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Software Testing Day 6 – Use Case Testing and Test Design

Notes

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This screenshot shows a web browser window displaying a presentation slide from Manipal Global Skills Academy. The slide title is "Software Testing Day 6 – Use Case Testing and Test Design". The browser interface includes tabs for "Shubha-slack/Testing-Learning", "Lumen", and "PDF to JPG Converter | Convert". The address bar shows the URL "lumen.u-next.com/learning-center/a0BJ1000000yzoqMAA/content-area/list/content/dcf0244c-6b1f-4863-94b4-d65897aa8cb7/pdf/notes?leftMenu=true&id=learning-center...". The page content features the Manipal Global Skills Academy logo, which consists of an orange stylized 'm' icon followed by the text "manipalglobal SKILLS ACADEMY". Below the logo, the slide title is centered. At the bottom of the slide, there is a "Notes" button. The browser's navigation bar at the bottom includes icons for back, forward, search, and other functions. The taskbar at the very bottom of the screen shows various pinned application icons and system status indicators like weather, battery level, and date/time.

Agenda

- What is Use Case? - UCD
- Identify Use Case Based Test cases
- Test Case Design – Introduction
- Test Case Design Template
- Types of Test Cases
- Test Case Design Reviews
- Requirement Traceability Matrix
- Comprehensive test case



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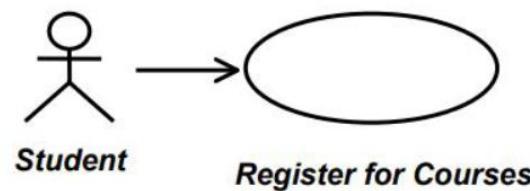
What are Use cases

- In a software development project, use cases define system software requirements
- Use case fully describes a sequence of actions performed by a system to provide an observable result of value to a person or another system using the product under development
- Use cases tell the customer what to expect, the developer what to code, the technical writer what to document, and the tester what to test
- Use cases are based on the Unified Modeling Language (UML) and can be visually represented in use-case diagrams. Figure 1 shows a use-case diagram depicting requirements for a university course registration system
- Test cases are key to the process because they identify and communicate the conditions that will be implemented in test and are necessary to verify successful and acceptable implementation of the product requirements
- They are all about making sure that the product fulfills the requirements of the system

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What are Use cases

- Use cases are shown in UML diagrams



- Use cases are described in text



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What are Use cases

- In Software testing, the term “use case” is used to describe all the possible steps a user may perform to interact with the system
- It allows you to chalk out all the possible techniques and how the end-user can use the application with a set of instructions to the system and the expected result of the interaction with the system
- It is a list of actions or event steps typically defining the interactions between an actor and system to achieve a goal.
- A use case is a graphical representation of a document explaining the steps an actor should perform to test the system.

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Why Use cases

A use case serves the following purpose:

- Manages scope requirements related to the project.
- Helps to establish the requirements.
- Depicts different ways by which a user can interact with the system.
- Visualizes the system architecture.
- Helps to evaluate the potential risks and system dependencies.
- Communicates complex technical requirements to relevant stakeholders easily.

Notes



Elements of Use case

- **Actor:** A single person or a group of people that interact with the system.
- **System:** A product/service/software under test.
- **Goal:** The successful user outcome.
- **Stakeholder(s):** A person, group, or company that is directly or indirectly involved in the project and who may affect or get affected by the outcome of the project.
- **Primary Actor:** A stakeholder who initiates an interaction with the system to achieve a goal.
- **Preconditions:** The state of a system and its environment that must be met before a specific test can be run.
- **Triggers:** Events that occur for a use case to begin.
- **Basic Flow of Success Scenario:** A Use case flow that demonstrates the ideal case in which nothing goes wrong.

