University of Dublin
Trinity College

# Information Modeling

… the art of communication of the design of information..

# Short Quiz

# Work in Pairs

Q1. Typically how many bits in a byte?

Q2. What are the ACID properties of a Transaction?

Q3. What does GDPR stand for?

Q4. UML is used for _____ and Design.

Q5. A Use Case diagram is used to represent the _____ of a system.

Q6.What are the missing activities in the Data Management model Architect, _____, Cleanse&Monitor, _____, Associate, _____

Q7. The “Semantic Web” potentially solves what of the 4 “V” challenges?

Q8. What does NoSQL stand for?

Q9. What is the difference between Database and Data Warehouse?

Q10. Name one advantage Solid State Drives have over traditional magnetic Hard Disks ?

# Work in Pairs

Q1. Typically how many bits in a byte? Eight

Q2. What are the ACID properties of a Transaction? Atomic, Consistent, Isolated, Durable

Q3. What does GDPR stand for? General Data Protection Regulation

Q4. UML is used for _Analysis_ and Design.

Q5. A Use Case diagram is used to represent the Functionality of a system.

Q6.What are the missing activities in the Data Management model
Architect, Integrate, Cleanse&Monitor, Manage, Associate, Archive

Q7. The “Semantic Web” potentially solves what of the 4 “V” challenges? Variety

Q8. What does NoSQL stand for? Not only SQL or Non SQL

Q9. What is the difference between Database and Data Warehouse?

Database allow for operational view; Data Warehouse allows for trend view

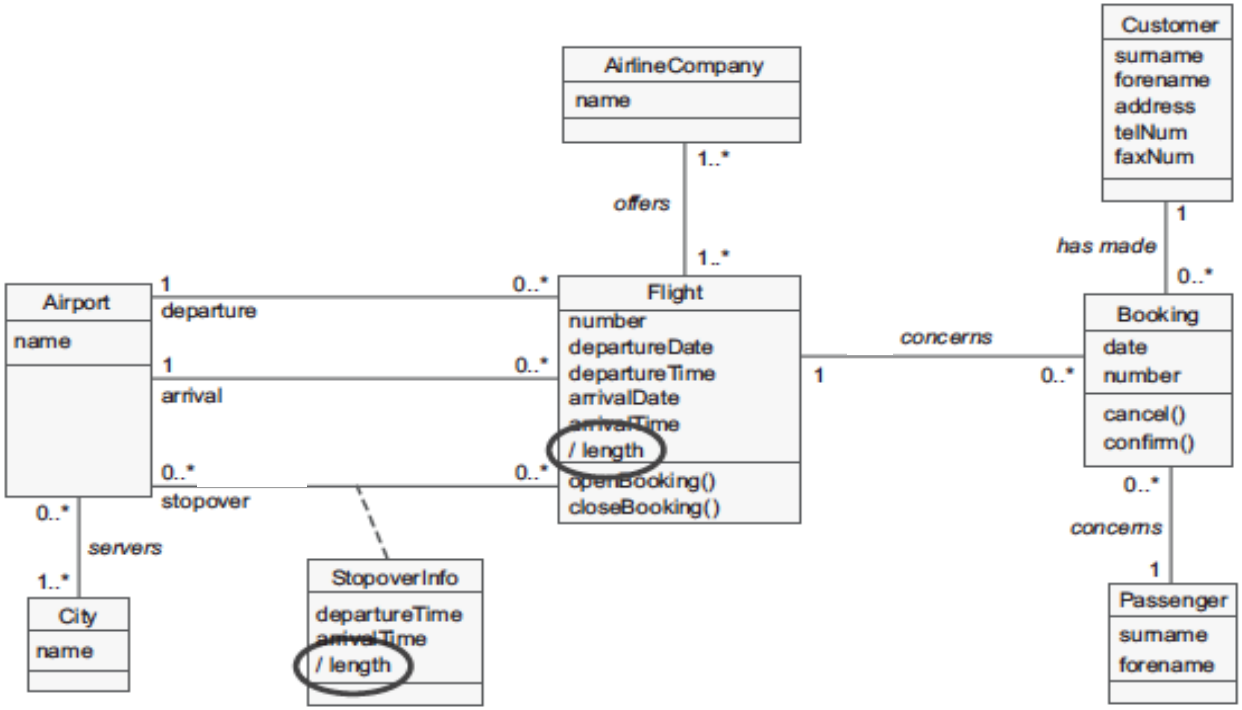
Q10. Name one advantage of Solid State Drive over traditional magnetic Hard Disk ? No moving parts

