CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Object Oriented Software Engineering

LECTURE 15

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Today's Outline:

- **Testing Object Oriented Applications:**

Test Case

Testing OOA and OOD model

Object Oriented Testing Strategies

Object Oriented Testing Methods

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

What is Test Case

- A test case is nothing but a set of conditions or variables under which a tester will determine whether a system under test satisfies requirements or works correctly.
- **Step 1: Test Case ID**
- Test cases should all bear unique IDs to represent them. In most cases, following a convention for this naming ID helps with organization, clarity, and understanding.
- **Step 2: Test Description**
- This description should detail what unit, feature, or function is being tested or what is being verified.
- **Step 3: Assumptions and Pre-Conditions**
- This entails any conditions to be met before test case execution. One example would be requiring a valid Outlook account for a login.
- **Step 4: Test Data**
- This relates to the variables and their values in the test case. In the example of an email login, it would be the username and password for the account.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

What is Test Case cont…

- **Step 5:** Steps to be Executed
- These should be easily repeatable steps as executed from the end user's perspective. For instance, a test case for logging into an email server might include these steps:
- Open email server web page.
- Enter username.
- Enter password.
- Click "Enter" or "Login" button.
- **Step 6:** Expected Result
- This indicates the result expected after the test case step execution. Upon entering the right login information, the expected result would be a successful login.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

What is Test Case cont…

- **Step 7:** Actual Result and Post-Conditions
- As compared to the expected result, we can determine the status of the test case. In the case of the email login, the user would either be successfully logged in or not. The post-condition is what happens as a result of the step execution such as being redirected to the email inbox.
- **Step 8:** Pass/Fail
- Determining the pass/fail status depends on how the expected result and the actual result compare to each other.
- Same result = Pass
  Different results = Fail

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Testing OOA And OOD Models

- Analysis and design models cannot be tested in the conventional sense, because they cannot be executed. However, formal technical reviews can be used to examine the correctness and consistency of both analysis and design models.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Object Oriented Analysis (OOA):

- Object Oriented Analysis (OOA) is the first technical activity performed as part of object oriented software engineering. OOA introduces new concepts to investigate a problem. It is based in a set of basic principles, which are as follows-
- The information domain is modeled.
- Behavior is represented.
- Function is described.
- Data, functional, and behavioral models are divided to uncover greater detail.
- Early models represent the essence of the problem, while later ones provide implementation details.