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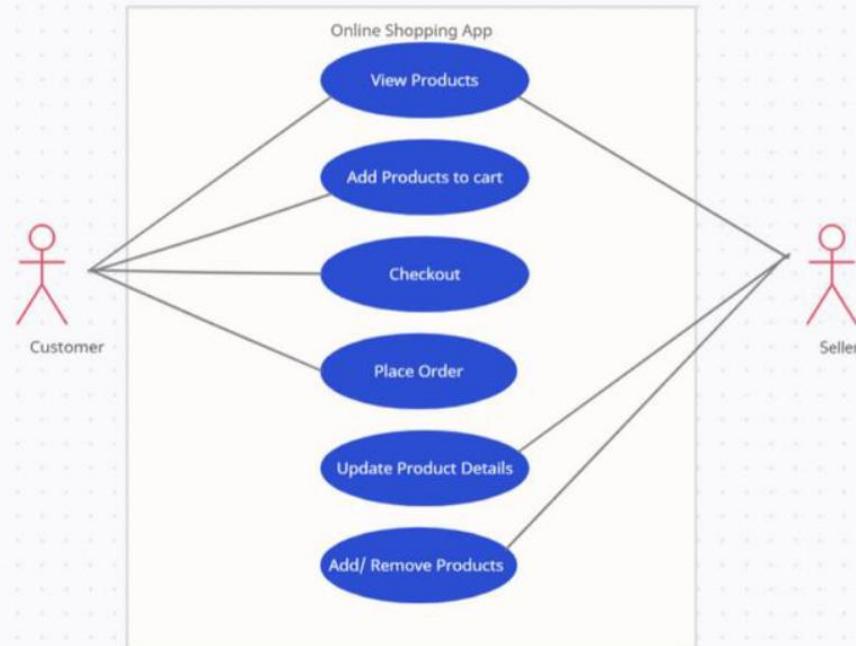
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Use Case Diagram



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How to write Use case for your project requirements?

Use Case Diagram

- **Brief description:** Brief description explaining the overall use case.
- **Pre-condition:** These are pre-conditions the user needs to fulfill before the use case begins.
- **System:** A system can be a product, service, or software to be taken into consideration.
- **Actors:** An actor is a user that can interact with the system and exhibit the required behavior. The actor can be another system, a piece of hardware, or an entire organization. We can have a primary and a secondary actor in a use-case scenario. A primary actor can help to initiate the interaction with the system, while a secondary actor can provide the required services to the system.
- **Basic flow or main scenario:** It is a specific sequence of actions and interactions between the actors and the system, commonly known as a use case instance. This is a typical workflow where an actor can get the expected output.
- **Alternate flow:** Apart from the typical workflow, a system can have an alternate workflow.
- **Exception flow:** The flow that prevents the user from achieving the desired outcome.
- **Post-conditions:** The post-conditions need to be validated after executing the use case.

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What is Use case Testing

Use case testing is a pictorial representation of depicting all the possible actors, their behavior, and system interactions. This type of testing lays a solid foundation for defining your functional requirements.

Testers and quality analysts refer to the use case testing results to ensure that all the required system functionalities are covered, and any missing gaps are closed.

Best practices

- It is recommended to maintain all the test assets, such as test cases and test results, in a centralized location so that all the project teams can easily access them.
- Finalize the naming conventions to be followed for your use cases so that it is easier for the teams to refer to them when required.
- Monitor the use case post conditions and metrics so that you can make the required changes or improvements in the long run. It helps to redefine or reinvent your testing strategies and processes.

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What is Use case Testing

- **The most important part of a use case for generating test cases is the flow of events**
- **The two main parts of the flow of events are:**
 - **basic flow of events**
 - **The basic flow of events should cover what "normally" happens when the use case is performed**
 - **alternate flows of events**
 - **The alternate flows of events covers behavior of an optional or exceptional character relative to normal behavior, and also variations of the normal behavior**
 - **You can think of the alternate flows of events as "detours" from the basic flow of events**

