Advanced Higher

Use Case Diagrams
Theory
Questions & Answers

Unified Modelling Language (UML)

Unified Modelling Language (UML) provides a standard way to visualise, specify, construct, and document the analysis and design of a software system.

UML is a pictorial language used to make software blueprints that can be used to model software and non-software systems.

UML use case diagram

To model a system, it is important to capture the dynamic behaviour of the system. Dynamic behaviour is when the system is running or operating.

The purpose of a use case diagram is to capture the dynamic aspect of the system. Use case diagrams:

are used to gather the requirements of the system

are used to get an outside view of the system

identify the internal and external factors that influence the system

show the interaction among the requirements as ‘actors’

aid communication between the client and the developer

Drawing a use case diagram

Use case diagrams consist of four components:

a system boundary

actors

use cases

relationships

System boundary

In a UML case diagram, a system boundary is shown as a rectangle. All components of the use case diagram are shown inside the system boundary.

The system boundary represents the limits of the system being developed: only those actors and processes to be considered are illustrated within the system boundary.

Actors

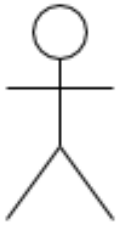
An actor interacts with the system being developed. The actor may be a human or an entity that interacts with the system, for example another system or server, and is external to the system being developed.

An actor performs a role in a system and may be a primary or secondary actor.

A primary actor is one that uses the system to achieve a goal, for example a customer buying an item.

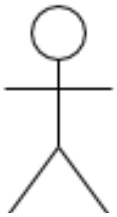
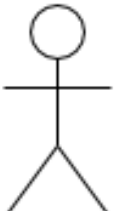
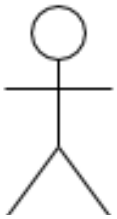
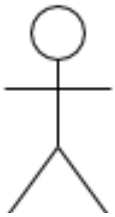
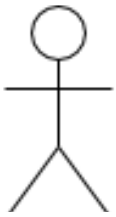
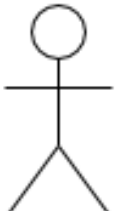
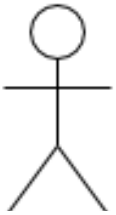
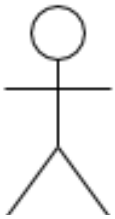
A secondary actor is one that supports the system in delivering the goal, for example a bank used to pay for the item.

A UML case diagram shows an actor by using the symbol:



The following are examples of actors, depending on the problem being solved.

Actor

Human	Systems software	Hardware	Timer (clock)
 Customer	 Payroll	 Phone network	 Scheduled backup
 Passenger	 Library	 Server	 Scheduled anti-virus

Use cases

A use case describes an action (process) or a sequence of actions (processes) that must be in the system being developed.

A UML case diagram shows a use case using an ellipse:

Use cases help to determine the requirements of the system under consideration, by describing the functionality that the system will provide.

Use case functionality (process) may be initiated by an actor or may be started by the system itself, providing a useful result to an actor.

Naming use cases

Each use case must have the name written within the ellipse. The name describes some observable or useful result to an actor.

Examples of naming are Update Subscription, Manage Account, and Place Order.

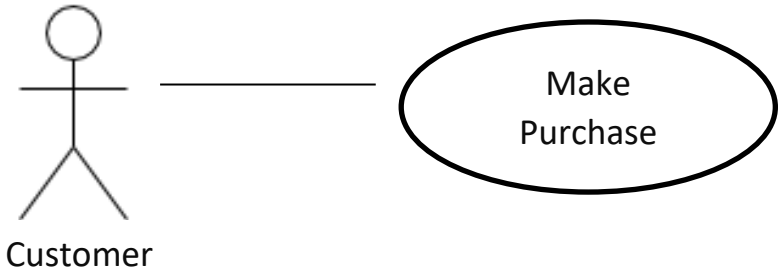
Relationships

A use case diagram can have five types of relationship:

association between an actor and a use case
generalisation of an actor
extend between two use cases
include between two use cases
generalisation of a use case

Association between actor and use case

Each actor must be associated with at least one use case, although it can be associated with many use cases.



A line with no arrowheads connects an actor to a use case.

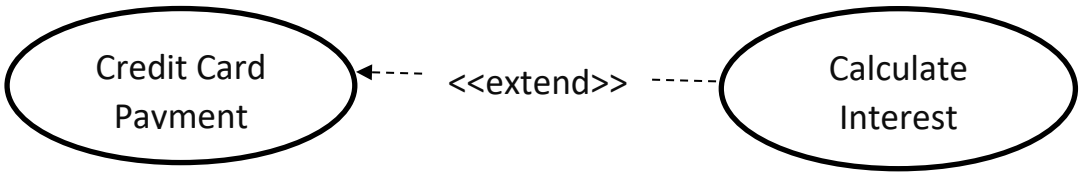
Generalisation of an actor

Generalisation of an actor means one actor can inherit the role of another actor. The descendant actor inherits all the use cases of the ancestor.

A line, with a single solid arrowhead pointing at the ancestor actor, connects a descendant actor to the ancestor actor.

