

Software Modelling & Analysis
March 2023

Question 1

a) List FOUR (4) criteria need to analyze in order to understand the business, organization and its systems. (4 marks)

Ans:- Four criteria to analyze a business, organization, and its systems:

- 1. Business Objectives and Goals:** Understanding the primary objectives and long-term goals of the organization is crucial. This includes identifying profitability targets, growth plans, and any specific missions or visions.
- 2. Processes and Workflows:** Analyzing the existing business processes and workflows helps in identifying inefficiencies, bottlenecks, and areas for improvement. This includes mapping out how tasks are performed and who is responsible for each step.
- 3. Technology Infrastructure:** Evaluating the organization's technology stack, including hardware, software, and networking, is essential. This helps in understanding the capabilities and limitations of the current IT infrastructure.
- 4. Stakeholders and Users:** Identifying and categorizing all stakeholders and users, such as employees, customers, suppliers, and regulatory bodies, is crucial. Understanding their needs and expectations is essential for system design.

b) State any FIVE (5) functional specifications in requirements engineering. (5 marks)

Ans:- Five functional specifications in requirements engineering:

- 1. User Authentication:** Specifies how users will be authenticated and authorized within the system, including login procedures, password policies, and access controls.
- 2. Data Input and Validation:** Describes how data is captured and validated, including data entry forms, input formats, and validation rules to ensure data integrity.
- 3. Reporting and Analytics:** Defines the types of reports and analytics that the system should provide, including data visualization, dashboards, and export capabilities.
- 4. Integration with External Systems:** Specifies how the system will interact with external systems or APIs, including data exchange formats, protocols, and error handling procedures.

5. Security and Privacy: Outlines security requirements, such as encryption, data protection, and compliance with relevant privacy regulations, to ensure the system's security and privacy.

c) Explain TWO (2) types of requirements. (6 marks)

Ans:- Two types of requirements:

1. Functional Requirements: These describe what the system should do, including its features, capabilities, and interactions. Functional requirements outline the specific behaviors and functions that the system must perform. For example, a functional requirement for an e-commerce website could be "Allow users to add products to their shopping cart."

2. Non-Functional Requirements: These specify the qualities and characteristics that the system should possess but are not directly related to its functionality. Non-functional requirements address aspects like performance, scalability, security, and usability. For example, a non-functional requirement could be "The website should load pages in less than two seconds."

d) Discuss the questionnaire fact finding method in requirements engineering. (10 marks)

Ans:- Questionnaire Fact-Finding Method in Requirements Engineering:

A questionnaire is a systematic method of gathering information from stakeholders to collect requirements. Here's a discussion of the questionnaire fact-finding method:

Questionnaires involve creating a set of structured questions that are distributed to relevant stakeholders. The process typically includes the following steps:

1. Questionnaire Design: Develop a well-structured questionnaire with clear, concise, and unambiguous questions. Questions should be designed to extract specific information about the system's requirements.

2. Distribution: Distribute the questionnaire to stakeholders, which may include end-users, managers, subject matter experts, and other relevant individuals. It can be distributed electronically or in print, depending on the audience.

3. Collection: Collect the completed questionnaires from respondents. Ensure that responses are anonymous if needed to encourage honest feedback.

4. Data Analysis: Analyze the responses to identify common themes, requirements, and priorities. Quantitative data can be analyzed statistically, while qualitative data may require categorization and interpretation.

5. Validation: Review the gathered requirements with stakeholders to validate and refine them. This step helps ensure that the requirements accurately reflect the needs and expectations of the organization.

6. Documentation: Document the finalized requirements derived from the questionnaire responses. These requirements serve as the basis for system design and development.

