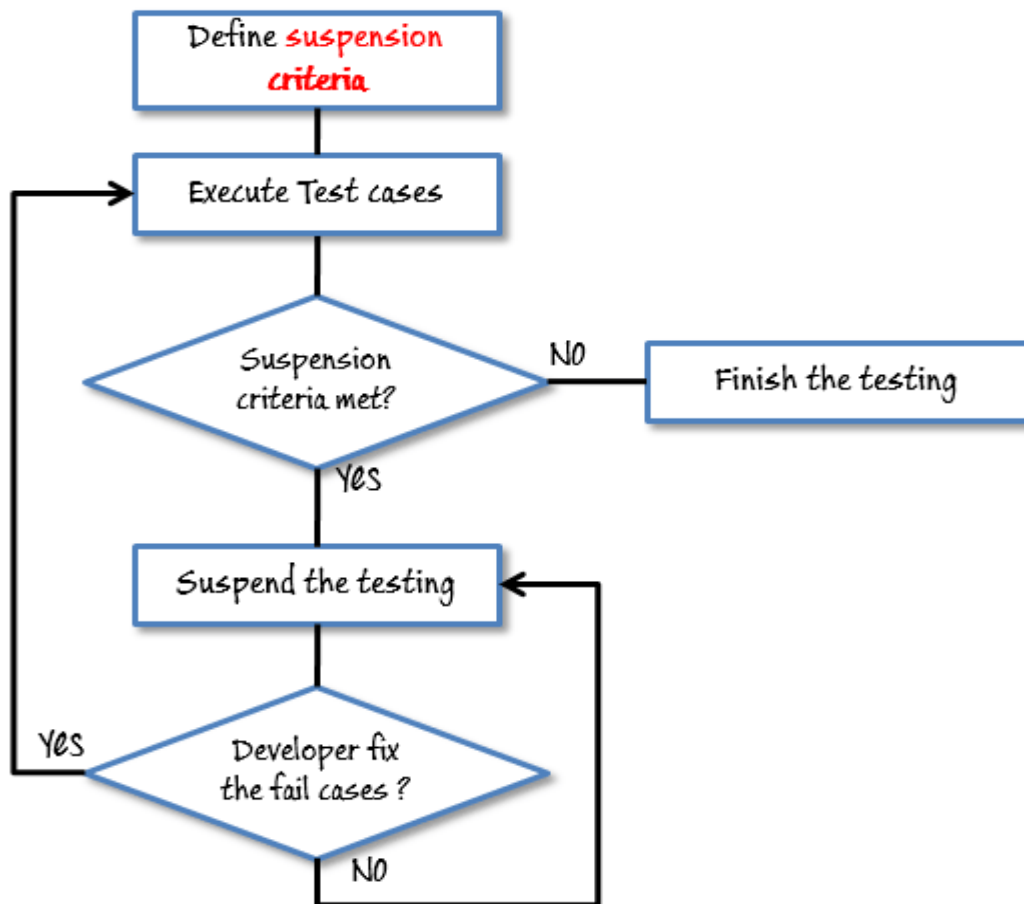
Step 4) Define Test Criteria

Test Criteria is a standard or rule on which a test procedure or test judgment can be based. There're 2 types of test criteria as following

Suspension Criteria

Specify the critical suspension criteria for a test. If the suspension criteria are met during testing, the active test cycle will be **suspended** until the criteria are **resolved**.

Example: If your team members report that there are **40%** of test cases failed, you should **suspend** testing until the development team fixes all the failed cases.



Exit Criteria

It specifies the criteria that denote a **successful** completion of a test phase. The exit criteria are the targeted results of the test and are necessary before proceeding to the next phase of development. Example: **95%** of all critical test cases must pass.

Roles and Responsibilities:

- **Test Manager** - Manages the entire testing activity (approve).

- **Test leader**- Prepare the test plan, Review test case, monitor defect tracking and Reports Preparation.

- **Test Engineer**- Prepare test case design and Daily reports.

