

Software Modelling & Analysis
May 2022

SECTION A (50 MARKS)

Q.NO. 1.

a. What is a requirement? Explain your answer.

Ans:- A requirement is a documented statement of a need, constraint, or condition that must be satisfied by a system, product, or project. Requirements serve as a bridge between the stakeholders' expectations and the design and development process. They define what a system or project is supposed to accomplish, how it should behave, and what its constraints and quality attributes are. Requirements can encompass various aspects, including functionality, performance, usability, security, and more.

b. Discuss how you can gather requirements in the project.

Ans:- Gathering requirements in a project is a crucial phase in requirement engineering, as it lays the foundation for the entire project.

Here are some methods and techniques for gathering requirements:

i. Stakeholder Interviews: Conduct one-on-one or group interviews with stakeholders, including end-users, clients, subject matter experts, and project managers. These interviews help in understanding their needs, expectations, and concerns.

ii. Surveys and Questionnaires: Distribute surveys and questionnaires to a larger group of stakeholders to collect structured feedback and data about their requirements.

iii. Workshops and Focus Groups: Organize workshops or focus groups with relevant stakeholders to facilitate discussions, brainstorming, and idea generation regarding project requirements.

iv. Document Analysis: Review existing documentation, such as business documents, user manuals, and system specifications, to extract valuable requirements information.

v. Observation: Observe users and system interactions in their natural environment to gain insights into their workflow and needs.

vi. Prototyping: Create low-fidelity or high-fidelity prototypes to visually demonstrate system functionality and gather feedback from stakeholders.

c. Explain with examples TWO (2) Functional Requirements and TWO (2) Non Functional Requirements.

Ans:-

Functional Requirements (FRs)

1. User Authentication (FR):- The system must provide a secure login mechanism that requires users to enter a valid username and password to access their accounts.

2. Inventory Management (FR):- The system must allow users to add, edit, and delete items in an online store's inventory. Users should also be able to view product details, such as price and availability.

Non-Functional Requirements (NFRs)

1. Performance (NFR):- The system must be able to handle a minimum of 100 concurrent users during peak hours without experiencing performance degradation. Response times for user actions should be less than 2 seconds.

2. Security (NFR):- The system must implement encryption for user data during transmission and storage. It should also enforce role-based access control to restrict unauthorized access to sensitive information.

d. Define a feasibility study in requirement engineering.

Ans:- A feasibility study is a crucial step in requirement engineering that assesses the viability and practicality of a proposed project or system. It aims to determine whether the project can be completed successfully within constraints such as time, budget, and available resources. The main objectives of a feasibility study are to evaluate technical, operational, economic, and scheduling aspects. It helps stakeholders make informed decisions about whether to proceed with a project or not.

e. What is risk analysis? Give TWO (2) examples of risk factors.

Ans:- Risk analysis is the process of identifying, assessing, and prioritizing potential risks or uncertainties that could affect the success of a project or the performance of a system. It involves analyzing the likelihood and impact of various risks and developing strategies to mitigate or manage them.

Here are two examples of risk factors:-

1. Technical Risk:- This type of risk involves uncertainties related to technology and development processes. For example, a technical risk in software development could be the uncertainty surrounding the compatibility of a new software module with existing infrastructure.

2. Market Risk:- Market risks pertain to uncertainties in the market conditions, such as changing customer preferences or economic fluctuations. For instance, a market risk for a retail business might be a sudden drop in consumer demand due to a recession.

ASSIGNMENT

Q.NO. 2.

a. Describe the process of how server delivers services to clients in client-server architecture.

Ans:- In client-server architecture, the process of delivering services to clients involves the following steps:

1. Client sends a request:- The client initiates communication by sending a request to the server. This request typically specifies the service or data it needs.

2. Server processes the request:- The server receives the request and processes it according to the requested service. This may involve accessing databases, performing calculations, or executing specific functions.

3. Server sends a response:- Once the server has processed the request, it sends a response back to the client. The response contains the requested data or the result of the requested service.

4. Client receives and handles the response:- The client receives the response and processes it, which may involve displaying data to the user or taking further actions based on the response.

b. Explain THREE (3) benefits of Unified Modeling Language (UML) modeling.

Ans:- Three benefits of Unified Modeling Language (UML) modeling are:

1. Communication:- UML provides a common visual language that allows stakeholders, including developers, designers, and non-technical team members, to communicate and understand the system's structure and behavior more effectively. This reduces ambiguity and ensures everyone is on the same page.