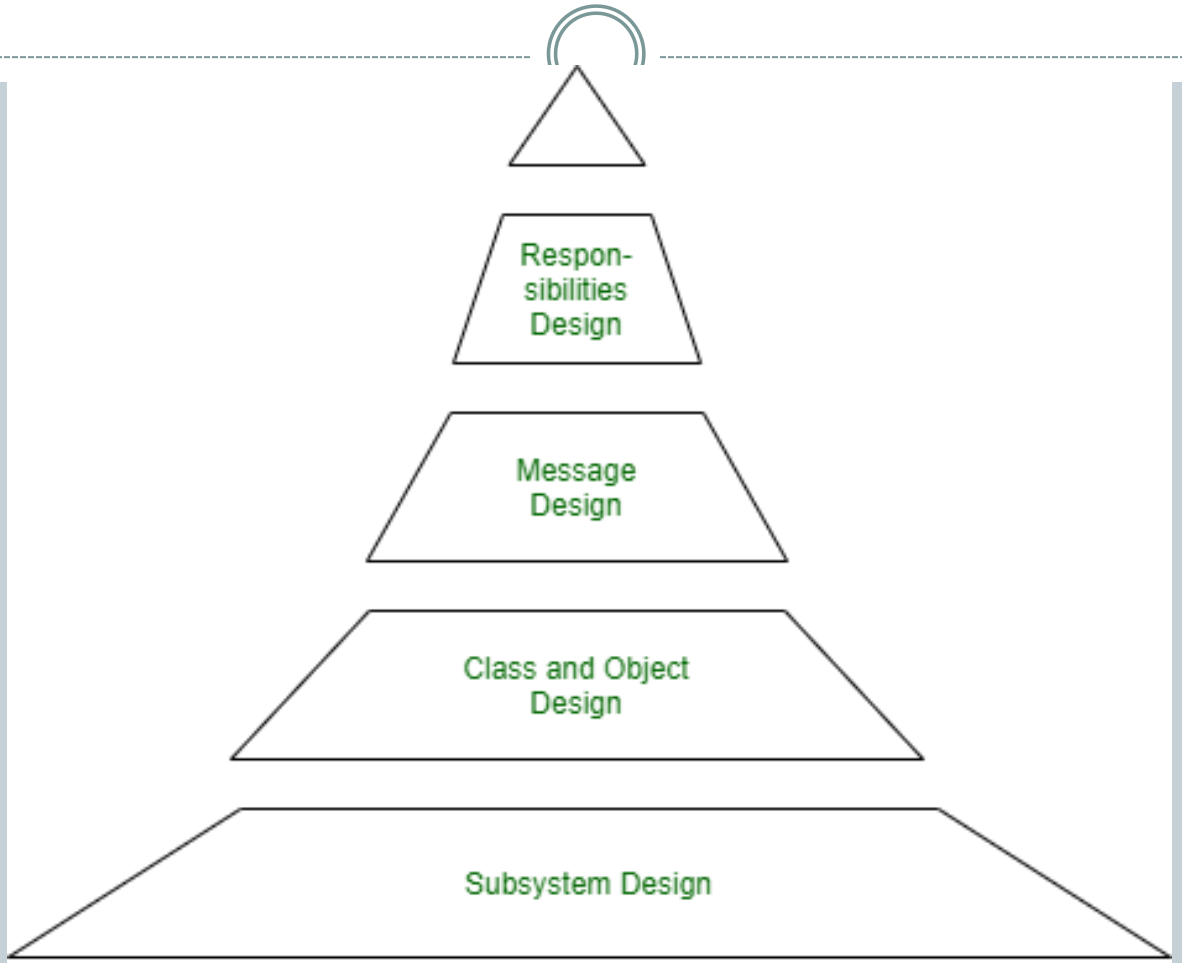
CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Object Oriented Design (OOD):

- An analysis model created using object oriented analysis is transformed by object oriented design into a design model that works as a plan for software creation. OOD results in a design having several different levels of modularity i.e., The major system components are partitioned into subsystems (a system level “modular”), and data their manipulation operations are encapsulated into objects (a modular form that is the building block of an OO system.).
- In addition, OOD must specify some data organization of attributes and a procedural description of each operation.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Object-Oriented Design Pyramid



The Object Oriented Design Pyramid

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Object-Oriented Design Pyramid

