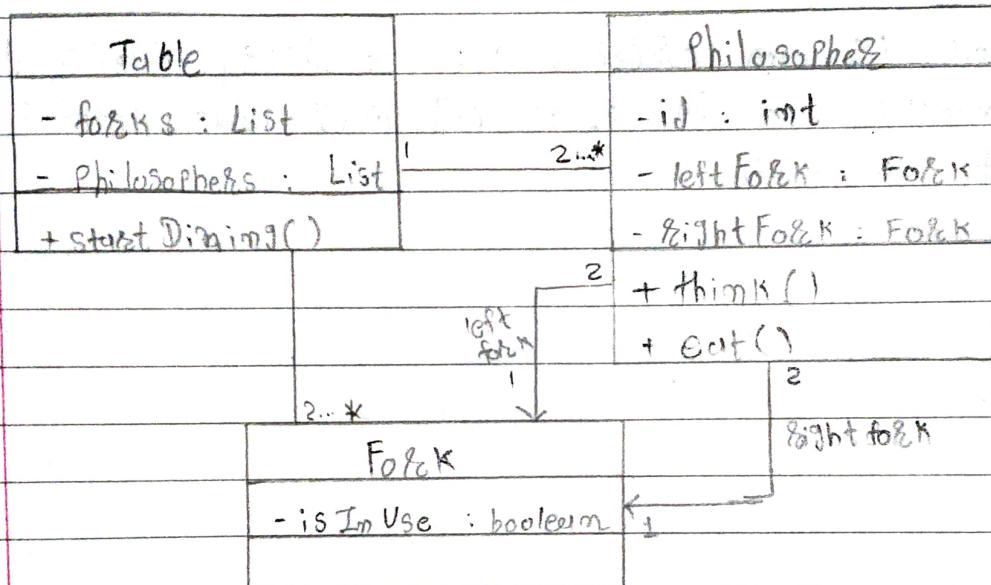


Assignment - 1

Q.1 Prepare a class diagram for the dining philosopher problem. There are 5 philosophers and 5 forks around a circular table. Each philosopher has access to 2 forks, one on either side. Each fork is shared by 2 philosophers. Each fork may be either on the table or in use by one philosopher. A philosopher must have 2 forks to eat.

Ans.



Q.2 The tower of Hanoi is a problem frequently ~~is used~~ used to teach recursive programming techniques. The goal is to move a stack of disks from one of three long pegs to another, using the third peg for maneuvering. Each disk is a different size. Disks may be moved from the top of a stack on a peg to the top of the stack on ~~any~~ any other peg, one at a time, provided a disk is never placed on another disk that is smaller than itself. The details of the algorithm for listing the series of required moves depend on the structure of the class diagram used. Prepare class diagrams for each of the following descriptions. Show classes and associations.

Do not show attributes or operations :

- A tower consists of 3 pegs. Each peg has several disks on it, in a certain order.
- A tower consists of 3 pegs. Disks on the pegs are organized into subsets called stacks.

A stack is an ordered set of disks. Every disk is in exactly one stack. A peg may have several stacks on it, in order.

Ans. (a)

Tower	Peg	Disk
3	1...3	1*
has.		0*

containing

Ans. (b)

Tower	Peg	Disk	Stack
3	1...3	1*	1*
has			has

containing

Q. 3

Prepare a portion of a class diagram for a library book checkout system that shows the late charges for an overdue book as a derived attribute.

Ans.

Book		Member
<ul style="list-style-type: none"> <li>- bookId : int</li> <li>+ title : string</li> <li>+ author : string</li> <li>+ available : boolean</li> <li>+ checkOut ()</li> <li>+ checkIn ()</li> </ul>		<ul style="list-style-type: none"> <li>- memberID : int</li> <li>- name : string</li> <li>- contactInfo : string</li> </ul>

1

4

Checkout	
<ul style="list-style-type: none"> <li>- CheckoutId : int</li> <li>- dueDate : date</li> <li>- returnDate : date</li> <li>- &lt;&lt;derived&gt;&gt; lateCharges : double</li> <li>+ calculateLateCharges ()</li> </ul>	0...*

0...\*

0...\*

Q.4 Consider an online airline reservation system. You may want to check airline Web sites to give your ideas.

a. List two actors. Explain the relevance of each actor.  
 b. One use case is to make a flight reservation. List four additional use cases at a comparable level of abstraction. Summarize the purpose of each ~~use case~~ use case with a sentence.

c. Prepare a use case diagram for an airline reservation system.

Ans.(a) Actors :-

1. Customer :-

- Relevance :- The customer is the primary user of the online airline reservation system. They interact with the system to search for flights, make reservations, and manage their bookings.

## 2. Administrator :-

- Relevance :- The administrator is a system actor responsible for managing and maintaining the airline reservation system. This may include tasks such as adding or updating flight information, managing user accounts, and resolving issues.

## Ans. (b)

### Use Cases :-

#### 1. Make Flight Reservation :-

- Purpose :- Allows a customer to search for flights based on various criteria (dates, destinations, etc) and make a reservation for a chosen flight.

#### 2. Cancel Reservation :-

- Purpose :- Permits a customer to cancel an existing flight reservation, updating the system and possibly triggering refund processes.

#### 3. Check Flight Status :-

- Purpose :- Enables the customers to check the status of a specific flight, providing real-time information about delays, cancellations, or other changes.