In pairs, From the problem statement below, draw a UML Class diagram. Include your names and student numbers and hand it up

This case study concerns a simplified flight booking system for a travel agency.
The interviews that we had with domain experts enabled us to summarise their knowledge of the field in the form of the following sentences:

1. Airline companies offer various flights.
2. A flight is open to booking and closed again by order of the company.
3. A customer can book one or more flights and for different passengers.
4. A booking concerns a single flight and a single passenger.
5. A booking can be cancelled or confirmed.
6. A flight has a departure airport and an arrival airport.
7. A flight has a departure day and time, and an arrival day and time.
8. A flight may involve stopovers in airports.
9. A stopover has an arrival time and a departure time.
10. Each airport serves one or more cities.

# A Possible Partial Solution




**In pairs- What questions/clarifications would you ask for the next iteration of modelling?**

# Cardinality of Relationships

unspecified

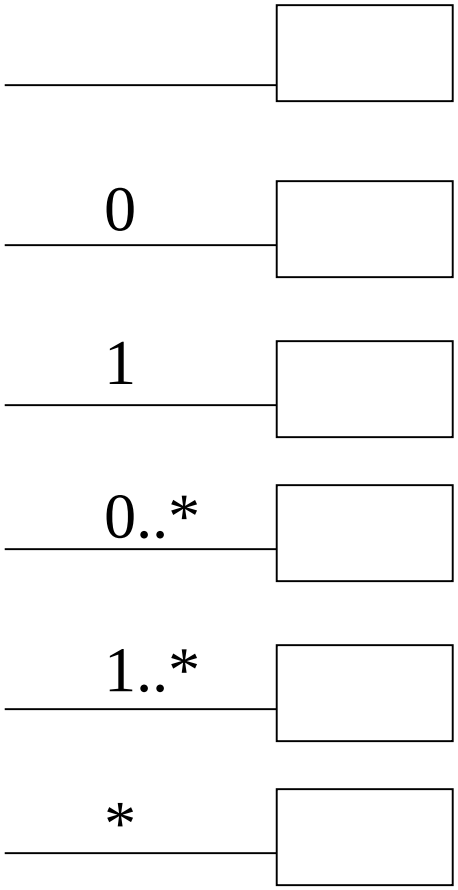
zero

one

zero or more

one or more

Many



# 4 Problem Statements-

1. We will look at some solutions to these on Thursday.
2. Students can attempt these
   Their attempts will be collected in class on Thursday and general feedback given.
   Please include Student Name and Student ID on any attempts.

CS2041: Use Case Exercise: From the problem statement below Identify Actors, Use Cases and draw use case diagram. Write a textual description for “Process Sale” use case, (a) for a normal scenario and (b) for an error scenario