Extend between two use cases

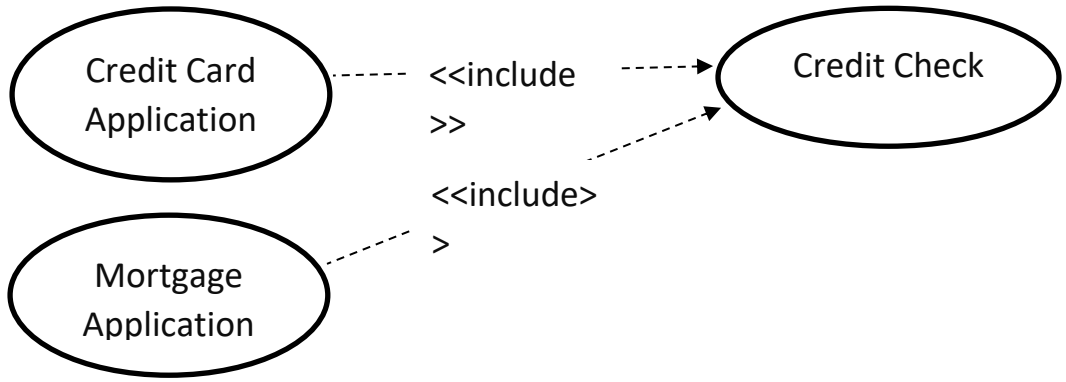
Extending a basic use case provides additional functionality to the system.



An extended use case is connected to a basic use case using a dashed line, with a single solid arrowhead pointing at the basic use case. The label <<extend>> is placed on the line.

Include between two use cases

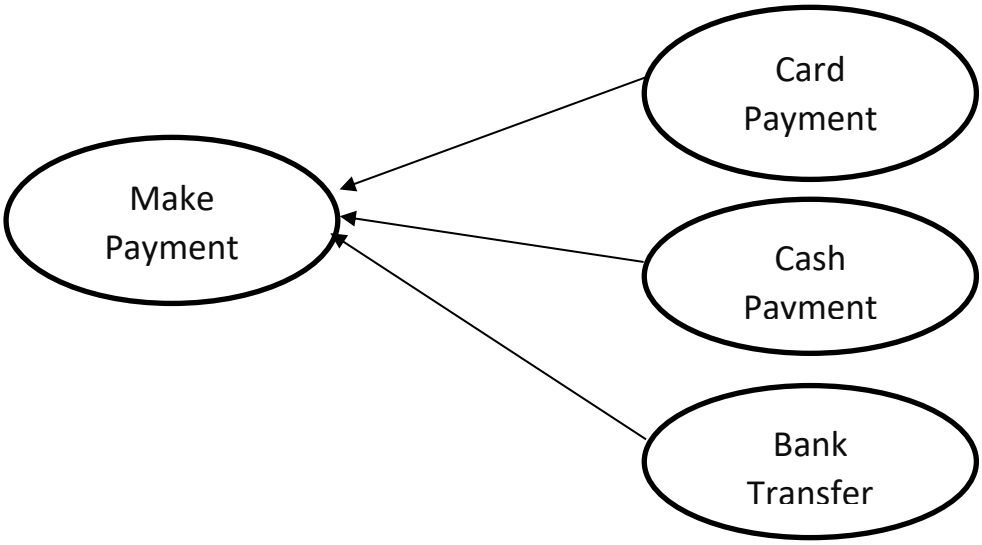
An included use case is part of the basic use case. It is a mandatory process, as the basic use case is incomplete without it.



An included use case is connected to the basic use case using a dashed line with a single solid arrowhead, pointing at the common basic use case. The label <<include>> is placed on the line.

Generalisation of a use case

This is similar to generalisation of an actor.



A line, with a single solid arrowhead pointing at the ancestor use case, connects a descendant use case to the ancestor use case.

Q1. **Requirements**: Develop a swimming portal for a swimming coach.

- The system must allow scheduling for swimming lessons.
- The system must allow swimmers view their competition time and results.
- The system must provide a payment system for termly fees.

Persona

Avril is a swimming coach and has a hectic life, swimming competitions are approaching and as an instructor she wants to schedule extra training hours for 15 kids, this should also fit into her extremely hectic work program.

User Story

Goals

She wants a quick way of booking pupils that require extra lessons.

She wants to be able to review available dates quickly on a portable device. She also wants swimmers to login to the system, make and pay for bookings, edit their details, view their previous competition time.

User Scenario

When Avril receives requests from swimmers for dates they would like extra training, she wishes to use the App to pull up a calendar for the next two months, to add a swimmers name as well as specific time for their training. She wants the app to alert each swimmer immediately with the scheduled information; each swimmer must then accept or reject the time allocated.

Each swimmer should be given generated login information to use on the system. Using this login information, swimmers will be able to login to the system, view their upcoming swim meets, add/change their personal details, to view data kept for competition times in each swimming technique. Abby should also be able to view all information entered by each swimmer.

Swimmers can also use the system to pay for each individual extra training session.

Task

Avril requires a swimming portal app urgently, you must design a use case diagram for the above scenario, your diagram should include at least one example for each of the following structures:

a) <<include >>
b) <<extend >>
c) generalization

Q2. **Requirement**: Develop a holiday booking App

The system must

- maintain a database of trips available
- Allow users to search for particular locations
- Allow users to view reviews
- Allow users to book a particular trip using various payment methods
- Allow users to change the textual language if they wish to do so.

Persona

Ben is a new dentist in Aberdeen, he is originally from Spain. He is ecstatic about his new job and looking forward to getting to know Scotland.

User Story

Goals

Ben would love to be able to take his family up to the highlands on holiday he wishes to book a hotel and transportation on any digital device.

He would also really like the information translated to Spanish.

