

Software Engineering Lab

ETMA 252

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MAHARAJA AGRASEN INSTITUTE OF TECHNOLOGY

COMPUTER SCIENCE & ENGINEERING DEPARTMENT

VISION

To Produce “Critical thinkers of Innovative Technology”

MISSION

To provide an excellent learning environment across the computer science discipline to inculcate professional behavior, strong ethical values, innovative research capabilities and leadership abilities which enable them to become successful entrepreneurs in this globalized world.

1. To nurture an **excellent learning environment** that helps students to enhance their problem solving skills and to prepare students to be lifelong learners by offering a solid theoretical foundation with applied computing experiences and educating them about their **professional, and ethical responsibilities**.
2. To establish **Industry-Institute Interaction**, making students ready for the industrial environment and be successful in their professional lives.
3. To promote **research activities** in the emerging areas of technology convergence.
4. To build engineers who can look into technical aspects of an engineering solution thereby setting a ground for producing successful **entrepreneur**.

VISION

To nurture young minds in a learning environment of high academic value and imbibe spiritual and ethical values with technological and management competence.

MISSION

The Institute shall endeavor to incorporate the following basic missions in the teaching methodology:

Engineering Hardware - Software Symbiosis

Practical exercises in all Engineering and Management disciplines shall be carried out by Hardware equipment as well as the related software enabling deeper understanding of basic concepts and encouraging inquisitive nature.

Life - Long Learning

The Institute strives to match technological advancements and encourage students to keep updating their knowledge for enhancing their skills and inculcating their habit of continuous learning.

Liberalization and Globalization

The Institute endeavors to enhance technical and management skills of students so that they are intellectually capable and competent professionals with Industrial Aptitude to face the challenges of globalization.

Diversification

The Engineering, Technology and Management disciplines have diverse fields of studies with different attributes. The aim is to create a synergy of the above attributes by encouraging analytical thinking.

Digitization of Learning Processes

The Institute provides seamless opportunities for innovative learning in all Engineering and Management disciplines through digitization of learning processes using analysis, synthesis, simulation, graphics, tutorials and related tools to create a platform for multi-disciplinary approach.



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Software Engineering Lab

Aim

Write down the problem statement for a suggested system of relevance.

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4C7

EXPERIMENT – 1

Aim:

Write down the problem statement for a suggested system of relevance.

Theory:

The problem statement is the initial starting point for a project. It is basically a one to three-page statement that everyone on the project agrees with that describes what will be done at a high level. The problem statement is intended for a broad audience and should be written in non-technical terms. It helps the non-technical and technical personnel communicate by providing a description of a problem. It doesn't describe the solution to the problem.

The input to requirement engineering is the problem statement prepared by customer.

It may give an overview of the existing system along with broad expectations from the new system.

The first phase of requirements engineering begins with requirements elicitation i.e., gathering of information about requirements. Here, requirements are identified with the help of customer and existing system processes. So, from here begins the preparation of problem statement.

So, basically a problem statement describes **what** needs to be done without describing **how**.

Performance Instruction:

1. Choose any one project from given list.
2. Collect all requirements
3. Identify functionalities
4. Write a one to three-page statement that everyone on the project agree with that describes what will be done at a high level.

Output:

PROBLEM STATEMENT FOR B2C SYSTEM

This would be a B2C System with 3 interfaces: an interface of an individual seller or small business an interface of a customer, and an efficient delivery system.

Current B2B systems don't support intermediary help for product delivery or transfer so we would provide aid for the same. This would also create revenue and employee opportunities

We aim at automating many operations performed at delivering the item to the customer. In many b2c services that already exist trade is carried out entirely at personal levels, with the risks of leaking of personal information and product not reaching the customer.

This can be solved if the seller uses one of the partner courier's services. The seller can fill up an online request with all the details for their parcel, get the parcel picked up at home get the cost of the delivery instantly when the pickup person arrives and a tracking ID is shared with both the seller and customer. A feedback system can also be implemented on both the sender and receiver end.

Features

1. **E-commerce website (Interface for the customer):** where the seller could decide what they want to buy.
2. **Interface for Seller:** This module allows the seller to put up their product's ad on the market.
3. **Personalized Delivery System:** This module allows the seller and customer to use the generated Tracking ID to track the current status of the product.
4. **Login Process:** This module allows valid customers to access the functionalities.
5. **Product Enquiry:** This module maintains the product details of a particular product.

6. **Update Products:** This module allows the customer to update the product status of their previous products they uploaded for sale.
7. **Product adds:** This module allows the customers to add products they want to sell.
8. **Update profile:** This module allows customers to change their password/ profile/ location/ details and verify contact details.
9. **Deals:** This module allows customers to view the details of their products and browse to view someone else's.

Viva Questions

1. What is problem statement?

Ans.

A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. It identifies the gap between the current (problem) state and desired (goal) state of a process or product. The first condition of solving a problem is understanding the problem, which can be done by way of a problem statement.

2. What are the benefits of writing problem statement?

Ans.

A problem statement is basically a statement that illustrates a clear vision and the overall method that will be used to solve the problem at hand. Usually used when doing research, a problem statement discusses any foreseeable tangible or intangible problems that the researcher may face throughout the course of the project.

3. Writing a problem statement, is really a beneficial for you in proceeding project?

Ans.

Yes, writing a problem statement should help in careful decision-making for project approval. Often, the problem statement will serve as the basis for the introductory section of a final proposal, directing the reader's attention to the issues that your proposed project will address.

4. Explain 5W's can be used to spark the problem?

Ans.

The Five 'W's are questions whose answers are considered basic in problem solving and information gathering. They are:

- Who
- What
- When
- Where
- Why

The 5 'W's can be used to spark the discussion about the problem. A problem statement expresses the words that will be used to keep the effort focused and it should represent a solvable problem.

5. What are steps that need to follow while writing problem statement?

Ans.

Steps that we need to follow while writing problem statement are:

1. Define the problem.
2. Reason for the problem's occurrence.
3. When the problem began or was first noticed.
4. Place of the problem's first occurrence or sighting.
5. The person or thing that the problem affects.
6. The sequence of events that resulted in the problem.

EXPERIMENT - 2

Software Engineering Lab

Aim

Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system.

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4C7

EXPERIMENT – 2

Aim:

Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system.

Theory:

Software Requirement Specification (SRS) is a document that describes the requirements of a computer system from the user's point of view. An SRS document specifies: The required behavior of a system in terms of: input data, required processing, output data, operational scenarios and interfaces. The attributes of a system including: performance, security, maintainability, reliability, availability, safety requirements and design constraints.

A well-designed, well-written SRS accomplishes four major goals:

- It provides feedback to the customer. An SRS is the customer's assurance that the development organization understands the issues or problems to be solved and the software behavior necessary to address those problems. Therefore, the SRS should be written in natural language (versus a formal language, explained later in this article), in an unambiguous manner that may also include charts, tables, data flow diagrams, decision tables, and so on.
- It decomposes the problem into component parts. The simple act of writing down software requirements in a well-designed format organizes information, places borders around the problem, solidifies ideas, and helps break down the problem into its component parts in an orderly fashion.
- It serves as an input to the design specification. As mentioned previously, the SRS serves as the parent document to subsequent documents, such as the software design specification and statement of work. Therefore, the SRS must contain sufficient detail in the functional system requirements so that a design solution can be devised.
- It serves as a product validation check. The SRS also serves as the parent document for testing and validation strategies that will be applied to the requirements for verification.

SRSs are typically developed during the first stages of "Requirements Development," which is the initial product development phase in which information is gathered about what requirements are needed--and not. This information-gathering stage can include onsite visits, questionnaires, surveys, interviews, and perhaps a return-on-investment (ROI) analysis or needs analysis of the customer or client's current business environment. The actual specification, then, is written after the requirements have been gathered and analyzed.

Performance Instruction:

Use IEEE SRS Document Template for drafting SRS for your system.

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- 3.2.2.4. Error Handling/ Response to Abnormal Situations

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B2C System SRS

1. INTRODUCTION

This document aims at defining the overall software requirements for 'BUYER TO CONSUMER SYSTEM'. Efforts have been made to define the requirements exhaustively and accurately. The final product will be having only features/functionalities mentioned in this document and assumptions for any additional functionality/feature should not be made by any of the parties involved in developing/testing/implementing/ using this product. In case it is required to have some additional features a formal change request will need to be raised and subsequently a new release of this document and/or product will be produced.

1.1 PURPOSE

This specification document describes the capabilities that will be provided by the software application 'BUYER TO CONSUMER SYSTEM'. It also states the various required constraints by which the system will abide. The intended audiences for this document are the development team, testing team and end users of the product.

1.2 SCOPE

The software product 'BUYER TO CONSUMER SYSTEM ' is an application that will be used for buying and delivering products put up by a local seller or business, by a customer. The application will manage the information about products put up by a seller on our website, which can be bought by an interested customer and delivered by an available delivery man . The seller can fill up an online request with all the details for their parcel, get the parcel picked up and get the cost of the delivery instantly when the pickup person arrives and a tracking ID is shared with both the seller and buyer to check the status of delivery, which is updated by the delivery agent. A communication system is also implemented for communication between each party. This application will greatly simplify and speed up the delivery and management of the delivery and product process of this system.

1.3 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

The following abbreviation has been used throughout this document

B2C : Buyer to Consumer

1.4 REFERENCES

- (i) GitHub Link - <https://github.com/syedareehaquasar/B2C-System>
- (ii) Deployment Link

1.5 OVERVIEW

The rest of this SRS document describes the various system requirements, interfaces, features and functionalities in detail.

2.OVERALL DESCRIPTION

This would be a B2C System with 3 interfaces: an interface of an individual seller or small business, an interface of a customer, and an efficient delivery system.

Current B2B systems don't support intermediary help for product delivery or transfer so we would provide aid for the same. This would also create revenue and employee opportunities

We aim at automating many operations performed at delivering the item to the customer. In many b2c services that already exist trade is carried out entirely at personal levels, with the risks of leaking of personal information and product not reaching the customer.

This can be solved if the seller uses one of the partner courier services. The seller can fill up an online request with all the details for their parcel, get the parcel picked up at home get the cost of the delivery instantly when the pickup person arrives and a tracking ID is shared with both the seller and customer. A feedback system can also be implemented on both the sender and receiver end.

2.1 PRODUCT PERSPECTIVE

The application will be a browser-based, self-contained and independent software product.

2.1.1 SYSTEM INTERFACES

None

2.1.2 USER INTERFACES

The application will have a user-friendly and web based interface.

Following users will interact with the application:

- Buyer
- Seller
- Deliverer

Following screens will be provided:

- (i) A signup screen for registering as a buyer or seller, a Login screen for entering the username, password and logging in as buyer, seller or a delivery agent) Access to different screens will be based upon the role of the user.
- (ii) For buyers, there will be a screen which will allow them to view the products put up by the seller. This screen consists of features like viewing the product, adding them to cart, tracking an ordered product. There will be a payment system implemented for buyers so that they can pay for their order at the time of checkout.
- (iii) For Sellers, there will be a screen that will allow them to add products, manage them and remove them. There will be an interface that will allow the seller to assign a delivery agent of his choice.
- (iv) For the delivery agent , there will be a screen where the orders which are assigned to him, are available. The information about the order, address and contact information of seller and buyer is also shared with the delivery agent . The delivery agent can generate a tracking ID which is shared with both the buyer and seller and the delivery agent can update the status of the shipping from his side.

- (v) There will be a communication system between each party which will allow us to resolve issues during phases of order and delivery.
- (vi) There will be a payment portal that supports many forms of payment like UPI, credit card etc. Cash on delivery option is also provided.

2.1.3 HARDWARE INTERFACES

1. Access to the internet is required to access the API Interfaces.
2. A computer or mobile device
3. Screen resolution of at least 800x600-required for proper and complete viewing of the screen. Higher resolution would not be a problem.

2.1.4 SOFTWARE INTERFACES

1. Any window -based operating system.
2. Any Browser to access the website based application.
3. Visual Studio Code —for coding /developing the software.
4. Libraries and programming languages such as react, nodejs, bootstrap, JavaScript and few others.

Software mentioned in pts. 3. and 4. above will be required only for development of the application. The final application will be packaged as an independent setup program that will be delivered to the client and can be accessed via any web browser.

2.1.5 COMMUNICATION INTERFACES

The B2C system shall use HTTP protocol for communication over the internet and for the intranet communication will be through TCP/IP protocol suite.

2.1.6 MEMORY CONSTRAINTS

For running the program no memory is needed.

At least 64 MB RAM and 4 GB space on the hard disk will be required for development of the program.

2.1.7 OPERATIONS

This product release will not cover any automated housekeeping aspects of the database. The DB used is mongoDB. The DB at the seller side will be responsible for adding, modifying or deleting product data local to their shop. Database backup and recovery will be handled by the DBA(mongoDB server).

2.1.8 SITE ADAPTATION REQUIREMENTS

The terminals at the client site will have to support the hardware and software interface specified in the above section.

2.2 PRODUCT FUNCTIONS

The system will allow access only to registered users with specific roles. Depending upon the user's role he/she will be able to access only specific modules of the system.

A summary of the major functions that the software will perform:

- (i) **A SIGNUP facility** for registering buyer and seller
- (ii) **A LOGIN facility** for logging in as a buyer, customer or as delivery agent.
- (iii) **Users (with role Seller)** will be able to add/modify/delete products on their respective shops which can be viewed by Buyer. For a given product in a shop, the amount of stock available, price of the product is set by the seller.
- (iv) **Users (with role Seller)** will be able to assign the delivery agent to an ordered product by the buyer.

- (v) **Users (with role Buyer)** will be able to view different shops of sellers and the products that each shop is offering. Buyer can select the amount of any product they want to buy and add them to cart.
- (vi) **Users (with role Buyer)** will be able to pay for their order when checking out their cart via two modes available : Online Payment and Cash on Delivery. Another Interface is available for Online Payment, where payment can be done using various methods.
- (vii) **Users (with role Delivery Agent)** will be able to get assigned to the delivery of a product by the seller. They get access to the details required for delivery.
- (viii) **Users (with Delivery Agent)** will be able to update the status of delivery to either : Delivering or Delivered.
- (ix) **Users (with role Buyer, Seller and Delivery Agent)** will be able to communicate with each other.

2.3 USER CHARACTERISTICS

- (i) Educational Level : At least a graduate should be comfortable with English.
- (ii) Experience : Should be well informed about the working of an e-commerce website and interacting with it.
- (iii) Technical expertise : Should be comfortable with general purpose applications of computers.

2.4 CONSTRAINTS

1. Since the DBMS being used in MongoDB standard/ free version, it will be able to store records upto a certain limit very large data records can't be stored for a longer duration of time.
2. Realtime online payments are not possible yet as integrated razorpay test credentials have to change to a real time account to be able to have live payments.

3. Admin of B2C System will have to implement a security policy to safeguard the product to be delivered and related information from being accessed by unauthorized users (by means of gaining access to the backend database).

2.5 ASSUMPTIONS AND DEPENDENCIES

The deliverer will approach the seller to be able to sign up as a deliverer and the seller has to authenticate the person before giving them access to be a deliverer.

2.6 APPORTIONING OF REQUIREMENTS

OTP verification of deliverers everytime they sign up as no credentials are associated with a deliverer.

3.SPECIFIC REQUIREMENTS

This section contains the software requirements to a level of detail sufficient to enable designers to design the system, and testers to test that system.

3.1 EXTERNAL INTERFACE REQUIREMENTS

3.1.1 USER INTERFACES

The following screens will be provided:

SignUp Screen :

It will allow buyers and sellers to register to the website. Signup Screen consists of details such as Full Name, email , phone number , shop name,

shop address, shop description etc. There is no Signup screen for the delivery agent , as they are registered and assigned by the seller.

Login Screen:

It will allow already registered users to access different screens based upon the user's role. Various fields available on this screen will be:

Role: Buyer or Seller

Phone Number: which acts as a user ID for a given user.

Password: Alphanumeric string which gives user access to their account

Role: Delivery Agent

Name: Registered name of the deliverer.

Phone No.: Registered phone number of the deliverer.

Buyer Screen:

This screen will be accessible only to users with role Buyer. It will allow the user to browse through different shops of different sellers, and view their products. In each shop there is contact information available about the seller with which the buyer can contact the seller.

Product Screen:

They are accessed on viewing a product from a shop. It includes description of product, its price, options like choosing the amount of the particular product buyer wants to order and an add to cart option

Cart Screen:

This screen will be accessible only to users with role Buyer. All the products that the buyer adds to cart while browsing the items in shops are

present here. An item present here can be removed too. This screen leads to two options for payment : Pay online , or Cash on Delivery.

Payment Screen :

The user is given 2 options either online payment or Cash on delivery. On selecting the Online Payment Option. It has a razorpay payment interface, which has several payment modes available, like UPI, debit card, credit card etc. In the UPI mode, the buyer can scan a QR generated via their mobile device and pay for the order.

Post-Payment Screen:

This screen comes on after successfully paying. It shows OrderID, paymentID. An order request is also sent to the seller after the buyer makes an order. There are other options on the screen that can be used to track the orders made by the buyer and check their status.

Seller Screen :

This screen will be accessible only to users with role Seller. It has options that allow sellers to post new products in their shop, to remove an existing product, update the stock of an existing product, check orders made by the buyers and assign a delivery agent to make these orders.

Add Product Screen :

This screen will be accessible only to users with role Seller. It is used by sellers to add a new product to their shop. To add a product, the seller has to enter details about it like, Product Name, Product Description, Price, Amount , Product Picture etc. After successfully adding a product , it can be viewed by the buyer in their interface.