ASSIGNWISE

Question 2

a) Describe the concept of object-orientation. (5 marks)

Ans:- Object-orientation is a programming and software design paradigm that is based on the concept of "objects." Objects are self-contained units that encapsulate data and behavior. The core principles of object-orientation include:

- **Encapsulation:** Objects hide their internal state and expose a well-defined interface for interacting with them. This helps in managing complexity and allows for information hiding.
- **Inheritance:** Objects can inherit attributes and behaviors from other objects, creating a hierarchical relationship. Inheritance promotes code reuse and establishes a "is-a" relationship between objects.
- **Polymorphism:** Polymorphism allows objects of different classes to be treated as instances of a common base class. This enables dynamic method invocation and flexibility in the use of objects.
- **Abstraction:** Abstraction involves simplifying complex systems by modeling them at a higher level of abstraction. Classes and objects are abstractions that represent real-world entities and their interactions.
- **Modularity:** Object-oriented systems are modular, meaning they can be divided into smaller, manageable units (objects and classes). This promotes code organization and maintainability.

b) Explain with example the object representation. (10 marks)

Object representation refers to how objects or entities are mentally organized and stored in our minds. It's a fundamental cognitive process that helps us recognize, understand, and interact with the world around us. There are different theories and models in psychology that attempt to explain how object representation works. One widely accepted theory is the prototype theory, which suggests that we form mental prototypes or abstract representations of objects based on our experiences and categorize new objects by comparing them to these prototypes.

Example: Object Representation of a "Bird"

Imagine you have never seen a bird before, and someone is describing a bird to you. They might say, "A bird is a small, feathered creature with wings that can fly." Based on this description, your brain starts to form a mental representation or prototype of a bird.

1. Prototype Formation: Your prototype of a bird might include key features like feathers, wings, small size, and the ability to fly. These are the defining characteristics you associate with the concept of a bird.

2. Categorization: As you encounter different birds in your life, your brain categorizes them as birds by comparing their features to your prototype. For example, when you see a robin, you recognize it as a bird because it has feathers, wings, and can fly, which match your prototype.

3. Variations: Your mental representation of a bird can accommodate variations. For instance, you encounter a penguin, which doesn't fly but still has feathers and wings (used for swimming). Your brain can adapt its prototype to include non-flying birds.

4. Inferences: Object representation also involves making inferences. If someone mentions a "bald eagle" and you know that eagles are a type of bird, you can infer that a bald eagle fits within your bird prototype, even if you've never seen one before.

5. Recognition: When you see a new bird you've never encountered, your brain quickly checks its features against your bird prototype. If the bird possesses the essential features, you recognize it as a bird.

c) Describe FIVE (5) functions and symbols for data dictionary notation. (5 marks)

Ans:- Data dictionary notation is used to describe data elements and their characteristics in a structured manner. Here are five common functions and symbols used in data dictionary notation:

1. Data Element Name: This is the name or identifier for a specific data element. It should be unique and descriptive.

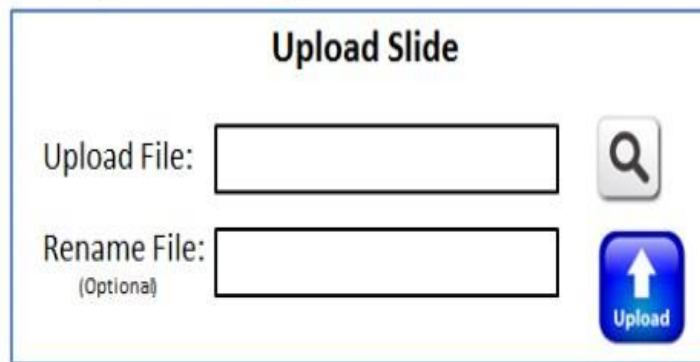
2. Data Type: Indicates the type of data that the element can store, such as text, numeric, date, or boolean. Common data type symbols include "T" for text and "N" for numeric.

3. Data Length: Represents the maximum length or size of the data element. It is often denoted as "L" followed by a number, e.g., L20 for a data element with a maximum length of 20 characters.

4. Data Format: Specifies the format or pattern that the data element should follow. For example, "D" may indicate a date format, and "999-99-9999" may specify the format for a social security number.

5. Data Description: Provides a detailed description of the data element, including its purpose, usage, and any additional notes or constraints. It is typically represented as a text description.

d) Write the data dictionary notations for Figure 1.