Step 5) Resource Planning

Resource plan is a **detailed summary** of all types of resources required to complete project task. Resource could be human, equipment and materials needed to complete a project

The resource planning is important factor of the test planning because helps in **determining** the **number** of resources (employee, equipment...) to be used for the project. Therefore, the Test Manager can make the correct schedule & estimation for the project.

This section represents the recommended resources for your project.

- **Human Resource**

The following table represents various members in your project team

No	Member	Tasks
1	Test Manager	Manage the whole project Define Project directions Acquire appropriate
2	Tester	Identifying and describing appropriate test techniques/tools/automation architecture Verify and assess the Test Approach Execute the tests, Log results, Report the defects. Tester could be in-sourced or out-sourced members, based on the project budget For the task which required low skill, I recommend you choose outsourced members to save project cost.
3	Developer in Test	Implement the test cases, test program, test suite etc.
4	Test Administrator	Builds up and ensures Test Environment and assets are managed and maintained Support Tester to use the test environment for test execution
5	SQA members	Take in charge of quality assurance Check to confirm whether the testing process is meeting specified requirements

- **System Resource**

No	Resources	Description
1	Server	Install the web application under test This includes a separate web server, database server, and application server if applicable
2	Test Tool	The testing tool is to automate the testing, simulate the user operation, generate the test results There are tons of test tools you can use for this project such as Selenium, QTP...etc.
3	Network	You need a Network include LAN and Internet to simulate the real business and user environment
4	Computer	The PC which users often use to connect the web server

Step 6) Plan Test Environment

What is the Test Environment?

A testing environment is a setup of software and hardware on which the testing team is going to execute test cases. The test environment consists of **real business** and **user** environment, as well as physical environments, such as server, front end running environment.

How to setup the Test Environment

Back to your project, how do you set up **test environment** for this banking website?

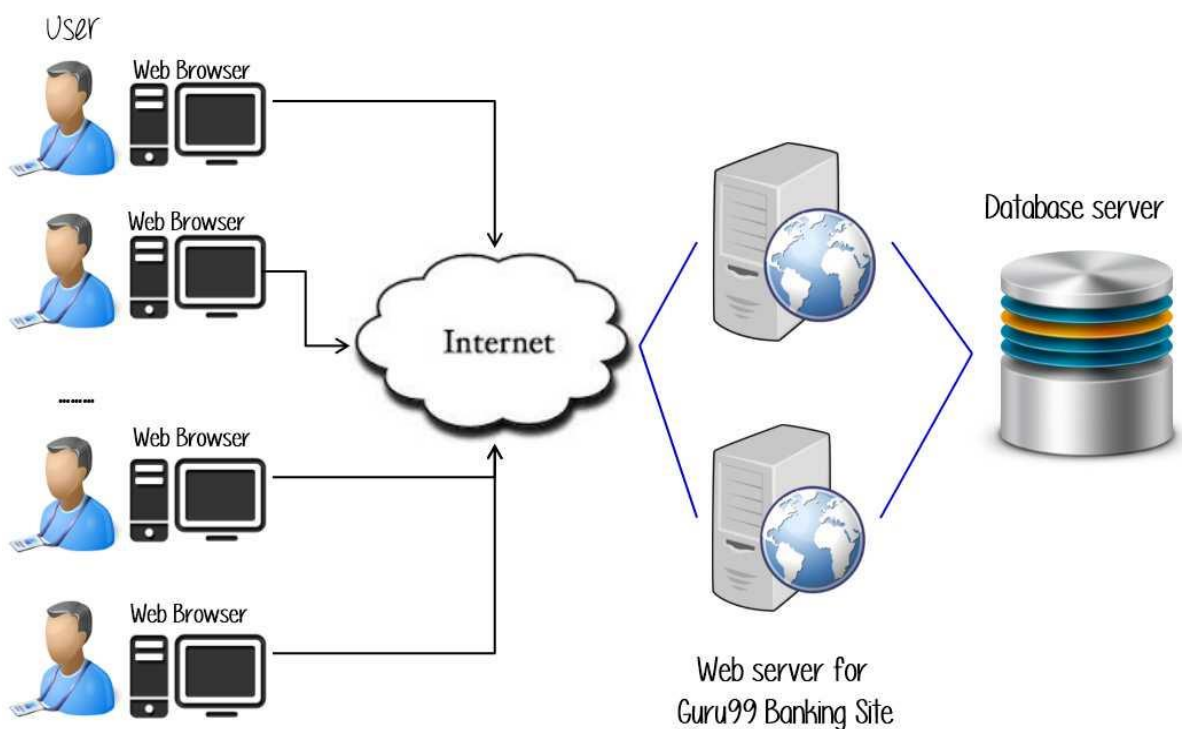
To finish this task, you need **a strong cooperation** between Test Team and Development Team