User Scenario

Ben will like an app he can use to book the trip for his family. He wishes to be able to search for most popular locations in the Highlands. He also wants to select Spanish for language translation, and the ability to use the app to compare prices and reviews posted by other users. Finally, Ben wants to be able to selects the number of travellers, date and use various payment methods (credit card, debit card or wire transfer) details to pay for the trip.

Task

The travel company wants to develop this app so it can be accessible to busy people like Ben. You have been tasked to design a use case diagram for the above scenario. Include examples of each of these constructs in your diagram:

a) <<include >>
b) <<extend >>
c) Use case generalization

HINT: you will find the Spanish language translation tricky as it is unclear whether you have to develop this yourself or interact with another actor e.g. Google Translate.

Q3. **Requirement**: Develop an additional module for a school management information system (MIS)

The system must:

- Allow the Senior Leadership Team (SLT) to browse for available teachers within periods
- Generate absence reports
- System must receive and/or notify teachers for cover requests
- Allow teachers update result and attendance data for pupils
- Allow SLT to view exam results and attendance data.

Persona

Eileen is a new deputy head teacher; she has just been promoted to the job and is very enthusiastic about taking the role. She is looking forward to getting to know the teachers and pupils in the new school.

User Story

Goals

To assist with the responsibilities of her new role Eileen wishes to have additional functionality added to the school's management information system (MIS) application to organise cover for classes due to teacher absences. She also wants to be able view the number of classes each teacher has covered.

She wants a system in which she can count and view each individual pupil's absences, and termly results and prelim exam mark.

User Scenario

Eileen wants an additional module added to the school's management information system which can be used for generating necessary reports. She wants the ability to be able to receive cover requests from teachers; search for available teachers for cover within that period/ lesson as well as receive future cover requests for up to 2 months. Eileen wants to count the number of cover each available teacher has completed to date so she can select teachers with the lowest numbers.

Eileen wants to receive alerts from teachers requesting absence reports for a pupil. She wants to use the system to search for the pupil and retrieve the absence reports for those specific dates.

Eileen also wishes to use the system to search for pupils' exam and prelim reports. The system should identify any omissions within the results and notify the subject teachers requesting these results. Teachers should also be able to update results in the system.

Task

Design a use case diagram for the schools MIS, Include these constructs in your diagram:

a) <<include >>
b) <<extend >>
c) generalization
d) association

Q4. Write an effective use case for a system to check and show the winnings for a monthly raffle. The customer enters their ticket number, the system detects that it matches the winning number of the month, registers the user as this month's winner, sends an email to the sales manager, congratulates the customer and gives them instructions on how to collect the prize.

Q5. Review the scenario below and model it with a use case diagram. Use at least one of each of the following constructs:

a) <<include >>
b) use case generalization
c) association

Scope: A FAST CASH cashpoint machine

Context of use: To withdraw cash

Scenario

Jemma, taking her two daughters to day care on the way to work, drives up to the Cashpoint Machine, runs her card across the card reader, enters her PIN code, selects FAST CASH, and enters £35 as the amount. The Cashpoint issues a £20 and three £5 bills, plus a receipt showing her account balance after the £35 is withdrawn. The cashpoint resets its screens after each transaction with FAST CASH, so that Jemma can drive away and not worry that the next driver will have access to her account. Jemma likes FAST CASH because it avoids the many questions that slow down the interaction. She comes to this particular Cashpoint because it issues £5 notes, which she uses to pay the day care, and she doesn't have to get out of her car to use it.

Q6. You have been asked to develop software for an insurance company to satisfy the scenario below, create a use case diagram modelling this software, taking into account the preconditions. Where it would be applicable, use these constructs in your diagram:

a) <<include >>
b) <<extend >>

Scope: "System" means A claims-capturing computer system

Context of use: To Capture loss fully

Primary Actor: Administrator

Preconditions: Administrator already logged in.

Scenario

Craig is a new driver who has just passed his driving test, on his way home soon after dropping off a friend, he turned at a junction and took a quick left and unknowingly collided with a van. Following the accident Craig tries to make a claim on his insurance.

Craig sends details of the accident to his insurance company. Upon receiving the details an administrator will first verify Craig's policy details to make sure he is entitled to make this claim. Then the administrator will search to check to see if the accident / claim have already been recorded. If it is a new claim the administrator will enter the details as a new claim and assign it to a claims adjuster. The claims adjuster will then be able to view the claim details and process the claim. To process the claim the claims adjuster will either approve or reject it based on their review of the details.

Specimen paper Q1

A new website is being developed for owners of electric cars.

Unregistered users of the website will be able to see the location of public charging stations.

Registered users of the website will be able to connect to one of the chargers and pay for the use of the charger via the website. Once the charge has completed, registered users will be able to view their charging history with details of locations, prices and charge level after each charge.

Draw a use-case diagram for this website. **3**

Old Prelim 2017 Q1

Squeaky Clean are a cleaning company that are updating their online app which allows customers to book the company's services. The current app allows customers to login and book then pay for a single cleaning service.

(a) Requirements for the updated online app are listed below.

The updated app will allow all users to:

- Access information about company services
- Book and pay for a basic service
- Create an account to become a customer

The updated app will allow customers to:

- Log-in to access the app as a customer
- Search for specialist services
- Book and pay for specialist services
- Update details of their account.

Draw a use case diagram to represent these requirements. **3**

2016 Past Paper

The owners of a monthly magazine decide to update the company website. The current website allows users to access online versions of articles printed in the monthly magazines.

Requirements for the updated website are listed below.