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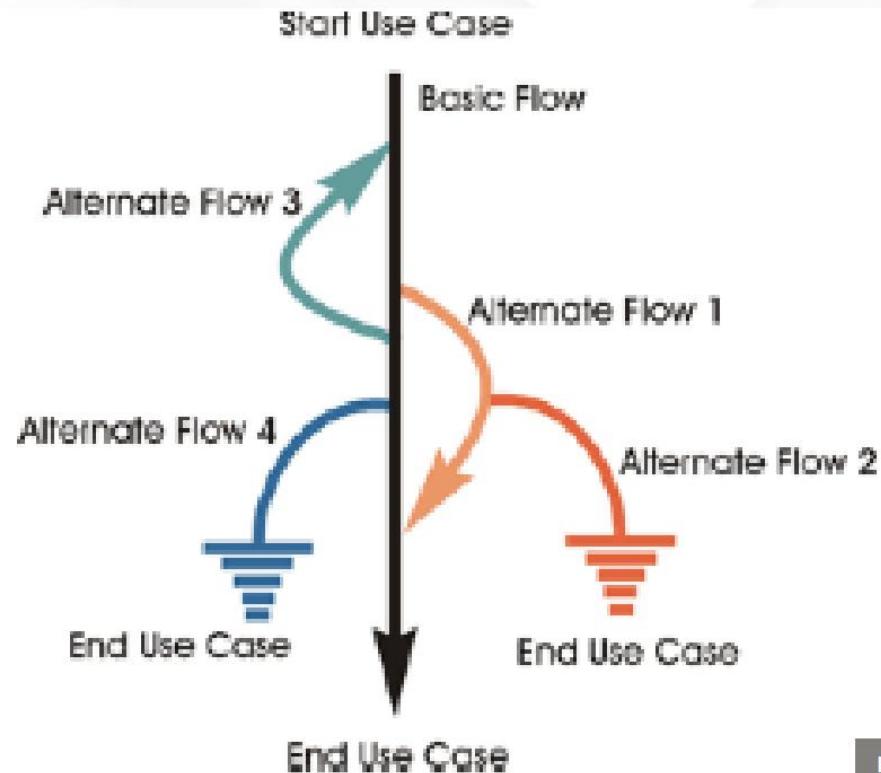


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What is Use case Testing



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What is Use case Testing

- **Basic Flow**

1. **Logon:** This use case starts when a Student accesses the Wylie University Web site. The system asks for, and the Student enters, the student ID and password.
2. **Select 'Create a Schedule':** The system displays the functions available to the student. The student selects "Create a Schedule."
3. **Obtain Course Information :** The system retrieves a list of available course offerings from the Course Catalog System and displays the list to the Student.
4. **Select Courses:** The Student selects four primary course offerings and two alternate course offerings from the list of available course.
5. **Submit Schedule:** The student indicates that the schedule is complete. For each selected course offering on the schedule, the system verifies that the Student has the necessary prerequisites.
6. **Display Completed Schedule:** The system displays the schedule containing the selected course offerings for the Student and the confirmation number for the schedule.

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What is Use case Testing

- **Alternate Flows**

1. **Unidentified Student:** In Step 1 of the Basic Flow, Logon, if the system determines that the student ID and/or password is not valid, an error message is displayed.
2. **Quit :** The Course Registration System allows the student to quit at any time during the use case. The Student may choose to save a partial schedule before quitting. All courses that are not marked as "enrolled in" are marked as "selected" in the schedule. The schedule is saved in the system. The use case ends.
3. **Unfulfilled Prerequisites, Course Full, or Schedule Conflicts:** In Step 5 of the Basic Flow, Submit Schedule, if the system determines that prerequisites for a selected course are not satisfied, that the course is full, or that there are schedule conflicts, the system will not enroll the student in the course.

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What is Use case Testing

4. **Course Catalog System Unavailable:** In Step 3 of the Basic Flow, Obtain Course Information, if the system is down, a message is displayed and the use case ends.
5. **Course Registration Closed:** If, when the use case starts, it is determined that registration has been closed, a message is displayed, and the use case ends.

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What is Use case Scenario

- **Use Case Scenario**

- A use-case scenario is an instance of a use case, or a complete "path" through the use case
- End users of the completed system can go down many paths as they execute the functionality specified in the use case
- Following the basic flow would be one scenario
- Following the basic flow plus alternate flow 1A would be another
- The basic flow plus alternate flow 2A would be a third, and so on

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Examples of Use cases

Case for 'Login' to a 'School Management System'.