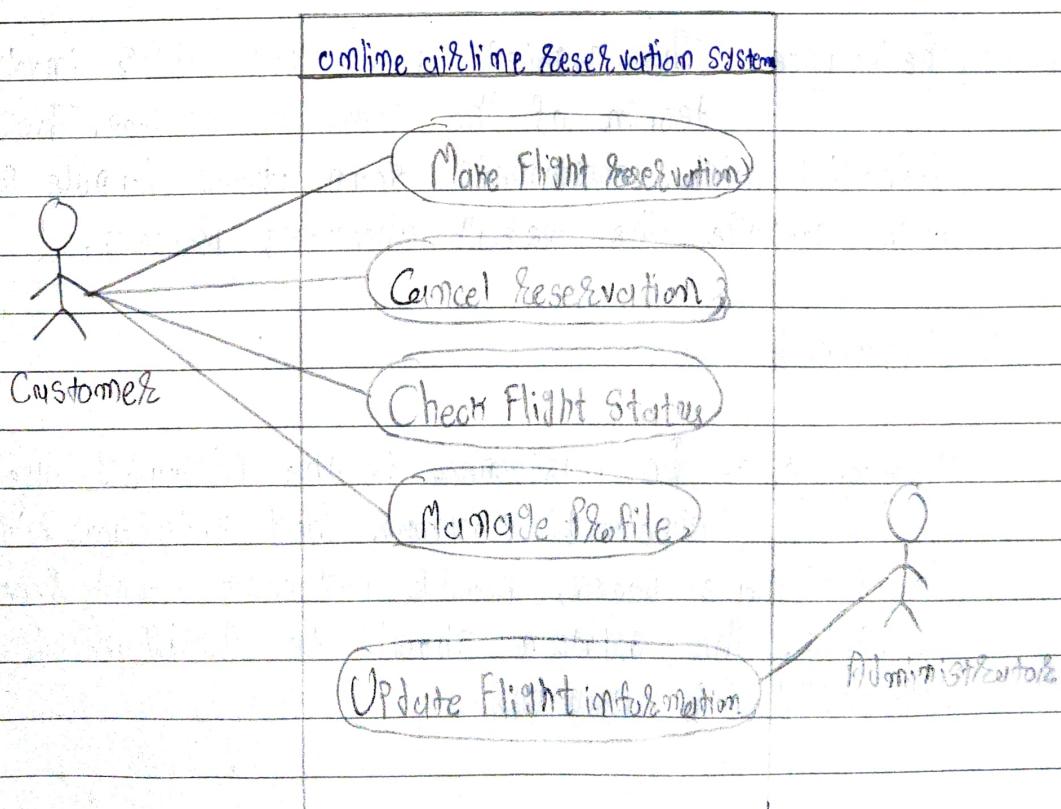
#### 4. Manage Profile :-

- Purpose :- Allows customers to manage their profiles, including updating personal information, preferences, and viewing past and upcoming reservations.

#### 5. Update Flight Information :-

- Purpose :- Permits administrators to update and manage flight information, including schedules, seat availability, and pricing.

#### A. (c) Use case diagram :-



Q.5

Consider a physical bookstore, such as in a shopping mall.

- a. List three actors that are involved in the design of a checkout system. Explain the relevance of each actor.
- b. One use case is the purchase items. Take the perspective of a customer and list another use case at a comparable level of abstraction. Summarize the purpose of each use case with a sentence.
- c. Prepare a use case diagram for a physical bookstore checkout system.

Ans.(a) Actors :-

1. cashier :-

- Relevance :- The cashier is a key actor involved in the design of the checkout system. They interact directly with customers, scan items, handle payments, and manage the overall checkout process.

2. Customer :-

- Relevance :- The customer is the primary user of the checkout system. They interact with the system to purchase books, provide payment, and receive receipts. The system should be designed to be user-friendly for customers.

### 3. Inventory manager :-

- Relevance :- The inventory manager is responsible for maintaining and updating the stock of books in the physical bookstore. They may interact with the checkout system to update inventory levels, track sales, and manage stock replenishment.

#### Ans.(b) Use Cases :-

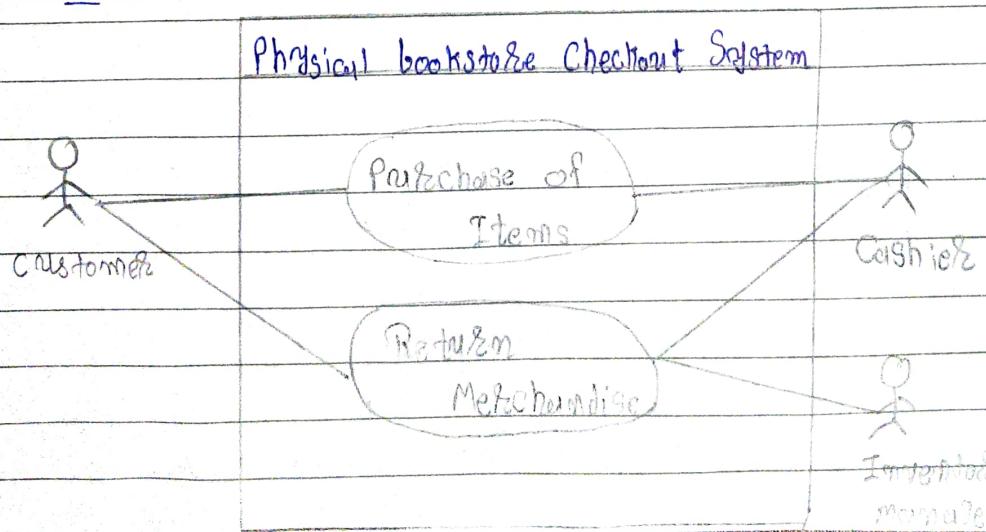
##### 1. Purchase of Items :-

- Purpose :- Allows customers to select books, bring them to the checkout counter, and complete the purchase transaction by providing payment.

##### 2. Return Merchandise :-

- Purpose :- Permits customers to return items they previously purchased, initiating a refund or exchange process.