2. Visualization:- UML diagrams offer a visual representation of a system's architecture, components, and interactions. This visual representation makes it easier to grasp complex systems, identify potential design flaws, and make informed decisions about system design and modifications.

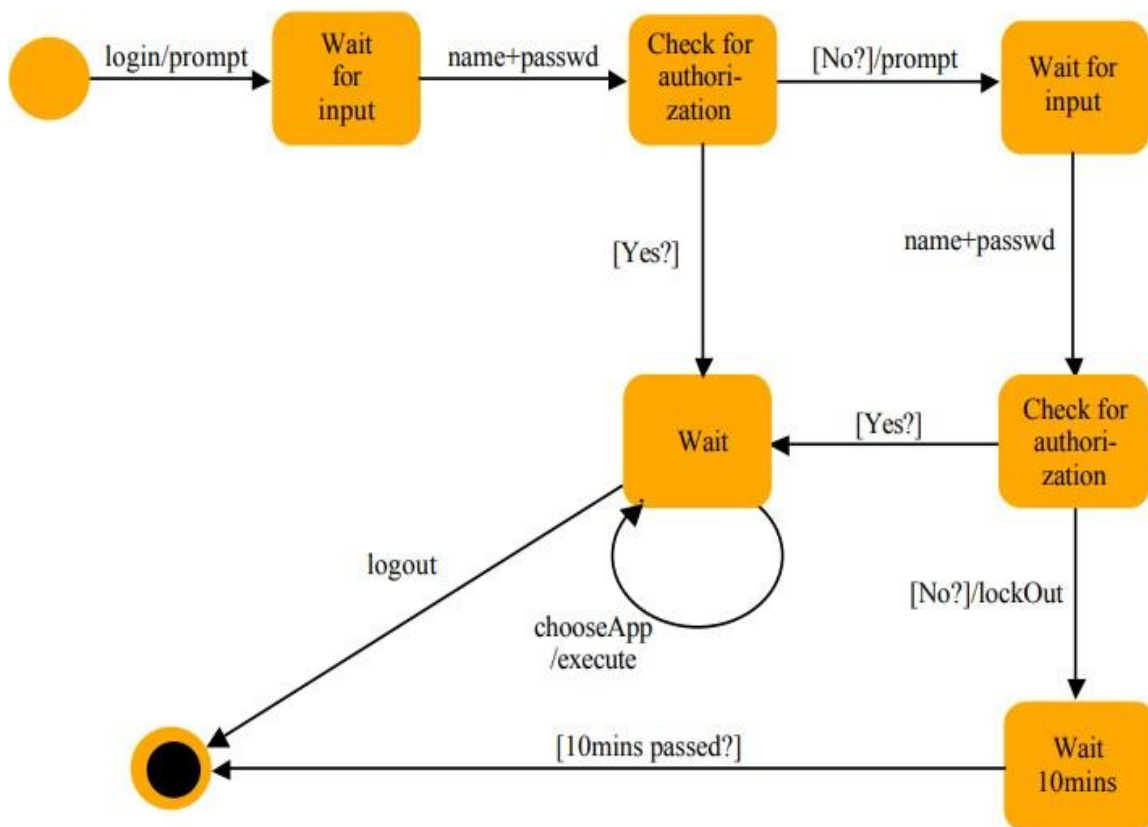
3. Design and Analysis: UML modeling facilitates the design and analysis of software systems before actual implementation. It helps in identifying potential issues, refining system architecture, and making design decisions early in the development process, reducing the cost and effort required to rectify issues later.

c. Draw a state machine diagram for the following scenario:

System ABC prompts the user name and password when the user clicks on a login button to checks that the user has authorization and logs the user in. If there is a problem with the name or password, the user is given one more chance to enter a valid name and password, otherwise the login program goes into a 5-minute time-out, then returns to idle mode. While the user is logged in, the user is allowed to execute different applications by clicking on appropriate buttons. The session terminates when the user clicks the log out button.

Ans:-

4. [User Interfaces; 15 marks] Draw a state diagram that specifies the dialogue structure of a login session. The session begins when the user clicks on a login button. Then the system prompts the user for her name and password, checks that the user has authorization and logs the user in. If there is a problem with the name or password, the user is given one more chance to input a valid name and password, otherwise the login program goes into a 10-minute time-out, then returns to idle mode. While the user is logged in, she is allowed to execute different applications by clicking on appropriate buttons. When the user clicks the “log out” button, the session terminates.



It is OK to loop back to the start state instead of an end state.

SECTION B (50 MARKS)

1. Case Study: Jail Prisoner System (JPS)

Read the following Jail Prisoner System functional requirement and answer the question.