Seller Order Screen :

This screen will be accessible only to users with role Seller. In this screen , sellers can see all the orders that are made for their products by the buyers, and accordingly they register and assign a delivery agent of their preference by adding the delivery agent's phone number and name. In this screen , the status of delivery can also be checked.

Buyer Order Screen :

This screen will be accessible only to users with role Buyer. In this screen , buyers can see all the orders that they have made. Here, they can check the status of delivery of their order, and contact the seller and delivery agent too.

Delivery Agent Screen :

This screen will be accessible only to users with role Delivery Agent. A Delivery Agent is registered by a Seller and an order is assigned to them for delivery by that Seller only. In their Interface they can see the assigned orders that are to be delivered. They can see the details like the details of Buyer, Seller and their contact information for delivery purposes. They can also update the status of the delivery which is reflected in both buyer and seller interface.

3.1.2. HARDWARE INTERFACES

As stated in section 2.1.3.

3.1.3 SOFTWARE INTERFACES

As stated in section 2.1.4.

3.1.4 COMMUNICATIONS INTERFACES

As stated in section 2.1.5.

3.2 SOFTWARE PRODUCT FEATURES

3.2.1 USER ACCOUNTS INFORMATION MAINTENANCE

Description : The system will maintain information about various users who will be able to access the system. The following information would be maintained that is common between all roles :

The following information is maintained for each role :

For Buyer : Name, Email, Phone No., Address, Password

For Seller : Name, Email, Phone No., Shop Name, Shop Address, Password

For Delivery Agent : Name, Phone No.

Validity Checks:

Only the database will be authorized to access the User Accounts Information Maintenance module. Any changes made by the user such as change of password will be reflected in the database

- Phone Number cannot be blank.
- Phone Number should be unique for every user.
- Email cannot be blank.
- Passwords cannot be blank.
- Address cannot be blank.
- Shop Name cannot be blank

Sequencing Information:

A User Account for a particular user has to be created in order for the system to be accessible to that user. In the website, the user has to be registered first using the sign up option , then they can log in anytime after that.

Error Handling/ Response to Abnormal Situations:

If any of the above validations/ sequencing flow does not hold true, appropriate error messages. will be prompted for users to do the needful.

3.2.2 PRODUCT INFORMATION MAINTENANCE

Description:

The system database will maintain information about the products that various sellers put up in their shop. The following information would be maintained for each product :

Product Name, Product Description, Product Picture, Product' Stock Available, Seller of the Product

The system database will allow creation/modification/deletion of new/existing products.

Validity Checks:

Only system databases will be authorized to access and maintain the Product information Maintenance module. Only Seller's can make changes to their respective products that will be reflected in the database.

- Product Name cannot be blank.
- Product Picture cannot be blank.
- Product Description cannot be blank.
- If Product's Stock becomes 0, it will show Out of Stock.
- Product Price cannot be zero.

Sequencing Information:

Product Info will have to be entered into the system database by the Seller using the interface provided before any they can be reflected on the webpage.

Error Handling/ Response to Abnormal Situations:

If any of the above validations/ sequencing flow does not hold true, appropriate error messages will be prompted for users to do the needful.

3.2.3 DELIVERY SYSTEM MAINTENANCE

Description :

The system database will maintain information like buyer's address and phone number, seller's address and phone number and the status of the product, whether it is delivered or yet to be delivered, it is updated by the delivery agent, stored in the database and shown to buyer and seller when they check the order status. The following information would be maintained for each delivery :

- Order Details.
- Order of the Status.
- The system will allow updates of status of the delivery by the delivery agent for a particular order.

Validity Checks:

- Only system databases will be authorized to access and maintain the Product information Maintenance module. Only users with the role Delivery Agent assigned the particular order can update the delivery status.
- Order Status can be changed to Delivered or shipped.

Sequencing Information:

Order will have to be made by the Buyer and Delivery agent will have to be assigned by the seller to that order before any delivery agent can access this module.

Error Handling/ Response to Abnormal Situations:

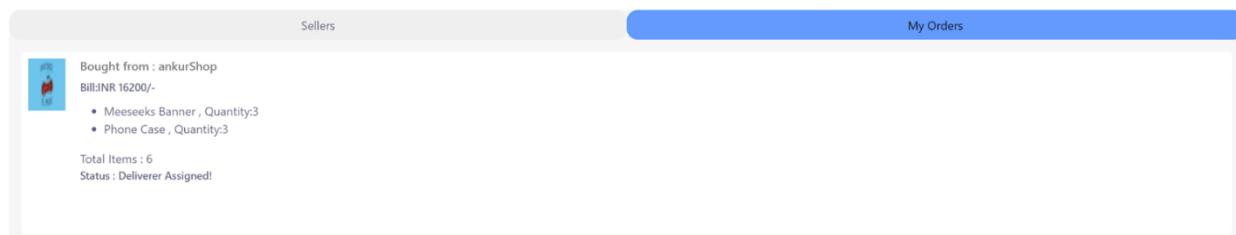
If any of the above validations/ sequencing flow does not hold true, appropriate error messages. and status will be prompted for users to do the needful.

3.2.4 ORDER GENERATION AND CONFIRMATION

Description :

The system will generate order receipt with a unique id along with the payment status and details to verify and confirm a particular order. The system database will be maintained and verified using razorpay APIs and Razorpay Dashboard.

ORDERS WILL HAVE THE FOLLOWING FORMAT :



The screenshot shows a mobile application interface for managing orders. At the top, there is a navigation bar with three horizontal lines, a central black circle, and a shopping cart icon. Below the navigation bar, the text "Hi, sdfsdgfh" is displayed. The main title "Here are your Orders" is centered above a search bar with the placeholder "search for Shop Name". Below the search bar, there are two tabs: "Sellers" and "My Orders", with "My Orders" being the active tab. The first order card displays the following details:
Bought from : ankurShop
Bill:INR 16200/-

- Meeseeks Banner , Quantity:3
- Phone Case , Quantity:3

Total Items : 6
Status : Deliverer Assigned!
The second order card displays the following details:
Bought from : dsxzfccgchvv
Bill:INR 738/-

- asdf , Quantity:6

Total Items : 6
Status : shipped for delivery

Validity Checks:

Users who have ordered the product, seller of the product and assigned deliverer will be able to access this module.

Sequencing Information:

Order for a particular Buyer can be generated by the system only after the payment is done by the buyer and verified by the system using Razorpay API. OrderID and a receipt will be generated after that.

Error Handling/ Response to Abnormal Situations:

If any of the above validations/ sequencing flow does not hold true, appropriate error messages will be prompted for users to do the needful.

3.3 PERFORMANCE REQUIREMENTS

None

3.4 DESIGN CONSTRAINTS

For designing Figma was used and the system is device responsive but still has to work on improving the user Interface.

3.5 SOFTWARE SYSTEM ATTRIBUTES

3.5.1 SECURITY

The application will be password protected. Users will have to enter a valid phone number, password and role in order to access the application.

3.5.2 MAINTAINABILITY

The application will be designed in a maintainable manner. It will be easy to incorporate new requirements in the individual modules when the need arises.

3.5.3 PORTABILITY

The application will be easily portable on any windows-based system that has a Web Browser.

3.6 LOGICAL DATABASE REQUIREMENTS

The following information will be placed in the database :

- User Information according to their Role (Buyer, Seller, Deliverer)
- Order Details
- Product details
- Cart Details
- Reviews

buyers

carts

deliverers

orders

products

reviews

sellers

3.7 OTHER REQUIREMENTS

Clients should have a working phone no. along with an email.

Conclusion

The SRS was written successfully by following the template described above.

Viva Questions

1. What are the objectives of requirement analysis?

Ans.

The purpose of the Requirements Analysis Phase is to transform the needs and high-level requirements specified in earlier phases into unambiguous (measurable and testable), traceable, complete, consistent, and stakeholder-approved requirements.

2. Define different types of requirements?

Ans.

According to IEEE standard 729, a requirement is defined as follows:

- A condition or capability needed by a user to solve a problem or achieve an objective
- A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification or other formally imposed documents
- A documented representation of a condition or capability as in 1 and 2.

A software requirement can be of 3 types:

- Functional requirements
- Non-functional requirements
- Domain requirements

Functional Requirements: These are the requirements that the end user specifically demands as basic facilities that the system should offer. All these functionalities need to be necessarily incorporated into the system as a part of the contract. These are represented or stated in the form of input to be given to the system, the operation performed and the output expected. They are basically the requirements stated by the user which one can see directly in the final product, unlike the non-functional requirements.

For example, in a hospital management system, a doctor should be able to retrieve the information of his patients. Each high-level functional requirement may involve several interactions or dialogues between the system and the outside world. In order to accurately describe the functional requirements, all scenarios must be enumerated.

There are many ways of expressing functional requirements e.g., natural language, a structured or formatted language with no rigorous syntax and formal specification language with proper syntax.

Non-functional requirements: These are basically the quality constraints that the system must satisfy according to the project contract. The priority or extent to which these factors are implemented varies from one project to other. They are also called non-behavioral requirements.

They basically deal with issues like:

- Portability
- Security
- Maintainability
- Reliability
- Scalability
- Performance
- Reusability
- Flexibility

NFR's are classified into following types:

- Interface constraints
- Performance constraints: response time, security, storage space, etc.
- Operating constraints
- Life cycle constraints: maintainability, portability, etc.
- Economic constraints

The process of specifying non-functional requirements requires the knowledge of the functionality of the system, as well as the knowledge of the context within which the system will operate.

Domain requirements: Domain requirements are the requirements which are characteristic of a particular category or domain of projects. The basic functions that a system of a specific domain must necessarily exhibit come under this category. For instance, in an academic software that maintains records of a school or college, the functionality of being able to access the list of faculty and list of students of each grade is a domain requirement. These requirements are therefore identified from that domain model and are not user specific.

3. Outline structure of SRS Document?

Ans.

1. Introduction

- (i) Purpose of this document
- (ii) Scope of this document
- (iii) Overview

2. General description

3. Functional Requirements

4. Interface Requirements

5. Performance Requirements

6. Design Constraints

7. Non-Functional Attributes

8. Preliminary Schedule and Budget

9. Appendices

Outline used for this SRS:

1. Introduction

- 1.1. Purpose
 - 1.2. Scope
 - 1.3. Definitions, Acronyms, and Abbreviations
 - 1.4. References
 - 1.5. Overview
- #### 2. Overall Description
- 2.1. Product Perspective
 - 2.1.1. System Interfaces

- 2.1.2. User Interfaces
 - 2.1.3. Hardware Interfaces
 - 2.1.4. Software Interfaces
 - 2.1.5. Communication Interfaces
 - 2.1.6. Memory Constraints
 - 2.1.7. Operations
 - 2.1.8. Site Adaptation Requirements
 - 2.2. Product Functions
 - 2.3. User Characteristics
 - 2.4. Constraints
 - 2.5. Assumptions and dependencies
 - 2.6. Apportioning of requirements
- 3. Specific Requirements
 - 3.1. External Interface Requirements
 - 3.1.1. User Interfaces
 - 3.1.2. Hardware Interfaces
 - 3.1.3. Software Interfaces
 - 3.1.4. Communications Interfaces
 - 3.2. Software Product Features
 - 3.2.1. USER ACCOUNTS INFORMATION MAINTENANCE
 - 3.2.1.1. Description
 - 3.2.1.2. Validity Checks
 - 3.2.1.3. Sequencing Information
 - 3.2.1.4. Error Handling/ Response to Abnormal Situations
 - 3.2.2. PRODUCT INFORMATION MAINTENANCE
 - 3.2.2.1. Description
 - 3.2.2.2. Validity Checks
 - 3.2.2.3. Sequencing Information
 - 3.2.2.4. Error Handling/ Response to Abnormal Situations
 - 3.2.3. DELIVERY SYSTEM MAINTENANCE
 - 3.2.3.1. Description
 - 3.2.3.2. Validity Checks
 - 3.2.3.3. Sequencing Information
 - 3.2.3.4. Error Handling/ Response to Abnormal Situations
 - 3.2.4. ORDER GENERATION AND CONFIRMATION
 - 3.2.4.1. Description
 - 3.2.4.2. Validity Checks
 - 3.2.4.3. Sequencing Information

- 3.2.4.4. Error Handling/ Response to Abnormal Situations
- 3.3. Performance Requirements
- 3.4. Design Constraints
- 3.5. Software System Attributes
 - 3.5.1. Security
 - 3.5.2. Maintainability
 - 3.5.3. Portability
- 3.6. Logical Database Requirements
- 3.7. Other Requirements

4. What are benefits of writing SRS document?

Ans.

- An SRS establishes the basis for agreement between the customer and the supplier on what the software product will perform.
- An SRS provides a reference for validation of the final product/software.
- A high-quality SRS is a prerequisite to high-quality product/software.
- A high-quality SRS reduces the development cost.

5. Define Functional and non-functional requirements?

Ans.

Functional Requirements: These are the requirements that the end user specifically demands as basic facilities that the system should offer. All these functionalities need to be necessarily incorporated into the system as a part of the contract. These are represented or stated in the form of input to be given to the system, the operation performed and the output expected. They are basically the requirements stated by the user which one can see directly in the final product, unlike the non-functional requirements.

Non-functional requirements: These are basically the quality constraints that the system must satisfy according to the project contract. The priority or extent to which these factors are implemented varies from one project to other. They are

also called non-behavioral requirements.

They basically deal with issues like:

- Portability
- Security
- Maintainability
- Reliability
- Scalability
- Performance
- Reusability
- Flexibility

FUNCTIONAL vs NONFUNCTIONAL REQUIREMENTS

	Functional requirements	Nonfunctional requirements
Objective	Describe what the product does	Describe how the product works
End result	Define product features	Define product properties
Focus	Focus on user requirements	Focus on user expectations
Documentation	Captured in use case	Captured as a quality attribute
Essentiality	They are mandatory	They are not mandatory, but desirable
Origin type	Usually defined by user	Usually defined by developers or other tech experts
Testing	Component, API, UI testing, etc. Tested before nonfunctional testing	Performance, usability, security testing, etc. Tested after functional testing
Types	External interface, authentication, authorization levels, business rules, etc.	Usability, reliability, scalability, performance, etc.

EXPERIMENT - 3

Software Engineering Lab

Aim

To perform the function oriented diagram: Data Flow Diagram (DFD), ER Diagram and Structured chart.

Syeda Reeha Quasar

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EXPERIMENT – 3

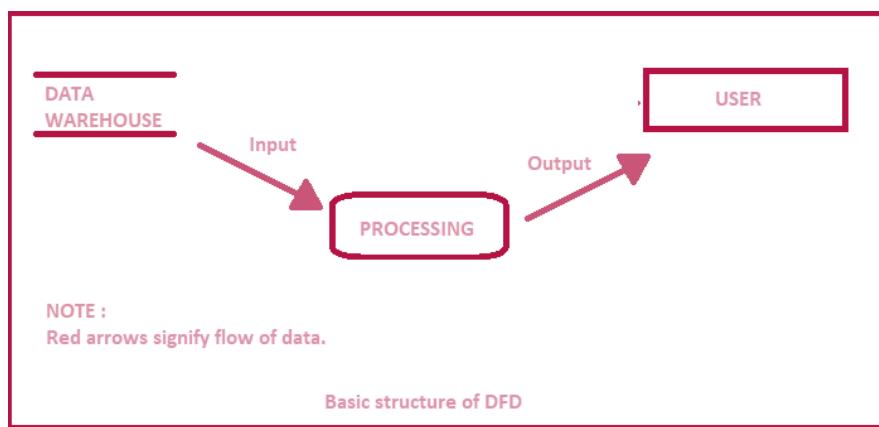
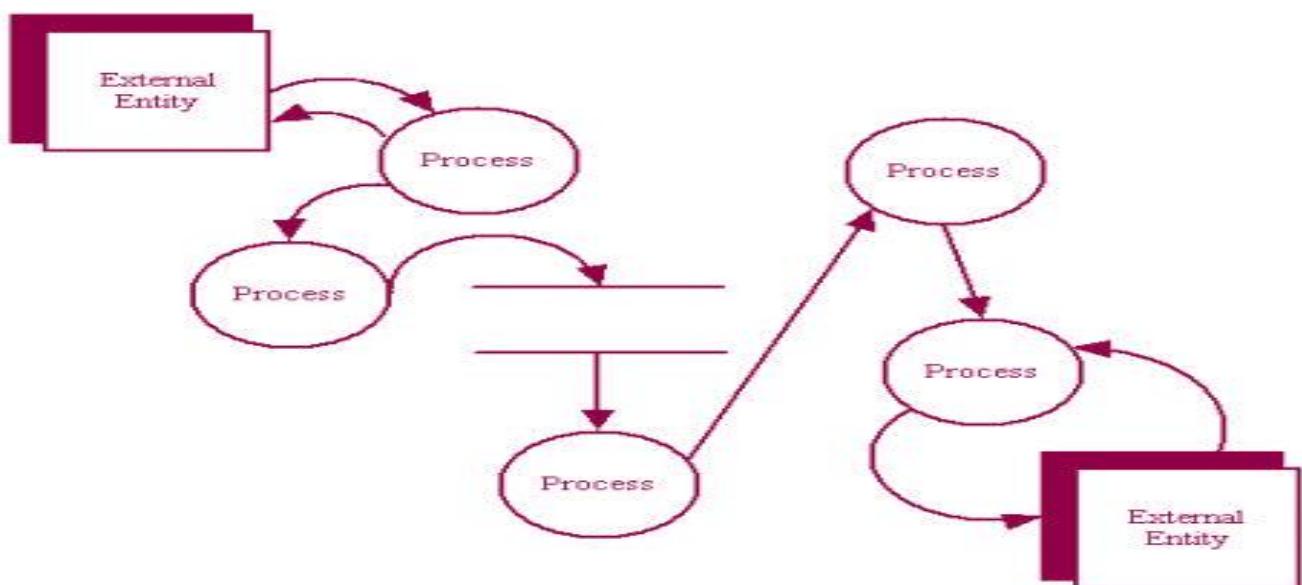
Aim:

To perform the function-oriented diagram: Data Flow Diagram (DFD), ER Diagram and Structured chart.