The image shows a web form titled "Upload Slide". It contains two text input fields. The first field is labeled "Upload File:" and has a magnifying glass icon to its right. The second field is labeled "Rename File:" with "(Optional)" written below it, and has a blue button with an upward arrow and the word "Upload" to its right.

Figure 1: Upload Slide

(5 marks)

Model Answer

Form Title = "Upload Slide"

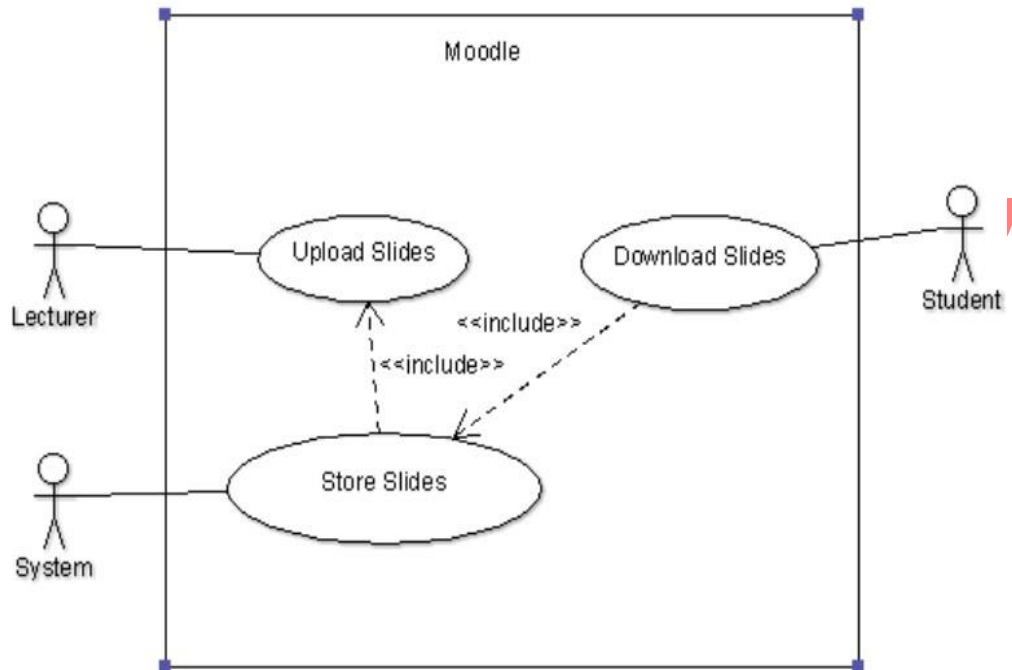
Upload = Upload File + (Rename File)