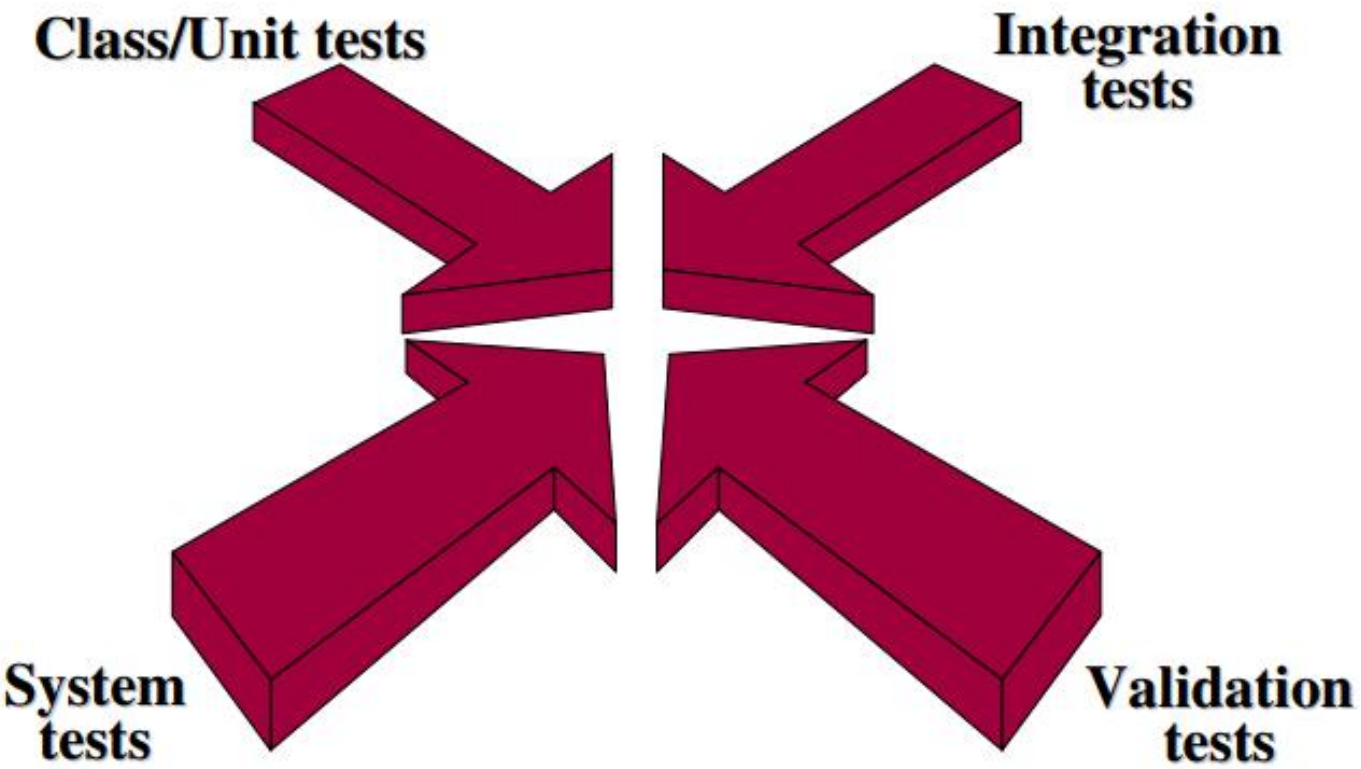
- **The Subsystem Layer :** It represents the subsystem that enables software to achieve user requirements and implement technical frameworks that meet user needs.
- **The Class and Object Layer :** It represents the class hierarchies that enable the system to develop using generalization and specialization. This layer also represents each object.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