Theory:

Data flow diagrams are versatile diagramming tools. With only four symbols, data flow diagrams can represent both physical and logical information systems. The four symbols used in DFD representation are data flows, data stores, processes, and sources / sinks (or external entities).

Data flow diagrams illustrate how data is processed by a system in terms of inputs and outputs.

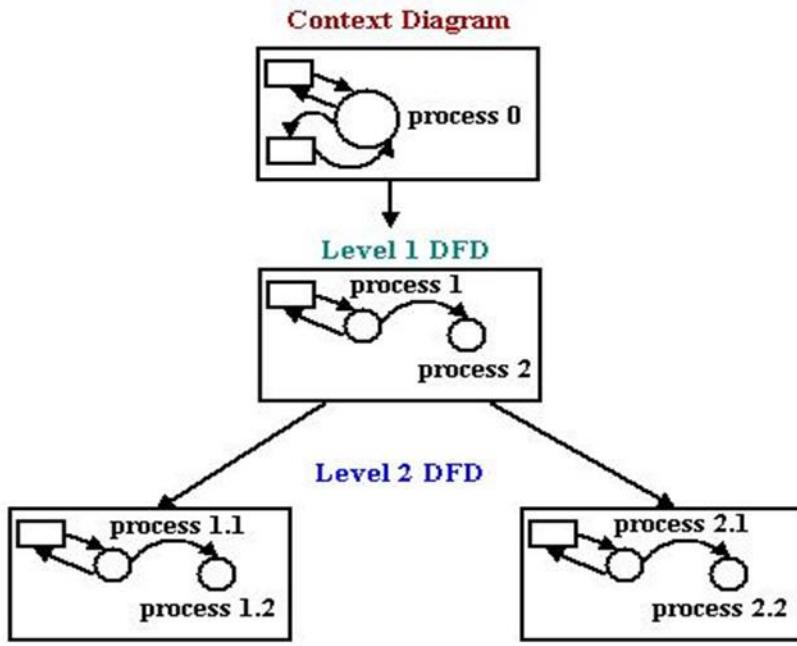


Symbols of DFD:

Name	Symbol	Description	Example
Entity		Used to represent people and organizations outside the system. They either input information to the system, accept output information from the system or both	
Process		These are actions that are carried out with the data that flows around the system. A process accepts input data and produces data that it passes on to another part of the DFD	
Data Flow		These represent the flow of data to or from a process	
Data Store		This is a place where data is stored either temporarily or permanently	

Data Flow Diagram Layers

Draw data flow diagrams in several nested layers. A single process node on a high-level diagram can be expanded to show a more detailed data flow diagram. Draw the context diagram first, followed by various layers of data flow diagrams.



ER Diagram:

An entity relationship model, also called an entity-relationship (ER) diagram, is a graphical representation of entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems. An entity is a piece of data—an object or concept about which data is stored.

Relationships Between Entities

A relationship is how the data is shared between entities. There are three types of relationships between entities:

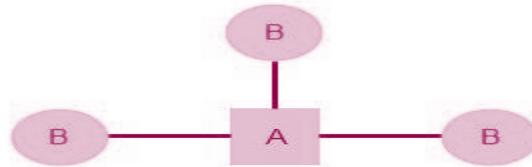
1. One-to-One

One instance of an entity (A) is associated with one other instance of another entity (B). For example, in a database of employees, each employee name (A) is associated with only one social security number (B).



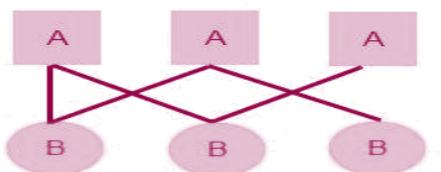
2. One-to-Many

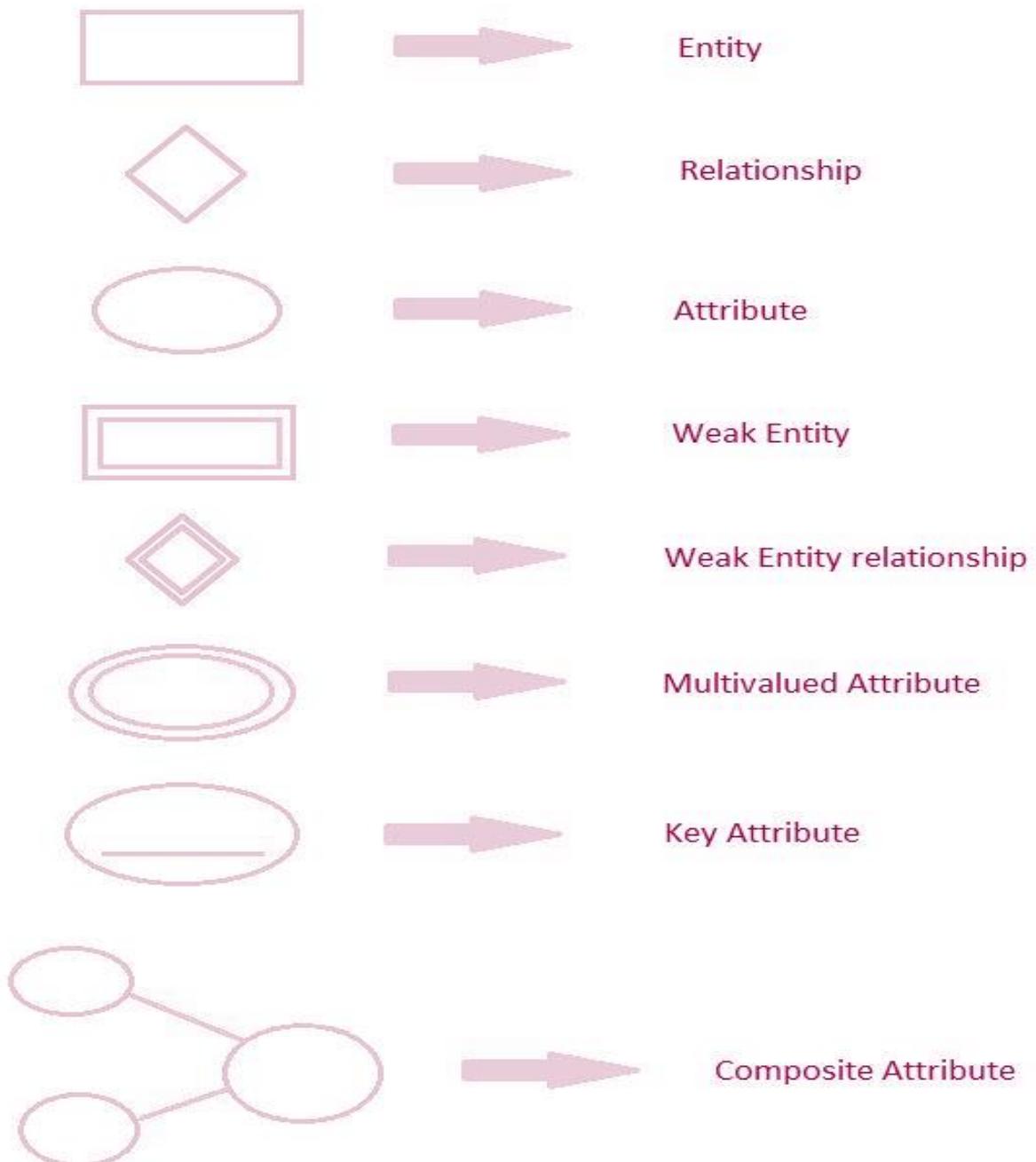
One instance of an entity (A) is associated with zero, one or many instances of another entity (B), but for one instance of entity B there is only one instance of entity A. For example, for a company with all employees working in one building, the building name (A) is associated with many different employees (B), but those employees all share the same singular association with entity A.



3. Many-to-Many

One instance of an entity (A) is associated with one, zero or many instances of another entity (B), and one instance of entity B is associated with one, zero or many instances of entity A. For example, for a company in which all of its employees work on multiple projects, each instance of an employee (A) is associated with many instances of a project (B), and at the same time, each instance of a project (B) has multiple employees (A) associated with it.



Symbols used to draw ER diagram:

A **Structure Chart** (SC) in software engineering is a chart which shows the breakdown of a system to its lowest manageable levels. They are used in structured programming to arrange program modules into a tree. Each module is represented by a box, which contains the module's name. The lines represent the connection and or ownership between activities and sub activities as they are used in organization charts. The tree structure visualizes the relationships between modules.

Performance Instructions:

To draw DFD

1. Identify various processes, data store, input, output etc. of the system and analyse it.
2. Use processes at various levels to draw the DFDs.

To draw ER Diagram

1. Identify all entities and their attributes.
2. Identify weak entities, attributes and their identifying relationship.
3. Design ER diagram according to norms.
4. Imply cardinalities on diagram.

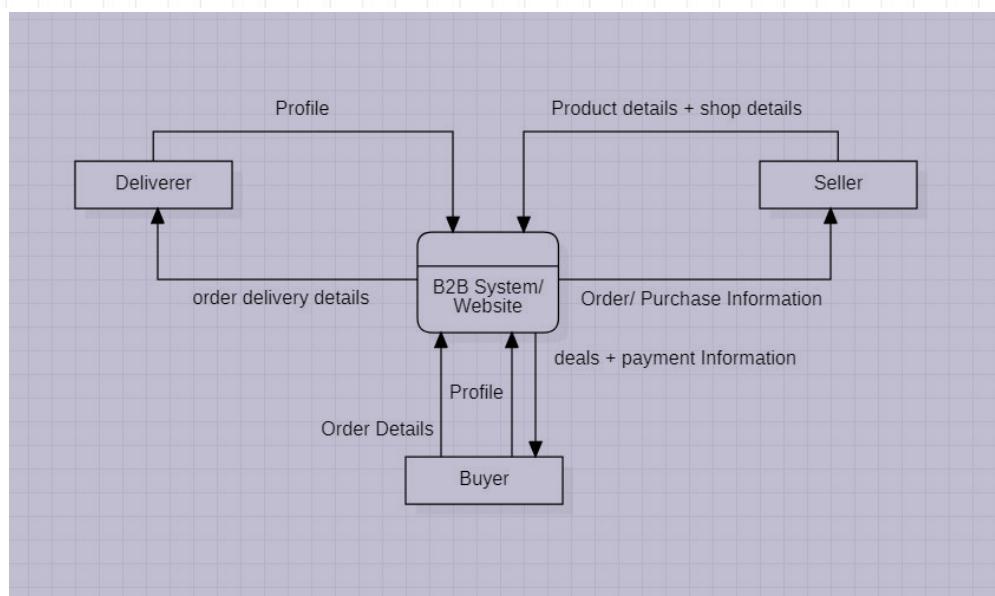
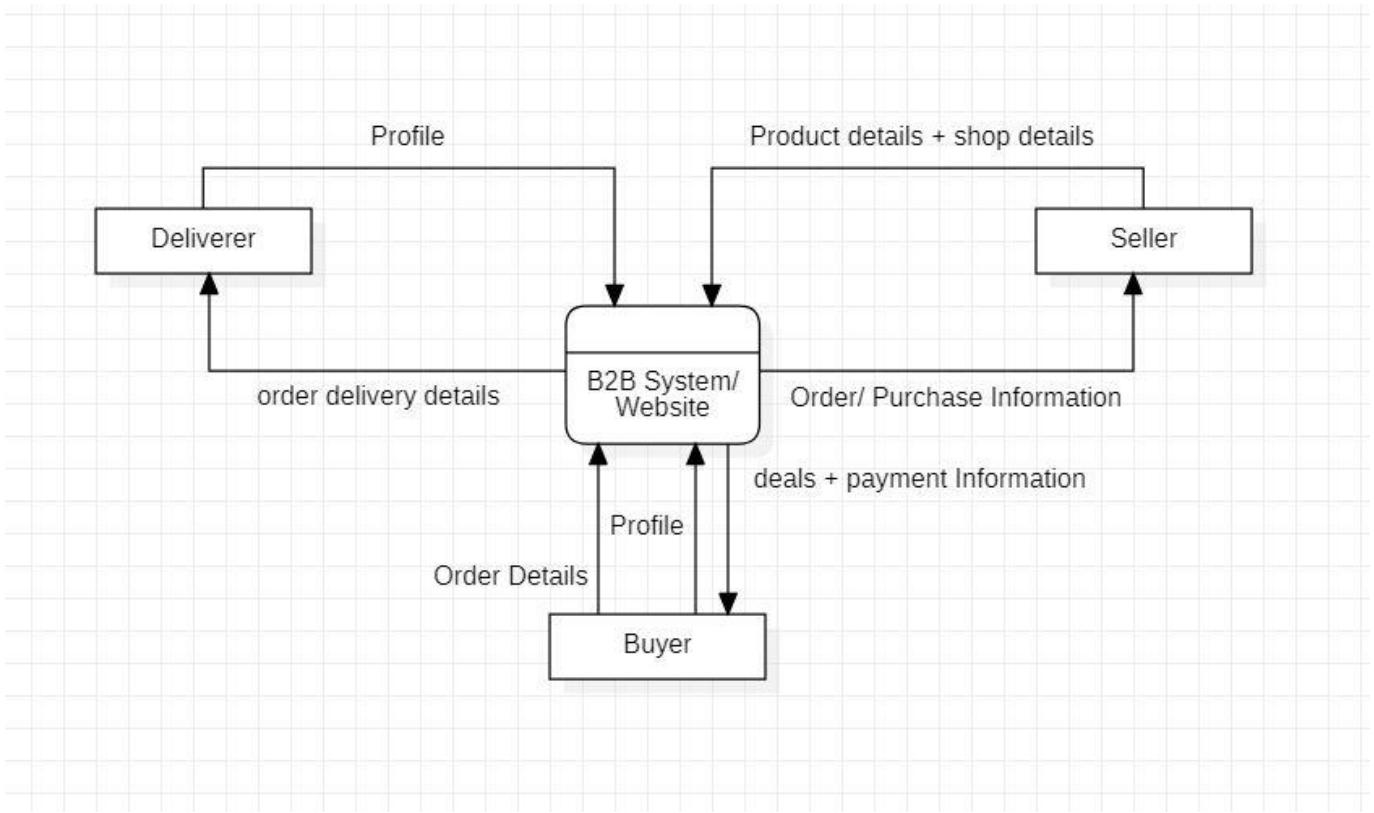
To draw structured Chart Diagram

1. Identify various modules, input, output etc. of the system.
2. Draw structured chart diagram describing it in form of levels.

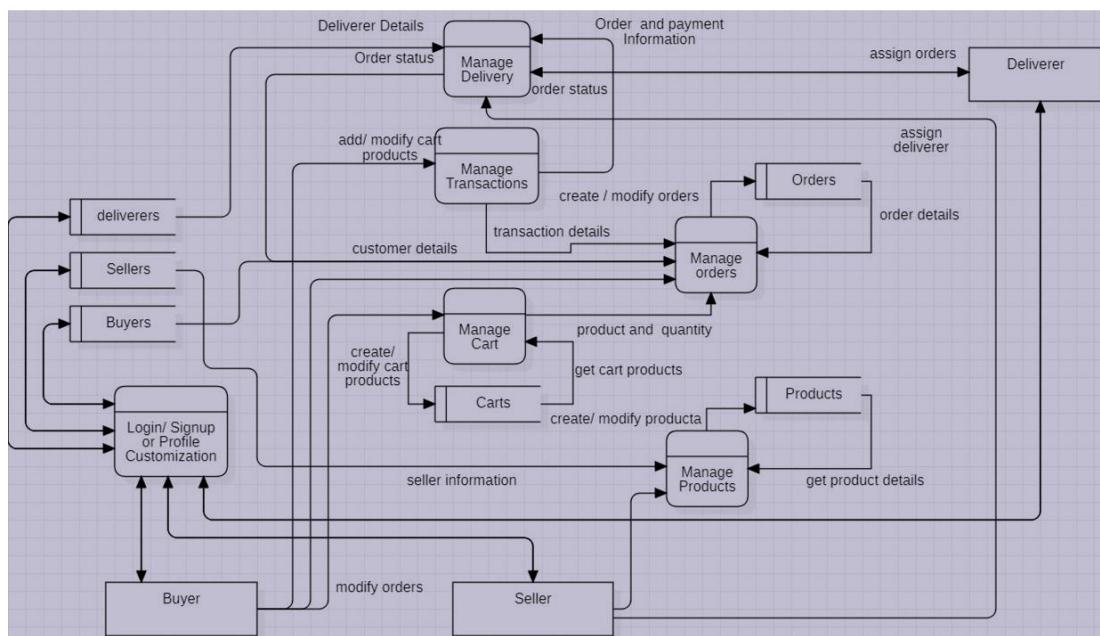
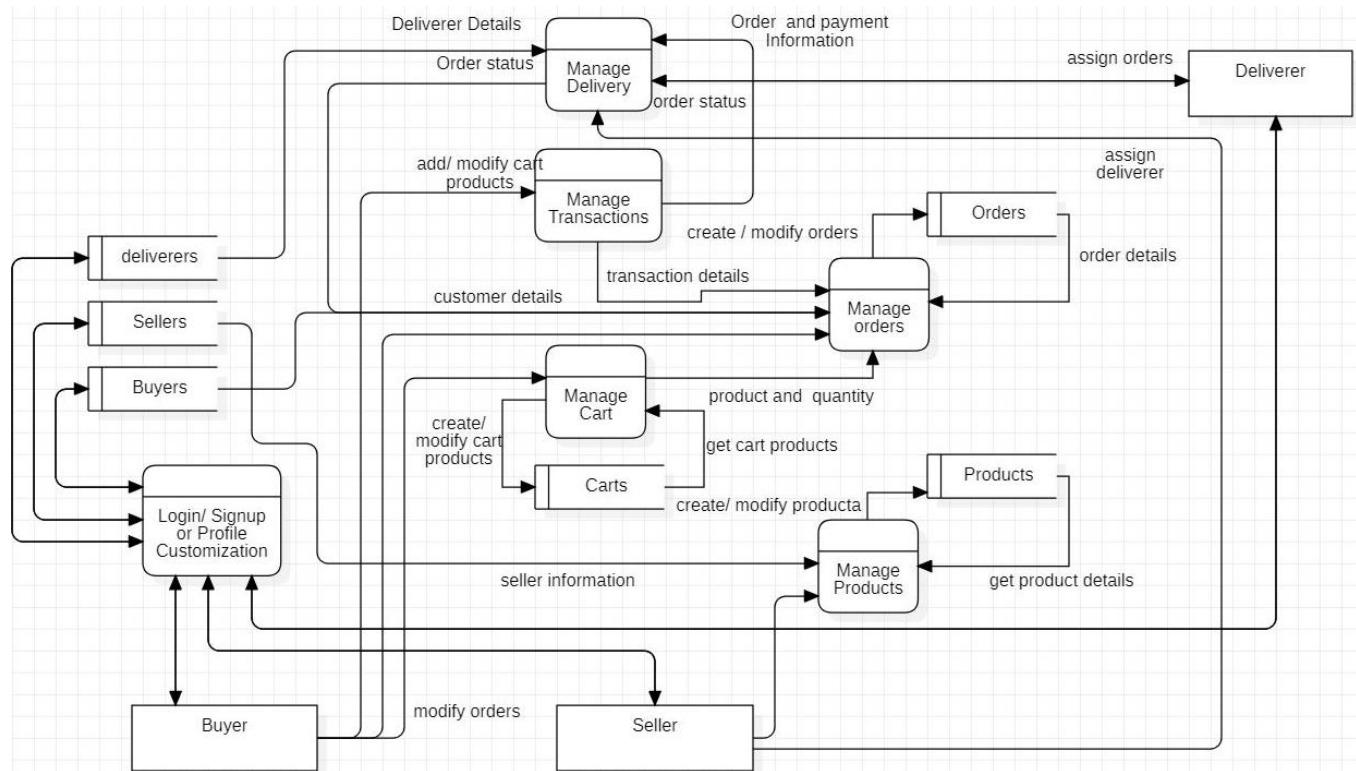
OUTPUT:

DFD (Data Flow Diagram):

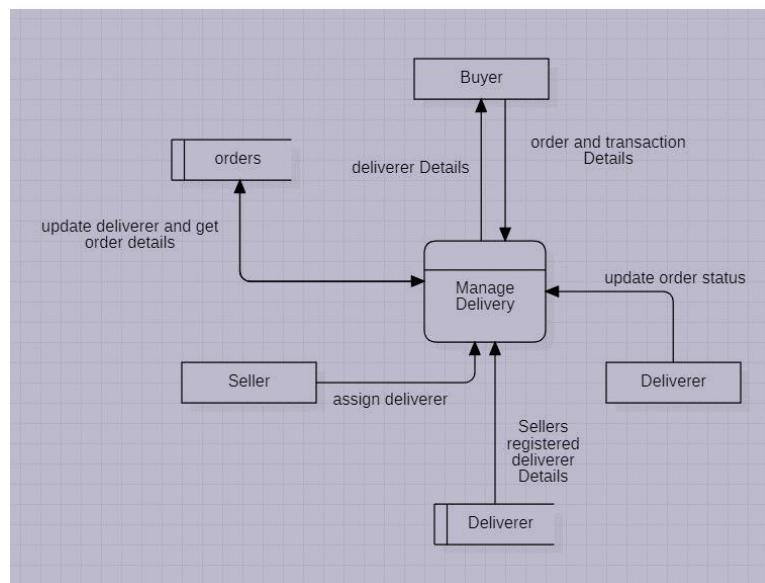
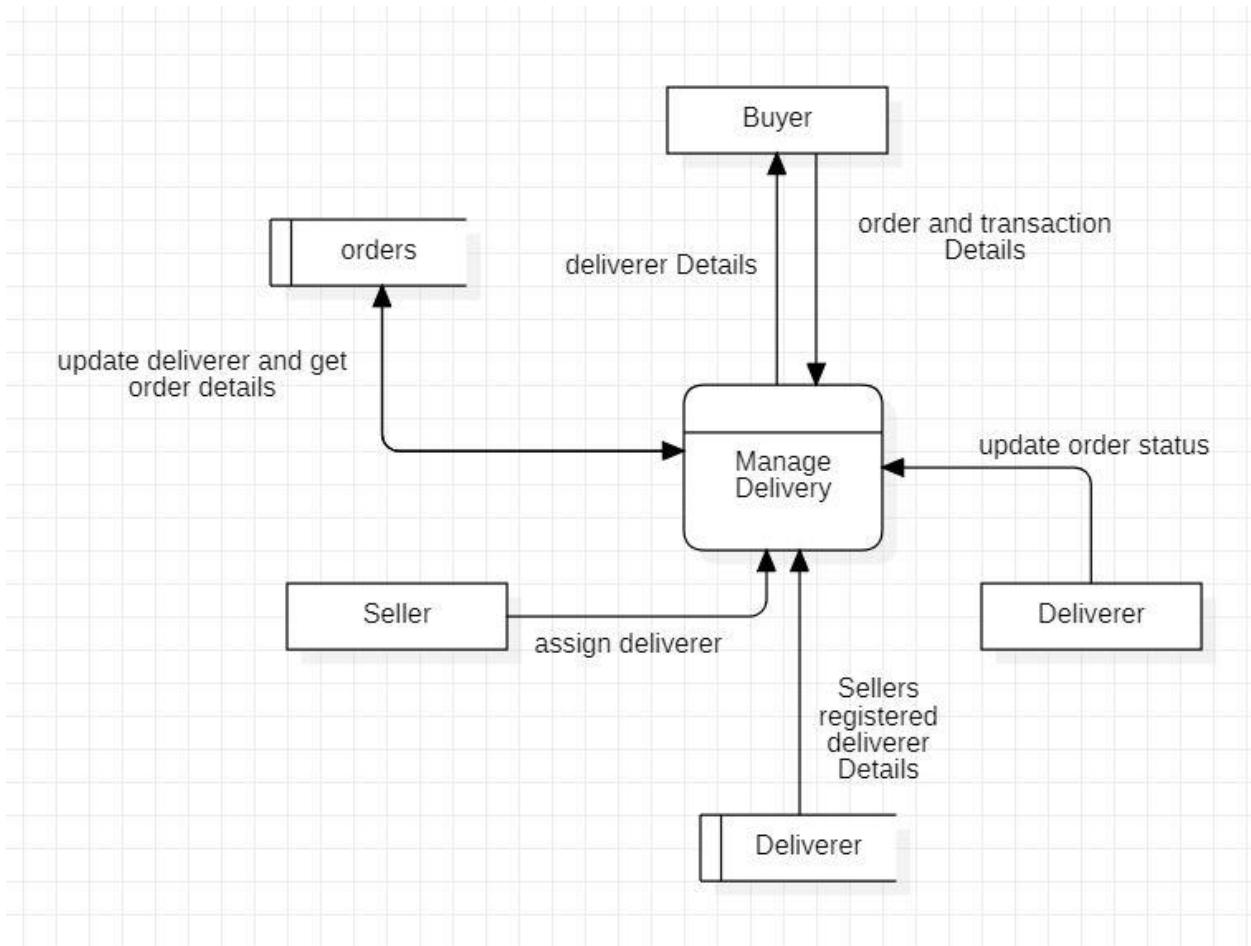
Level 0:



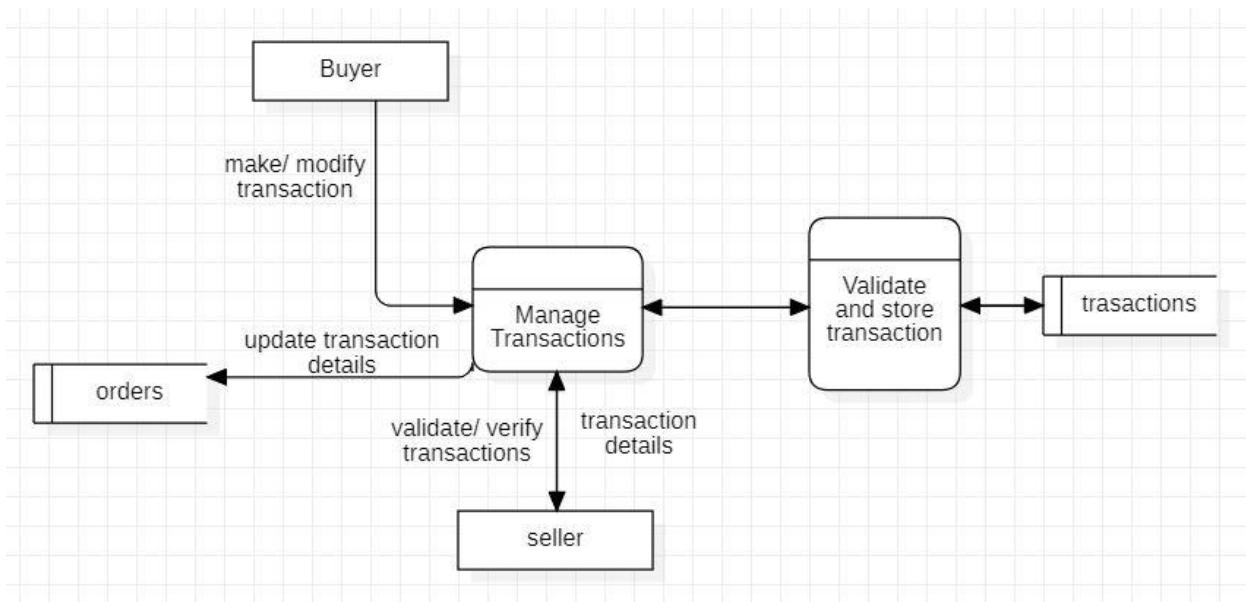
Level 1:



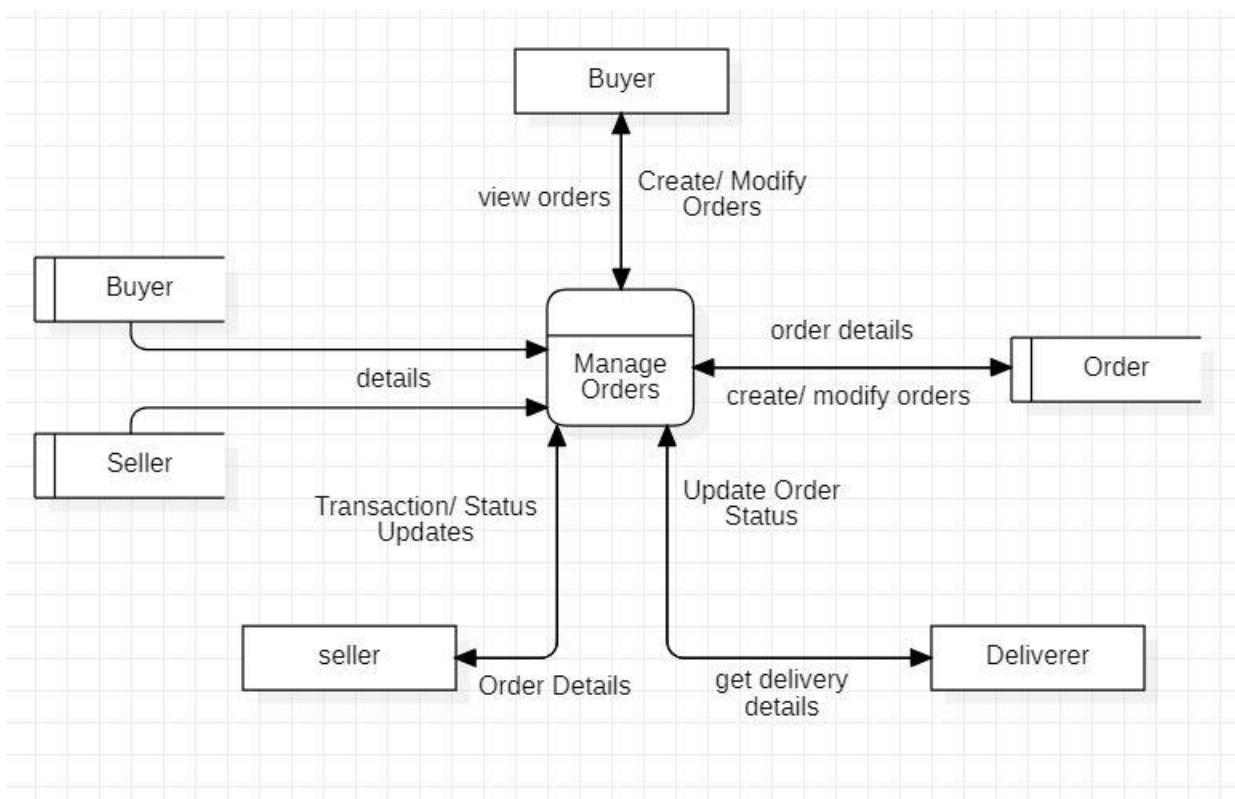
Level 2.1:



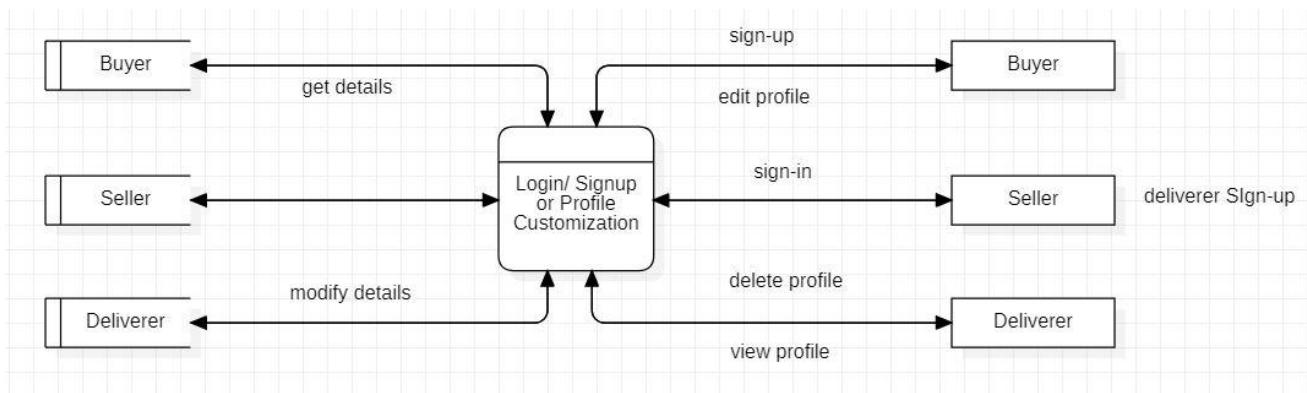
Level 2.2:



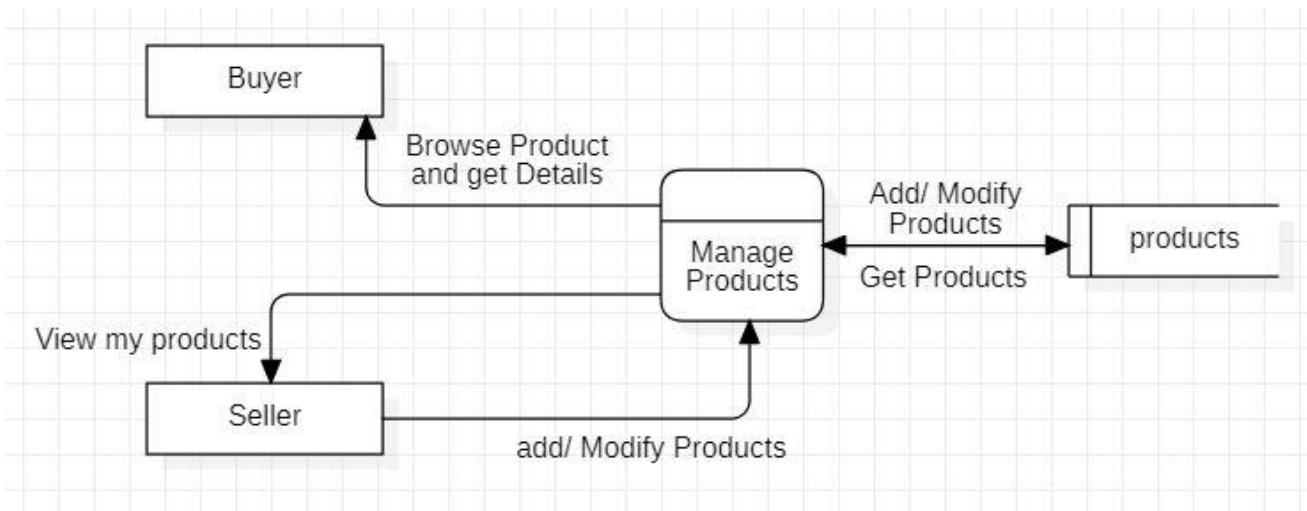
Level 2.3:



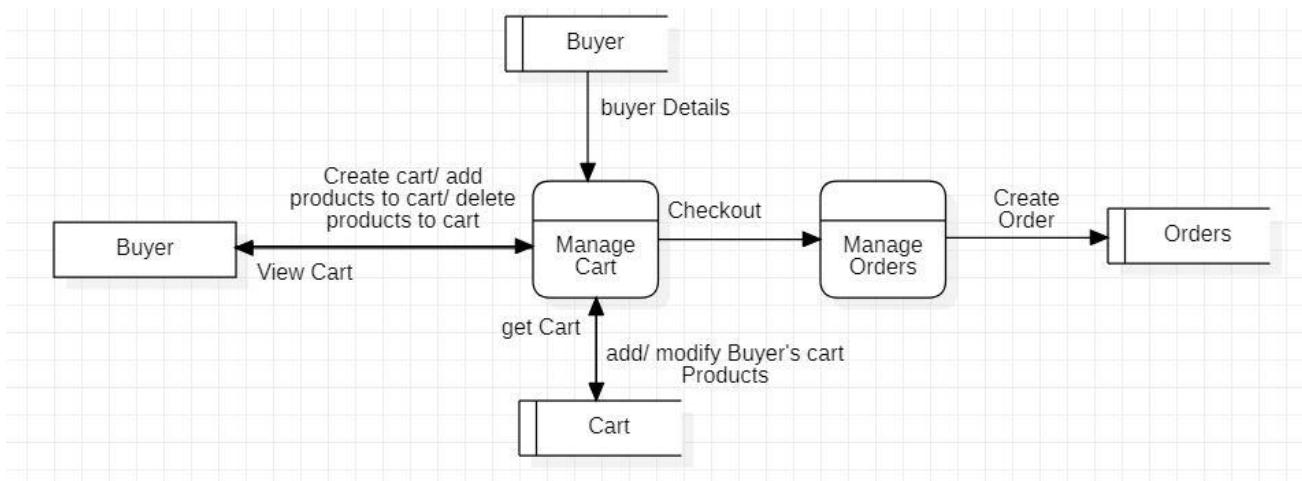
Level 2.4:



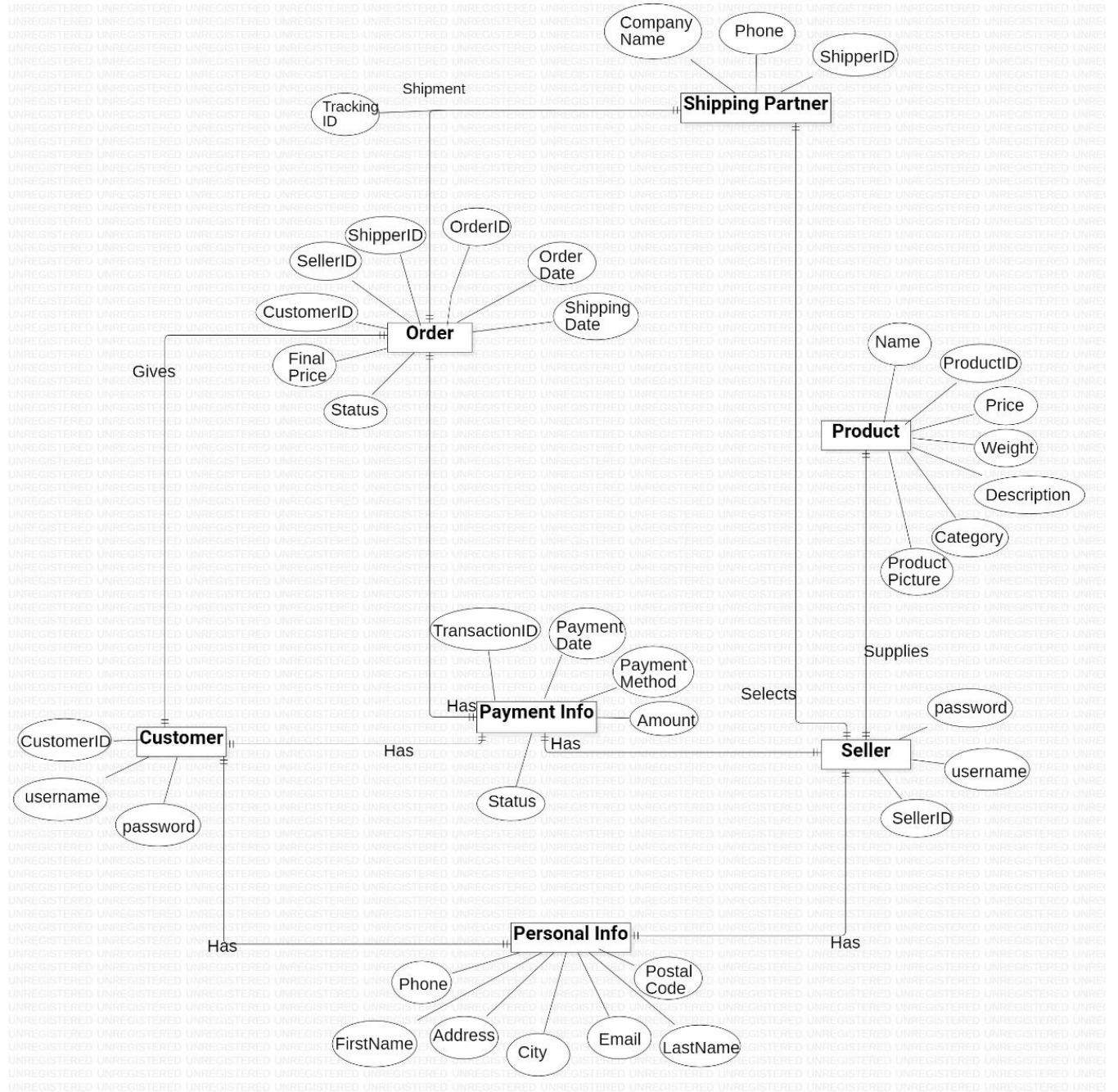
Level 2.5:



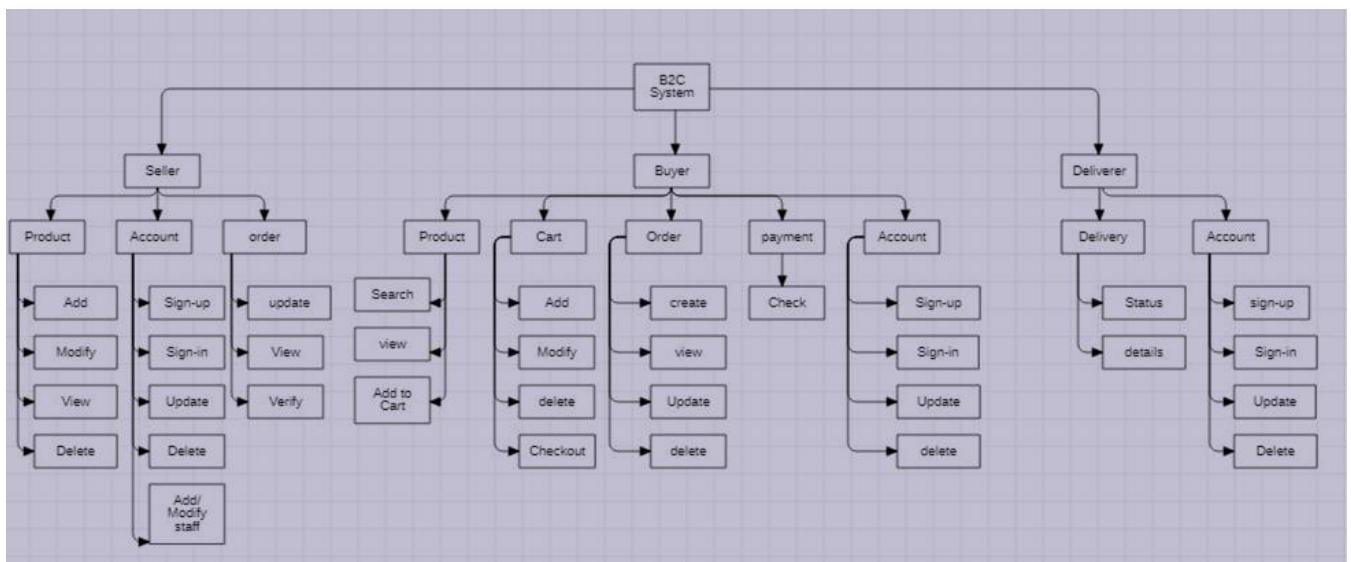
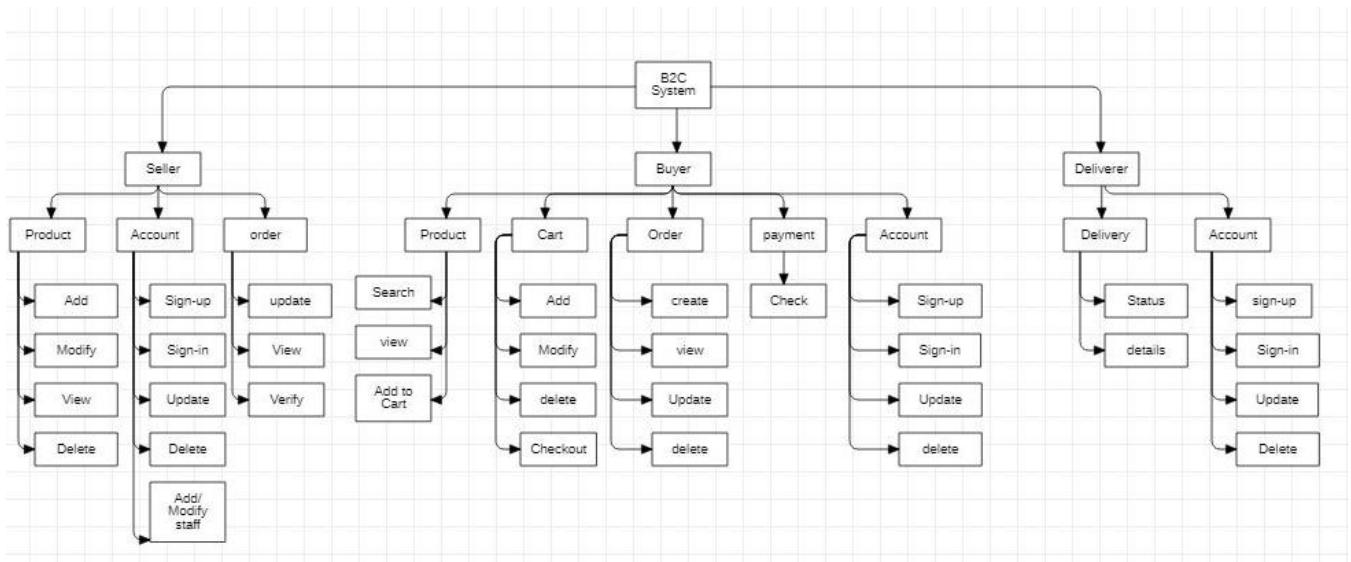
Level 2.6:



ER (Entity Relation) Diagram:



Structured Diagram:



Viva Questions

1. Define DFD? What are different levels of DFD?

Ans.

Data flow diagrams are versatile diagramming tools. With only four symbols, data flow diagrams can represent both physical and logical information systems. The four symbols used in DFD representation are data flows, data stores, processes, and sources / sinks (or external entities).

0-level DFD:

It is also known as a context diagram. It's designed to be an abstraction view, showing the system as a single process with its relationship to external entities. It represents the entire system as a single bubble

1-level DFD:

In 1-level DFD, the context diagram is decomposed into multiple bubbles/processes. In this level, we highlight the main functions of the system

2-level DFD:

2-level DFD goes one step deeper into parts of 1-level DFD. It can be used to plan or record the specific/necessary detail about the system's functioning.

2. Describe symbols used for constructing DFDs?

Ans.

The four symbols used in DFD representation are data flows, data stores, processes, and sources / sinks (or external entities).

3. Distinguish between a data flow diagram and a flow chart with example?

Ans.

The main difference between DFD and Flowchart is that DFD is a graphical diagram that represents the data flow of a system while a flowchart is a graphical diagram that represents the sequence of steps to solve a problem.

4. Explain structured chart diagram?

Ans.

A Structure Chart (SC) in software engineering is a chart which shows the breakdown of a system to its lowest manageable levels.

5. Describe symbols used for constructing structured chart diagram?

Ans.

Module - It represents process or subroutine or task. A control module branches to more than one sub-module. Library Modules are re-usable and invokable from any module.

Condition - It is represented by small diamond at the base of module. It depicts that control module can select any of sub-routine based on some condition.

Jump - An arrow is shown pointing inside the module to depict that the control will jump in the middle of the sub-module.

Loop - A curved arrow represents loop in the module. All sub-modules covered by loop repeat execution of module.

Data flow - A directed arrow with empty circle at the end represents data flow.

Control flow - A directed arrow with filled circle at the end represents control flow.

6. Explain ER diagram?

Ans.

An entity relationship model, also called an entity-relationship (ER) diagram, is a graphical representation of entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems.

7. What is entity? Explain strong and weak entity?

Ans.

Entity : An entity is an object or component of data. An entity is represented as rectangle in an ER diagram. The entity set which does not have sufficient attributes to form a primary key is called as Weak entity set. An entity set that has a primary key is called as Strong entity set.

8. Explain structured chart diagram?

Ans.

Attributes are the properties which define the entity type. They are characteristics of the entity that help users to better understand the database. Attributes are included to include details of the various entities that are highlighted in a conceptual ER diagram.

EXPERIMENT - 4

Software Engineering Lab

Aim

To perform the user's view analysis for the suggested system: Use case diagram.

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EXPERIMENT – 4

Aim:

To perform the user's view analysis for the suggested system: Use case diagram.

Theory:

The use-case diagram can provide the user's view for designing of the software product. And it can also be tested by matching up the requirements with the use-cases.

When to Use: Use Cases Diagrams

Use cases are used in almost every project. They are helpful in exposing requirements and planning the project. During the initial stage of a project most use cases should be defined, but as the project continues more might become visible.

Actors: Are NOT part of the system – they represent anyone or anything that must interact with the system.

- Only input information to the system.
- Only receive information from the system.
- Both input to and receive information from the system.
- Represented in UML as a stickman.

Use Case

- A sequence of transactions performed by a system that yields a measurable result of values for a particular actor.
- A use case typically represents a major piece of functionality that is complete from beginning to end. A use case must deliver something of value to an actor

Use Case Relationships Between actor and use case.

- Association / Communication.
- Arrow can be in either or both directions; arrow indicates who initiates communication.

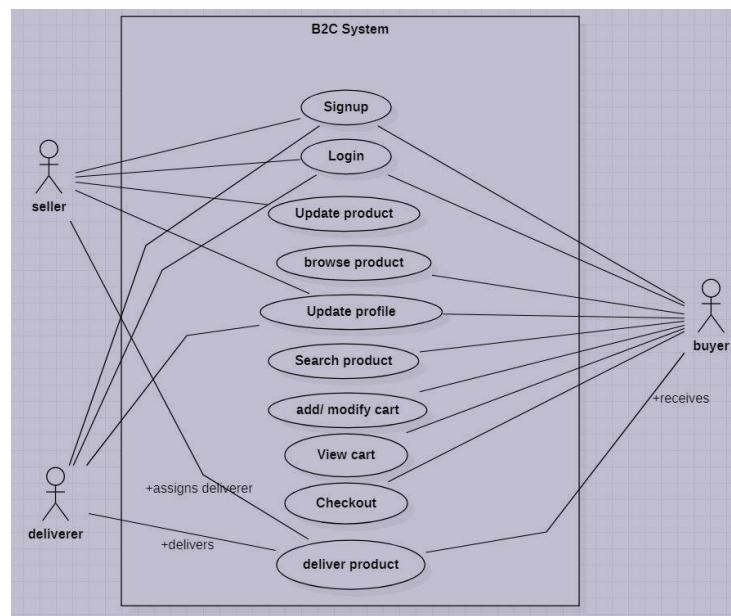
Between use cases (generalization):

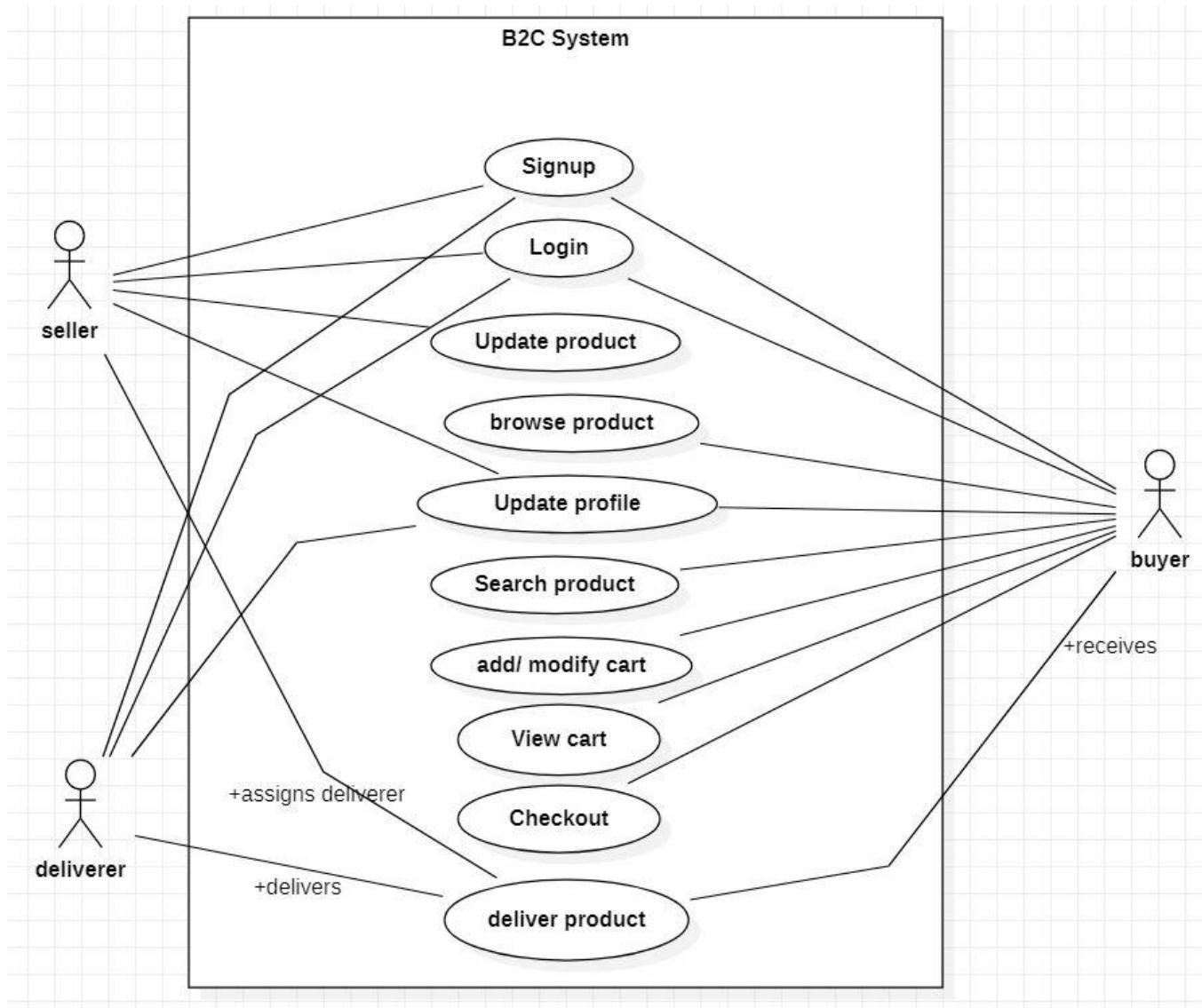
Uses: Where multiple use cases share pieces of same functionality.

