bcs

The Chartered Institute for IT

BCS Certificate in Systems Modelling Techniques (UML)

NOTE:

These are sample questions, with marking guidelines, for each of the BCS Diploma certificate modules. Each sample question has been written to help candidates prepare for the module examination by providing an example of the general approach adopted by these questions. Therefore, the total marks assigned to the sample questions will vary depending upon the certificate module.

The BCS Examination Providers are accredited to set the examinations for the certificate modules and part of the accreditation process requires Providers to demonstrate their ability to set rigorous examination papers. The sample questions are not intended for use by Examination Providers as a basis for setting their own examination papers and should not be viewed as a template for these examinations.

SYSTEM MODELLING TECHNIQUES (UML)

Use Case Question

Scenario 1

The Northstar Hotel's website allows potential guests to make a room reservation, specifying the dates and type of room. If they have registered with the website previously their stored details are used to speed up the process, otherwise they are required to register as a new customer. Each reservation is given a unique reservation code.

Before the date of their stay they may enter this reservation code into the website to amend or cancel the reservation. Amendments can include altering the dates, changing the room type or the number of guests in each room.

When the guests arrive at the hotel the reservation id is used by the receptionist to quickly find the reservation to check them in with.

At the end of their stay the receptionist checks the guests out, at this point the hotel system validates their payment through the card payment system; a printed invoice may be requested by the guest at this point.

The hotel has many room types available, each with a room-type name, number of guests and additional facility information. Each room in the hotel has a room number and is of one specific type. The maintenance of this data is performed using a separate system out of scope of this exercise.
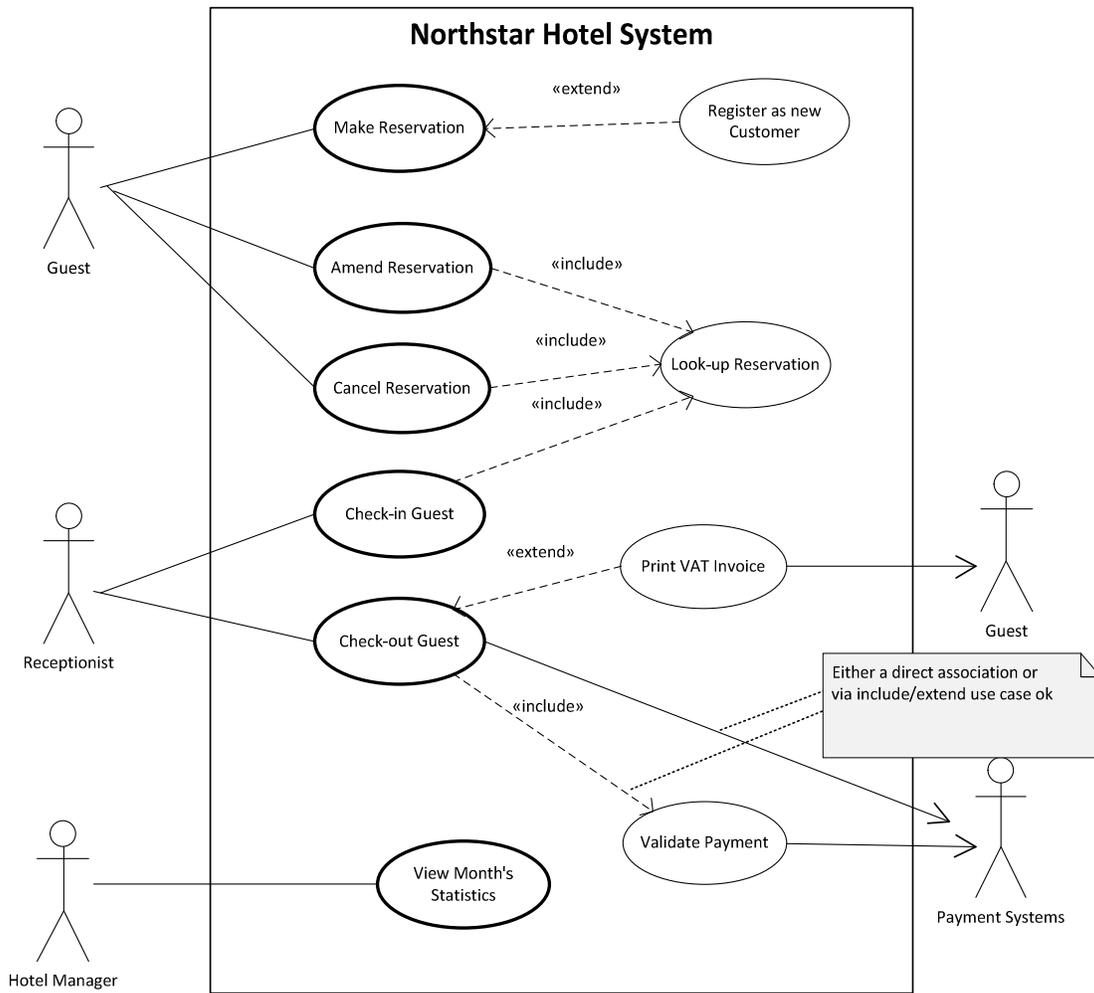
Monthly reports are prepared by the system which may be viewed on request by the Hotel Manager.

