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Internal Assessment Test 3 – September 2023

Sub:	Software Engineering							Sub Code:	22MCA23
Date:	26/09/2023	Duration:	90 min's	Max Marks:	50	Sem:	II	Branch	MCA

Note : Answer FIVE FULL Questions, choosing ONE full question from each Module

		MARKS	OBE	
			CO	RBT
	PART I			
1	What is System Modeling? Explain the different System Perspectives. **OR**	[10]	CO1	L1
2	a. What is design pattern? Explain four elements of design pattern. b. Explain Interaction and Behavioral Models	[10]	CO1	L1
	PART II			
3	Draw and explain the state machine model of simple microwave oven. **OR**	[10]	CO5	L3
4	Give the context of MHC-PMS and draw the class diagram for MHC-PMS.	[10]	CO5	L2
	PART III			
5	Draw a sequence diagram describing data collection of weather information system **OR**	[10]	CO5	L3
6	What is Model Driven Engineering? State the three types of abstract system models produced.	[10]	CO3	L2
	PART IV			
7	State and explain Development Testing and its three levels - unit testing, component testing and system testing **OR**	[10]	CO4	L2
8	Differentiate between a). Verification & Validation (b) Alpha & Beta testing	[10]	CO4	L2
	PART V			
9	With the help of neat diagram explain various stages of acceptance testing process. **OR**	[10]	CO3	L2
10	Define 'program evolution dynamics. Discuss Lehman's Law for program evolution dynamics.	[10]	CO3	L2

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Solution

1. What is System Modeling? Explain the different System Perspectives.

System modeling is the process of developing abstract models of a system, with each model presenting a different view or perspective of that system. It is about representing a system using some kind of graphical notation, which is now almost always based on notations in the **Unified Modeling Language** (**UML**). Models help the analyst to understand the functionality of the system; they are used to communicate with customers.

Models can explain the system from **different perspectives**:

- An **external** perspective, where you model the context or environment of the system.
- An **interaction** perspective, where you model the interactions between a system and its environment, or between the components of a system.
- A **structural** perspective, where you model the organization of a system or the structure of the data that is processed by the system.
- A **behavioral** perspective, where you model the dynamic behavior of the system and how it responds to events.

Five types of UML diagrams that are the most useful for system modeling:

- **Activity** diagrams, which show the activities involved in a process or in data processing.
- **Use case** diagrams, which show the interactions between a system and its environment.
- **Sequence** diagrams, which show interactions between actors and the system and between system components.
- **Class** diagrams, which show the object classes in the system and the associations between these classes.
- **State** diagrams, which show how the system reacts to internal and external events.

2. a. What is design pattern? Explain four elements of design pattern

The design pattern is a description of the problem and the essence of its solution, so that the solution may be reused in different settings.

→ The pattern is not a detailed specification.

→ Patterns and Pattern Languages are ways to describe best practices, good designs, and capture experience in a way that it is possible for others to reuse this experience.

→ Design patterns are usually associated with object-oriented design.

→ The general principle of encapsulating experience in a pattern is one that is equally applicable to any kind of software design

→ The four essential elements of design patterns were defined by the 'Gang of Four' in their patterns book:

- A name that is a meaningful reference to the pattern.
- A description of the problem area that explains when the pattern may be applied.

- A solution description of the parts of the design solution, their relationships, and their responsibilities. This is not a concrete design description. It is a template for a design solution that can be instantiated in different ways. This is often expressed graphically and shows the relationships between the objects and object classes in the solution.
- A statement of the consequences—the results and trade-offs—of applying the pattern. This can help designers understand whether or not a pattern can be used in a particular situation.

2. b. Explain Interaction and Behavioral Models

From the term Interaction, it is clear that the diagram is used to describe some type of interactions among the different elements in the model. This interaction is a part of dynamic behavior of the system.

This interactive behavior is represented in UML by two diagrams known as Sequence diagram and Collaboration diagram. The basic purpose of both the diagrams are similar.

Sequence diagram emphasizes on time sequence of messages and collaboration diagram emphasizes on the structural organization of the objects that send and receive messages.

