DA-IICT

IT 314: Software Engineering

Requirement Validation
&
System Level Test Cases from Use Cases
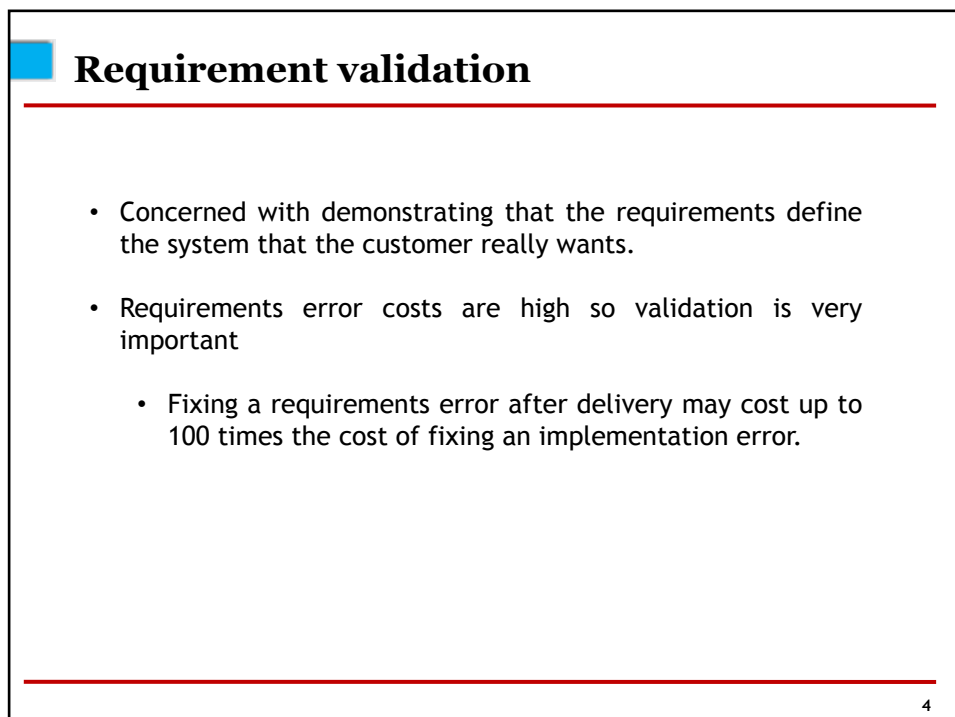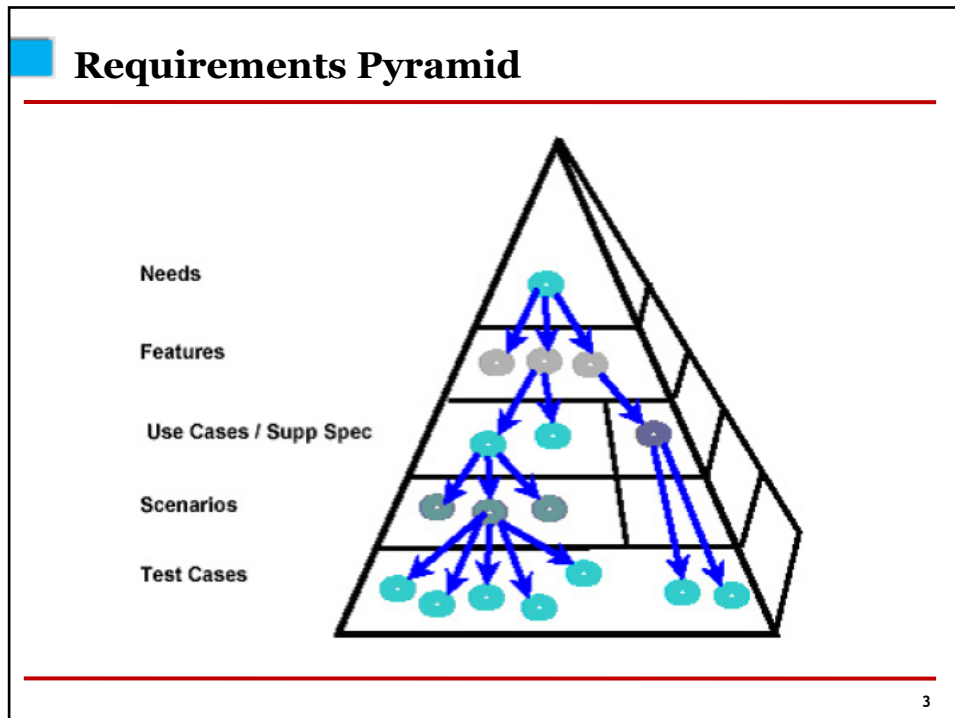
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System Level test Cases:

User Stories

Front of the card (Functionality – NF) – Who, What and Why?

Back of the card – Acceptance Criteria

(detailed form)

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Requirements Pyramid

Requirement validation

- Concerned with demonstrating that the requirements define the system that the customer really wants.

- Requirements error costs are high so validation is very important

    - Fixing a requirements error after delivery may cost up to 100 times the cost of fixing an implementation error.

Requirement checking

- Validity. Does the system provide the functions which best support the customer's needs?

- Consistency. Are there any requirements conflicts?

- Completeness. Are all functions required by the customer included?

- Realism. Can the requirements be implemented given available budget and technology?

- Verifiability. Can the requirements be checked?

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Requirements validation techniques

- Requirements reviews
  - Systematic manual analysis of the requirements.

- Prototyping
  - Using an executable model of the system to check requirements.

- Test-case generation
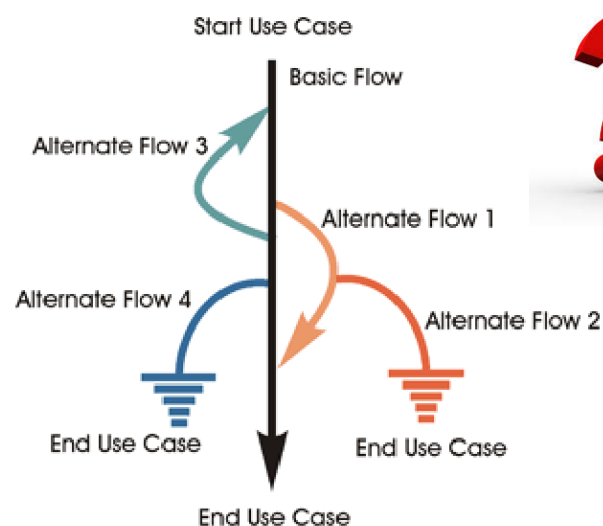 - Developing tests for requirements to check testability.

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Requirements reviews

- Regular reviews should be held while the requirements definition is being formulated.

- Both client and contractor staff should be involved in reviews.

- Reviews may be formal (with completed documents) or informal. Good communications between developers, customers and users can resolve problems at an early stage.

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Test Generation from Requirements