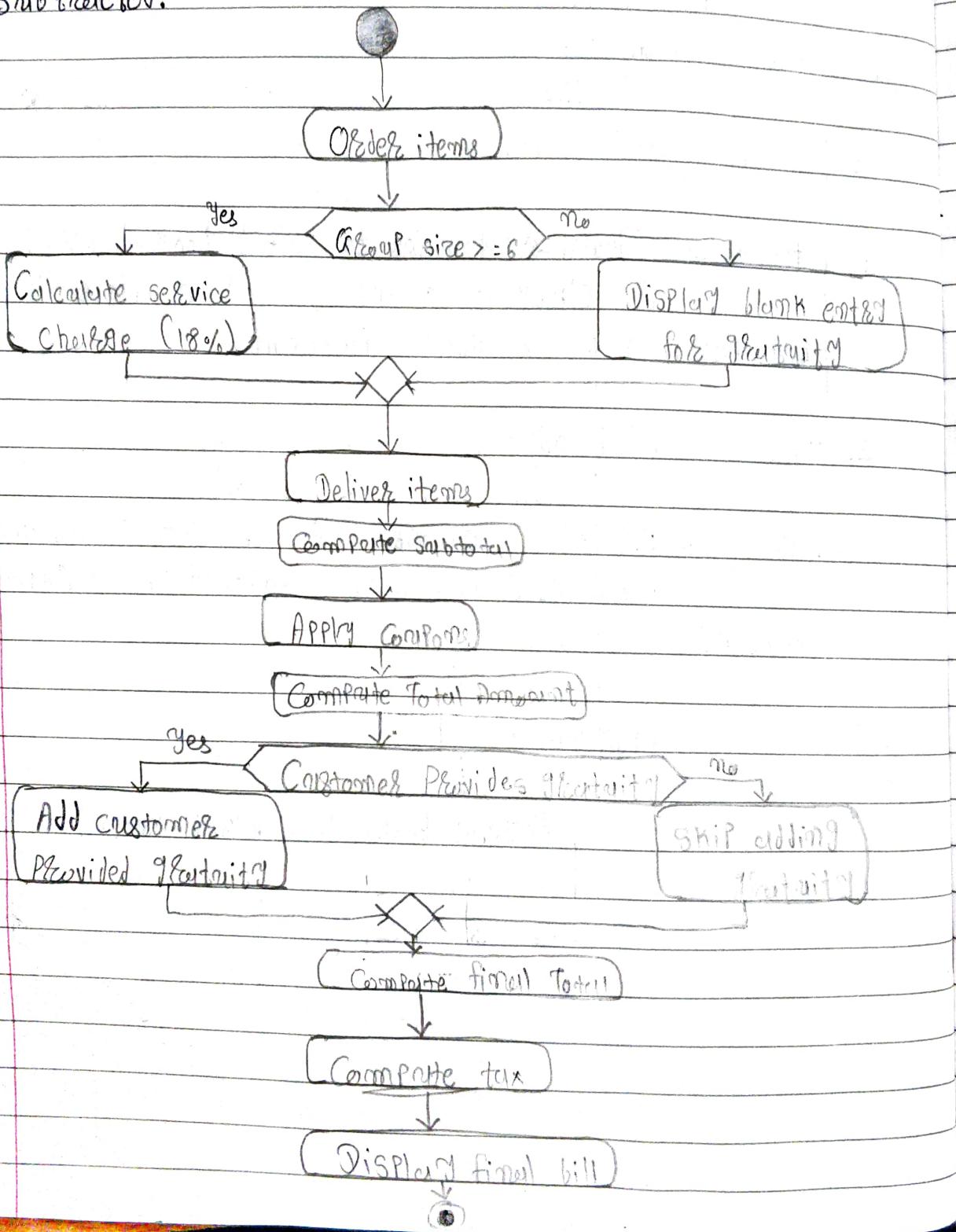
#### Ans.(c) Use Case diagram :-



Q.6

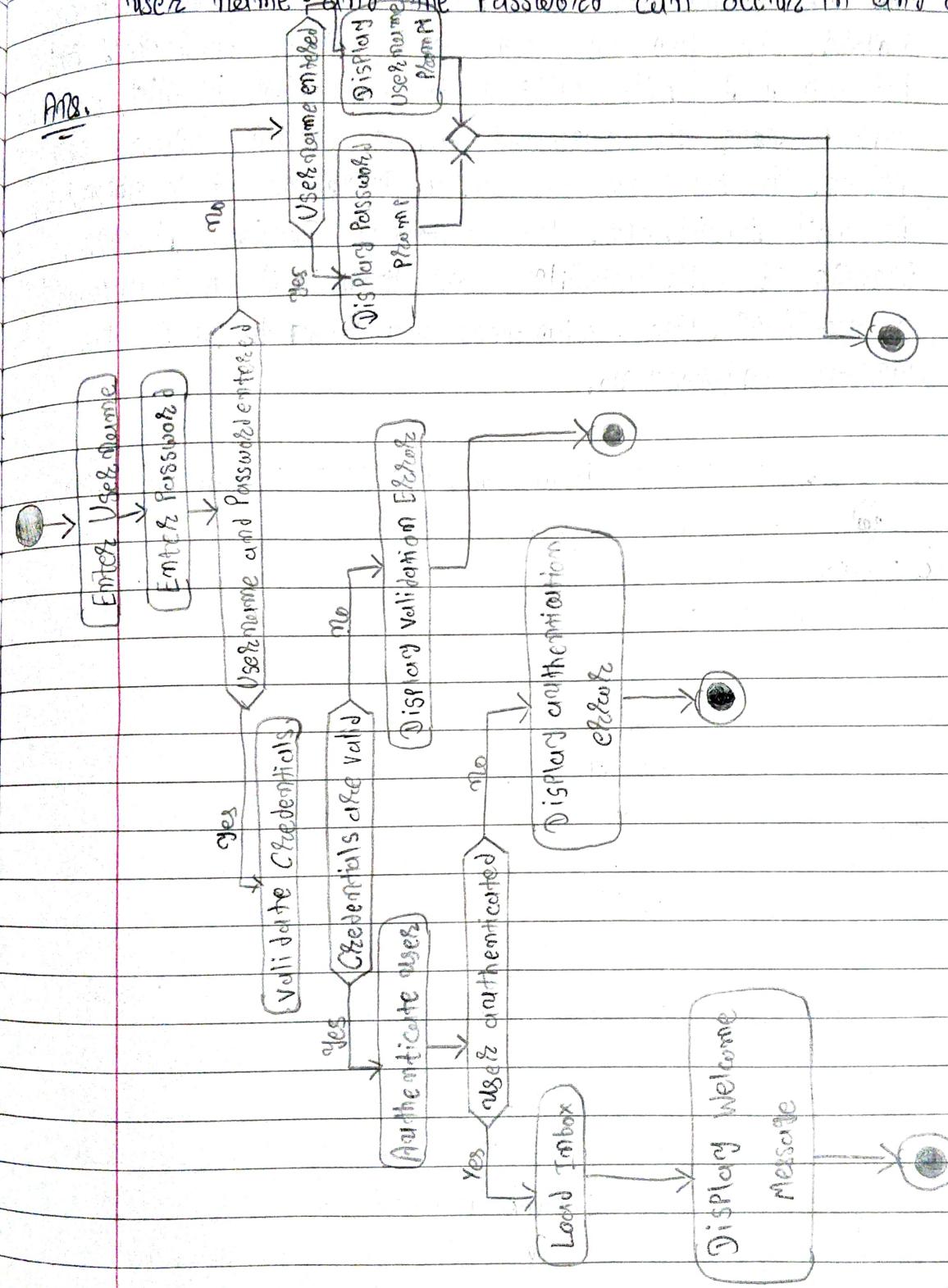
Prepare an activity diagram for computing a restaurant bill. There should be a charge for each delivered item. The total amount should be subject to tax and a service charge of 18% for groups of six or more. For smaller groups, there should be a blank entry for a gratuity according to the customer's direction. Any coupons or gift certificates submitted by the customer should be subtracted.

Ans.



Q. 7 Prepare an activity diagram that elaborates the details of logging into an email system. Note that entry of the user name and the password can occur in any order.