# PROBLEM STATEMENT

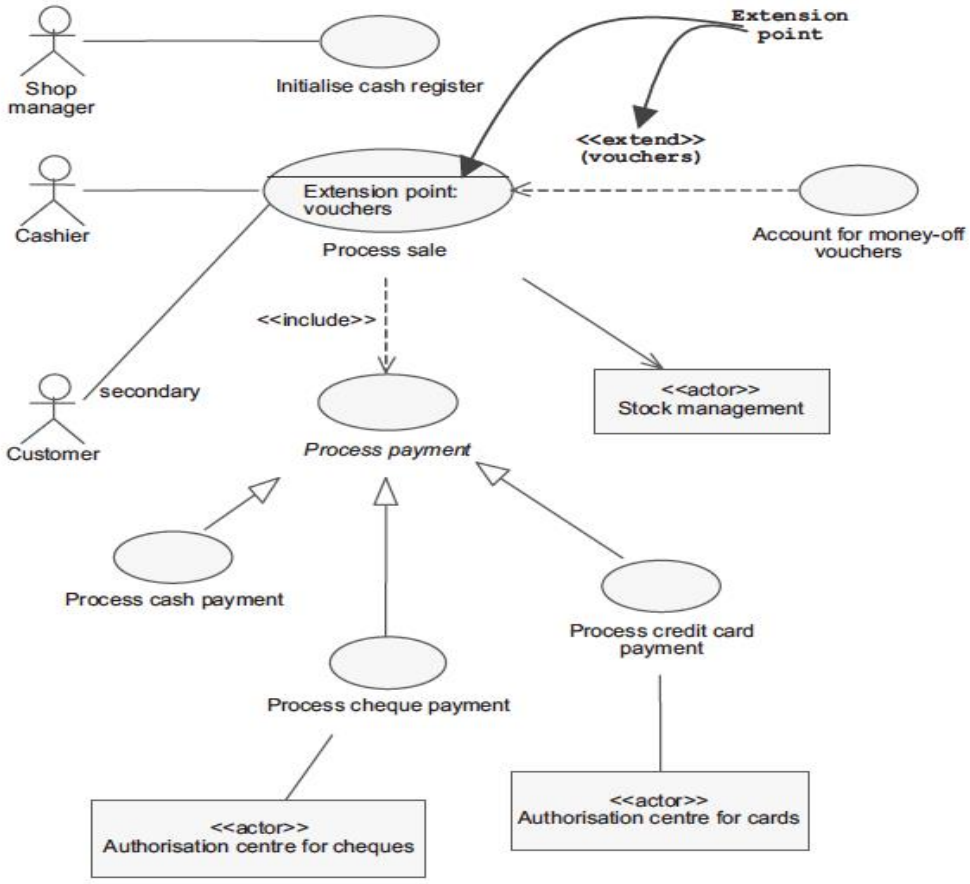
The standard procedure of using a cash register is as follows:

- A customer arrives at the checkout to pay for various items
- The cashier records the bar code number of each item, as well as the quantity if it is greater than one.
- The cash register displays the price of each item and its description.
- When all the purchases are recorded, the cashier indicates the end of the sale.
- The cash register displays the total cost of the purchases.
- The customer selects his or her payment method:
  - Cash: the cashier takes the money from the customer and puts it in the cash register, the cash register indicates how much change the customer is to be given;
  - Cheque: the cashier verifies that the customer is financially solvent by sending a request to an authorisation centre via the cash register;
  - Credit card: a banking terminal forms part of the cash register. It sends a request for authorisation to an authorisation centre, according to the card type.
- The cash register records the sale and prints a receipt.
- The cashier gives the receipt to the customer.

Once the items have been entered, the customer can present money-off vouchers for certain items to the cashier. When the payment transaction is finished, the cash register sends the information on the number of items sold to the stock management system.

Every morning, the shop manager initialises the cash registers for the day.

# Partial Possible Solution for Process Sale

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**In pairs- What questions/clarifications would you ask for the next iteration of modelling?**

# Process Sale – Text Description

**Title**: Process sale **Type**: detailed essential

**Summary**: a customer arrives at the checkout with the items he or she would like to purchase. The cashier records the items and collects payment. At the end of the transaction, the customer leaves with the items.

**Actors**: Cashier (primary), *Customer (secondary)*.

**Creation date**: 05/17/02 **Date of update**: 11/10/02

**Version**: 1.1 **Person in charge**: Pascal Roques

# Normal Scenario: Process Sale

**Preconditions:**

- The cash register is open; a checkout assistant is signed on to it.

**Main success scenario:**

1. This use case starts when a customer arrives at the checkout with items that he or she would like to purchase.
2. The cashier records each item. If there is more than one of the same item, the cashier also indicates the quantity.
3. The cash register establishes the price of the item and adds the information on the item to the sale in progress. The cash register displays the description and the price of the item in question.
4. Once the cashier has recorded all the items, he or she indicates that the sale is finished.
5. The cash register calculates and displays the total amount of the sale.
6. The cashier informs the customer of the total amount.
7. The customer chooses a payment method:
   a. In the case of cash payment, execute the "Process cash payment" use case;
   b. In the case of credit card payment, execute the "Process credit card payment" use case;
   c. In the case of cheque payment, execute the "Process cheque payment" use case.
8. The cash register records the sale that has been carried out and prints a receipt.
9. The cashier gives the cash register receipt to the customer.
10. The customer leaves with the items he or she has purchased.