The updated website will allow **all** users to:

- access a maximum of five free articles every month
- search for articles over 12 months old
- subscribe to the full service using a secure payment system

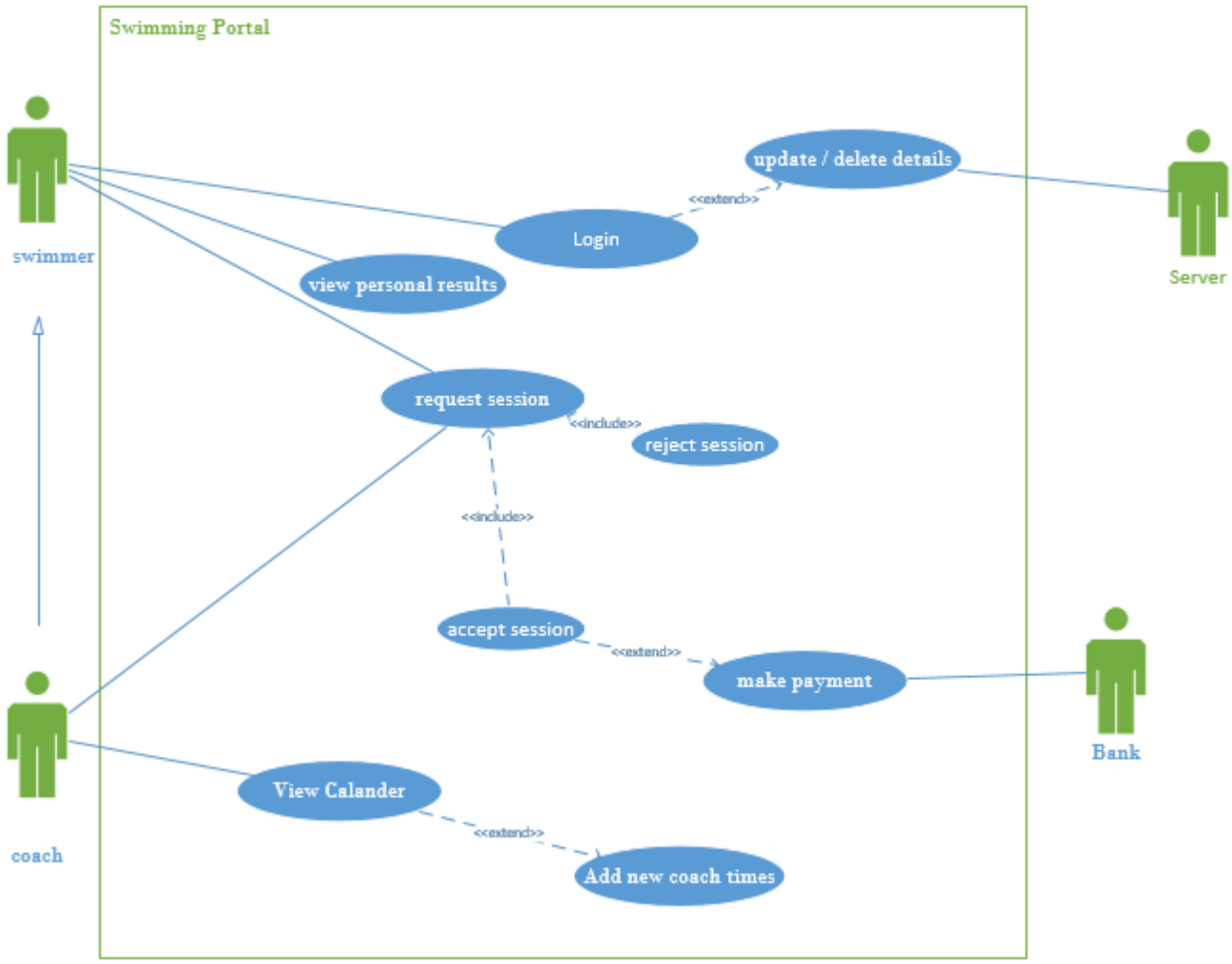
The updated website will allow **subscribed** users to:

- login to gain access to the full service
- access any number of articles
- search for articles without restriction
- renew their subscription at a reduced rate using a secure payment system