You should ask the developer some questions to understand the web application under test **clearly**. Here're some recommended questions. Of course, you can ask the other questions if you need.

- What is the maximum user connection which this website can handle at the same time?
- What are hardware/software requirements to install this website?
- Does the user's computer need any particular setting to browse the website?

Following figure describes the test environment of the banking website



Step 7) Schedule & Estimation

Task	Duration	Resource
Test Plan	3	1
Test Design	5	3

Step 8) Test Deliverables

Test Deliverables is a list of all the documents, tools and other components that has to be developed and maintained in support of the testing effort.

There are different test deliverables at every phase of the software development lifecycle.



Test deliverables are provided **before** testing phase.

- Test plans document.
- Test cases documents
- Test Design specifications.

Test deliverables are provided **during** the testing

- Test Scripts
- Simulators.
- Test Data
- Test Traceability Matrix
- Error logs and execution logs.

Test deliverables are provided **after** the testing cycles is over.

- **Test Results/reports**

- Defect Report
- Installation/ Test procedures guidelines
- **Release notes**

5.Unit Testing:-

What is Unit Testing?

Unit Testing of software applications is done during the development (coding) of an application.

The objective of Unit Testing is to isolate a section of code and verify its correctness. In procedural programming a unit may be an individual function or procedure

The goal of Unit Testing is to isolate each part of the program and show that the individual parts are correct. Unit Testing is usually performed by the developer.

Why do Unit Testing? Why is it important?

Sometimes software developers attempt to save time by doing minimal unit testing. This is a myth because skimping on unit testing leads to higher [Defect](#) fixing costs during [System Testing](#), [Integration Testing](#) and even [Beta Testing](#) after the application is completed. Proper unit testing done during the development stage saves both time and money in the end.

How to Create Unit Test Cases

Unit testing is commonly automated, but may still be performed manually. The IEEE does not favor one over the other. A manual approach to unit testing may employ a step-by-step instructional document.

Under the automated approach-

- A developer could write another section of code in the application just to test the function. They would later comment out and finally remove the test code when the application is done.
- They could also isolate the function to test it more rigorously. This is a more thorough unit testing practice that involves copy and pasting the function into its own testing environment to other than its natural environment. Isolating the code helps in revealing unnecessary dependencies between the code being tested and other units or data spaces in the product. These dependencies can then be eliminated.

A coder may use a UnitTest Framework to develop automated test cases. Using an automation framework, the developer codes criteria into the test to verify the correctness of

the unit. During execution of the test cases, the framework logs those that fail any criterion. Many frameworks will also automatically flag and report in summary these failed test cases. Depending on the severity of a failure, the framework may halt subsequent testing.

Unit Testing Benefits and 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 Limitations

- 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.

It's recommended unit testing be used in conjunction with other testing activities

Unit Testing Techniques

- Structural Techniques
- Functional Testing Techniques
- Error Based Techniques

Unit Testing Best Practices


- Unit Test cases should be independent. In case of any enhancements or change in requirements, unit test cases should not be affected.
- Test only one code at a time.
- Follow clear and consistent naming conventions for your unit tests
- In case of a change in code in any module, ensure there is a corresponding unit [Test Case](#) for the module, and the module passes the tests before changing the implementation
- Bugs identified during unit testing must be fixed before proceeding to the next phase in SDLC
- Adopt a "test as you code" approach. The more code you write without testing, the more paths you have to check for errors.