Purpose of Interaction Diagrams

The purpose of interaction diagrams is to visualize the interactive behavior of the system. Visualizing the interaction is a difficult task. Hence, the solution is to use different types of models to capture the different aspects of the interaction.
Sequence and collaboration diagrams are used to capture the dynamic nature but from a different angle.
The purpose of interaction diagram is −

- To capture the dynamic behaviour of a system.
- To describe the message flow in the system.
- To describe the structural organization of the objects.
- To describe the interaction among objects.

Behavioral Model is specially designed to make us understand behavior and factors that influence behavior of a System. Behavior of a system is explained and represented with the help of a diagram. This diagram is known as State Transition Diagram. It is a collection of states and events. It usually describes overall states that a system can have and events which are responsible for a change in state of a system.
So, on some occurrence of a particular event, an action is taken and what action needs to be taken is represented by State Transition Diagram.

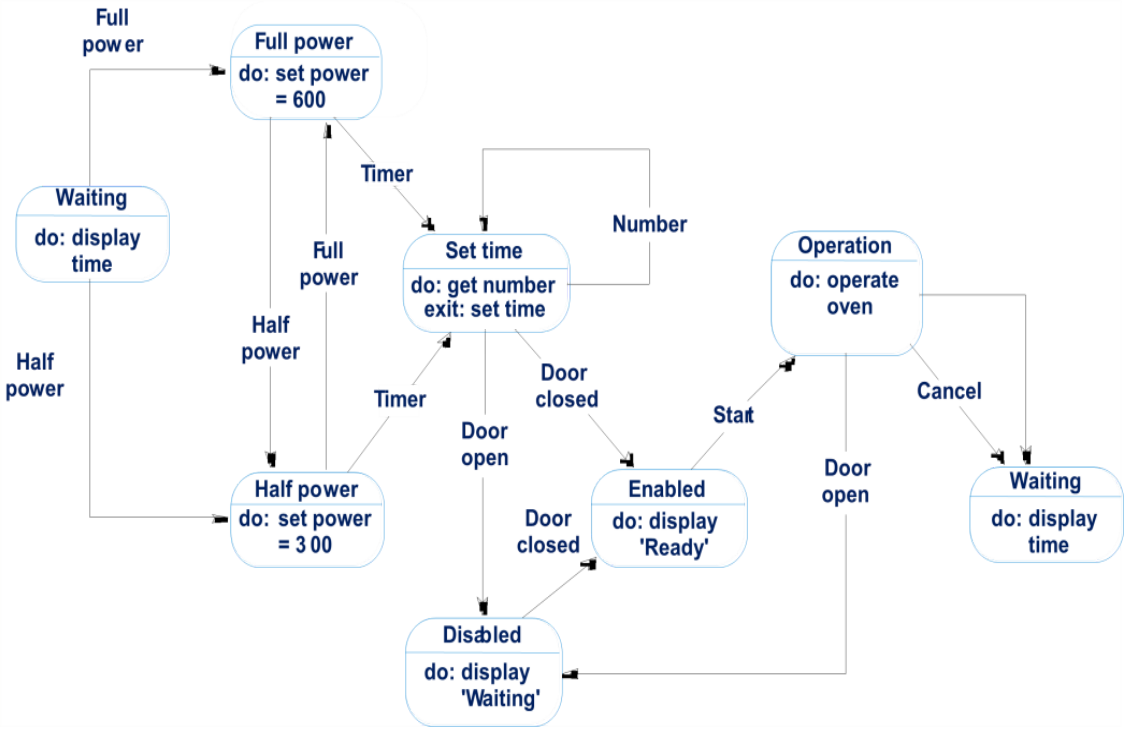
3. Draw and explain the state machine model of simple microwave oven

Microwave oven state table description

State	Description
Waiting	The oven is waiting for input. The display shows the current time.
Half power	The oven power is set to 300 watts. The display shows ‘Half power’.
Full power	The oven power is set to 600 watts. The display shows ‘Full power’.
Set time	The cooking time is set to the user’s input value. The display shows the cooking time selected and is updated as the time is set.
Disabled	Oven operation is disabled for safety. Interior oven light is on. Display shows ‘Not ready’.