**In pairs- What questions/clarifications would you ask for the next iteration of modelling?**

# Error Scenarios: Process Sale

*E1: customer is unable to pay*

The E1 sequence starts at point 1 of the main success scenario.

2. The customer does not have enough cash to pay for the items.
3. The cashier cancels the whole sale and the use case fails, or the customer pays using another payment method (Cf. "Process cheque payment", or "Process credit card payment").

*E2: cashier is unable to give change*

The E1 sequence starts at point 4 of the main success scenario.

5. The cash register drawer does not contain enough change in order to give the customer the money he or she is owed.
6. The cashier asks his or her supervisor for more change, or suggests to the customer that he or she pay using a different payment method (Cf. "Process cheque payment", or "Process credit card payment").

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**In pairs- What questions/clarifications would you ask for the next iteration of modelling?**

# CS2041: Use Case Exercise

From the statement below

1. Identify Actors, Use Cases and draw use case diagram
2. Write a textual description for the “withdraw money using a visa card” use case [where the visa customer is not a customer of the bank], (a) for a normal scenario and (b) for an error scenario

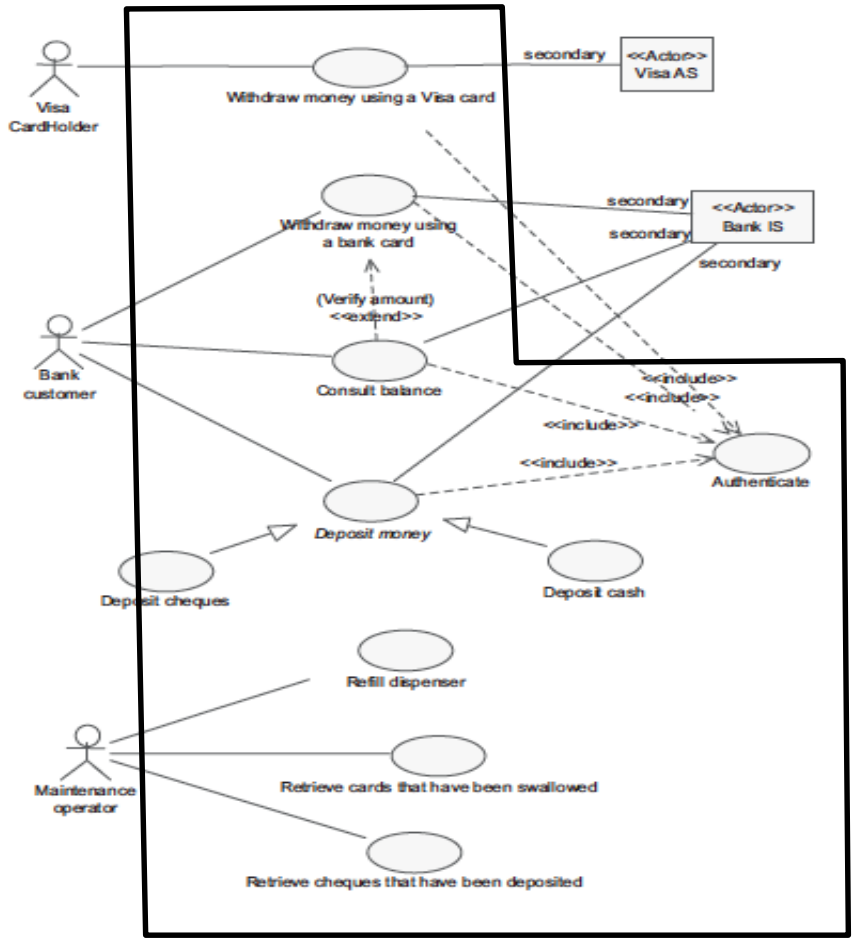
This case study concerns a simplified system of the automatic teller machine (ATM). The ATM offers the following services:

1. Distribution of money to every holder of a smartcard via a card reader and a cash dispenser.
2. Consultation of account balance, cash and cheque deposit facilities for bank customers who hold a smartcard from their bank.