ASSIGNMENT

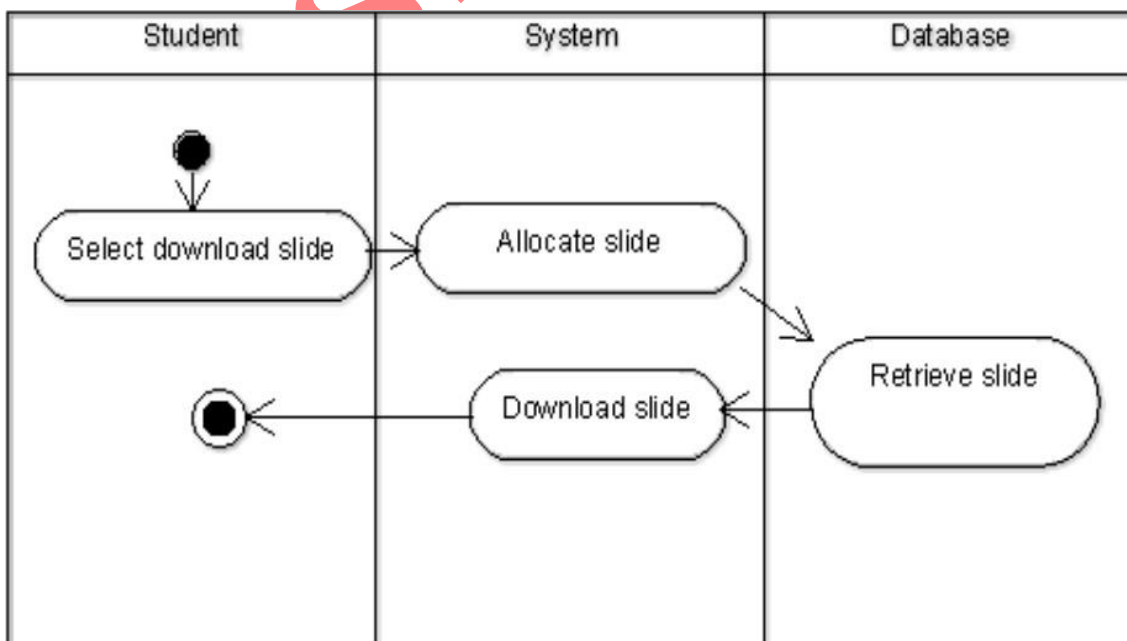
Question 3

a) Model a use case diagram demonstrating Moodle, where a lecturer can upload the slides, which will be stored in the system. The students may then download the slides. (13 marks)

Ans:-



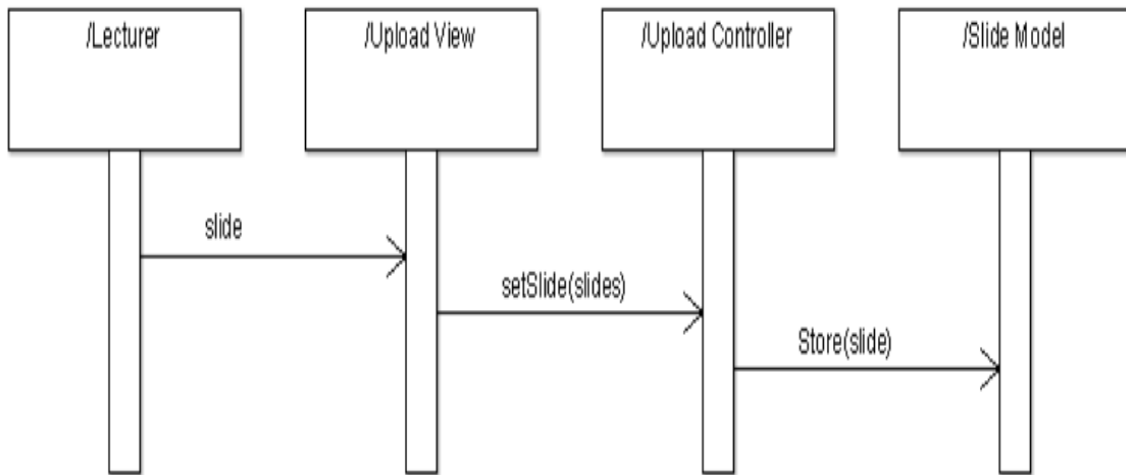
b) Model an activity diagram demonstrating a student downloading the slides from the Moodle. (12 marks)



Question 4

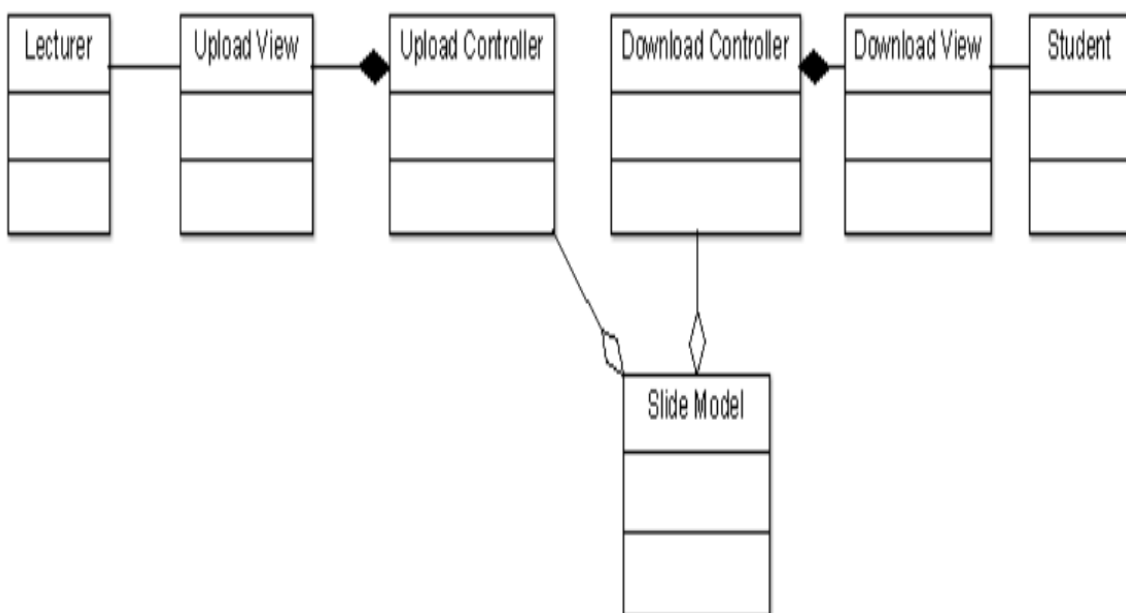
a) Model a sequence diagram demonstrating a lecturer uploading the slides into the Moodle. (7 marks)