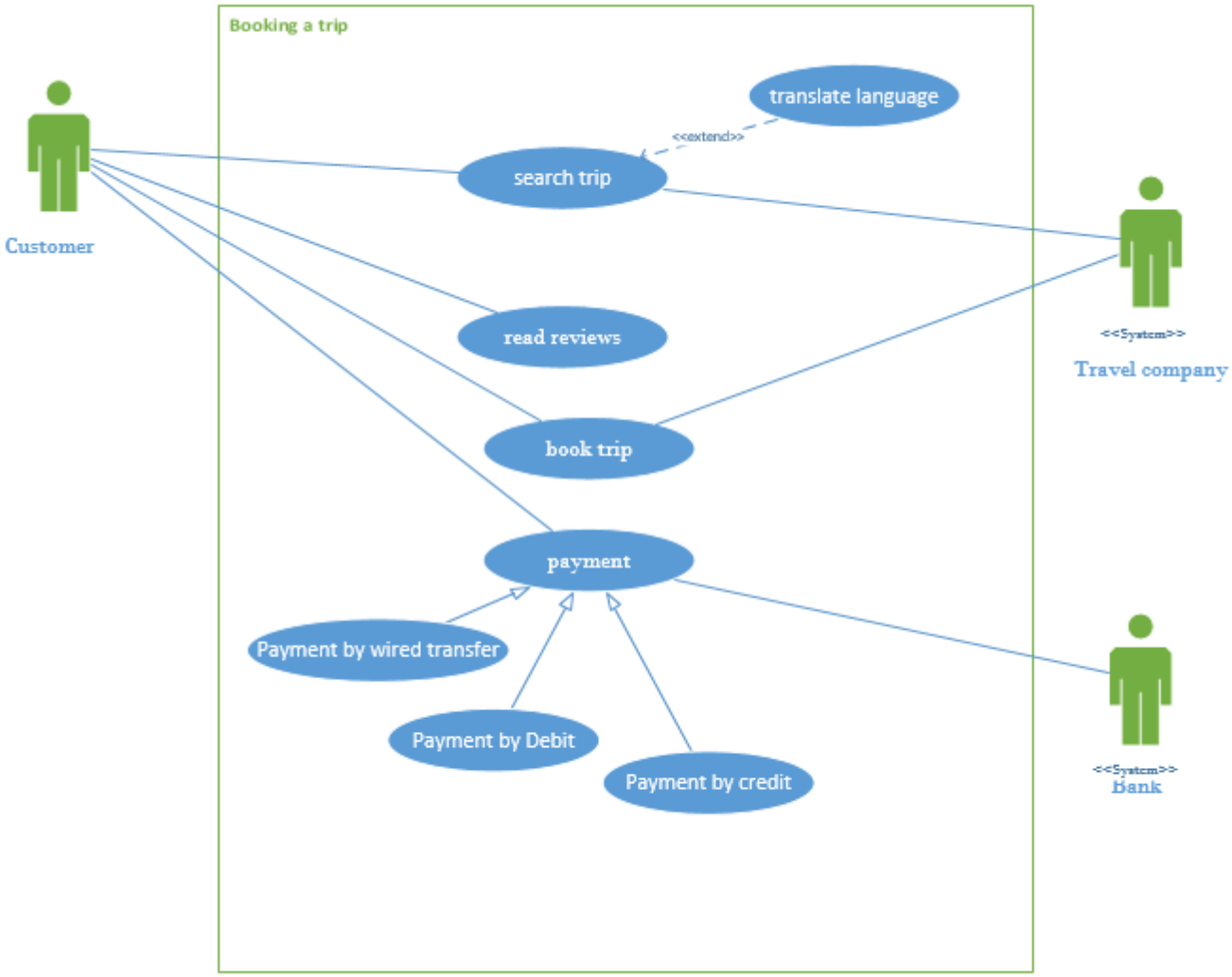
Draw a use case diagram to represent these requirements.

Answers:

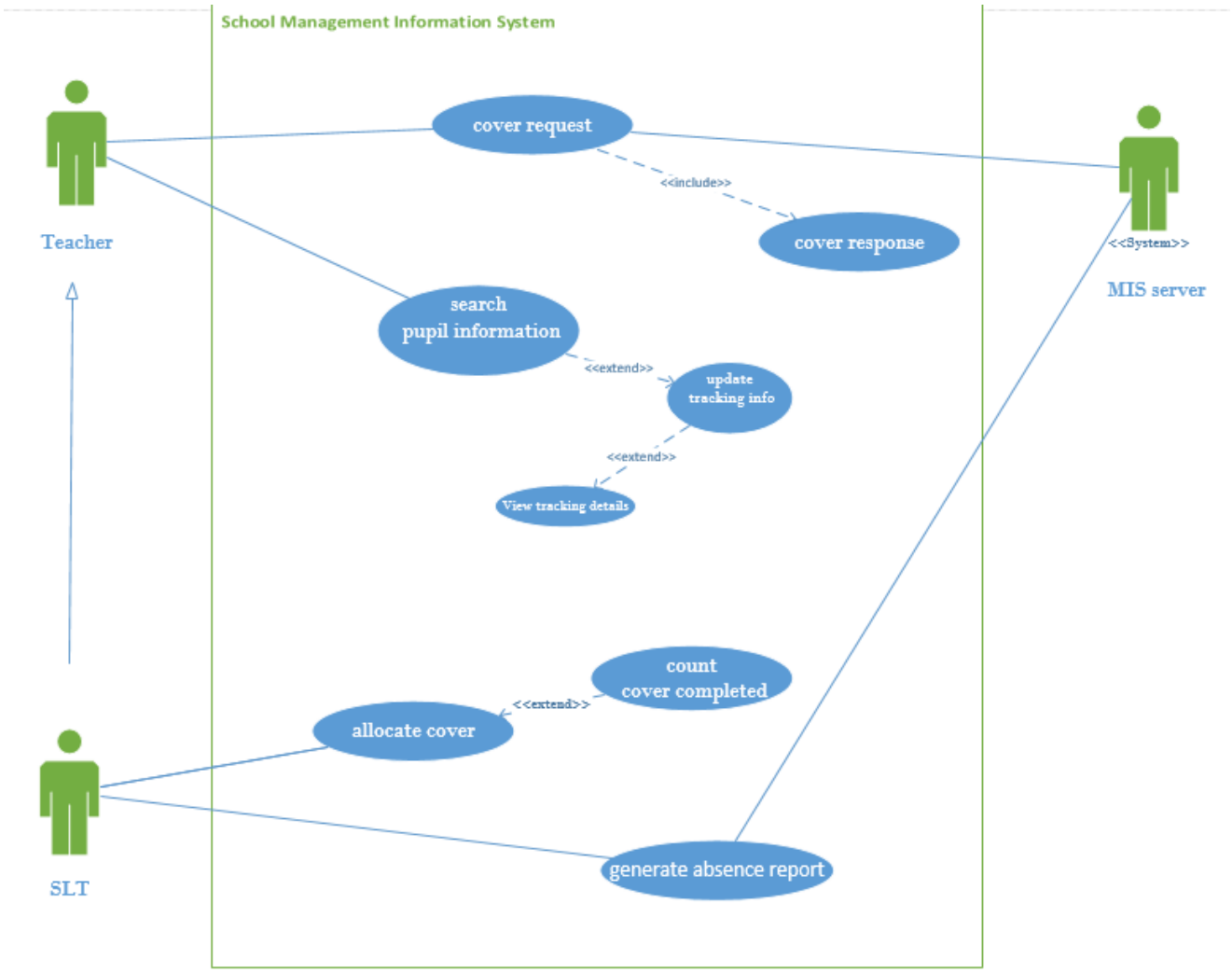
1. **Swimming Portal Class diagram**



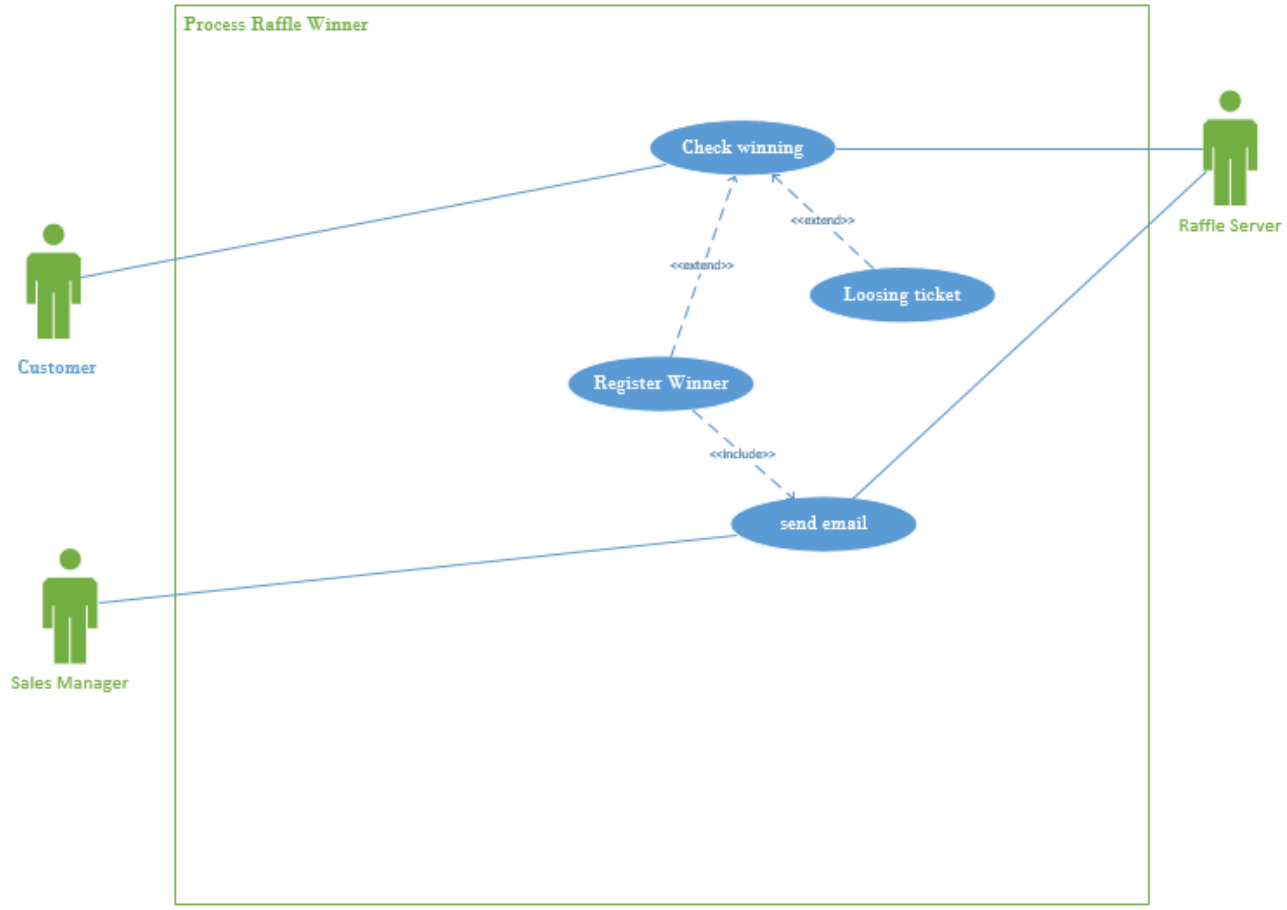
2. Travel Information Class Diagram



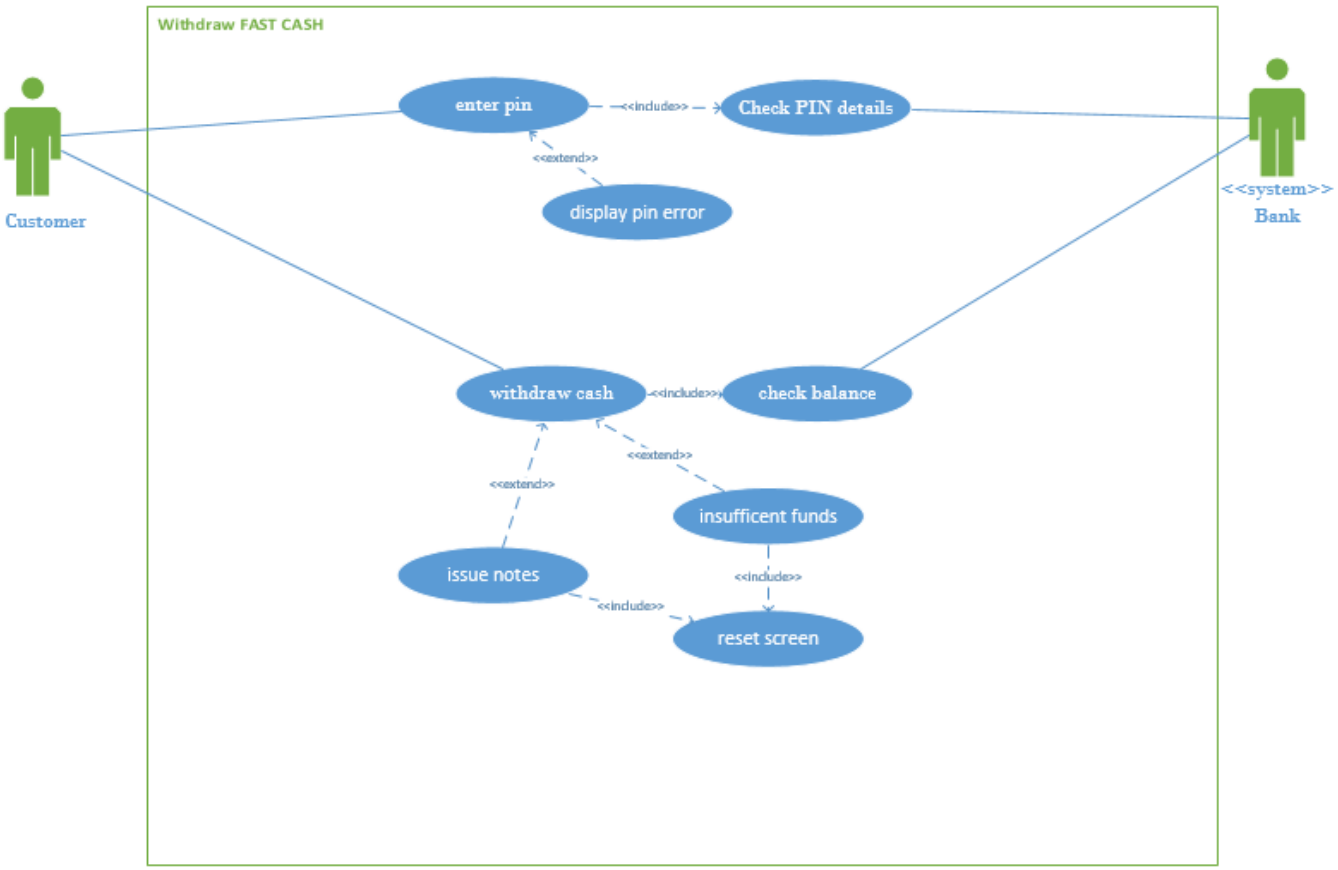
3. School Management information System



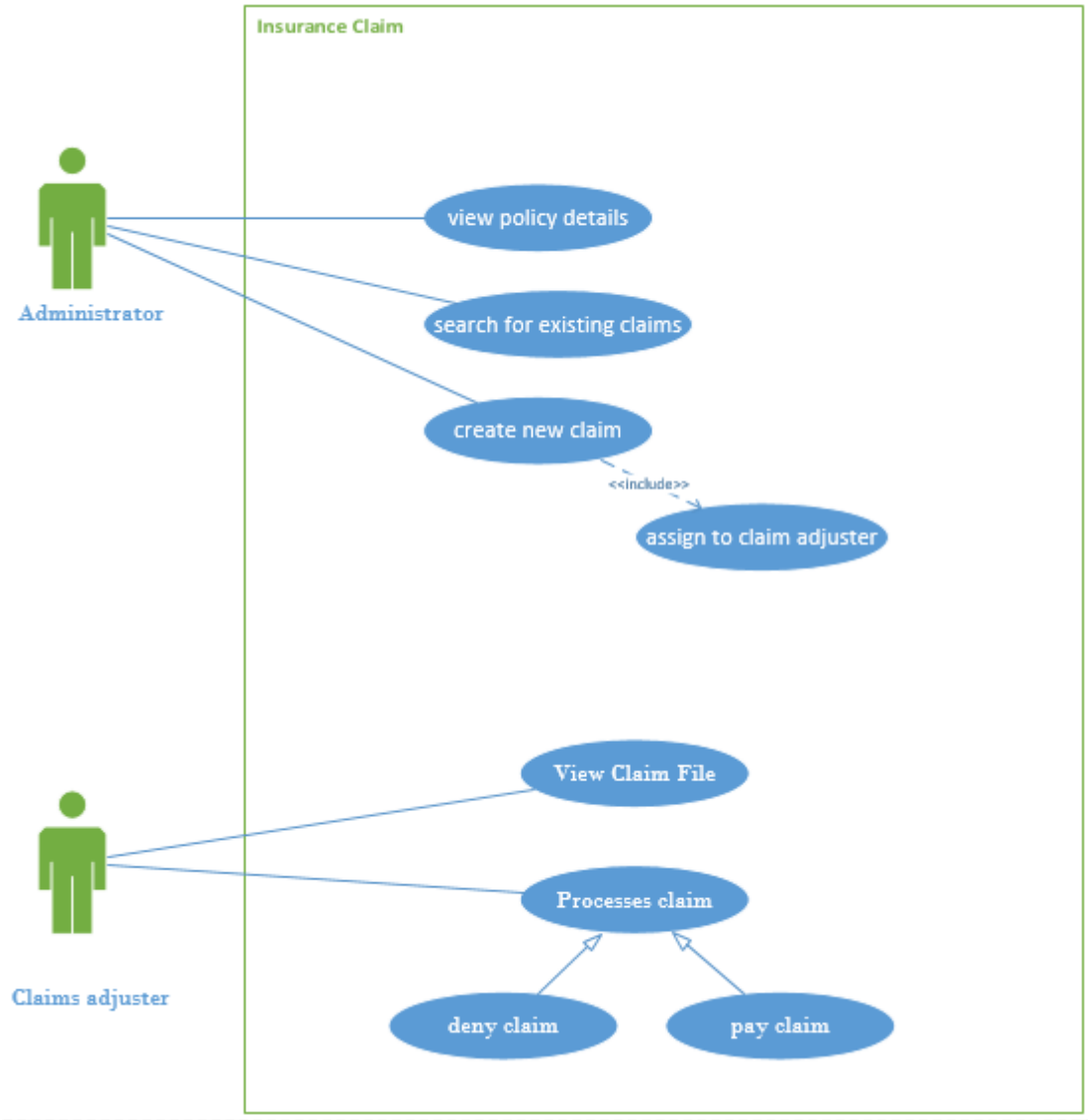
4. Monthly Raffle



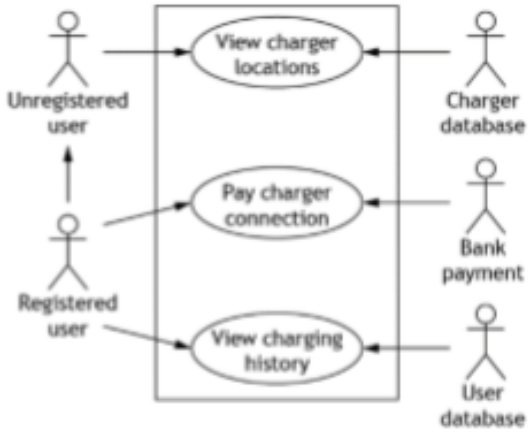
5. FAST CASH


Withdraw FAST CASH
Customer
enter pin
<<include>>
Check PIN details
<<extend>>
display pin error
<<system>>
Bank
withdraw cash
<<include>>
check balance
<<extend>>