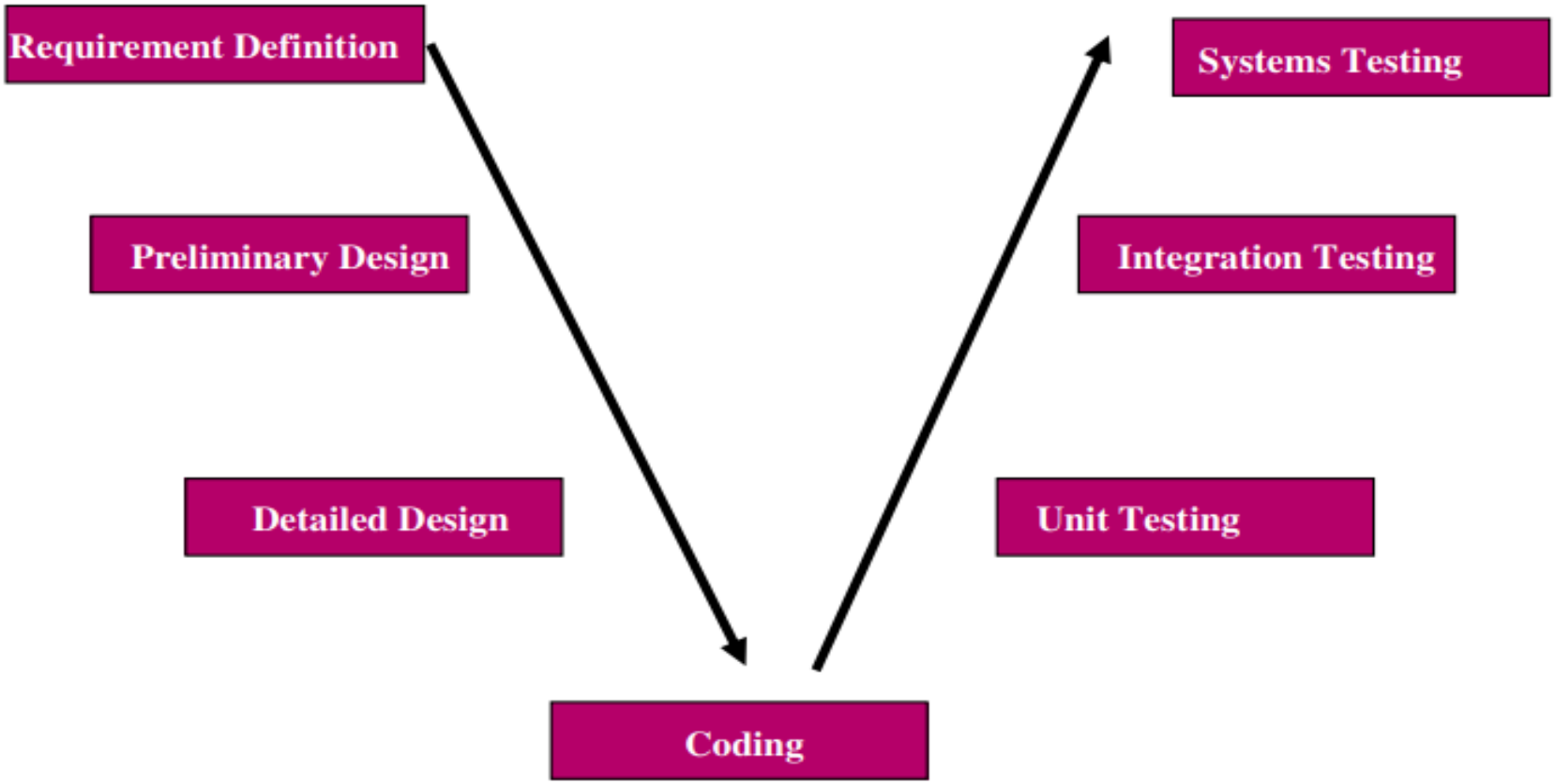
Object-Oriented Design Pyramid

- **The Message Layer :** It represents the design details that enable each object to communicate with its partners. It establishes internal and external interfaces for the system.
- **The Responsibilities Layer :** It represents the data structure and algorithmic design for all the attributes and operations for each object.