Do not forget either that:

3. All transactions are made secure.
4. It is sometimes necessary to refill the dispenser, etc.

# A possible solution ATM

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Do not forget either that:

3. All transactions are made secure.
4. It is sometimes necessary to refill the dispenser, etc.

**In pairs- What questions/clarifications would you ask for the next iteration of modelling?**

# Use Case Description

**Title:** Withdraw money using a Visa card

**Summary:** this use case allows a Visa card holder, who is not a customer of the bank, to withdraw money if his or her daily limit allows it.

**Actors:** Visa CardHolder (primary), Visa AS (secondary).

**Creation date:** 02/03/02 **Date of update:** 08/19/03

**Version:** 2.2 **Person in charge:** Pascal Roques

*Flow of events*

**Preconditions:**

- The ATM cash box is well stocked.
- There is no card in the reader.

# Use Case Description: Normal Scenario

1. The Visa CardHolder inserts his or her card in the ATM's card reader.
2. The ATM verifies that the card that has been inserted is indeed a Visa card.
3. The ATM asks the Visa CardHolder to enter his or her pin number.
4. The Visa CardHolder enters his or her pin number.
5. The ATM compares the pin number with the one that is encoded on the chip of the card.
6. The ATM requests an authorisation from the VISA authorisation system.
7. The VISA authorisation system confirms its agreement and indicates the daily balance.
8. The ATM asks the Visa CardHolder to enter the desired withdrawal amount.
9. The Visa CardHolder enters the desired withdrawal amount.
10. The ATM checks the desired amount against the daily balance.
11. The ATM asks the Visa CardHolder if he or she would like a receipt.
12. The Visa CardHolder requests a receipt.
13. The ATM returns the card to the Visa CardHolder.
14. The Visa CardHolder takes his or her card.
15. The ATM issues the notes and a receipt.
16. The Visa CardHolder takes the notes and the receipt.

**In pairs- What questions/clarifications would you ask for the next iteration of modelling?**

# Use Case Description: Error Scenario

**Error sequences:**

*E1: invalid card*
The E1 sequence starts at point 2 of the main success scenario.

3. The ATM informs the Visa CardHolder that the smartcard is not valid (unreadable, expired, etc.) and confiscates it; the use case fails.

*E2: conclusively incorrect pin number*
The E2 sequence starts at point 5 of the main success scenario.

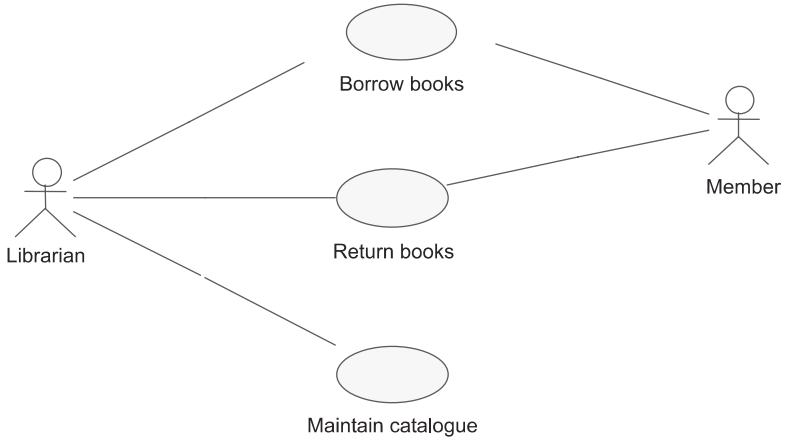
6. The ATM informs the Visa CardHolder that the pin is incorrect for the third time.
7. The ATM confiscates the smartcard.
8. The VISA authorisation system is notified; the use case fails.

*E3: unauthorised withdrawal*
The E3 sequence starts at point 6 of the main success scenario.