Question

Produce a System Use Case diagram for the above scenario.

(18 marks)

Northstar Hotel System

Guest

«extend»
Make Reservation ← - - - - - - Register as new Customer

Amend Reservation «include»

Cancel Reservation «include» → Look-up Reservation

«include»

Check-in Guest

Receptionist

«extend»
Print VAT Invoice → Guest

Check-out Guest

«include»

Validate Payment

Either a direct association or via include/extend use case ok

Payment Systems

View Month's Statistics

Hotel Manager

Note: *depending on assumptions then some of the extend associations may be represented by include associations, and vice-versa. The only true means of determining this would be to produce full use case descriptions.*

Element	Details	Max Marks
System Boundary	1 Mark for displaying and naming the system boundary - Another *allowable answer is that two boundaries are presented, one representing the website and another the main system. Only one mark though*	1
Actors	1 Mark for each actor, [up to 4] - Candidates include Guest/Customer (only 1 mark if both), Receptionist, Hotel Manager, Payment System - Time should not be marked correct; see below	4
Use Cases	1 Mark for correctly named (verb-object/noun) use cases [up to 6] - This includes sub-use cases that are included or extended providing they are reasonable - Functional decomposition should be avoided, as should anything that does not truly represent an interaction across the system boundary	6
Use Case~Actor Associations	½ (0.5) marks for each correct actor to use case association crossing system boundary[up to 10 ~ 5 marks] - A use case's interactions with secondary actors are counted in addition to the primary actor to use case association	5
Include/extend associations	1 mark for each correct include and extend use case example [up to 2 examples] - multiple use cases including same use case counts as single example - Depending on both assumptions made and definition of include/extend allow for various interpretations, however see note above about functional decomposition and truly representing interactions	2
TOTAL		**18 marks**

Annotated Scenario

The Northstar Hotel's website allows potential **guests** to **make a room reservation**, specifying the dates and type of room. If they have registered with the website previously their stored details are used to speed up the process, otherwise they are required to **register as a new customer**. Each reservation is given a unique reservation code.	**Guest**->**Make Reservation** **Guest**->**Register as new customer**
Before the date of their stay they may enter this reservation code into the website to **lookup the reservation** to **amend** or **cancel**. Amendments can include altering the dates, changing the room type or the number of guests in each room.	**Guest**->**Amend reservation** **Guest**->**Cancel reservation** *Both include* ->(**lookup/find reservation**) **Receptionist**->**Check-in guest** *Also includes*->(**lookup/find reservation**)
When the guests arrive at the hotel the reservation id is used by the **receptionist** to quickly **find the reservation** to **check them in** with.	
At the end of their stay the receptionist **checks the guests out**, at this point the hotel system **validates their payment** through the **card payment system**; a **printed invoice** may be requested by the guest at this point.	**Receptionist**->**Check out guest** *Includes or extended by(based on assumption)* **Validate payment**->**Card Payment System** *Check out guest also includes or extended by* **Print Invoice**->**Guest**
The hotel has many room types available, each with a room-type name, number of guests and additional facility information. Each room in the hotel has a room number and is of one specific type. The maintenance of this data is performed using a separate system out of scope of this exercise.	**Hotel Manager**->**View monthly report***
Monthly reports are prepared by the system which may be **viewed on request** by the **Hotel Manager**.	

*Note that a time driven use case producing the report is not credited as that is not a true interaction across the system boundary; in this scenario the hotel manager initiates viewing the report at a later time. Had the report been output specifically at the time the report is prepared this may have then represented an interaction.

Class Diagram question

Scenario 2

A company holds the following information about the vehicles it owns.

▪ Registration number (all vehicles)
▪ Engine capacity (cc) (all vehicles)
▪ Next vehicle test date (all vehicles)
▪ Laden weight (vans and lorries only)
▪ Unladen weight (Vans only)
▪ Carrying capacity (Vans only)
▪ Number of wheels (Lorries only)
▪ Towing capacity (Lorries only)
▪ Licence grade required (Lorries only)