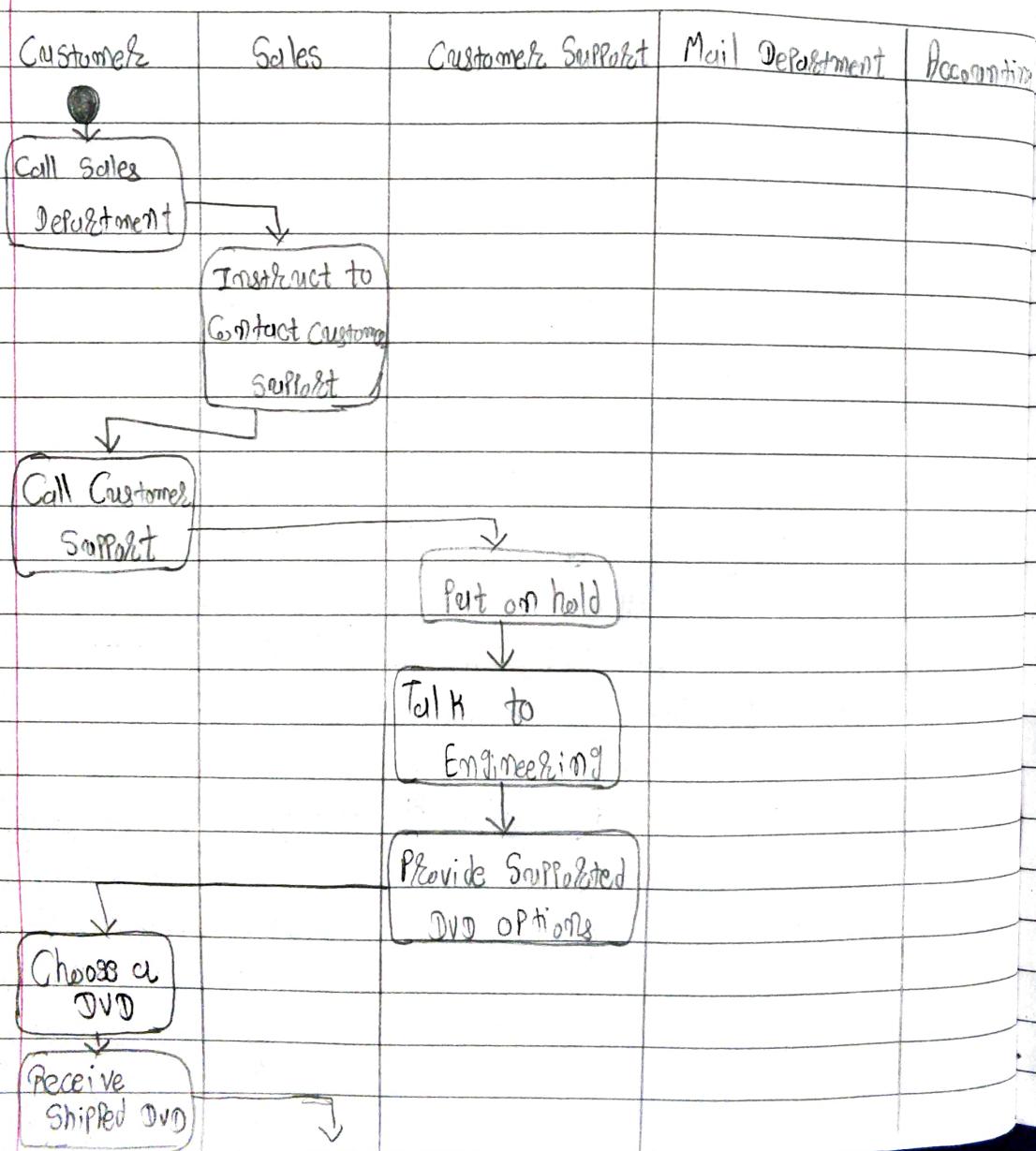
Ans.

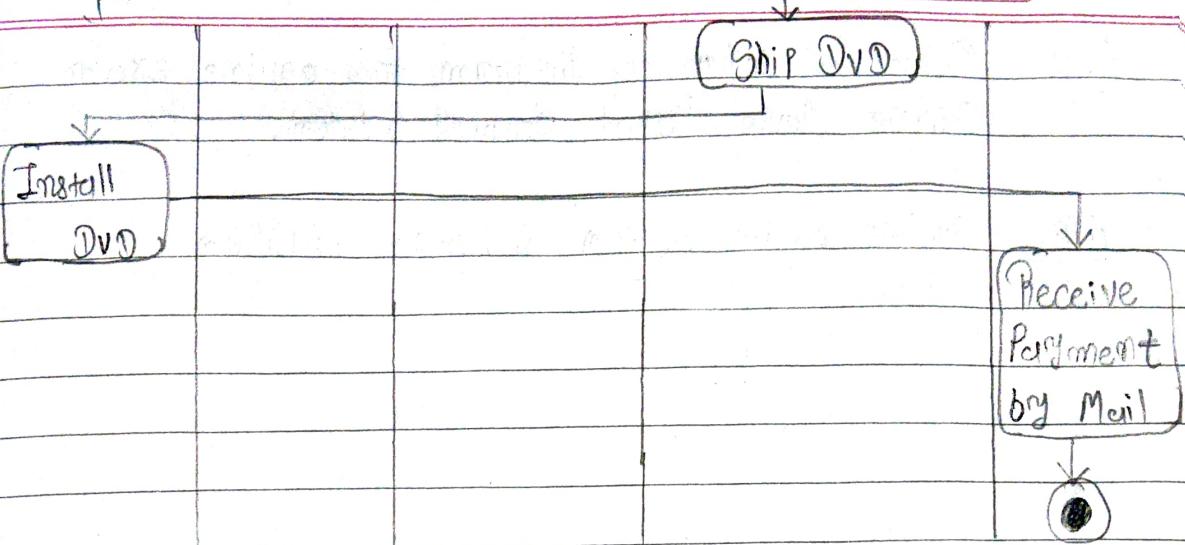


Q. 8

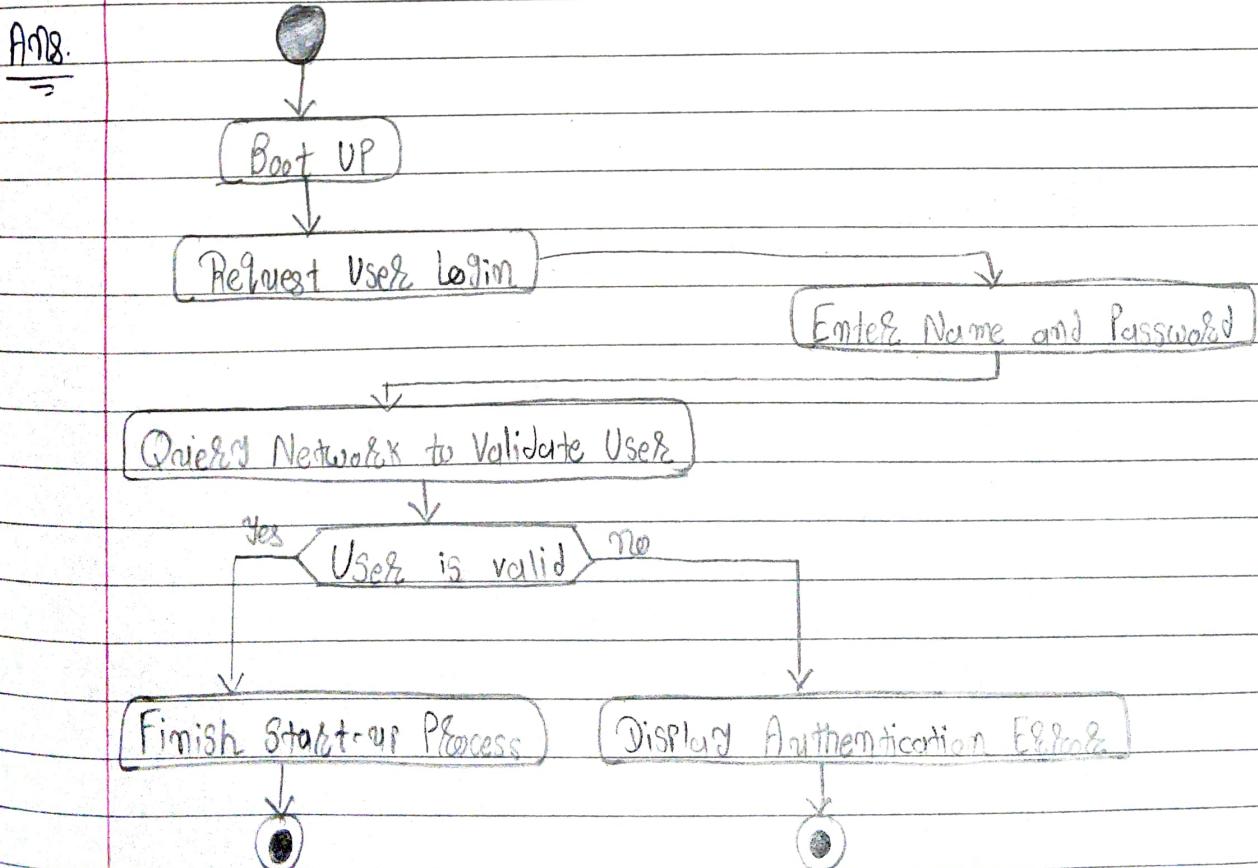
A customer decides to upgrade her PC and purchase a DVD player. She begins by calling the sales department of the PC vendor and they tell her to talk to customer support. She then calls customer support and they put her on hold while talking to engineering. Finally, customer support tells the customer about several supported DVD options. The customer chooses a DVD, and it is shipped by the mail department. The customer receives the DVD, installs it satisfactorily, and then mails her payment to accounting.