A penal centre has been built outside the town of X, for keeping prisoners convicted of only one offense or of white collar crimes. The prison facility has a constant flow of prisoners into and out of the prison. They are also moving prisoners within the prison based on their good behaviour. On a day to day basis, approximately 120 prisoner changes take place. The changes are processed in the prison control centre office by Mr. Azlan. Each day, the new prisoner processing division receives the new prisoners, conducts a physical examination, assigns the prisoners to living quarters and sends the information file on the new prisoners to Mr. Azlan's office. Mr. Azlan adds information on the new prisoner to a prisoner information database kept on her PC. He also updates his prisoner locator log which keeps records of where each prisoner resides. Finally, he files the actual folder away in an enormous storehouse of file cabinets which contains information on all prisoners who have ever stayed at X. If a new prisoner is found to have been a previous occupant of X, he consolidates both files.

As prisoners stay in X, the officials review their behaviour record. Good behaviour or closeness to release time warrant an upgrade in accommodations, usually to minimum security housing. Movement of prisoners to new quarters is done on a weekly basis. Orders are issued to move the prisoners and the move information is sent to Mr. Azlan. He makes these changes in his prisoner locator log and her prisoner information database. He also pulls the prisoners long terms file and notes good behavior commendations.

A release review and parole board reviews prisoner records on a daily basis and generates a set of prisoners to be released either into the custody of a parole officer or without any restrictions. They notify the prisoner and send an update of the release to Mr. Azlan's office. He removes the prisoner from his prisoner information database and prisoner locator log and updates the long-term file of the prisoner to reflect the release.

i. Draw the Context Level Diagram for the Jail Prisoner System.

ii. Draw the Level 0 Data Flow Diagram for the Jail Prisoner System.

2. Case Study: Millenium Car Transport Services Company For Question 2 (i) and (ii)

Read the Millenium Car Transport Services Company case study and answer the questions.

The Millenium Car Transport Services Company runs a car service that carries passengers to and from the Kuala Lumpur International Airport (KLIA, Malaysia) to their homes or places of business. They maintain a database of customers on a PC in order to schedule pickups and also to keep their customers from having to repeat address information each time they call the car service. The database for the customers is accessed by customer telephone number. If a customer is picked up sometimes at their home and sometimes at their office, both home and office telephone numbers and addresses are stored in the database. The customer may also schedule a pickup from the airport when his or her flight arrives or may call from the airport and reserve a car which will come in approximately five to ten minutes.

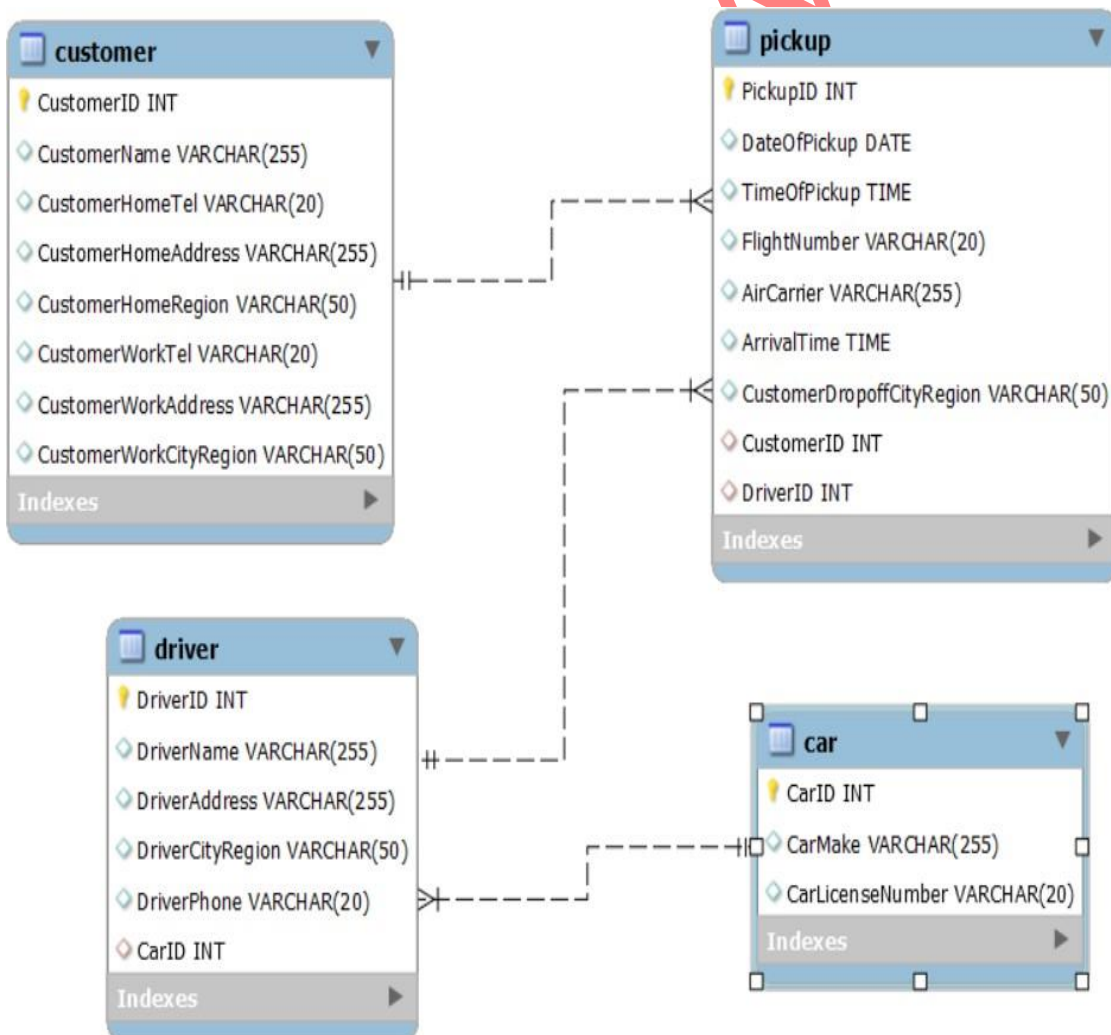
When a request for a pickup comes in, the dispatcher checks for available drivers, calls one and assigns them to a customer. Typically cars are assigned to the driver each workday and often a driver will take a car home for an early morning pickup if needed.