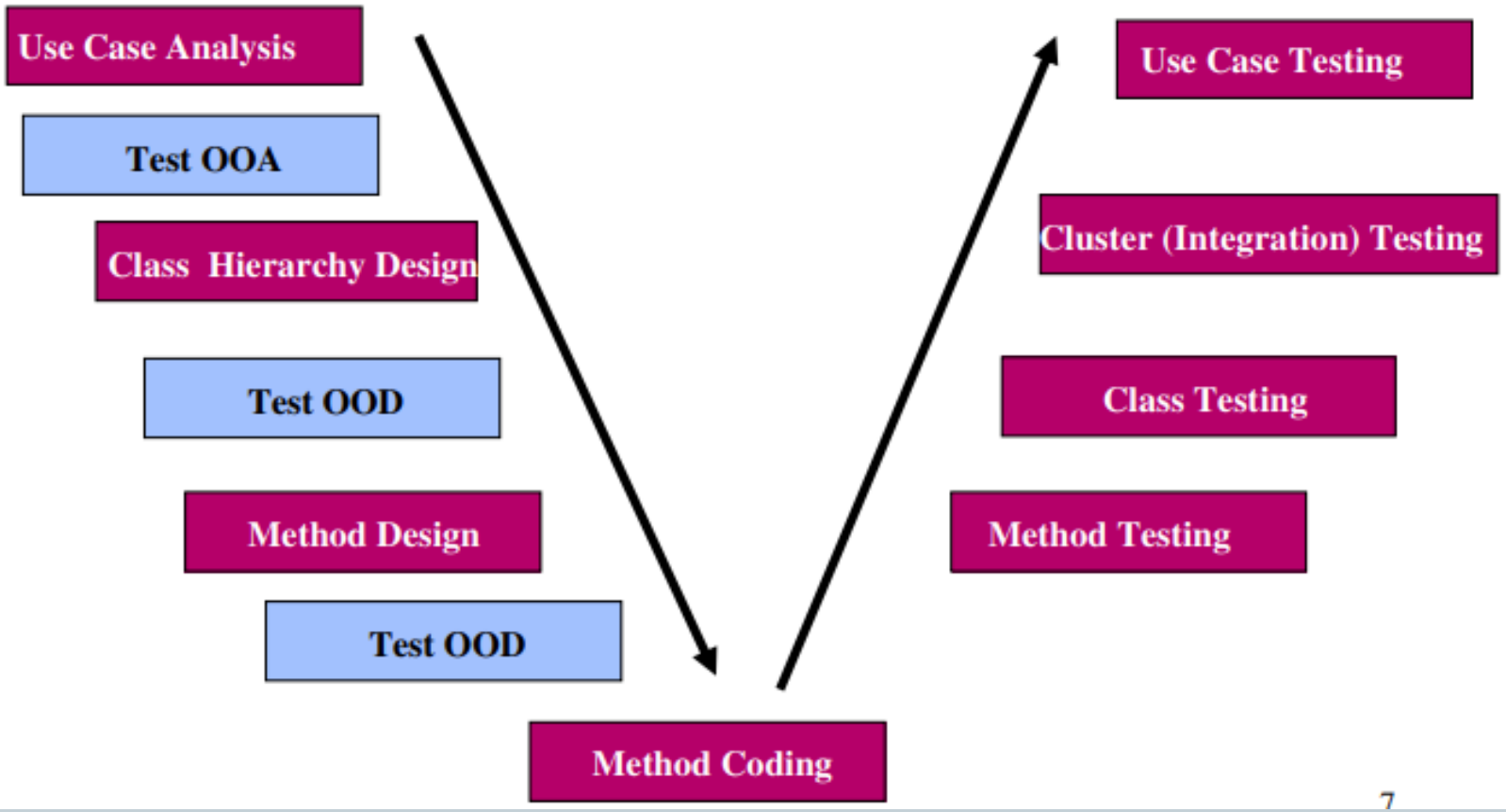
Testing OO Code



The Structured Testing Pyramid



The OO Testing Pyramid



CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Correctness of OOA and OOD Models

- The notation and syntax used to represent analysis and design models will be tied to the specific analysis and design method that is chosen for the project. Hence, syntactic correctness is judged on proper use of the symbology; each model is reviewed to ensure that proper modeling conventions have been maintained.
- During analysis and design, semantic correctness must be judged based on the model's conformance to the real world problem domain. If the model accurately reflects the real world (to a level of detail that is appropriate to the stage of development at which the model is reviewed), then it is semantically correct. To determine whether the model does, in fact, reflect the real world, it should be presented to problem domain experts, who will examine the class definitions and hierarchy for omissions and ambiguity. Class relationships (instance connections) are evaluated to determine whether they accurately reflect real world object connections.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Consistency of OOA and OOD Models

- The consistency of OOA and OOD models may be judged by "considering the relationships among entities in the model. An inconsistent model has representations in one part that are not correctly reflected in other portions of the model".