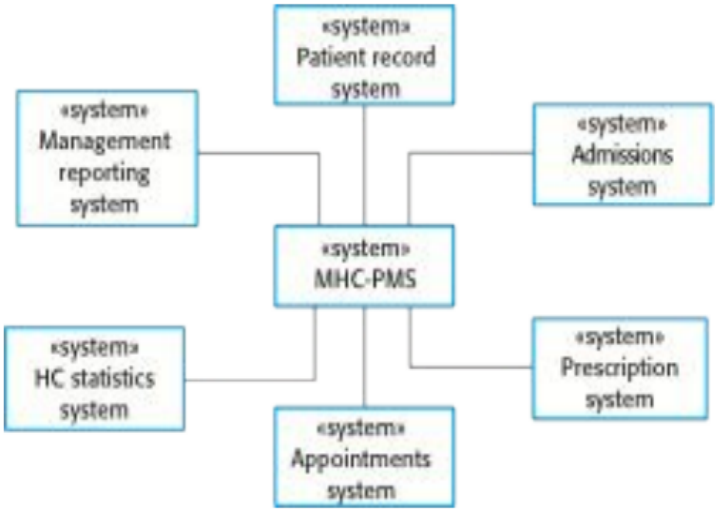
Enabled	Oven operation is enabled. Interior oven light is off. Display shows 'Ready to cook'.
Operation	Oven in operation. Interior oven light is on. Display shows the timer countdown. On completion of cooking, the buzzer is sounded for 5 seconds. Oven light is on. Display shows 'Cooking complete' while buzzer is sounding.

Microwave oven model (State diagram)