Start Use Case

Basic Flow

Alternate Flow 3

Alternate Flow 1

Alternate Flow 4

Alternate Flow 2

End Use Case

End Use Case

End Use Case

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Use Case Structure

Use Case Name

1 Brief Description
2 Actors
3 Flow of Events
   3.1 Basic Flow
      3.1.1 Step 1
      3.1.2 Step 2...
   3.2 Alternative Flows
      3.2.1 Alternative Flow 1
        3.2.1.1 Step 1
        3.2.1.1 Step 2...
      3.2.1 Alternative Flow
   3.3 Error Flows
      3.3.1 Error Flow 1...
        3.3.1.1 Step 1
        3.3.1.1 Step 2...
   3.4 Sub- Flows
      3.4.1 Sub-Flow 1...
        3.4.1.1 Step 1
        3.4.1.1 Step 2...
4 Special requirements
5 Pre-Conditions
6 Post-Conditions
7 Extension Points
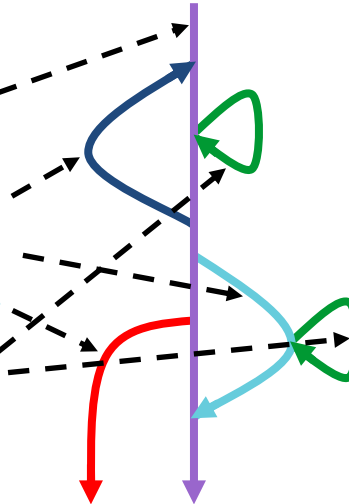
- Each path through the use case is a Use Case Scenario

- One use case may contain many Use Case Scenarios

- All Use Case Scenarios must be covered during development and testing but not necessarily in the same iteration

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Use Case Diagram for a University Course Registration System

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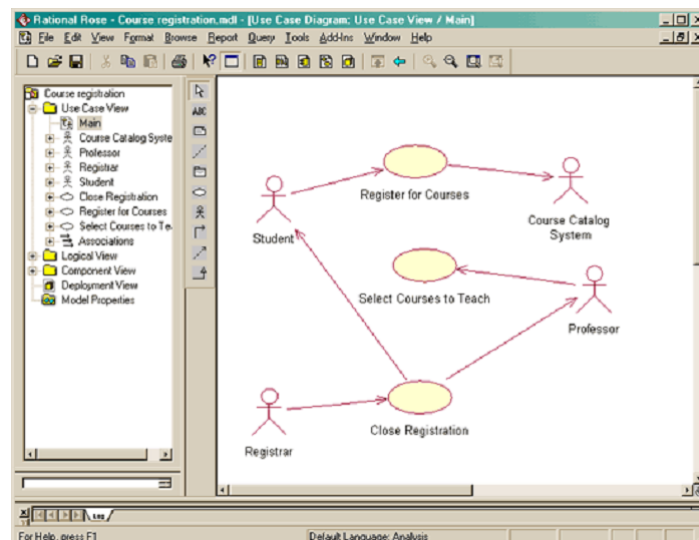
Register for Courses: Basic Flow

1. Logon
This use case starts when a Student accesses the 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 offerings.

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Register for Courses: Basic Flow

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.

What NEXT....

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Register for Courses: Alternate Flow

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. 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.

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Register for Courses: Alternate Flow

4. 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. A message is displayed that the student can select a different course. The use case continues at Step 4, Select Courses, in the basic flow. 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.

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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Use Case Scenarios

Scenario 1	Basic Flow			
Scenario 2	Basic Flow	Alternate 1		
Scenario 3	Basic Flow	Alternate 1	Alternate 2	
Scenario 4	Basic Flow	Alternate 3		
Scenario 5	Basic Flow	Alternate 3	Alternate 1	
Scenario 6	Basic Flow	Alternate 3	Alternate 1	Alternate 2
Scenario 7	Basic Flow	Alternate 4		
Scenario 8	Basic Flow	Alternate 3	Alternate 4	

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Test Case Generation

We will describe a three-step process for generating test cases from a fully-detailed use case:

1. For each use case, generate a full set of use-case scenarios.

2. For each scenario, identify at least one test case and the conditions that will make it "execute"

3. For each test case, identify the data values with which to test.

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Generating Scenarios

Scenario Name	Flow	Alternate
Scenario 1 - Successful registration	Basic Flow	
Scenario 2 - Unidentified student	Basic Flow	A1
Scenario 3 - User quits	Basic Flow	A2
Scenario 4 - Course Catalog system unavailable	Basic Flow	A4
Scenario 5 - Registration closed	Basic Flow	A5
Scenario 6 – Cannot enroll	Basic Flow	A3

Once the full set of scenarios has been identified, the next step is to identify the test cases.