Use swimlanes diagram to show the various interactions.

Ans.



Q.9 Consider a workstation that is turned on. It goes through a boot sequence and then requests that the user log in. After entry of a name and password, the workstation queries the network to validate the user. Upon validation, the workstation then finishes its start-up process. Draw activity diagram for the mentioned scenario.

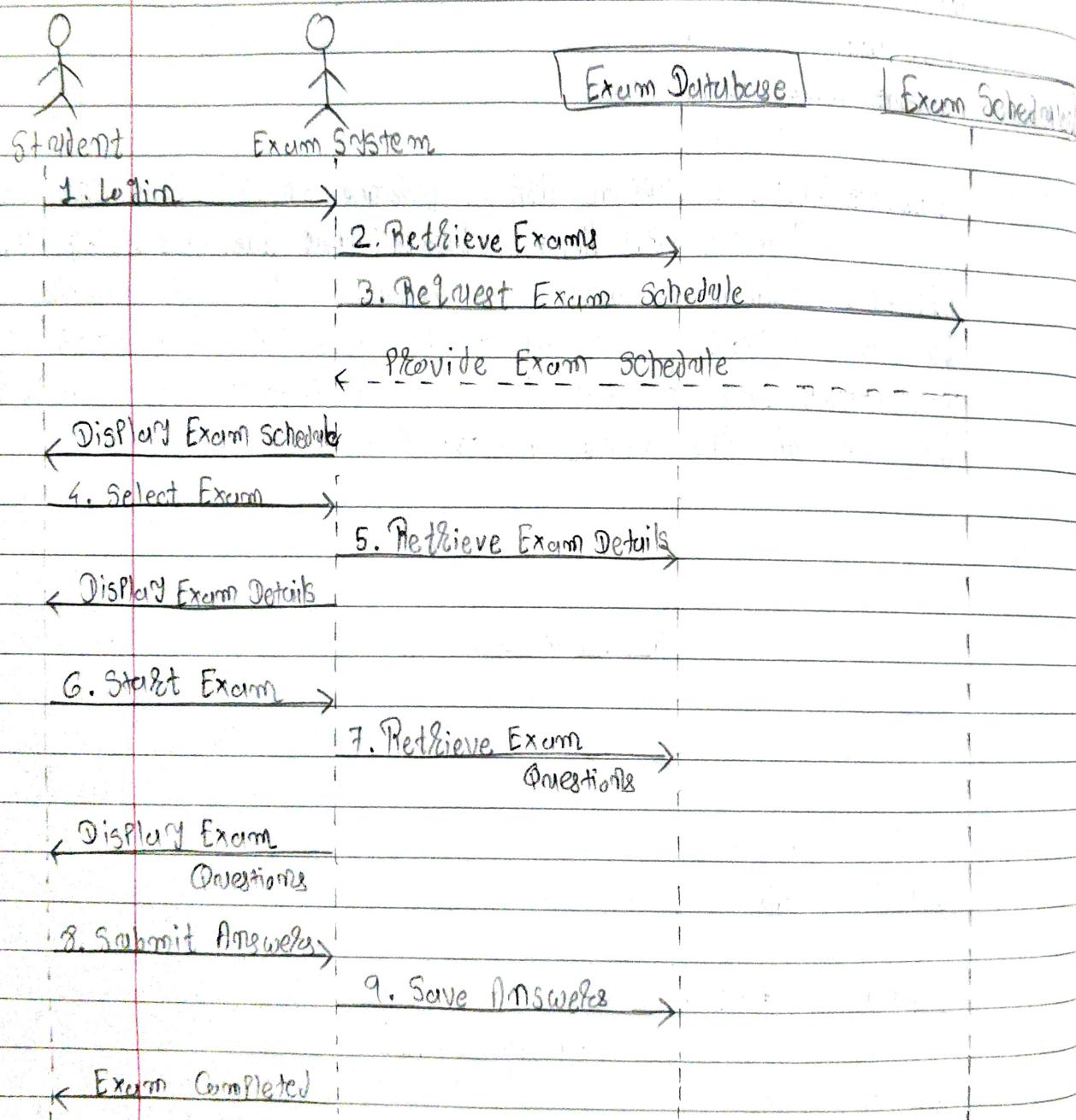


Q. 10

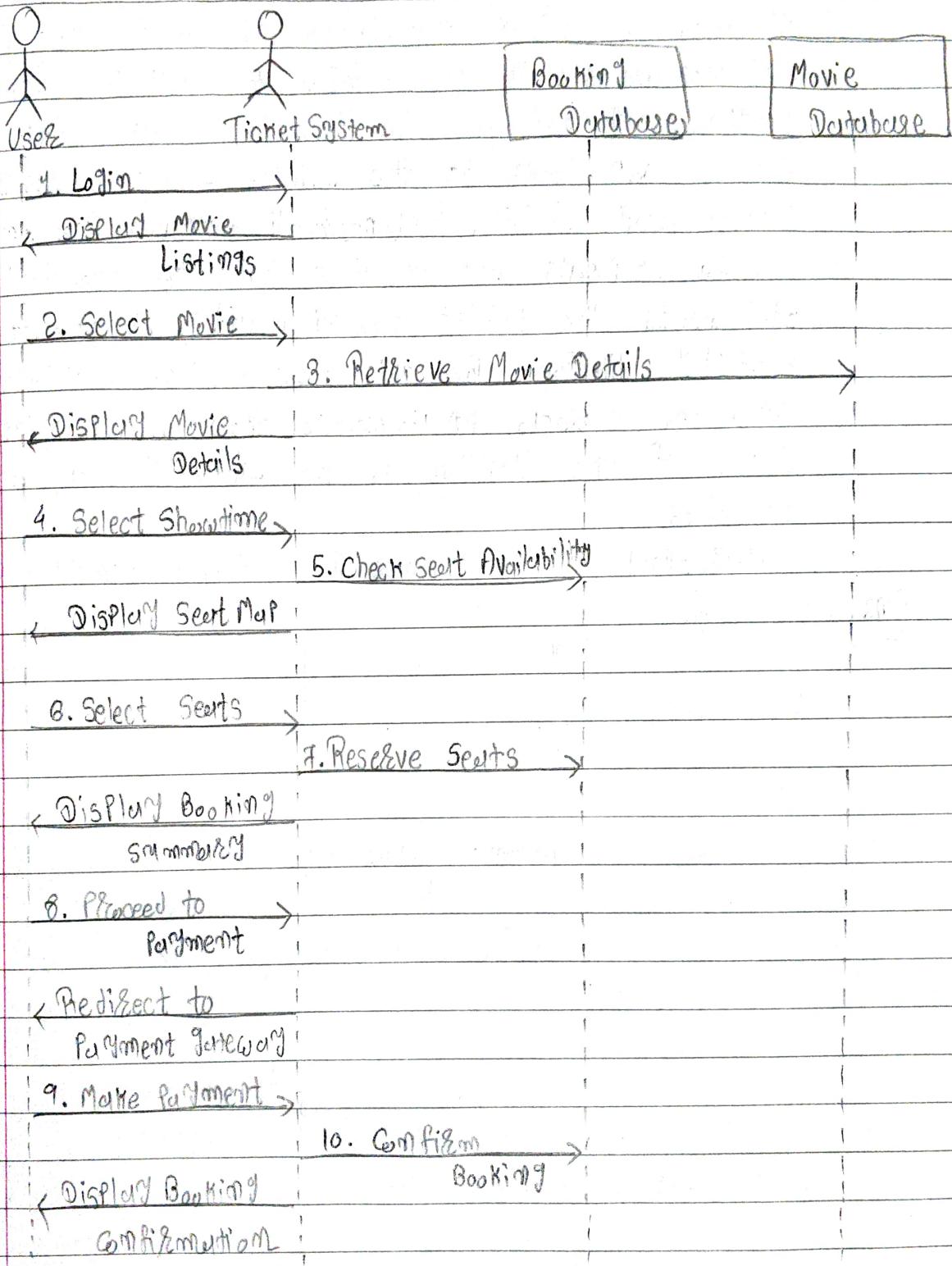
Draw a sequence diagram for online exam system and Online Movie Ticket Booking System.

Ans.

Online Exam System Sequence diagram :-



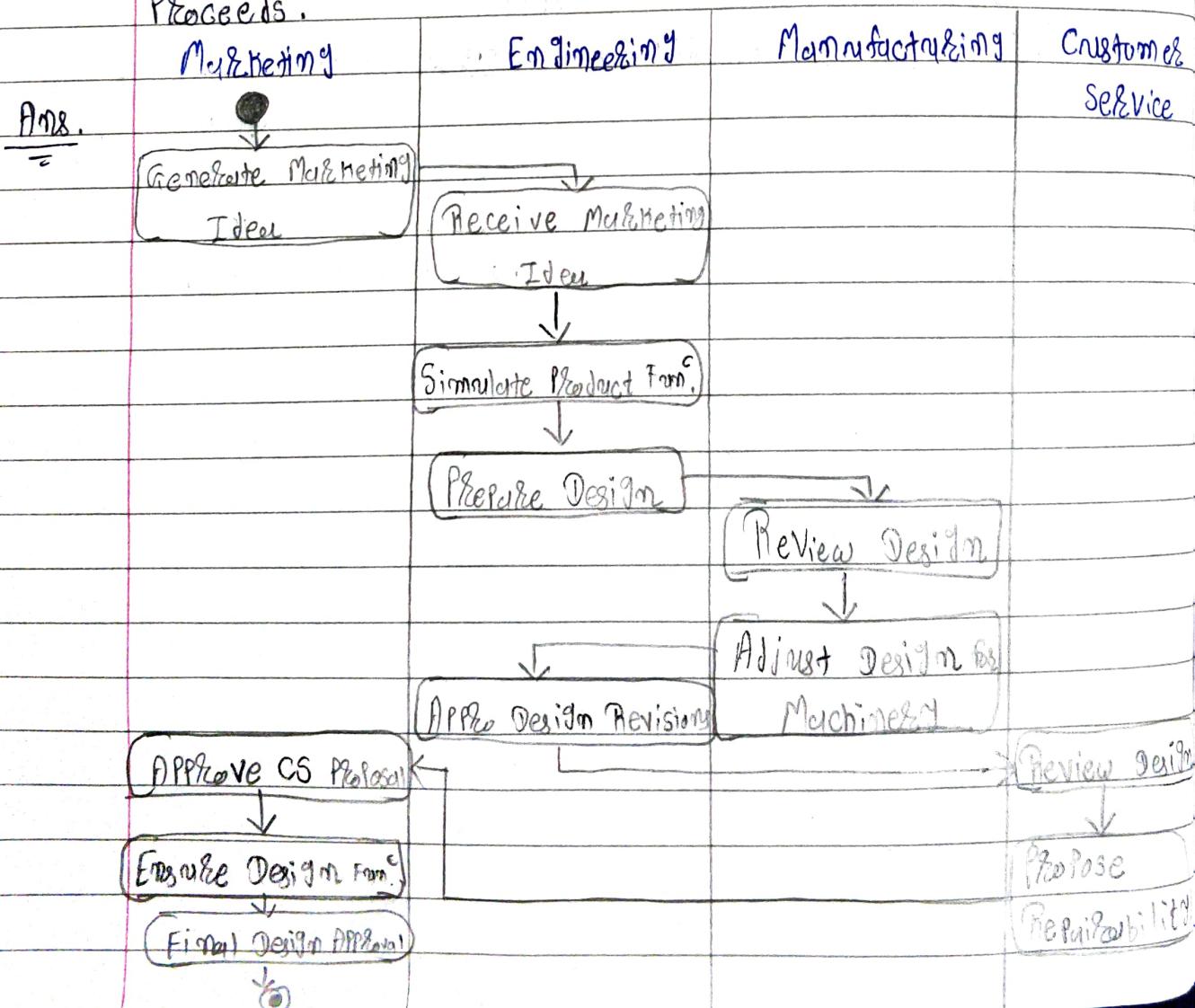
## Online Movie Ticket Booking System :