Keep on a straight path with proper unit testing.



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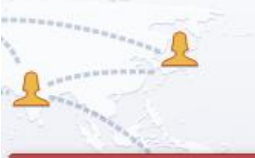
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Create an account

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What's your name?



Birthday

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1	Project Name	Facebook				
2	Module Name	Sign up				
3	Created By	Anuj Doshi				
4	Creation Date	22-08-2018				
5	Reviewed By	Anuj Doshi				
6	Reviewed Date	15-09-2018				
7						
8						
9	Test Scenario	Test Scenario Description	Test Case Id	Test Case Description	Precondition	Post condition
10	TS_FB_001	Verify the signup functionality of facebook page	TC_FB_FN_001	Enter Valid First Name Field	1.1 Not allow the numeric value	It allow us to move to the next field
					1.2 Not allow the white space between the	FirstName:123

Expected Result	Actual Result	Status	Executed By	Executed Date	Comment
Error Message "First Name Not in numeric"	Tooltip will be display to show an error	Pass	Anuj Doshi	22/08/2018	No Comment
Error Message "First Name Not in	Tooltip will be display to				

12				1.3 Not allow the special character		FirstName:Anu
13				1.4 Not allow the blank field		FirstName:
14		TC_FB_LN_00	Enter Valid Surname Field	2.1 Not allow the numeric value		Surname:1234
				2.2 Not allow the white space		

Error Message "Special Character is Not allow in the first name"	Tooltip will be display to show an error	Pass	Anuj Doshi	22/08/2018	No Comment
Error Message "Not Be Blank"	Highlights will	Pass	Anuj Doshi	22/08/2018	No Comment
Error Message "Surname Not in numeric"	Tooltip will be display to show an error	Pass	Anuj Doshi	22/08/2018	No Comment
Error Message "Surname	Tooltip will be				

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16				2.3 Not allow the special character		Surname:Dos
17				2.4 Not allow the blank field		Surname:
			Enter Valid			

Error Message "Special Character is Not allow in the surname"	Tooltip will be display to show an error	Pass	Anuj Doshi	22/08/2018	No Comment
Error Message "Not Be Blank"	Highlights will be showed	Pass	Anuj Doshi	22/08/2018	No Comment
Error Message "Mobile	Tooltip will be				Mobile Number and email has a same text field so if we enter the mobile number this

18		TC_FB_MN_00	Enter Valid Mobile Number	3.1 Not allow the character		Mobile Number
19				3.2 Not allow the special character		Mobile Number

Error Message "Mobile Number Not in Character"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	Mobile Number and email has a same text field so if we enter the mobile number this validation will be checked
Error Message "Special Character is not allow in mobile number"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error Message "It	Tooltip will be				Activate Windows Go to Settings to activate Windows

				3.3 Not allow the blank field		Mobile Numbe
				3.4 Not allow the white space		Mobile Numbe
				4.1 Not allow the white space		Email:-anuj doshi@gmail.com
	TC	FB	EM	00	Enter Valid En	

Error Message "It should not be blanked"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error Message "It should not allow the white space"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error Message "Not allow the white space in this field"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	Email and Mobile Number has a same text field so if we enter the email this validation will be checked

24				4.2 Not allow the blank field		Email:-
25		TC_FB_PS_00	Enter Valid Pa	5.1 Not allow the white space		Password:-an
26				5.2 Not allow the blank		Password:-
				5.3 Not allow the first name that you have entered in first name		

Error Message "Mandatory Field"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error Message "Password not contain white space"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error Message "Mandatory Field"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error Message "It seems you enter the firstname in password"	Tooltip will be display to				

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28				5.4 It should have at least minimum 8 character long		Password:-123
29				5.5 It should have at least one character in Upper case		Password:-Anu
30				5.6 It should have at least one special character		Password:-anu

Error Message "Minimum length is 8 character long"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error Message "It should have at least one letter in Upper case"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error Message "It should have at least one special character"	Tooltip will be display to show an error	Pass	Anuj Doshi	28/08/2018	No Comment
Error					

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