The diagram illustrates a UML Use Case Diagram for a 'School login system'. At the center is an oval labeled 'Login'. Four external actors are shown as stick figures with lines pointing to the 'Login' use case: 'Students', 'Teacher', 'Parents', and 'Admin'. From the 'Login' use case, three additional ovals branch out: 'Reset Password', 'Forgot Password', and 'Staff'. The 'Staff' oval is connected to an actor 'Staff' on the right side of the diagram.

School login system

Students

Teacher

Parents

Admin

Staff

Login

Reset Password

Forgot Password

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Examples of Use cases

Case for ‘Login’ to a ‘School Management System’.

Use Case Name	Login
Use case Description	A user login to System to access the functionality of the system.
Actors	Parents, Students, Teacher, Admin
Pre-Condition	System must be connected to the network.
Post -Condition	After a successful login a notification mail is sent to the User mail id

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Examples of Use cases

Case for 'Login' to a 'School Management System'.

Main Scenarios	Serial No	Steps
Actors/Users	1	Enter username Enter Password
	2	Validate Username and Password
	3	Allow access to System
Extensions	1a	Invalid Username System shows an error message
	2b	Invalid Password System shows an error message
	3c	Invalid Password for 4 times Application closed

Notes



Agenda

- Test Case Design – Introduction
- Test Case Design Template,
- Types of Test Cases
- Test Case Design Reviews,
- Requirement Traceability
- Comprehensive test cases
- BRD
- FSD scope Matrix



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Test Design - Introduction

- The test case design is a document that Quality Analysts prepare to define the testing strategy and scope and provide other details such as testing prerequisites, test steps, postconditions, and expected results

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Test Design - Introduction

A basic example of test case design:

Title: Login to the website or app

Description: User should be able to successfully log in to their account on the website/app

Preconditions: User must already be registered and use their correct login details

Assumptions: They are using a supported device or browser to log in

Test Steps:

1. Open website or app

2. Enter the username and password in the appropriate fields

3. Click “login”

Expected Result: The user should log in successfully.

Notes



Test Design – Positive Scenarios

Test Scenario ID	Login-1		Test Case ID	Login-1A			
Test Case Description	Login – Positive test case		Test Priority	High			
Pre-Requisite	A valid user account		Post-Requisite	NA			
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Browser	Test Result	Test Comments
1	Launch application	https://www.facebook.com/	Facebook home	Facebook home	IE-11	Pass	[Priya 10/17/2017 11:44 AM]: Launch successful
2	Enter correct Email & Password and hit login button	Email id : test@xyz.com Password: *****	Login success	Login success	IE-11	Pass	[Priya 10/17/2017 11:45 AM]: Login successful

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Test Design – Negative Scenarios

Test Scenario ID	Login-1	Test Case ID	Login-1B				
Test Case Description	Login – Negative test case	Test Priority	High				
Pre-Requisite	NA	Post-Requisite	NA				
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Browser	Test Result	Test Comments
1	Launch application	https://www.facebook.com/	Facebook home	Facebook home	IE-11	Pass	[Priya 10/17/2017 11:44 AM]: Launch successful
2	Enter invalid Email & any Password and hit login button	Email id : invalid@xyz.com Password: *****	The email address or phone number that you've entered doesn't match any account. Sign up for an account.	The email address or phone number that you've entered doesn't match any account. Sign up for an account.	IE-11	Pass	[Priya 10/17/2017 11:45 AM]: Invalid login attempt stopped
3	Enter valid Email & incorrect Password and hit login button	Email id : valid@xyz.com Password: *****	The password that you've entered is incorrect. Forgotten password?	The password that you've entered is incorrect. Forgotten password?	IE-11	Pass	[Priya 10/17/2017 11:46 AM]: Invalid login

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Types of Testcases

- **Functionality Test Case**
- **User Interface Test Case**
- **Performance Test Case**
- **Integration Test Case**
- **Database Test Case**
- **Security Test Case**
- **User Acceptance Test Case**

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Types of Testcases – Functionality testcase

Functionality test cases are used to verify if an application's interface works with the rest of the system and its users. The tests recognize the success or failure of functions the software is expected to perform.