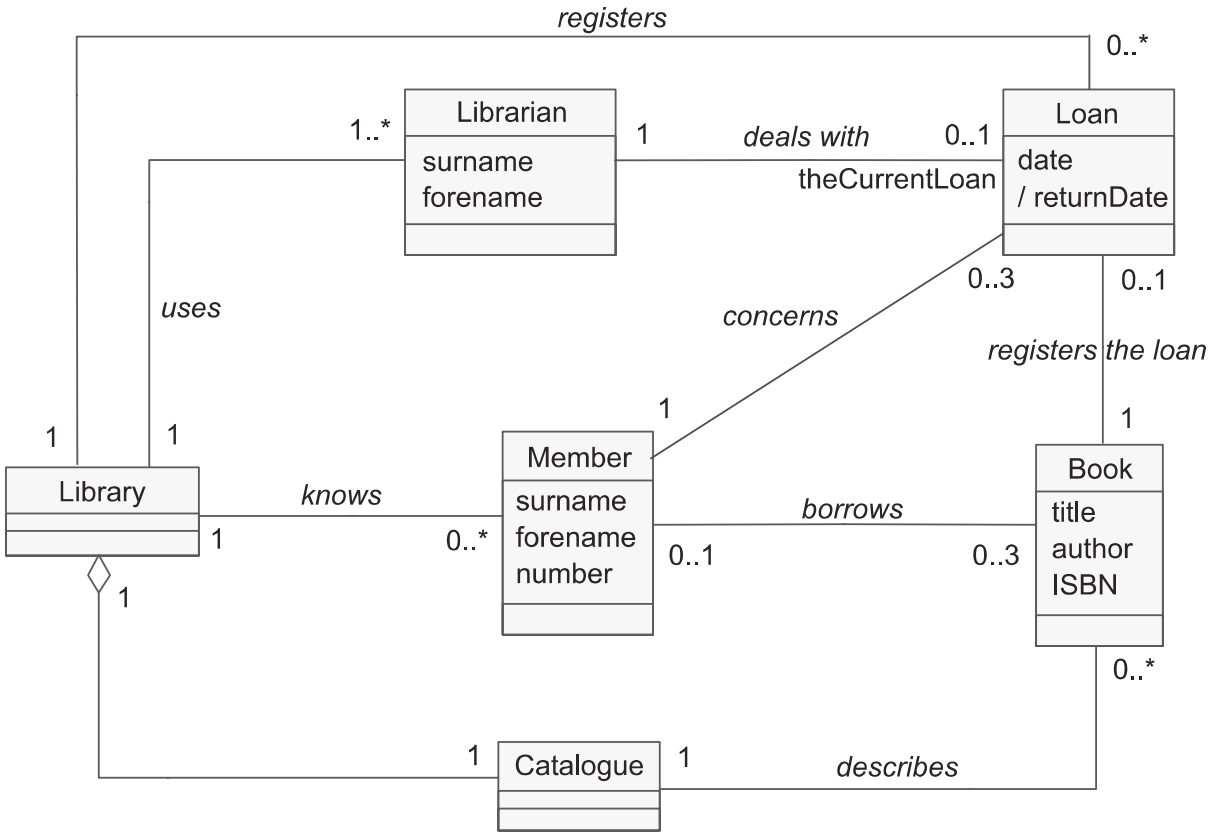
7. The VISA authorisation system forbids any withdrawal.
8. The ATM ejects the smartcard; the use case fails.

**In pairs- What questions/clarifications would you ask for the next iteration of modelling?**

From the use case diagram below, draw a UML Class diagram including associations, cardinalities, any derived attributes etc.
for a Library System including classes: Library, Loan, Catalogue, Member, Book, Librarian