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

Consistency of OOA and OOD Models

- To assess consistency, each class and its connections to other classes should be examined. The **class-responsibility-collaboration** model and an object-relationship diagram can be used to facilitate this activity. The CRC model is composed on CRC index cards. Each CRC card lists the class name, its responsibilities (operations), and its collaborators (other classes to which it sends messages and on which it depends for the accomplishment of its responsibilities). The collaborations imply a series of relationships (i.e., connections) between classes of the OO system. The object-relationship model provides a graphic representation of the connections between classes. All of this information can be obtained from the OOA model .

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

To evaluate the class model the following steps have been recommended :

- **1. Revisit the CRC model and the object-relationship model.** Cross check to ensure that all collaborations implied by the OOA model are properly represented.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

To evaluate the class model the following steps have been recommended :

- **2. Inspect the description of each CRC index card to determine if a delegated responsibility is part of the collaborator's definition.** For example, consider a class defined for a point-of-sale checkout system, called credit sale. This class has a CRC index card illustrated in figure For this collection of classes and collaborations, we ask whether a responsibility (e.g., read credit card) is accomplished if delegated to the named collaborator (credit card). That is, does the class credit card have an operation that enables it to be read? In this case the answer is, "Yes." The object-relationship is traversed to ensure that all such connections are valid.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

To evaluate the class model the following steps have been recommended :

Class name: Credit sale	
Class type: Transaction event	
Class characteristics: Nontangible, atomic, sequential, permanent, guarded	
Responsibilities:	Collaborators:
Read credit card	Credit card
Get authorization	Credit authority
Post purchase amount	Product ticket
	Sales ledger
	Audit file
Generate bill	Bill

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

To evaluate the class model the following steps have been recommended :

- **3. Invert the connection to ensure that each collaborator that is asked for service is receiving requests from a reasonable source.** For example, if the credit card class receives a request for purchase amount from the credit sale class, there would be a problem. Credit card does not know the purchase amount.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

To evaluate the class model the following steps have been recommended :

- **4. Using the inverted connections examined in step 3, determine whether other classes might be required and whether responsibilities are properly grouped among the classes.**
- **5. Determine whether widely requested responsibilities might be combined into a single responsibility.** For example, read credit card and get authorization occur in every situation. They might be combined into a validate credit request responsibility that incorporates getting the credit card number and gaining authorization.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

To evaluate the class model the following steps have been recommended :

- **6. Steps 1 through 5 are applied iteratively to each class and through each evolution of the OOA model.**

Once the OOD model is created, reviews of the system design and the object design should also be conducted. The system design depicts the overall product architecture, the subsystems that compose the product, the manner in which subsystems are allocated to processors, the allocation of classes to subsystems, and the design of the user interface. The object model presents the details of each class and the messaging activities that are necessary to implement collaborations between classes.

CHITKARA UNIVERSITY
HIMACHAL PRADESH - NAAC Accredited

To evaluate the class model the following steps have been recommended :

- The system design is reviewed by examining the object-behavior model developed during OOA and mapping required system behavior against the subsystems designed to accomplish this behavior. Concurrency and task allocation are also reviewed within the context of system behavior. The behavioral states of the system are evaluated to determine which exist concurrently. Use-case scenarios are used to exercise the user interface design.

- The object model should be tested against the object-relationship network to ensure that all design objects contain the necessary attributes and operations to implement the collaborations defined for each CRC index card. In addition, the detailed specification of operation details (i.e., the algorithms that implement the operations) are reviewed using conventional inspection techniques.

CHITKARA UNIVERSITY

HIMACHAL PRADESH - NAAC Accredited

THANK YOU