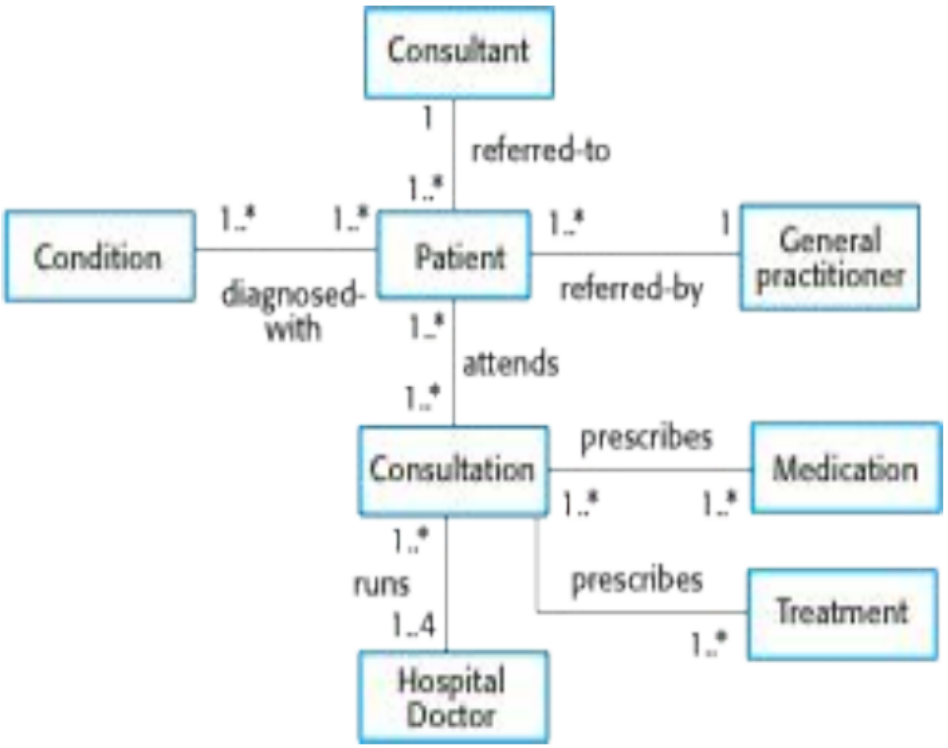


4. Give the context of MHC-PMS and draw the class diagram for MHC-PMS.

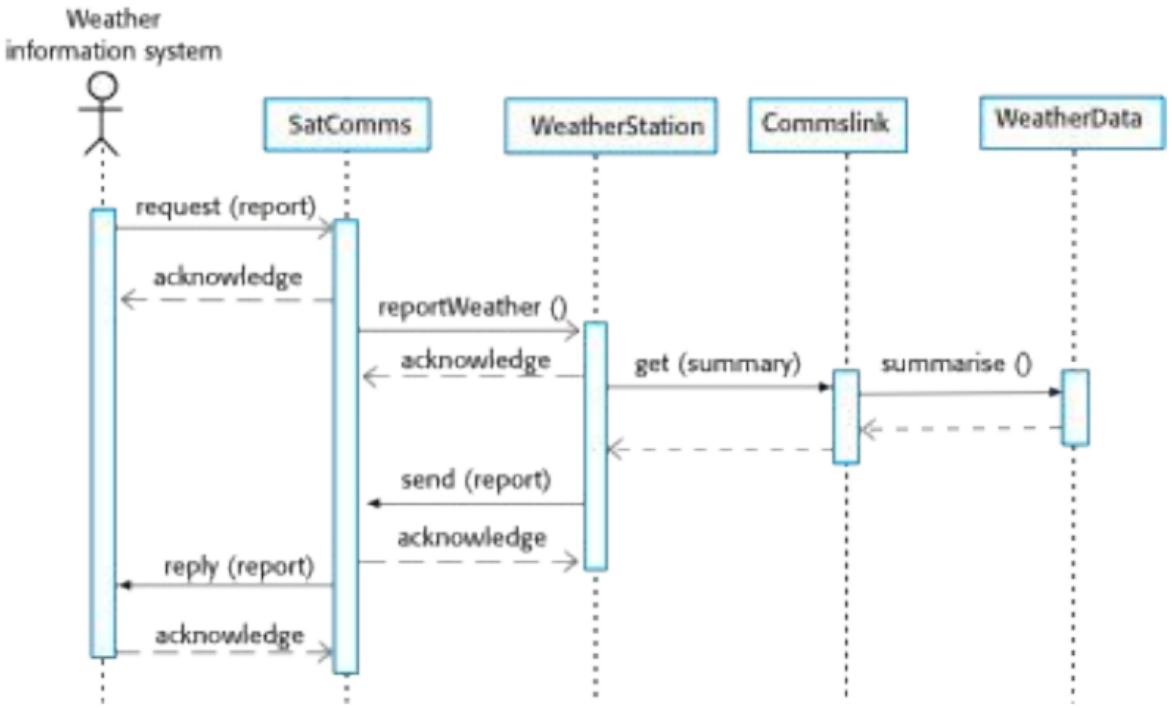
Context of MHC-PMS



Class Diagram



5. **Draw a sequence diagram describing data collection of weather information system**



6. What is Model Driven Engineering? State the three types of abstract system models produced.

- Model-driven engineering (**MDE**) is an approach of software development where **models** rather than programs are **the principal outputs** of the development process.
- The programs that are executed on a hardware/software platform are then **generated automatically** from the **models**.

MDA is a model-focused approach to software design and implementation that uses a subset of UML models to describe a system.
Models at different levels of abstraction are created. From a high-level, platform independent model, it is possible, in principle, to generate a working program without manual intervention.
Types of Models:

A computation independent model (CIM)

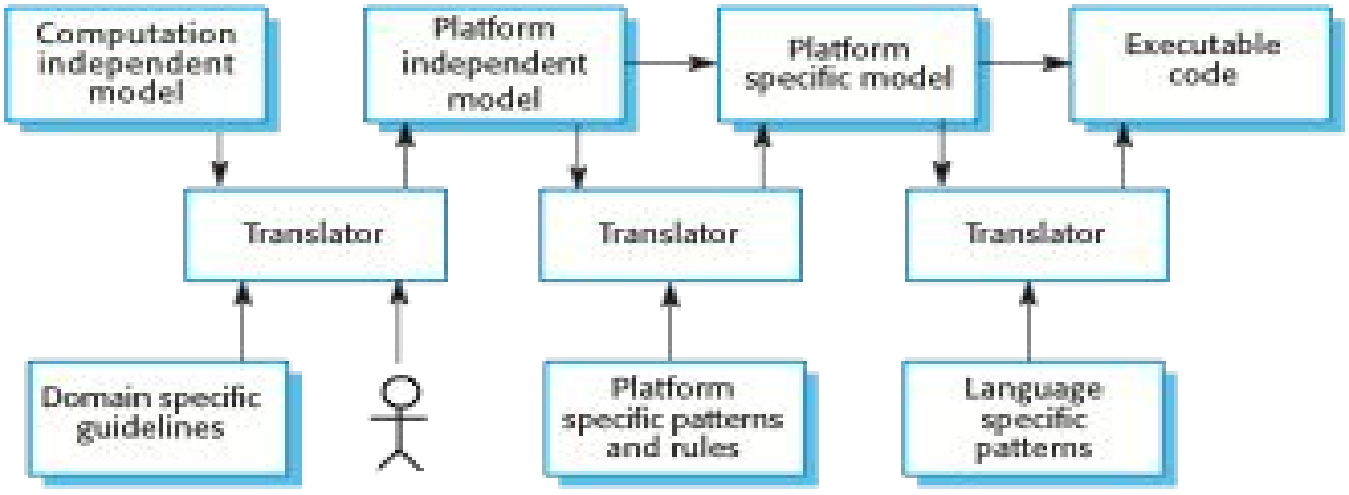
- These model the important domain abstractions used in a system. CIMs are sometimes called domain models.