Performance Instruction:

1. Identify various processes, use-cases, actors etc. of the system and analyse it.
2. Use processes at various levels and draw use case diagram.

Output:





Viva Questions

1. Explain use case approach of requirement elicitation?

Ans.

This technique combines text and pictures to provide a better understanding of the requirements. The use cases describe the 'what', of a system and not 'how'. Hence, they only give a functional view of the system. The components of the use case design include three major things – Actor, Use cases, use case diagram.

2. Explain term: use-case, use-case scenarios, use-case diagrams?

Ans.

A use case is a written description of how users will perform tasks on your website. It outlines, from a user's point of view, a system's behavior as it responds to a request.

A use case scenario is a single path through the use case. unlike a use case which is a step-by-step enumeration of the tasks carried out during a process (with the associated actors), a scenario is much more free-form.

A use case diagram can summarize the details of your system's users (also known as actors) and their interactions with the system.

3. What are actors and use cases?

Ans.

An **actor** in use case modelling specifies a role played by a user or any other system that interacts with the subject. An Actor models a type of role played by an entity that interacts with the subject (e.g., by exchanging signals and data), but which is external to the subject.

A **use case** is a written description of how users will perform tasks on your website. It outlines, from a user's point of view, a system's behaviour as it responds to a request.

4. Explain guidelines that should be kept in mind while creating use cases?

Ans.

Consider the following:

- Single statement per line
- Always have a subject – “User” or “System”
- Be concise – remember, use cases are not end requirements – you should be demonstrating the interaction between the system and user, but not detailed specifications
- Use an active voice

5. Name the person who invented use case approach?

Ans.

Ivar Jacobson first formulated textual and visual modelling techniques for specifying use cases.

EXPERIMENT - 5

Software Engineering Lab

Aim

To draw the structural view diagram for the system: Class diagram, object diagram.

Syeda Reeha Quasar

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EXPERIMENT – 5

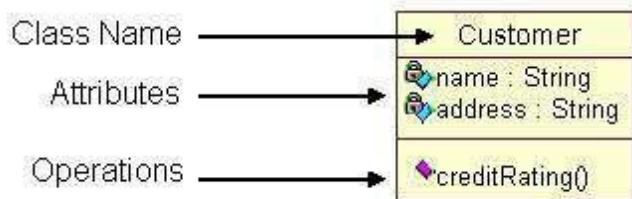
Aim:

To draw the structural view diagram for the system: Class diagram, object diagram.

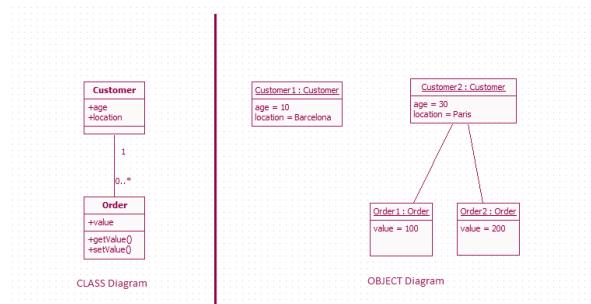
Theory:

Class diagrams are widely used to describe the types of objects in a system and their relationships. Class diagrams model class structure and contents using design elements such as classes, packages and objects. Class diagrams describe three different perspectives when designing a system, conceptual, specification, and implementation.

Classes are composed of three things: a name, attributes, and operations. Below is an example of a class:



Object diagrams are derived from class diagrams so object diagrams are dependent upon class diagrams. Object diagrams represent an instance of a class diagram. The basic concepts are similar for class diagrams and object diagrams. Object diagrams also represent the static view of a system but this static view is a snapshot of the system at a particular moment. Object diagrams are used to render a set of objects and their relationships as an instance.



Performance Instruction:

To draw class diagram

1. Identify various elements such as classes, member variables, member functions etc. of the class diagram
2. Draw the class diagram as per the norms

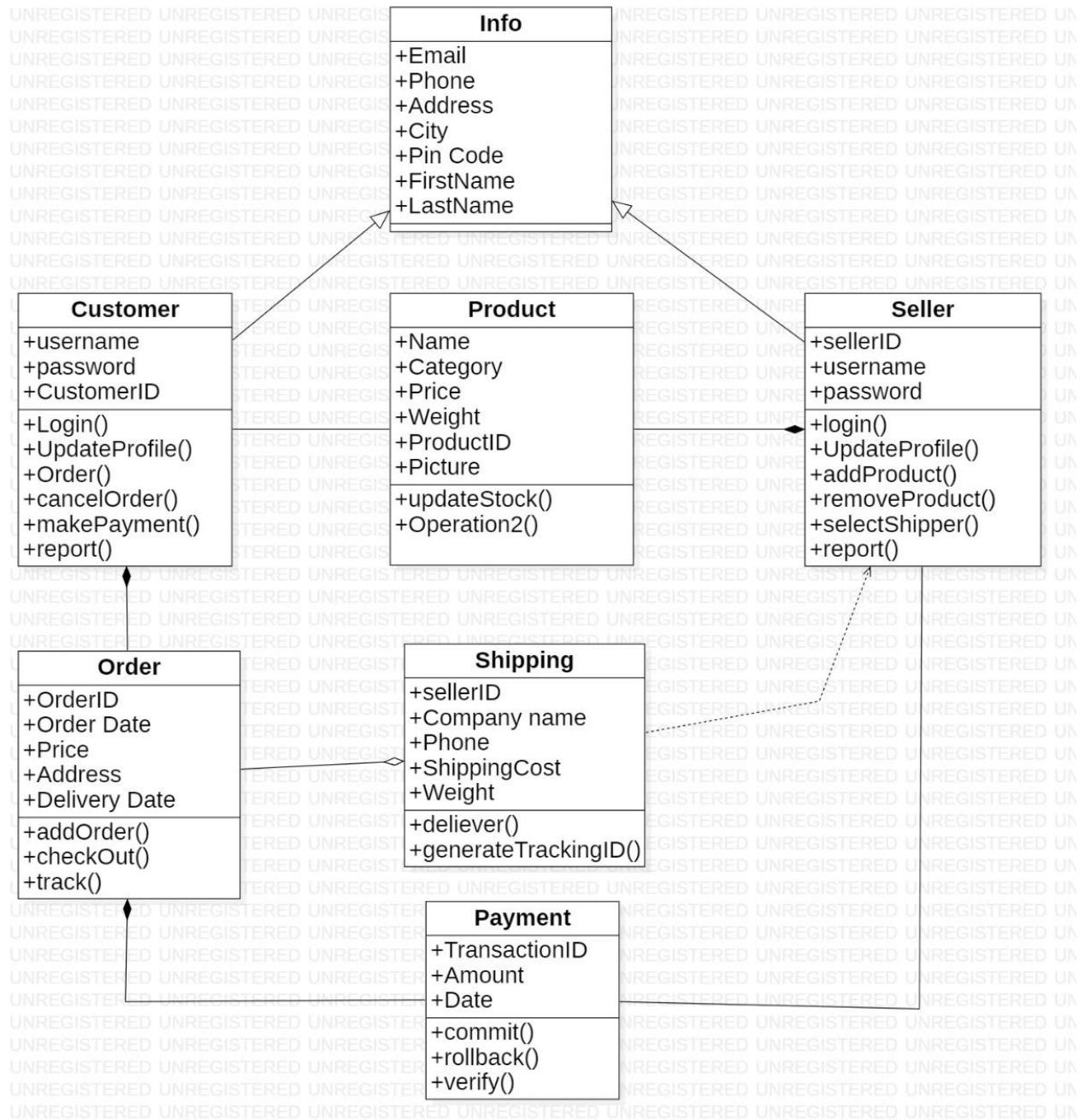
To draw object diagram

1. First, analyse the system and decide which instances have important data and association.
2. Second, consider only those instances, which will cover the functionality.
3. Third, make some optimization as the number of instances are unlimited.

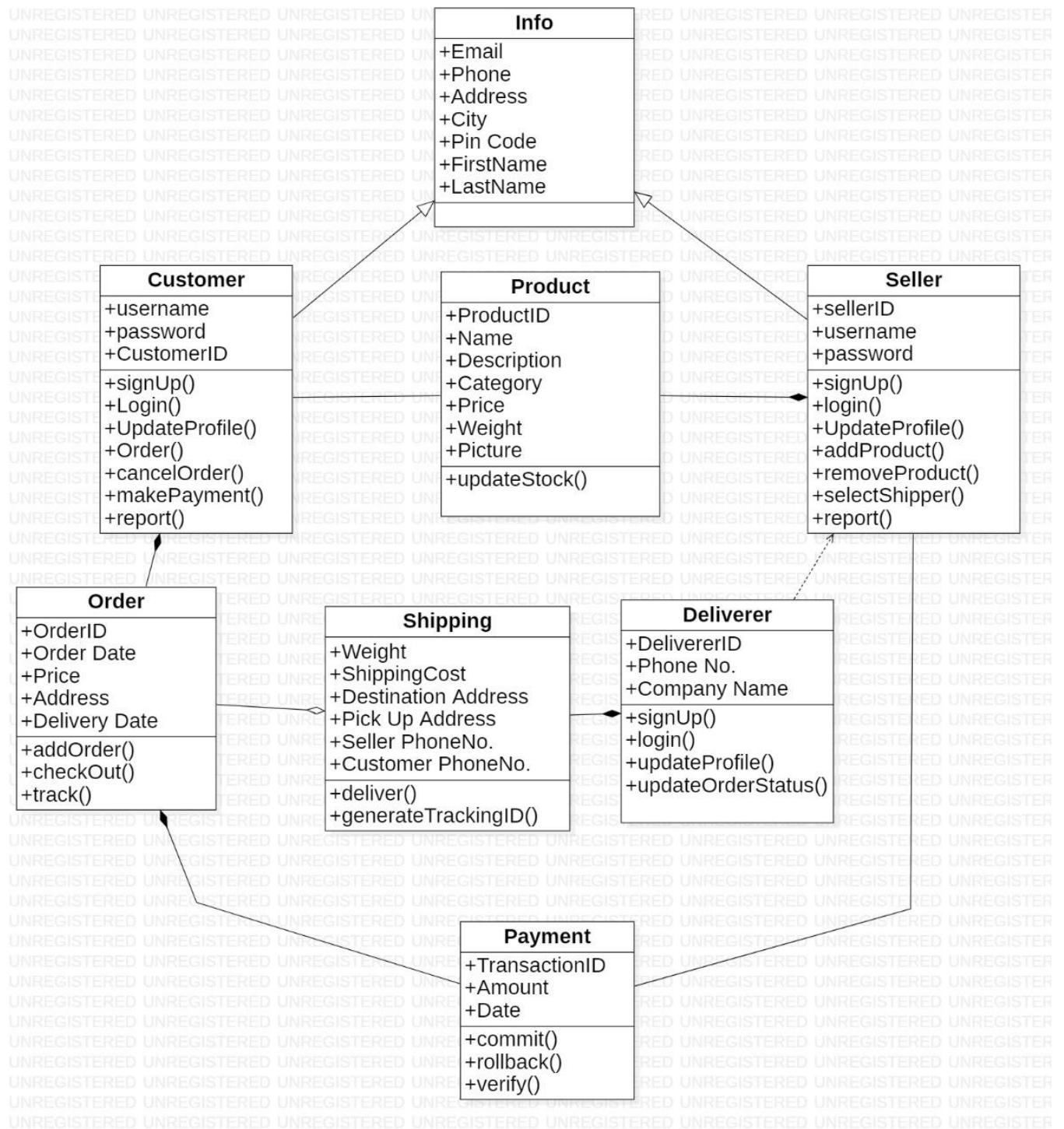
Class Diagram vs Object Diagram	
More Information Online: WWW.DIFFERENCEBETWEEN.COM	
DEFINITION	Class Diagram A type of static structural diagram that describes structure of the system by showing classes, their attributes, methods and relationship among classes.
MAIN REPRESENTATION	Defines classes or blue prints and show how they relate to each other.
METHOD OF WRITING	In a class diagram, the class name starts with uppercase. e.g. - Student
	In an object diagram, the object name is in lowercase, and it is underlined. e.g., s1: Student

Output:

Class Diagram



Object Diagram



Viva Questions

1. Explain class diagram?

Ans.

A class diagram is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

2. Explain four types of relationship used in class diagram?

Ans.

Inheritance (or Generalization):

A generalization is a taxonomic relationship between a more general classifier and a more specific classifier. Each instance of the specific classifier is also an indirect instance of the general classifier.

Association

Associations are relationships between classes in a UML Class Diagram. They are represented by a solid line between classes. Associations are typically named using a verb or verb phrase which reflects the real-world problem domain.

Realization

Realization is a relationship between the blueprint class and the object containing its respective implementation level details. This object is said to realize the blueprint class.

Dependency

An object of one class might use an object of another class in the code of a method. If the object is not stored in any field, then this is modelled as a dependency relationship.

3. Explain terms classes, interfaces, collaborations and dependency?

Ans.

Classes

A template for creating objects and implementing behavior in a system. In UML, a class represents an object or a set of objects that share a common structure and behavior. They're represented by a rectangle that includes rows of the class name, its attributes, and its operations

Interfaces

Interfaces are model elements that define sets of operations that other model elements, such as classes, or components must implement. An implementing model element realizes an interface by overriding each of the operations that the interface declares.

Collaborations

It is used to show the relationship between the objects in a system. Both the sequence and the collaboration diagrams represent the same information but differently. Instead of showing the flow of messages, it depicts the architecture of the object residing in the system as it is based on object-oriented programming. An object consists of several features.

Dependency

An object of one class might use an object of another class in the code of a method. If the object is not stored in any field, then this is modeled as a dependency relationship.

4. Explain object diagram?

Ans.

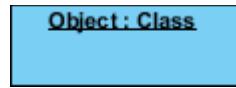
Object diagrams represent an instance of a class diagram. The basic concepts are similar for class diagrams and object diagrams. Object diagrams also represent the static view of a system but this static view is a snapshot of the system at a particular moment.

5. Explain symbols used in it?

Ans.

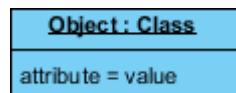
Object Names:

- Every object is actually symbolized like a rectangle, that offers the name from the object and its class underlined as well as divided with a colon.



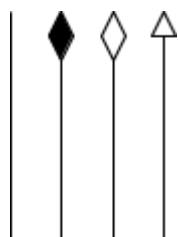
Object Attributes:

- Similar to classes, you are able to list object attributes inside a separate compartment. However, unlike classes, object attributes should have values assigned for them.



Links:

- Links tend to be instances associated with associations. You can draw a link while using the lines utilized in class diagrams.



EXPERIMENT - 6

Software Engineering Lab

Aim

To draw the behavioral view diagram: State-chart diagram, Activity diagram.

Syeda Reeha Quasar

14114802719

4C7

EXPERIMENT – 6

Aim:

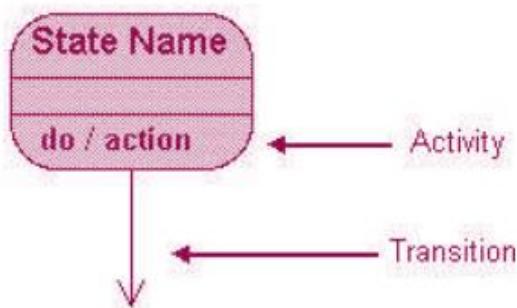
To draw the behavioural view diagram: State-chart diagram, Activity diagram.

Theory:

behavioral diagrams visualize, specify, construct, and document the dynamic aspects of a system. The behavioral diagrams are categorized as follows: use case diagrams, interaction diagrams, state–chart diagrams, and activity diagrams.

State–Chart Diagrams

State chart diagrams represent the behavior of entities capable of dynamic behavior by specifying its response to the receipt of event instances.