A functionality test case is the black-box testing type that utilizes for its base, the specifications or user stories of the software being tested. It enables the tests to be performed without requiring access to the internal structures of the software under test.

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Types of Testcases – Functionality testcase

Example:

- i. Verify that the User is able to login by entering valid credentials and clicking on the 'Login' button.
- ii. Verify a link functionality in a webpage.

Note: Functional Testing can be done in both ways, manual Testing and Automation Testing.

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Types of Testcases – Functionality testcase

A	B	C	D
TC ID	Specifications	Steps To Execute	Expected Result
TC-01	Check the Name on Card, Card Number, Expiration date, CVV are mandatory fields in the	1. Select the card type 2. Do not fill any information 3. Click on Submit button	It should show the validation message for all the required fields
TC-02	Check the error message when enter invalid input for mandatory fields	1. Select the card type 2. Enter invalid card number [Check for CVV, Expiration date] 3. Click on submit button	It should show error message for invalid details

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Types of Testcases – User Interface testcase

User interface test cases are used to verify that specific pieces of the Graphical User Interface (GUI) look and work as expected. These types of test cases can be used to identify cosmetic inconsistencies, grammar and spelling errors, links, and any other elements the user interacts with or sees.

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Types of Testcases – User Interface testcase

Example:

i. Verify Font sizes and element alignments in a web page.

Note: Manual Testing testing is recommended for usability testing, Automation testing is impractical.

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Types of Testcases – User Interface testcase

True False **Radio Button**

Check Check **Check Box**

Text Box

List Box

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Types of Testcases – Performance testcase

Performance test cases validate response times and overall effectiveness of an application.

That is, after executing an action, how long does it take for the system to respond?

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Types of Testcases – Performance testcase

Example: How long does it take for the system to authenticate a user, and load the next page? When multiple people login at the same time, does the application remain stable?

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Types of Testcases – Performance test case

Example:

- i. Verify 5000 Concurrent users load on a website.

**Note: Manual testing is impractical for conducting performance testing,
Automation testing only possible.**

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Types of Testcases – Integration testcase

Integration testing is of all merged modules

It is called as integration in order to verify the combined functionality after integration.

The main aim of integration test cases is to ensure interfaces between the different modules are working properly.

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Types of Testcases – Integration testcase

Example: Checking the link between the home page and the “favorites” section. When you add an item as a “favorite”, from the homepage, does it appear in the “favorites” section?

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Types of Testcases – Data base testcase

Database test cases are used for verifying what's happening background of an application.

To write these test cases, you need to have a very strong knowledge of the entire application, the database tables, and the stored procedures.

The testing team will repeatedly use SQL queries to develop database test cases.

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Types of Testcases – Data base testcase

Verify data integration of customer information.

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Types of Testcases – Security testcase

Security test cases help ensure the application restricts actions and permissions wherever necessary.

These test cases are written to protect data when and where it needs to be safeguarded.

Security test cases are used to drive penetration testing and other types of security-based tests.

Authentication and encryption are often the main focus in security test cases. The security team (if one exists) is usually responsible for writing and conducting these tests.

Notes



Types of Testcases – Security testcase

Example: If a user reaches X number of failed login attempts, does the account become locked? Is a user able to upload data without being logged in?

Example:

- i. Verify User Login Locking,
- ii. Verify the login session timeout,
- iii. Verify Logged in page in a different browser.)

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Types of Testcases – UAT testcases

User acceptance test cases, or “UAT” test cases, help the team test the user acceptance testing environment.

These test cases should be broad, covering all areas of the application.

The purpose of these test cases isn’t to find bugs (hopefully they’ve already been found and fixed in previous testing), but to verify the application is acceptable to the user.

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Types of Testcases – UAT testcases

Example: If testing for instance, a photo management application for a photography studio, the client (the user) should test that they are able to upload and manage their photos in a way that fits their business needs.

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Test Case Design Reviews

Types Of Reviews

- Reviewing your own work – Self Checking
- Peer- review
- Supervisory

What Do We Review?