  ✧ A platform independent model (PIM)

- These model the operation of the system without reference to its implementation. The PIM is usually described using UML models that show the static system structure and how it responds to external and internal events.

  ✧ *Platform specific models (PSM)*

- These are transformations of the platform-independent model with a separate PSM for each application platform. In principle, there may be layers of PSM, with each layer adding some platform-specific detail.



7. State and explain Development Testing and its three levels - unit testing, component testing and system testing

Development testing includes all testing activities that are carried out by the team developing the system.

The tester of the software is usually the programmer who developed that software, although this is not always the case.

1.Unit testing, where individual program units or object classes are tested. Unit testing should focus on testing the functionality of objects or methods.

2. Component testing, where several individual units are integrated to create composite components. Component testing should focus on testing component interfaces.

3. System testing, where some or all of the components in a system are integrated and the system is tested as a whole. System testing should focus on testing component interactions.

8. Differentiate between

a). Verification & Validation (b) Alpha & Beta testing

Verification	Validation
The verifying process includes checking documents, design, code, and program	It is a dynamic mechanism of testing and validating the actual product
It does not involve executing the code	It always involves executing the code
Verification uses methods like reviews, walkthroughs, inspections, and desk- checking etc.	It uses methods like Black Box Testing, White Box Testing, and non-functional testing
Whether the software conforms to specification is checked	It checks whether the software meets the requirements and expectations of a customer
It finds bugs early in the development cycle	It can find bugs that the verification process can not catch
Target is application and software architecture, specification, complete design, high level, and database design etc.	Target is an actual product
QA team does verification and make sure that the software is as per the requirement in the SRS document.	With the involvement of testing team validation is executed on software code.
It comes before validation	It comes after verification

Criterion	Alpha Testing	Beta Testing
Testers	Internal employees of the organization	A sample group of end-users who aren't part of organization
Environment	Takes place in a controlled or lab environment	Doesn't require any specific lab environment
Performed	Within the organization or at the developer's site	At the client's location or with end users
Time of testing	Before launching the product	At the time of product marketing
Validation	Checks for functionality, internal design, and system requirements	Checks for reliability and security in detail
Goals	Ensures product quality and design, making it ready for beta testing	Evaluate customer satisfaction for full release
Testing Type	Covers black-box and white-box testing	Covers black-box testing
Duration	Includes multiple test cycles, each for 1-2 weeks, varying with the number of issues	A few test cycles are required, depending on user's feedback
After testing	Developers immediately work on any identified issues or bugs	Feedback received is usually implemented as future versions of product

9. With the help of neat diagram explain various stages of 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

10. Define 'program evolution dynamics. Discuss Lehman's Law for program evolution dynamics.

Program evolution dynamics is the study of the processes of system change.After several major empirical studies, Lehman and Belady proposed that there were a number of 'laws'
which applied to all systems as they evolved.

Law	Description
Continuing change	A program that is used in a real-world environment must necessarily change, or else become progressively less useful in that environment.
Increasing complexity	As an evolving program changes, its structure tends to become more complex. Extra resources must be devoted to preserving and simplifying the structure.
Large program evolution	Program evolution is a self-regulating process. System attributes such as size, time between releases, and the number of reported errors is approximately invariant for each system release.
Organizational stability	Over a program's lifetime, its rate of development is approximately constant and independent of the resources devoted to system development.