Q.11

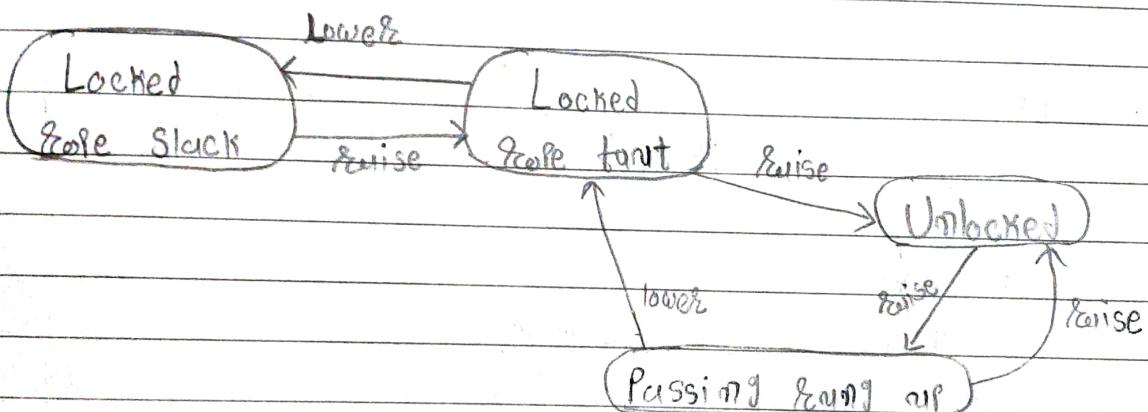
A company is manufacturing a new product and must coordinate several departments. The Product starts out as a new marketing idea that goes to engineering. Engineering simulates the function of the product and prepares a design. Manufacturing reviews the design and ~~fixes~~ adjusts it to conform to existing machinery. Engineering approves the revisions and customer service then looks at the design - a good design must enable ready repair. Engineering approves the customer service proposals and ensures that the resulting design still meets the target functionality. Construct an activity diagram for this process. Use swimlanes to show the various interactions. Show the changes in the state of the design as the activity diagram.

Proceeds.



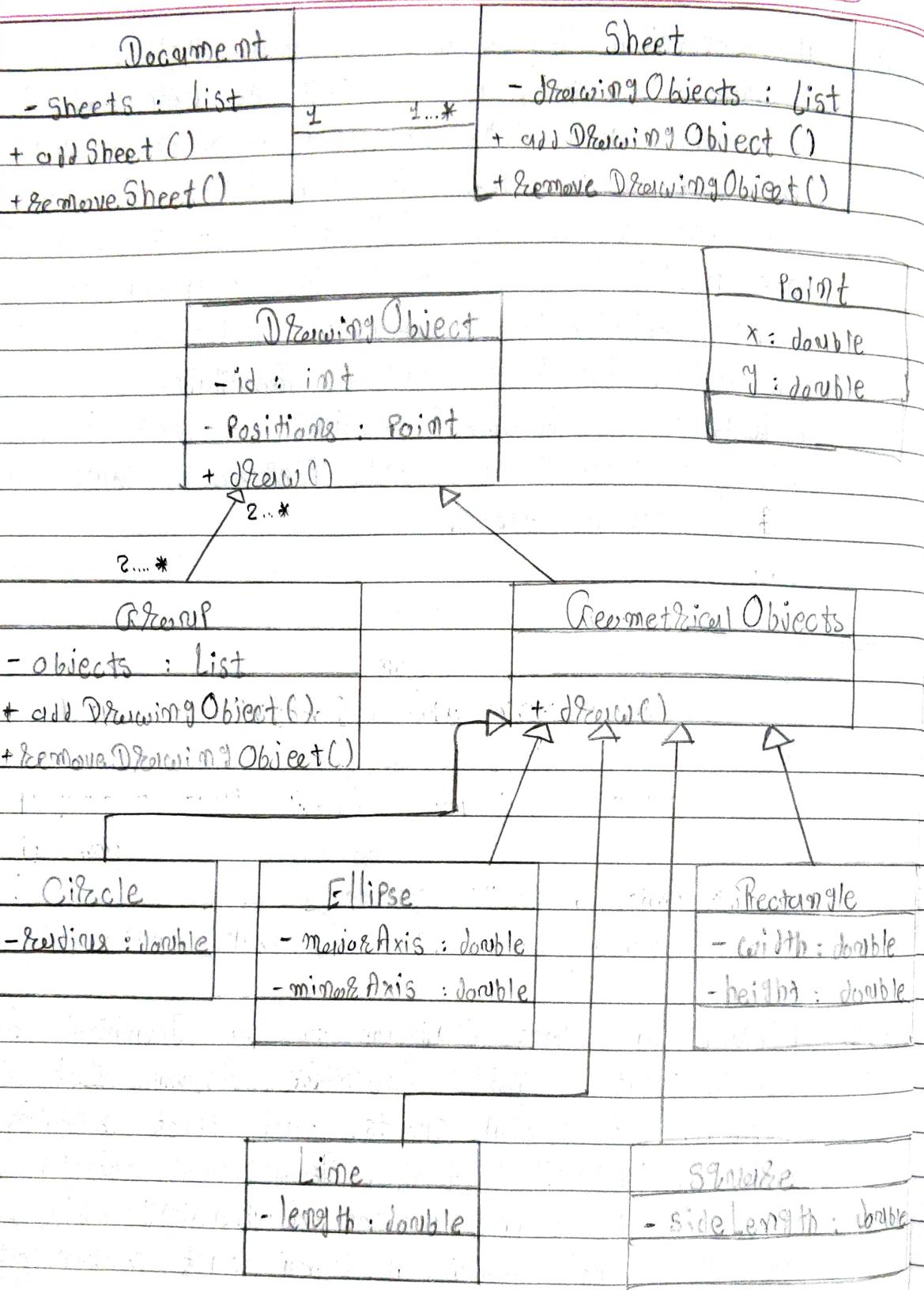
Q.12

An extension ladder has a rope, pulley, and latch for raising, lowering, and locking the extension. When the latch is locked, the extension is mechanically supported and you may safely climb the ladder. To release the latch, you raise the extension slightly with the rope. You may then freely raise or lower the extension. The latch produces a clucking sound as it passes over rungs of the ladder. The latch may be reengaged while raising the extension by either reversing direction just as the latch is passing a rung. Prepare a state diagram of an extension ladder.

A.12.Q.13

Prepare a class diagram for a graphical document editor that supports grouping. Assume that a document consists of several sheets. Each sheet contains drawing objects, including texts, geometrical objects, and groups. A group is simply a set of drawing objects, possibly including other groups. A group must contain at least two drawing objects. A drawing object can be a direct member of at most one group. Geometrical objects include circles, ellipses, rectangles, lines and squares.