A state–chart diagram shows a state machine that depicts the control flow of an object from one state to another. A state machine portrays the sequences of states which an object undergoes due to events and their responses to events.

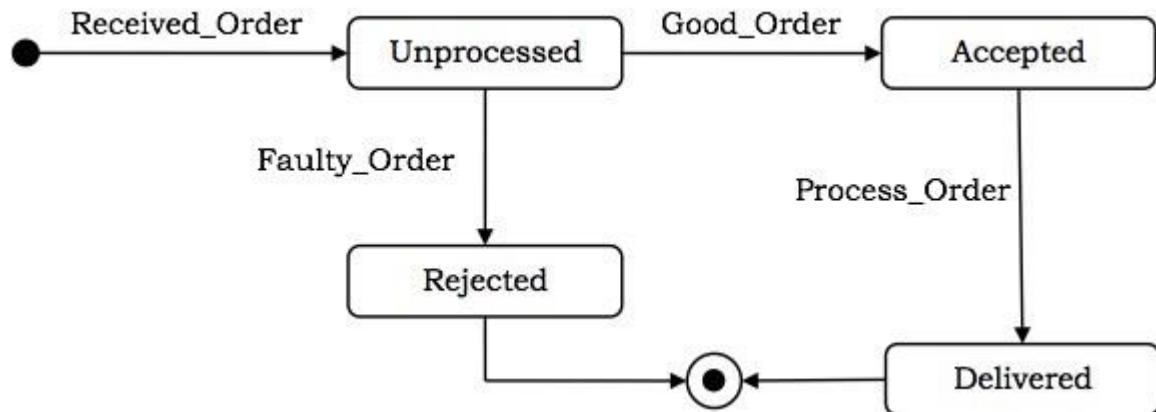
State–Chart Diagrams comprise of –

- States: Simple or Composite
- Transitions between states
- Events causing transitions
- Actions due to the events

State-chart diagrams are used for modeling objects which are reactive in nature.

Example

In the Automated Trading House System, let us model Order as an object and trace its sequence. The following figure shows the corresponding state–chart diagram.



Activity Diagrams

An activity diagram depicts the flow of activities which are ongoing non-atomic operations in a state machine. Activities result in actions which are atomic operations.

Activity diagrams describe the workflow behavior of a system. Activity diagrams are similar to state diagrams because activities are the state of doing something. The diagrams describe the state of activities by showing the sequence of activities performed. Activity diagrams can show activities that are conditional or parallel. Activity diagrams show the flow of activities through the system. Diagrams are read from top to bottom and have branches and forks to describe conditions and parallel activities. A fork is used when multiple activities are occurring at the same time. The diagram below shows a fork after activity1. This indicates that both activity2 and activity3 are occurring at the same time. After activity2 there is a branch. The branch describes what activities will take place based on a set of conditions. All branches at some point are followed by a merge to indicate the end of the conditional behavior started by that branch. After the merge all of the parallel activities must be combined by a join before transitioning into the final activity state.

Activity diagrams comprise of –

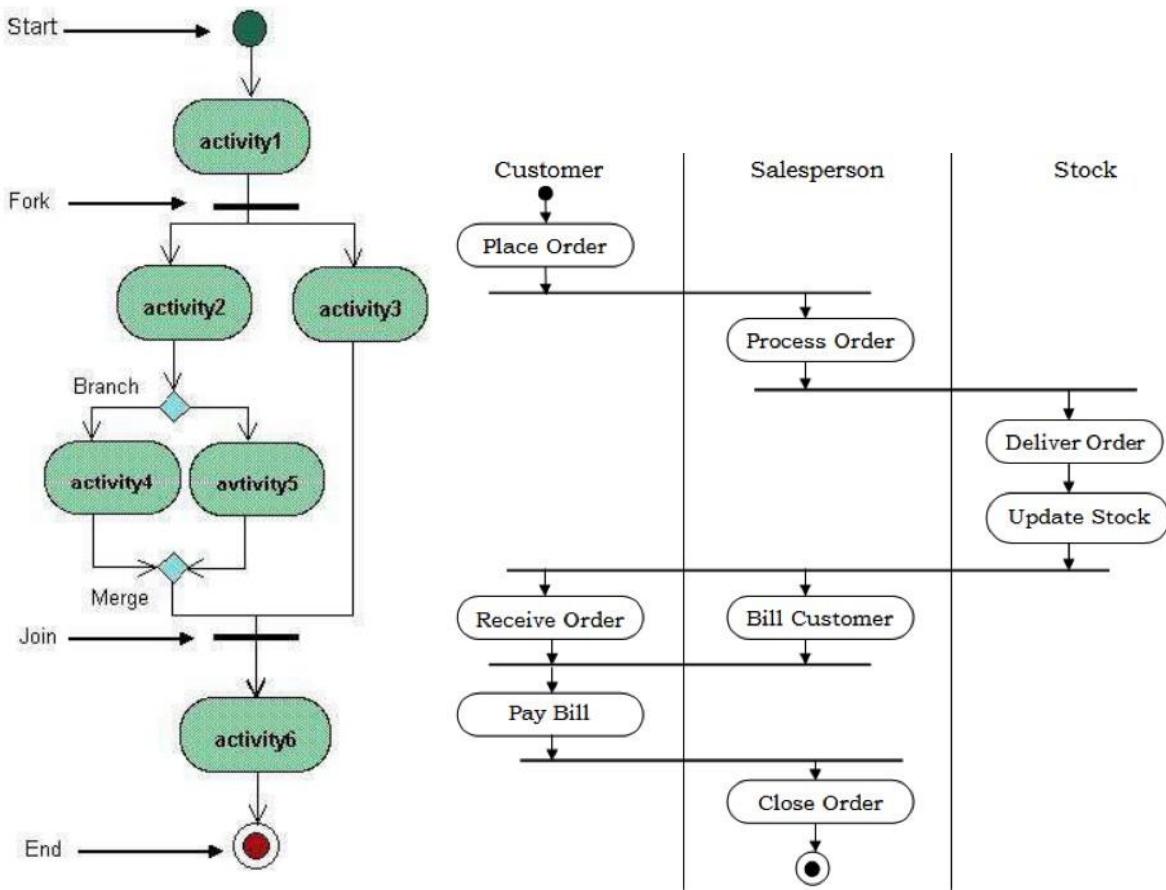
- Activity states and action states
- Transitions
- Objects

Activity diagrams are used for modeling –

- workflows as viewed by actors, interacting with the system.
- details of operations or computations using flowcharts.

Example

The following figure shows an activity diagram of a portion of the Automated Trading House System.



Performance Instruction:

To draw state chart diagram

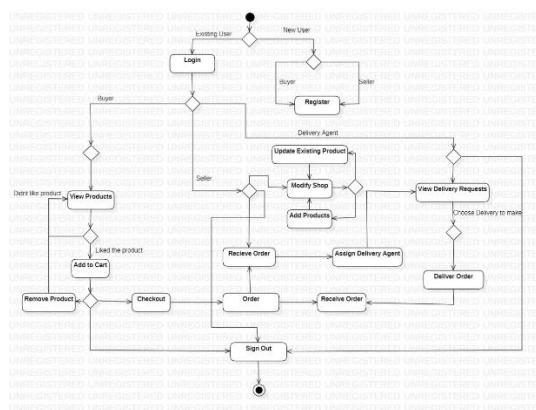
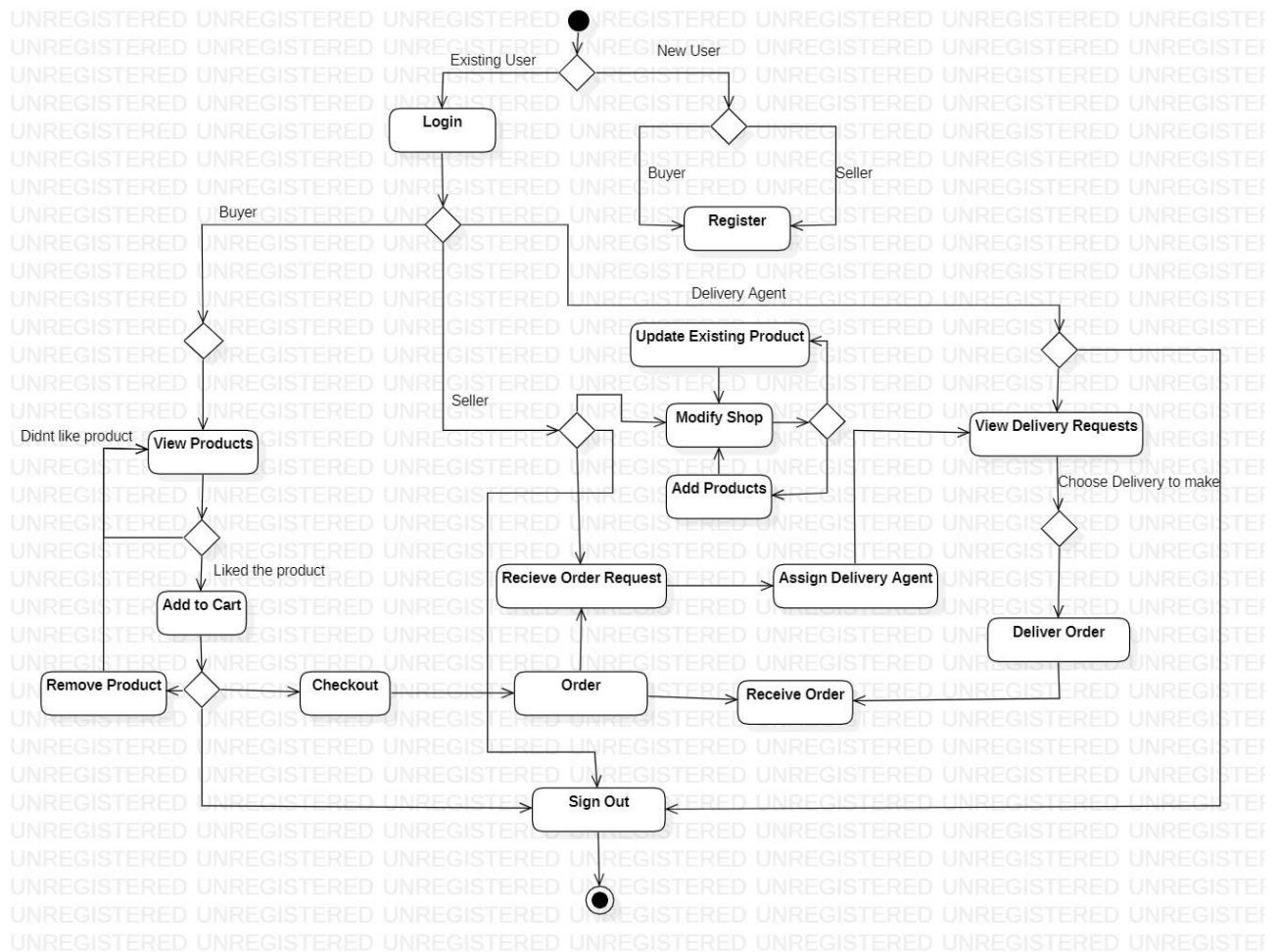
1. Identify various elements states and their different transition of the state-chart diagram.
2. Draw the state-chart diagram as per the norms.

To draw activity diagram

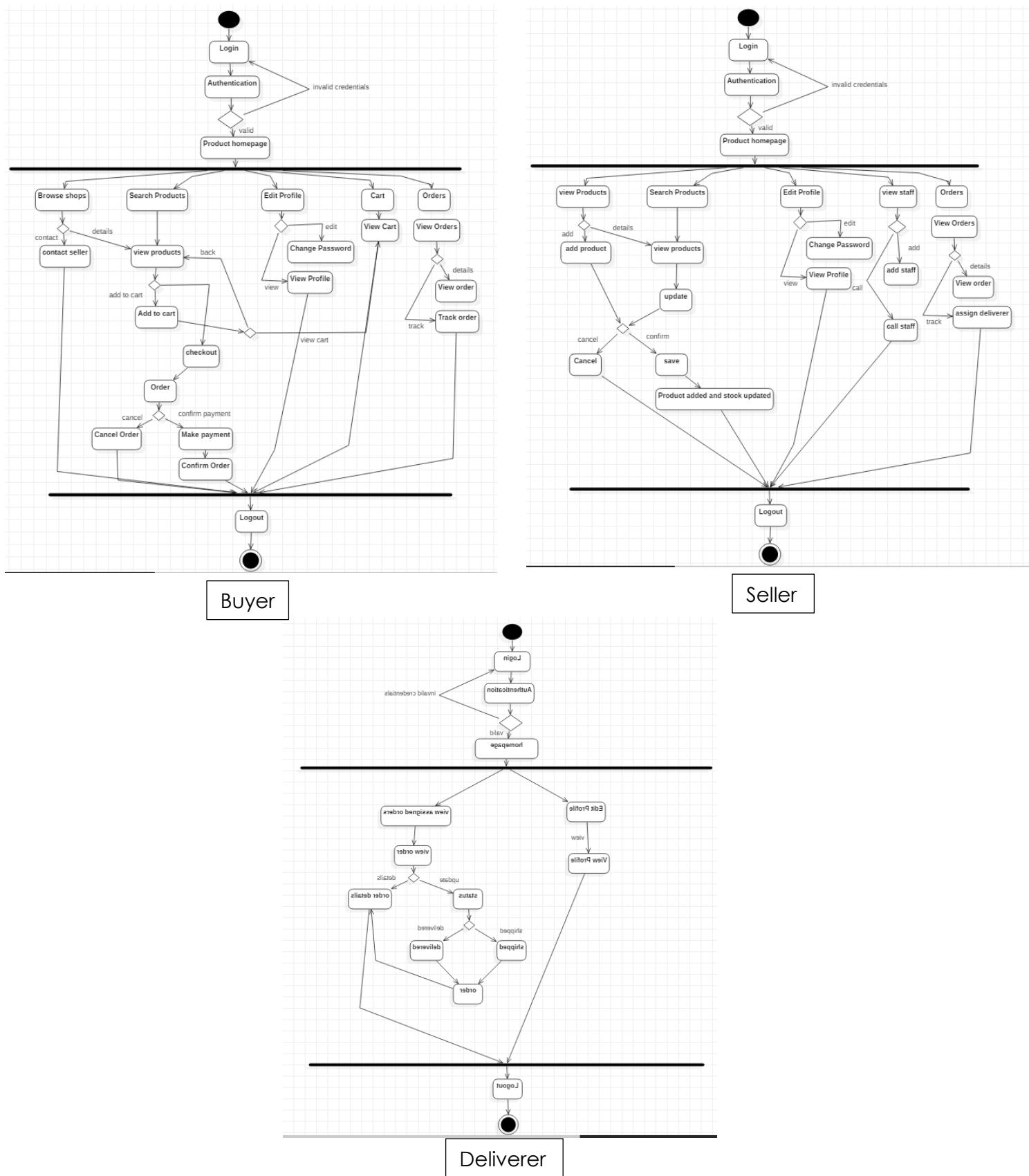
1. Identify various elements such as different activity their boundaries etc. of the activity diagram.
2. Draw the activity diagram as per the norms.

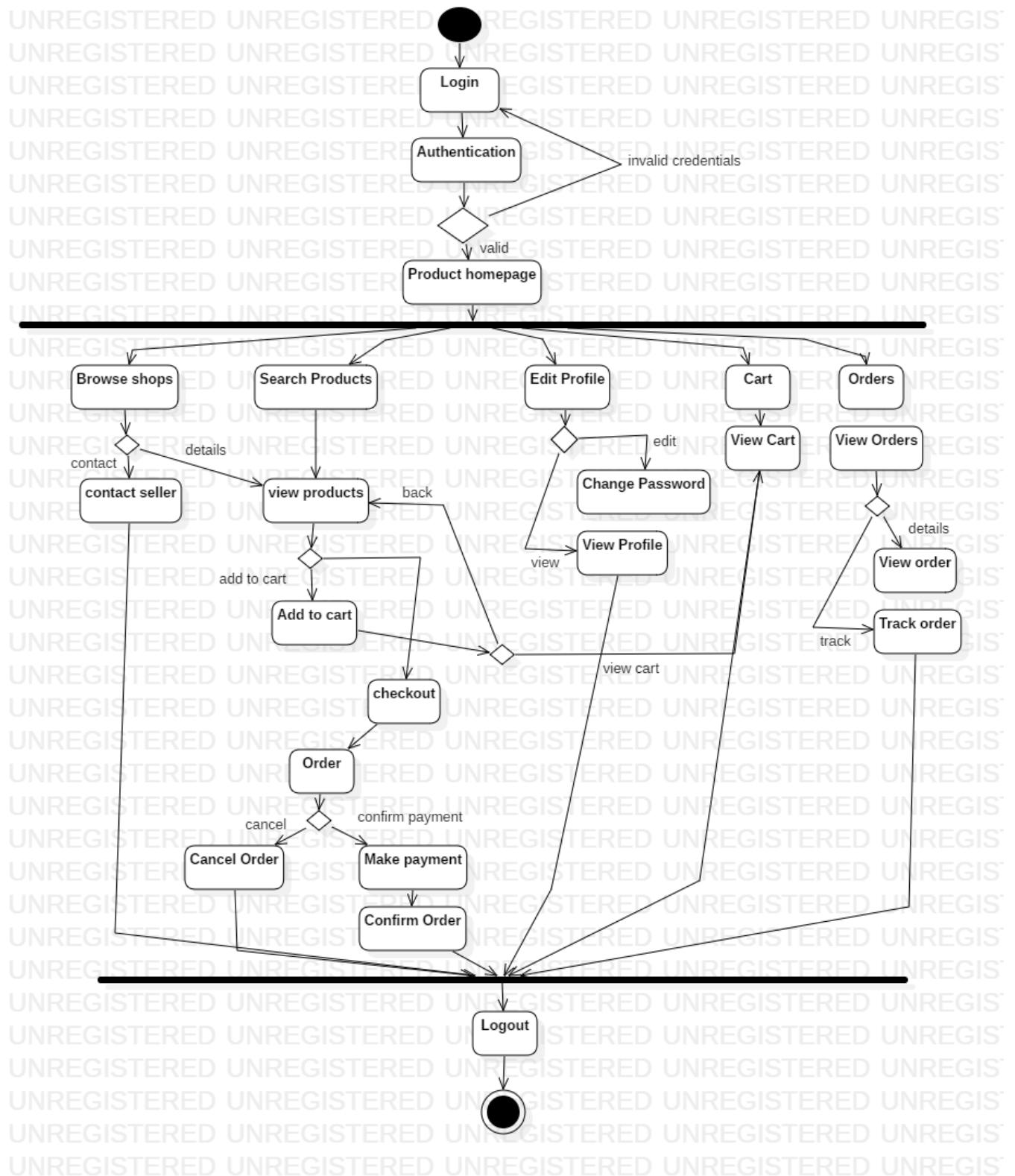
Output:

State Chart Diagram

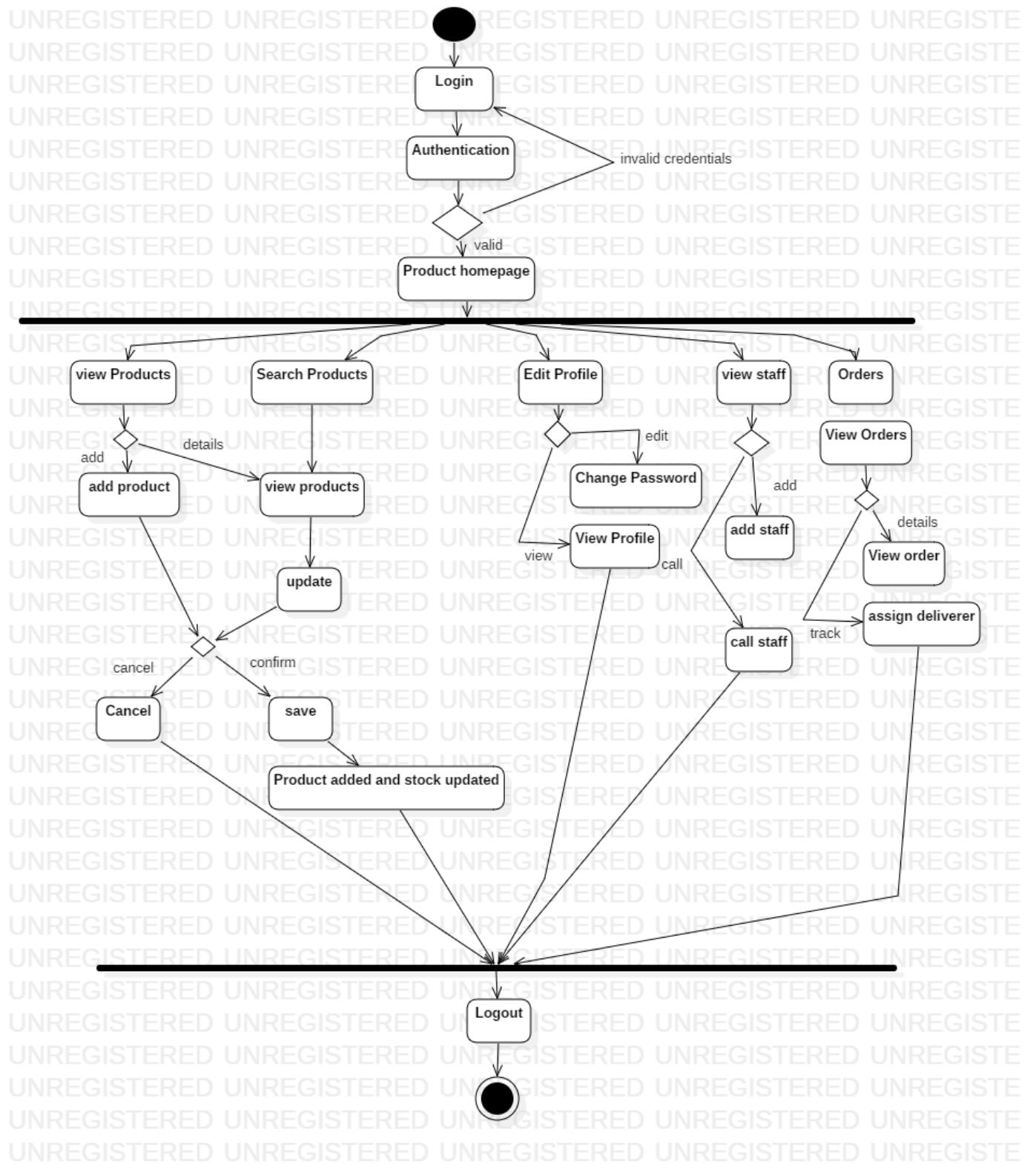


Activity Diagram

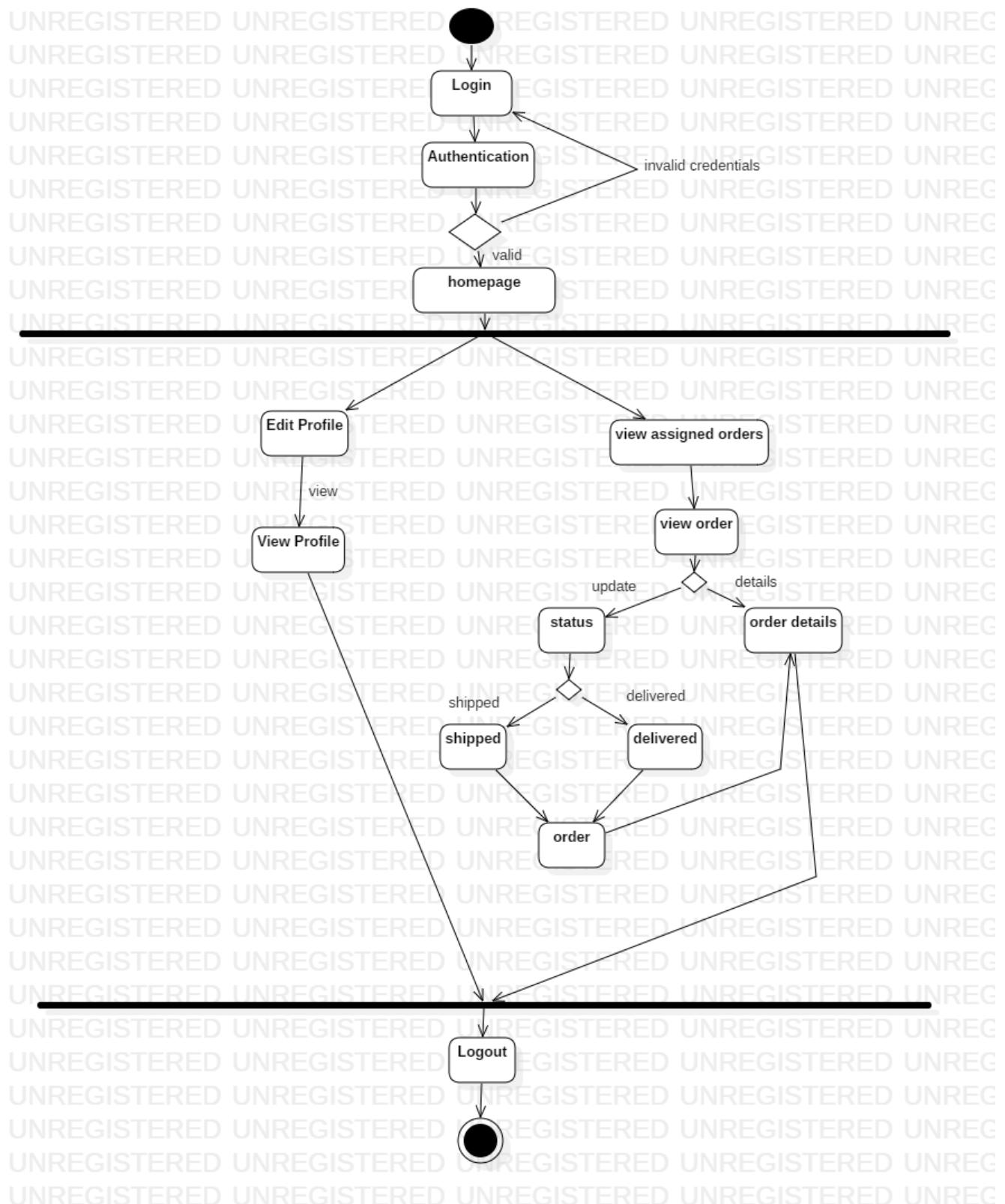




Buyer



Seller



Deliverer

Conclusion:

State Chart and Activity diagram were made successfully by following above steps.

Viva Questions

1. How activity diagram explains behavioral view of system?

Ans.

An activity diagram is a behavioral diagram i.e. it depicts the behavior of a system. An activity diagram portrays the control flow from a start point to a finish point showing the various decision paths that exist while the activity is being executed.

2. Explain steps followed to construct activity diagram?

Ans.

Step 1: Figure out the action steps from the use case

Here you need to identify the various activities and actions your business process or system is made up of.

Step 2: Identify the actors who are involved

If you already have figured out who the actors are, then it's easier to discern each action they are responsible for.

Step 3: Find a flow among the activities

Figure out in which order the actions are processed. Mark down the conditions that have to be met in order to carry out certain processes, which actions occur at the same time and whether you need to add any branches in the diagram. And do you have to complete some actions before you can proceed to others?

Step 4: Add swimlanes

You have already figured out who is responsible for each action. Now it's time to assign them a swimlane and group each action they are responsible for under them.

3. How state chart diagram explains behavioral view of system?

Ans.

Statechart diagram defines the states of a component and these state changes are dynamic in nature. Its specific purpose is to define the state changes triggered by events. Events are internal or external factors influencing the system.

4. Explain steps followed to construct state chart diagram?

Ans.

1. Identify the initial state and the final terminating states.
2. Identify the possible states in which the object can exist (boundary values corresponding to different attributes guide us in identifying different states).
3. Label the events which trigger these transitions.

5. Explain symbols used to construct these diagrams?

Ans.

STATE CHART DIAGRAM

States

States represent situations during the life of an object. You can easily illustrate a state in SmartDraw by using a rectangle with rounded corners.

**A simple state****A state with internal activities**

Transition

A solid arrow represents the path between different states of an object. Label the transition with the event that triggered it and the action that results from it. A state can have a transition that points back to itself.



Initial State

A filled circle followed by an arrow represents the object's initial state.



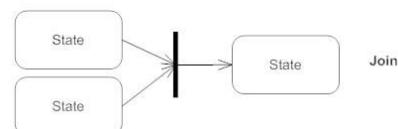
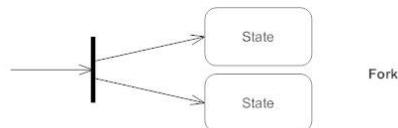
Final State

An arrow pointing to a filled circle nested inside another circle represents the object's final state.



Synchronization and Splitting of Control

A short heavy bar with two transitions entering it represents a synchronization of control. The first bar is often called a fork where a single transition splits into concurrent multiple transitions. The second bar is called a join, where the concurrent transitions reduce back to one.



ACTIVITY DIAGRAM

Initial State or Start Point

A small filled circle followed by an arrow represents the initial action state or the start point for any activity diagram. For activity diagram using swimlanes, make sure the start point is placed in the top left corner of the first column.



Start Point/Initial State

Activity or Action State

An action state represents the non-interruptible action of objects. You can draw an action state in SmartDraw using a rectangle with rounded corners.



Action Flow

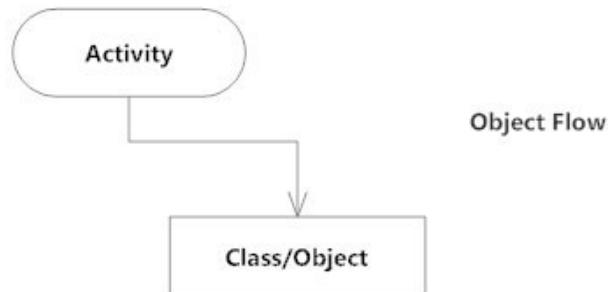
Action flows, also called edges and paths, illustrate the transitions from one action state to another. They are usually drawn with an arrowed line.



Action Flow

Object Flow

Object flow refers to the creation and modification of objects by activities. An object flow arrow from an action to an object means that the action creates or influences the object. An object flow arrow from an object to an action indicates that the action state uses the object.



Decisions and Branching

A diamond represents a decision with alternate paths. When an activity requires a decision prior to moving on to the next activity, add a diamond between the two activities. The outgoing alternates should be labeled with a condition or guard expression. You can also label one of the paths "else."



Guards

In UML, guards are a statement written next to a decision diamond that must be true before moving next to the next activity. These are not essential, but are useful when a specific answer, such as "Yes, three labels are printed," is needed before moving forward.

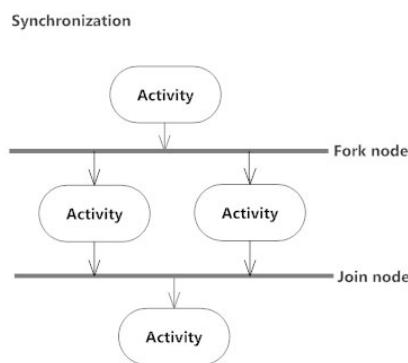


Synchronization

A fork node is used to split a single incoming flow into multiple concurrent flows. It is represented as a straight, slightly thicker line in an activity diagram.

A join node joins multiple concurrent flows back into a single outgoing flow.

A fork and join mode used together are often referred to as synchronization.



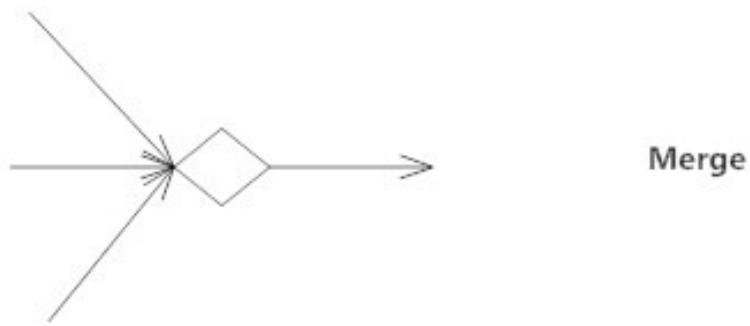
Time Event

This refers to an event that stops the flow for a time; an hourglass depicts it.



Merge Event

A merge event brings together multiple flows that are not concurrent.



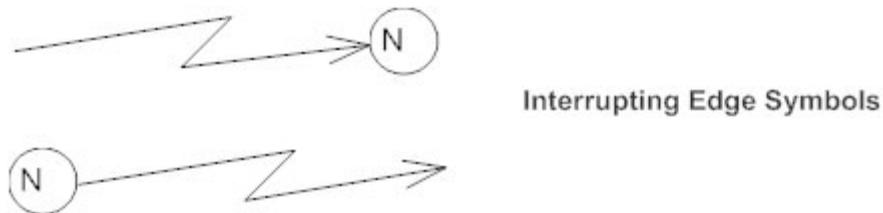
Sent and Received Signals

Signals represent how activities can be modified from outside the system. They usually appear in pairs of sent and received signals, because the state can't change until a response is received, much like synchronous messages in a sequence diagram. For example, an authorization of payment is needed before an order can be completed.



Interrupting Edge

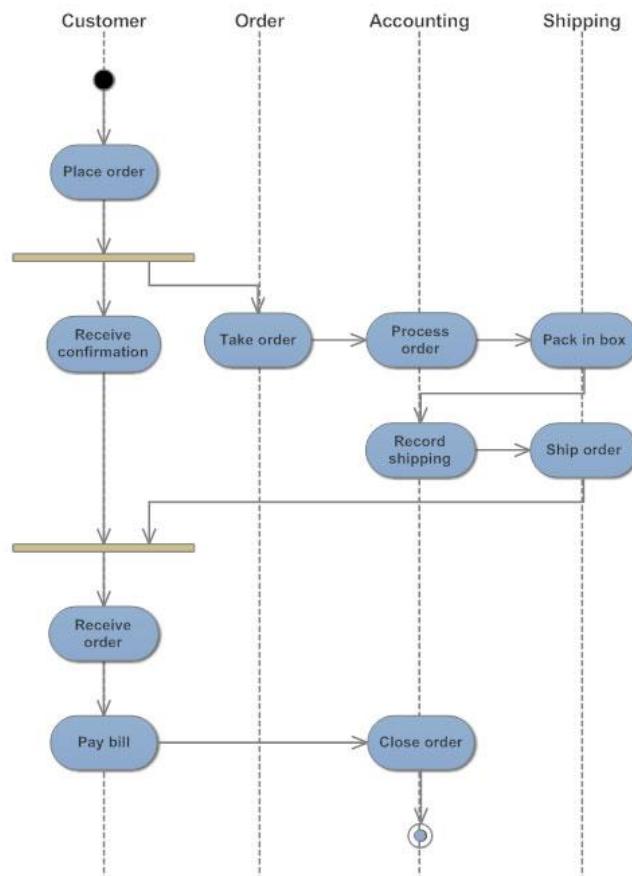
An event, such as a cancellation, that interrupts the flow denoted with a lightning bolt.



Swimlanes

Swimlanes group related activities into one column.

UML Activity Diagram: Order Processing



Final State or End Point

An arrow pointing to a filled circle nested inside another circle represents the final action state.