The relevant customer and driver attributes kept in the database for managing the customer pickup and delivery is as follows:

Customer Name
Customer Home Telephone Number
Customer Home Address
Customer Home Region
Customer Work Telephone Number
Customer Work Address
Customer Work City Region
Date of Pickup
Time of Pickup
Driver assigned to Pickup
Pickup Information
Flight Number
Air Carrier

Arrival Time
 Customer Drop-off City Region
 Driver ID
 Driver Name
 Driver Address
 Driver City Region
 Driver Phone Number
 Car ID
 Car Make
 Car License Number

i. Draw a normalized ER diagram that captures the meaning of the data shown above. Specify the cardinalities, attributes and keys of each entity and relationship of your diagram.



Relationships:

1. Customer-Pickup (1 to Many):

- Each customer can have multiple pickups.
- Each pickup is associated with one customer.
- Foreign Key: CustomerID (in Pickup entity).

2. Pickup-Driver (Many to 1):

- Each pickup is assigned to one driver.
- Each driver can be associated with multiple pickups.
- Foreign Key: DriverID (in Pickup entity).

3. Driver-Car (1 to 1):

- Each driver is associated with one car.
- Each car is assigned to one driver.
- Foreign Key: CarID (in Driver entity).

ii. The current interface used by clerical staff for data entry for this car database is line-based. Your customer wants to redesign this interface to improve productivity and lower data entry error rates which are currently quite high.

Describe FIVE (5) important qualities that meet by the customer satisfaction and current interface users to help you decide on a design.

Ans:-

1. Usability: The redesigned interface should be user-friendly and intuitive. Users, including clerical staff, should be able to navigate and perform data entry tasks with ease. The interface should minimize the learning curve and ensure that users can efficiently input data without confusion or errors.

2. Efficiency: The new interface should significantly improve productivity by streamlining data entry processes. It should reduce the time required to enter customer and driver information, assign drivers to pickups, and update records. Faster data entry can lead to quicker response times for customer requests.

3. Accuracy: High data entry error rates are a concern, so the new interface should incorporate features that enhance data accuracy. This may include validation checks, auto-population of common fields, and error prompts to correct

inaccuracies before they become significant issues. Ensuring data accuracy is crucial for customer satisfaction and operational efficiency.

4. Accessibility: The interface should be accessible to all relevant users, including those with disabilities. It should adhere to accessibility standards, such as WCAG (Web Content Accessibility Guidelines), to ensure that individuals with varying abilities can use the system effectively. This inclusivity will demonstrate the company's commitment to customer service.

5. Integration: The new interface should seamlessly integrate with other systems or software used by the company. This includes any scheduling or dispatch systems, customer communication tools, and reporting platforms. Integration ensures data consistency across various company functions and enhances overall operational efficiency.

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