Everything created has to be reviewed. The following are some of the common artifacts reviewed:

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Test Case Design Reviews

- Test plan
- Test scenarios
- Test templates
- Test cases
- Test data
- Reports



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Test Case Design Reviews

Why Review?

- To uncover errors
- To check for completeness
- To make sure the standards and guidelines are adhered to or not.

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Test Case Design Reviews

How To Review?

The following are the list of activities involved:

- Define the criteria – Have a checklist of what to look for?
- Perform the check
- Record your results
- Share, discuss and implement the changes required
- Version control the documents involved
- Sign off and use the doc as intended.

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Test Case Design Reviews

Define the criteria - Have a checklist of what to look for?

Perform the check

Record your results

Share, discuss and implement the changes required

Version control the documents involved

Sign off and use the doc as intended.

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Requirement Traceability

Requirement Traceability Matrix (RTM) is a document that maps and traces user requirement with test cases.

It captures all requirements proposed by the client and requirement traceability in a single document, delivered at the conclusion of the Software development life cycle.

The main purpose of Requirement Traceability Matrix is to validate that all requirements are checked via test cases such that no functionality is unchecked during Software testing.

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Requirement Traceability

Requirement Traceability Matrix (RTM) is a document that maps and traces user requirement with test cases.

It captures all requirements proposed by the client and requirement traceability in a single document, delivered at the conclusion of the Software development life cycle.

The main purpose of Requirement Traceability Matrix is to validate that all requirements are checked via test cases such that no functionality is unchecked during Software testing.

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Requirement Traceability

The traceability matrix is typically a worksheet that contains the requirements with its all possible test scenarios and cases and their current state, i.e. if they have been passed or failed. This would help the testing team to understand the level of testing activities done for the specific product.

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Requirement Traceability

Why RTM is Important?

The main agenda of every tester should be to understand the client's requirement and make sure that the output product should be defect-free.

This would mean that the software requirements provided by the client have to be further split into different scenarios and further to test cases. Each of this case has to be executed individually.

A question arises here on how to make sure that the requirement is tested considering all possible scenarios/cases?

How to ensure that any requirement is not left out of the testing cycle?

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Requirement Traceability

Which Parameters to include in Requirement Traceability Matrix?

- Requirement ID
- Requirement Type and Description
- Test Cases with Status

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Requirement Traceability

Req No	Req Desc	Testcase ID	Status
123	Login to the application	TC01,TC02,TC03	TC01-Pass TC02-Pass
345	Ticket Creation	TC04,TC05,TC06, TC07,TC08,TC09 TC010	TC04-Pass TC05-Pass TC06-Pass TC06-Fail TC07-No Run
456	Search Ticket	TC011,TC012, TC013,TC014	TC011-Pass TC012-Fail TC013-Pass TC014-No Run

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Requirement Traceability

Sno	Req ID	Req Desc	TC ID	TC Desc	Test Design	Test Designer	UAT Test Req?	Test Execution			Defects?	Defect ID	Defect Status	Req Coverage Status
								Test Env	UAT Env	Prod Env				
5	1	Req01	TC01	Login with Invalid Username and valid password	Completed	XYZ	No	Passed	No Run	No Run	None	None	N/A	Partial
6	2	Req01	TC02	Login with Valid Username and invalid password	Completed	Y2A	No	Passed	No Run	No Run	None	None	N/A	Partial
7	3	Req01	TC03	Login with valid credentials	Completed	XYZ	Yes	Passed	Passed	No Run	Yes	DFCT001	Test OK	Partial

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Requirement Traceability

As illustrated above, a requirement traceability matrix can:

- Show the requirement coverage in the number of test cases
- Design status as well as execution status for the specific test case
- If there is any User Acceptance test to be done by the users, then UAT status can also be captured in the same matrix.
- The related defects and the current state can also be mentioned in the same matrix.