# A Possible Solution

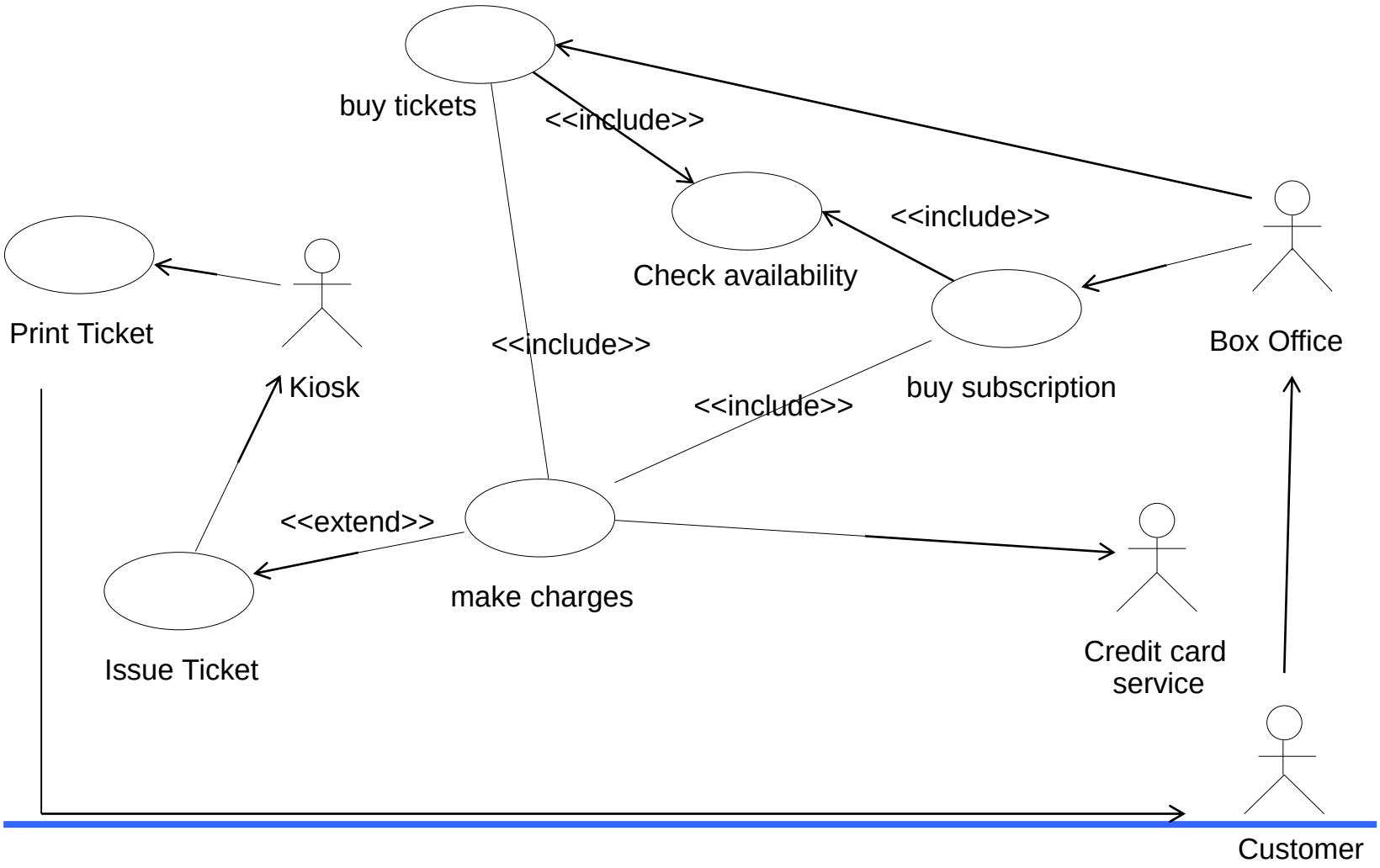



**In pairs- What questions/clarifications would you ask for the next iteration of modelling?**

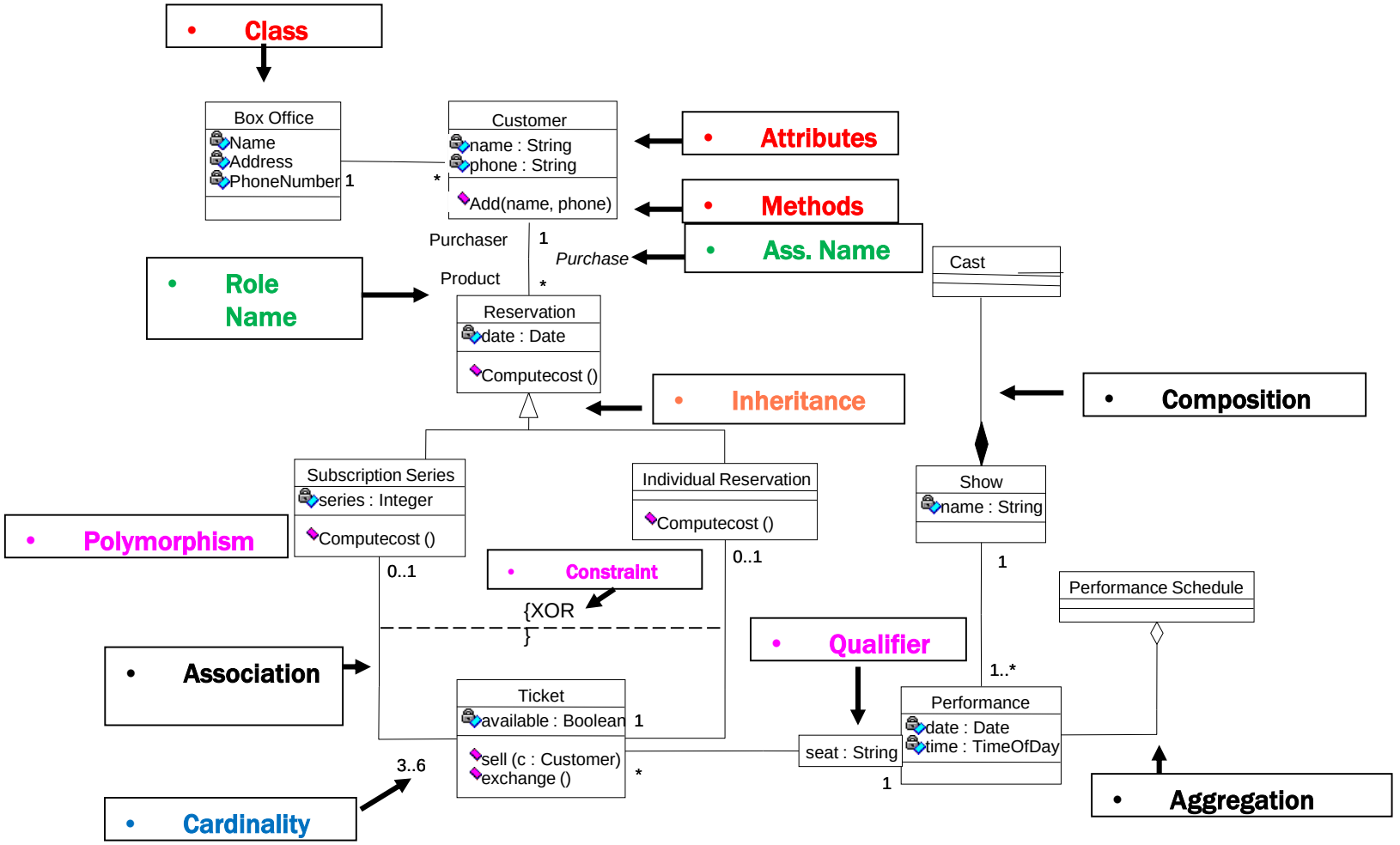
# CS2041: Class Diagram Exercise
draw a UML Class diagram including associations, cardinalities, any derived attributes etc.
for a Theatre Ticket Booking System

- Customers may have many reservations
- Each reservation is made by one customer through a box office
- Reservations are of two kinds – subscription series and individual
- Each reservation is associated with a ticket or tickets
- Each ticket is either associated with a subscription series reservation or an individual reservation but not both
- A subscription series comprises at least 3 but not more than 6 tickets
- Each ticket or subscription must be paid for
- Customers can pay by credit card or cash
- Tickets are issued from a kiosk
- Every performance has many tickets available each with a unique seat number.
- A performance can be identified by a show, date and time.
- A performance schedule is a list of performances for a particular show.
- A cast and a reserve cast is associated with each show
- A cast is composed of a group of actors

# Example Use Case Diagram



# Class Diagram

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# Interesting Reads for Reading week…..

London Ambulance Service- https://pdfs.semanticscholar.org/23ea/815b5f5e3a28d872bbe07c0504e166246e8b.pdf

Therac Disaster- http://sunnyday.mit.edu/papers/therac.pdf

PPARS- Irish Health Service- https://www.imt.ie/opinion/guest-posts/could-ppars-happen-again-a-costly-lesson-for-the-hse-02-11-2007/

NIMIS Less than symbol Incident- https://www.hse.ie/eng/services/publications/hospitals/nimis-less-than-symbol-incident.pdf

When you are finished reading reflect on one of the incidents and list the points which caused/exacerbated/contributed to the situation.

# Design Pattern Book


**Design Patterns: Elements of Reusable Object-Oriented Software**
By Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides

Published 1994

# References

**Some of the examples and the UML tutorials come from**

*UML in Practice*, Author: Pascal Roques, Publisher: Wiley;