<<extend>>
insufficent funds
issue notes
<<include>>
<<include>>
reset screen

6. Insurance Claim

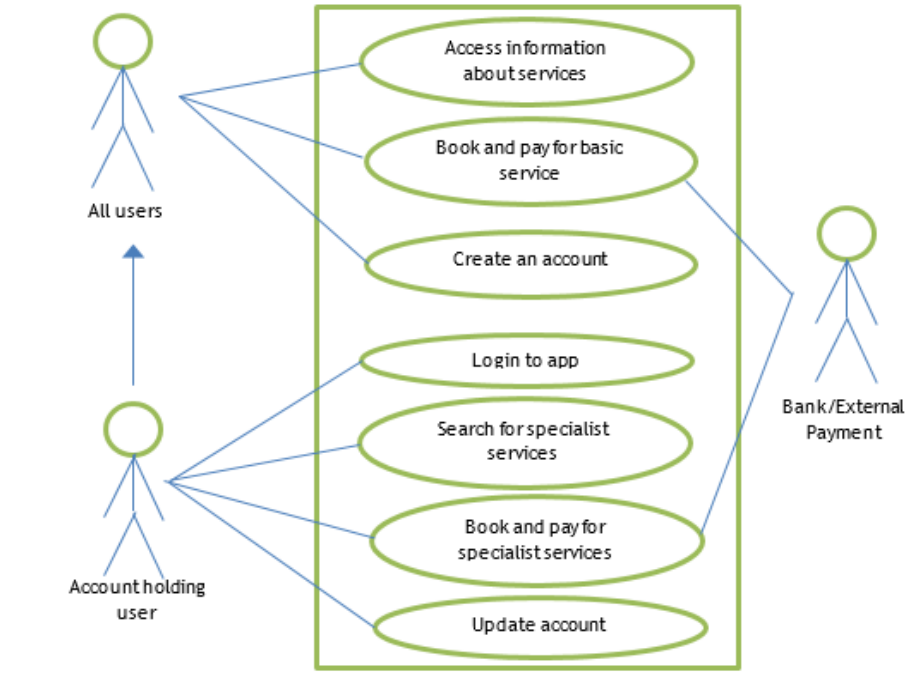


Specimen Question 1

	Expected response	Max mark	Additional guidance
		3	1 mark for 3 use cases. 1 mark for registered and unregistered actors interacting with correct use cases. 1 mark for any database actor (charger, bank or user) interacting with correct use cases.

Old prelim 2017

a		Requirements for the updated online app are listed below. The updated app will allow all users to: • Access information about company services • Book and pay for a basic service • Create an account to become a customer	The updated app will allow customers to: Log-in to access the app as a customer Search for specialist services Book and pay for specialist services Update details of their account. Draw a use case diagram to represent these requirements. **1 mark for actors** **1 mark for processes** **1 mark for correct links to actors.**	3



2016 Past Paper

The following is a sample use case diagram for this scenario.