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Requirement Traceability

As illustrated above, a requirement traceability matrix can:

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Creation of Requirement Traceability Matrix

Step 1: Our sample Test Case is

“Verify Login, when correct ID and Password is entered, it should log in successfully”

TestCase #	Test Case	Test Steps	Test Data	Expected Result
1	Verify Login	1) Go to Login Page 2) Enter UserID 3) Enter Password 4) Click Login	id= Guru99 pass= 1234	Login Successful

when correct password and id entered, it should login successfully

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Creation of Requirement Traceability Matrix

Step 2: Identify the Technical Requirement that this test case is verifying. For our test case, the technical requirement is T94 is being verified.

T94 If userid and password are valid. Login

T94 is our technical
requirement that verifies
successful login

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Creation of Requirement Traceability Matrix

Step 3: Note this Technical Requirement (T94) in the Test Case.

TestCase #	TR #	Note the Technical Requirement in the test case	Test Steps	Test Data	Expected
1	T94	Verify Login	1) Go to Login Page 2) Enter UserID 3) Enter Password 4) Click Login	id= Guru99 pass= 1234	Login Successful

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Creation of Requirement Traceability Matrix

Step 4: Identify the Business Requirement for which this TR (Technical Requirement-T94) is defined

BR#	Module Name	Applicable Roles	Description
B1	Login and Logout	Manager Customer	<p>Customer: A customer can login using the login page</p> <p>Manager: A manager can login using the login page of customer. Post Login homepage will show different links based on role</p>

Identify the Business Requirement for which T94 is defined

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Creation of Requirement Traceability Matrix

Step 5: Note the BR (Business Requirement) in Test Case

TestCase #	BR #	TR #	Test Case	Test Steps	Test Data	Expe
1	B1	T94	Verify Login	1) Go to Login Page 2) Enter UserID 3) Enter Password 4) Click Login	id= Guru99 pass= 1234	Login Successful

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Creation of Requirement Traceability Matrix

Step 6: Do above for all Test Cases. Later Extract the First 3 Columns from your Test Suite. RTM in testing is Ready!

Business Requirement #	Technical Requirement #	Test Case ID
B1	T94	1
B2	T95	3
B3	T96	3
B4	T97	4

Requirement Traceability Matrix

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Lab Session – Creation of Requirement Traceability matrix

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Comprehensive Testcases

POSITIVE, NEGATIVE, AND DESTRUCTIVE TEST CASES

- Positive test cases use valid inputs to verify that a software product is doing what it's supposed to do.
- The purpose is to make sure the system doesn't spit out errors when it's not supposed to
- Negative test cases use invalid inputs and verify that the software is not doing what it is not supposed to do. Negative testing intends to ensure that the system validates against invalid inputs by throwing errors or otherwise not allowing the system to perform in a certain way.
- Destructive test cases are created to learn what the system can handle until it breaks or "destructs." Load testing and script injections are common approaches to destructive testing. QA engineers can use one of the following techniques: applying a significant load to the system that results in a failure; injecting JavaScript into a web form with malicious intent; fast-clicking in an attempt to break a webpage, etc

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ATTRIBUTES OF A MANUAL TEST CASE

- **ID – a unique combination of letters and numbers.**
- **Summary – the main idea of a test case, a brief description of its contents.**
- **For example, a manual test case for login page can look like this: “Check customer login with valid data.”**
- **Preconditions – a list of actions to perform before executing a test case. The credentials can be also included if needed. Steps – a description of the actions required for verification.**
- **Postconditions – a list of actions that return the system to its original state (if needed).**
- **Expected result – what we expect after successful test case execution.**
- **Actual result – what we get after test case execution (if needed).**
- **Status – Success, Failed, Blocked (if needed).**

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PROPERTIES OF A GOOD TEST CASE

In short, a test case should be:

- **Easy to understand and execute for all team members**
- **Accurate**
- **Easy to trace as per requirements**
- **Repeatable; reusable.**

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BEST PRACTICES OF TEST CASE WRITING

- Before starting a new test case,
- No Duplicate testcases present
- Test case covers 100% of the requirements you are to verify.
- Theory of testing techniques, such as Boundary Value Analysis, Equivalence Partition, State Transition Technique, Error Guessing Technique should be considered
- End-user who will interact with the system.
- Include the credentials if they are necessary for test execution.
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