We can do this by analyzing the scenarios and reviewing the use case textual description as well.

There should be at least one test case for each scenario, but there will probably be more.

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Identifying Test Cases

3A. Unfulfilled Prerequisites, Course Full, or Schedule Conflicts

Then, additional test cases may be required to test all the possibilities. In addition, we may wish to add test cases to test boundary conditions.

The next step in fleshing out the test cases is to reread the use-case textual description and find the conditions or data elements required to execute the various scenarios.

For the Register for Course use case, conditions would be student ID, password, courses selected, etc.

Test Case ID	Scenario/ Condition	Student ID	Password	Courses selected	Prerequisites fulfilled	Course Open	Schedule Open	Expected Result

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Identifying Test Cases

Once all of the test cases have been identified, they should be reviewed and checked to ensure accuracy and to identify redundant or missing test cases. Nest step is to identify actual data values.

Test Data:

Without test data, test cases (or test procedures) can't be implemented or executed; they are just descriptions of conditions, scenarios, and paths. Therefore, it is necessary to identify actual values to be used in implementing the final tests.

By using use cases to generate test cases testing teams can get started much earlier in the lifecycle, allowing them to identify and repair defects that would be very costly to fix later, ship on time, and ensure that the system will work reliably.

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Test Cases

Now that you have all the scenarios, you need to get the test cases. There are four steps to do that:

1. Identify variables **for each use case step**
2. Identify significantly different options **for each variable**
3. Combine options **to be tested into test cases**
4. **Assign** values to variables

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Purchase the books

B1 User enters web site address in the browser.

System displays login page.

B2 User enters an **email** address and a **password**. [String]

System confirms correct login, presents main page, and prompts for a search string.

B3 User enters **search string** – partial name of a book. [String]

System returns all books matching search criteria.

B4 User selects a book. **Select [Click]**

System presents detailed information about a book.

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Purchase the books

B5 User adds the book to a shopping cart. **[Button Click]**

System presents the Shopping cart contents to the user.

B6 User selects "proceed to checkout" option. **[button click]**

System asks for confirmation of a shipping address.

B7 User confirms shipping address. **[Button Click]**

System presents the shipping options

B8 User selects shipping option. **[Shipping method] [int]**

Systems asks for the payment.

B9 User confirms the payment through the system. **[Payment] [Boolean]**

System asks for final confirmation to place an order.

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Purchase the books

B10 User places the order. **[Button Click]**

System returns a confirmation number.

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Different options for each var.

email	Pwd	SS	Book	Add	Checkout	Shipping	Order
R	R	R					
E |	E |	E |				5	
1	5 |	1	F	-	-	3	-
50	6	300	L			2	
51 |	10	301 |				1	
L |	11 |						
I |	L |						

email: 1 to 50 characters
Pwd: atleast 6 characters – 10
Search S: 1-300

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Test Cases

Step	Variable	TC1	TC2
B1	Website	Actual URL	Actual URL
B2	email	Regular	6
B2	PWd	Regular	7
B3	SS	30 char	200
B4	select	First	Last
B5	Add	Y	Y
B6	checkout	Y	Y
B7	address	Y	Y
B8	payment	Y	Y
B9	shipping	5	1
B10	order	Y	Y

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Values to the variables (TC1)

Step	Variable	Value	ER	AR	P/F
B1	Website	www.amazon.com	Logon Screen		
B2	email	saurabh@gmail.com			
B2	PWd	1234567	Main Screen		
B3	SS	"Software Testing"	List of books		
B4	select	First Selection	Book details		
B5	Add	Add to cart	Cart contents		
B6	checkout	Proceed to checkout	Prompt for address		
B7	address	Confirm address on file	Prompt for payment		
B8	payment	Done	Prompt for shipping		
B9	shipping	5 days	Prompt for confirmation		
B10	order	Confirm	Order number		

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