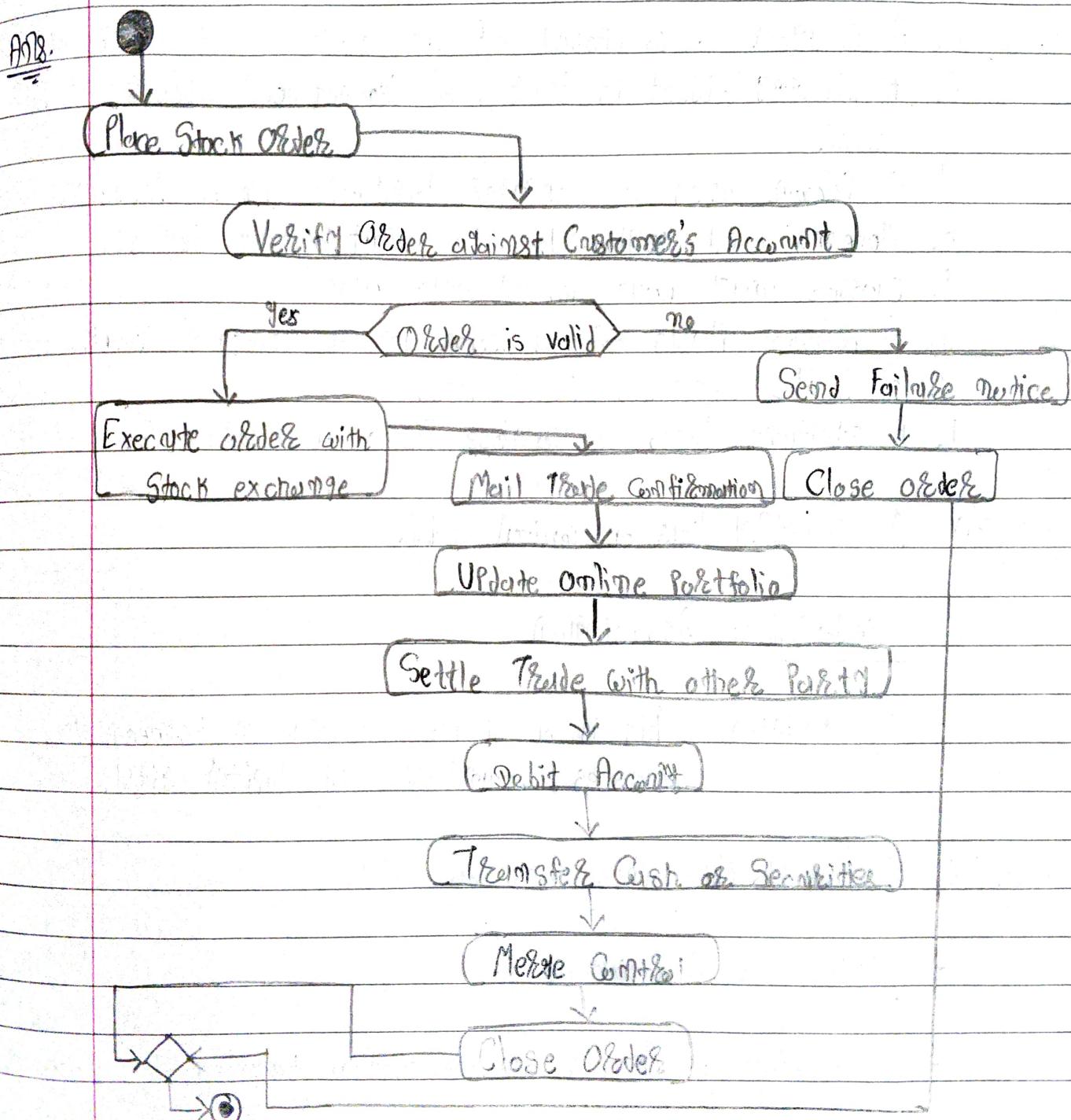
A.13.

Q. 14

Draw an activity diagram for stock maintenance system.

**Scenario:** The online stock broker first verifies the order against the customer's account, and then executes it with the

Stock exchange. If the order executes successfully, the system does three things concurrently: mails trade confirmation to the customer, updates the online portfolio to reflect the results of the trade, and settles the trade with the other party by debiting the account and transferring cash or securities. When all three concurrent threads have been completed, the system merges control into a single thread and closes the order. If the order execution fails, then the system sends a failure notice to the customer and closes the order.



Q.15 Categorize the following relationships into generalization, aggregation, or association. Beware, there may be many associations in the list, so do not assume every relationship involving three or more classes is a generalization.  
Explain your answers:

- a. A country has a capital city.
- b. A dimming philosopher uses a fork.
- c. A file is an ordinary file or a directory file.
- d. Files contain records.
- e. A polygon is composed of an ordered set of points.
- f. A drawing object is text, a geometrical object, or a group.
- g. A person uses a computer language on a project.
- h. Modems and keyboards are input/output devices.
- i. Classes may have several attributes.
- j. A person plays for a team in a certain year.
- k. A route connects two cities.
- l. A student takes a course from a professor.

Ans. (a) A country has a capital city.

- Category :- Association

- Explanation :- This is a simple association between two classes, Country and Capital city.

Ans. (b) A dimming philosopher uses a fork.

- Category :- Association

- Explanation :- This is an association between two classes,

Diminishing Philosophies and Form.

Ans.(c) A file is an ordinary file or a directory file.

- Category : Generalization

- Explanation : This describes a generalization relationship, where File is a superclass, and Ordinary file and Directory file are subclasses.

Ans.(d) Files contain records.

Files contain records.

- Category : Association

- Explanation : This is an association between two classes, Files and Records.

Ans.(e) A Polygon is composed of an ordered set of Points.

- Category : Association

- Explanation : This is an association between two classes, Polygon and Points.

Ans.(f) A drawing object is text, a geometrical object, or a group.

- Category : Generalization

- Explanation : This describes a generalization relationship, where Drawing object is a superclass, and Text, Geometrical object, and Group are subclasses.

Ans.(g)

A person uses a computer's language on a project.

- Category : Association

- Explanation : This is an association between two classes, Person and Computer Language.

Ans.(h)

Modems and keyboards are input/output devices.

- Category : Generalization

- Explanation : This describes a generalization relationship, where input/output device is a superclass, and Modem and Keyboard are subclasses.

Ans.(i)

Classes may have several attributes.

- Category : Association

- Explanation : This is an association between two classes, Classes and Attributes.

Ans.(j)

A person plays for a team in a certain year.

- Category : Association

- Explanation : This is an association between three classes, Person, Team and Year.

Ans.(k)

A route connects two cities.

- Category : Association

- Explanation :- This is an association between two classes, Route and Cities.

Ans. (1) A student takes a course from a professor.

- Category :- Association
- Explanation :- This is an association between three classes, Student, Course and Professor.