Ans:-



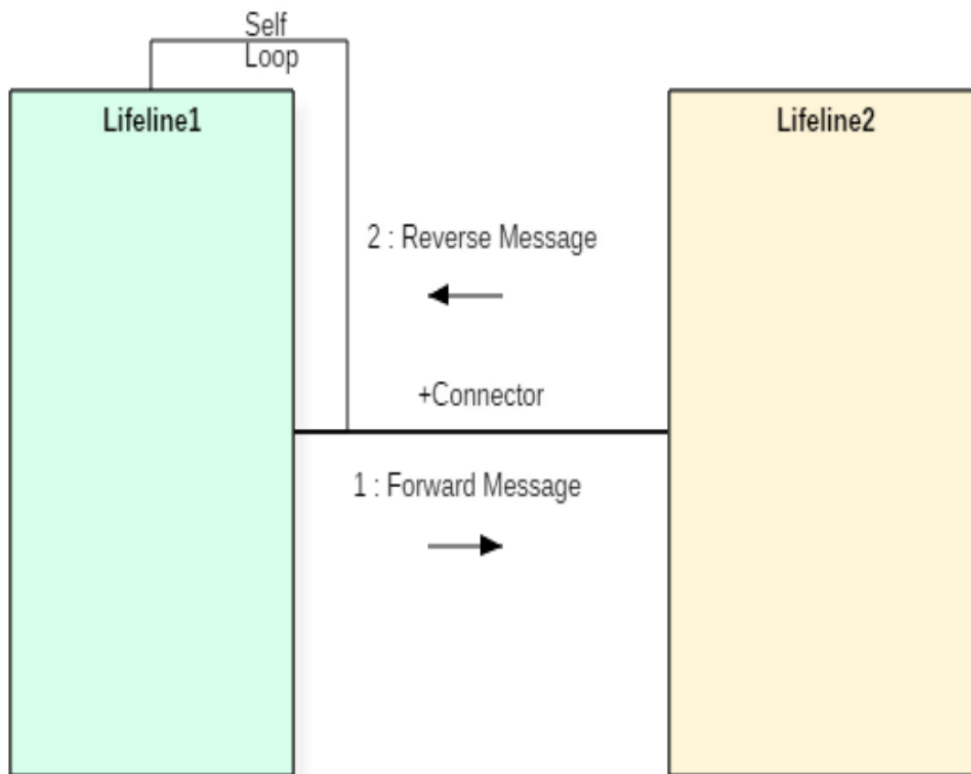
b) Draw a simplified class diagram demonstrating the Moodle where a lecturer can upload the slides, which will be stored in the system. The students may then download the slides. (10 marks)

Ans:-



c) Model any ONE (1) example for each collaboration diagram and state transition diagram. (8 marks)

Ans:- A state transition diagram is a visual representation that illustrates the various states an entity or system can exist in, as well as the transitions or events that cause it to change from one state to another.



ASSIST