The company also holds information about the trailers that can be used on a lorry. Each trailer has a trailer number, a load capacity and a date of last service. The company has 40 lorries and 120 trailers. The company needs to record which trailers can be attached to which lorries. A lorry may not be allocated a certain trailer, or it may be allocated one or more trailers. A trailer may be allocated to more than one lorry, but it has to be allocated to least one lorry.
The manufacturer of each vehicle has to be recorded. The company may have many vehicles made by the same manufacturer (e.g. Ford), but it does not store information about manufacturers for which it does not have a vehicle. A vehicle (such as a Transit) is only made by one manufacturer.
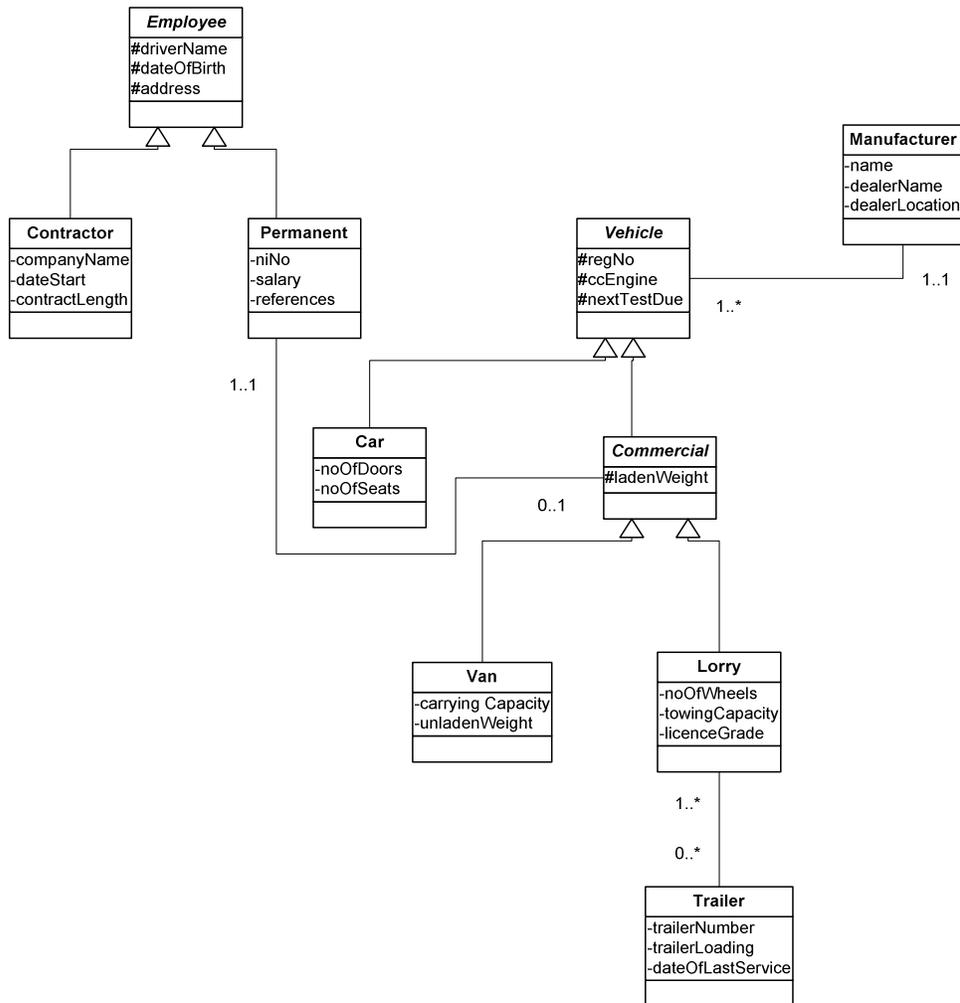There are two types of employee, contractors and permanent. The attributes driver name, date of birth and address are held for all drivers. The attributes company name, start date and contract length are held for contractors. The attributes national insurance number, salary and references are held for contract staff. Both vans and lorries must be allocated to a permanent employee. Each van or lorry is allocated to just one permanent employee. A permanent employee has a maximum of 1 lorry or van allocated to them. However, there are some permanent employees (office staff) who do not have a lorry or van allocated to them.

Question

Draw a class diagram for this scenario, explicitly showing the data items of each class and sub-class.

(21 marks)

Employee
#driverName
#dateOfBirth
#address

Contractor
-companyName
-dateStart
-contractLength

Permanent
-niNo
-salary
-references

Manufacturer
-name
-dealerName
-dealerLocation

Vehicle
#regNo
#ccEngine
#nextTestDue

1..*   1..1

1..1

Car
-noOfDoors
-noOfSeats

Commercial
#ladenWeight

0..1

Van
-carrying Capacity
-unladenWeight

Lorry
-noOfWheels
-towingCapacity
-licenceGrade

1..*

0..*

Trailer
-trailerNumber
-trailerLoading
-dateOfLastService

- 0.5 mark for each class or sub-class up to a maximum of 5 marks

- 0.5 marks for each attribute set up to a maximum of 5 marks

- 1 marks for the Vehicle generalisation

- 1.5 marks for the Commercial generalisation

- 1 mark for the employee generalisation

- 2 marks for the correct association multiplicities between lorry and trailer

- 2 marks for the correct association multiplicities between manufacturer and vehicle

- 2 marks for the correct association multiplicities between permanent employee and commercial

- 0.5 marks for notating abstract classes up to a maximum of 1.5 marks

Total: 21 marks

Interaction diagram question

Scenario 3

An application for a Parking Enforcement System (PES) is being built for a number of local authorities to manage their parking enforcement processes. The application receives information about new fines uploaded from the attendant's handsets. Most fines are then paid within the allowed period and that payment recorded against the fine which is then closed. Sometimes only part of the fine is received in which case the outstanding balance should be updated but the fine still active.
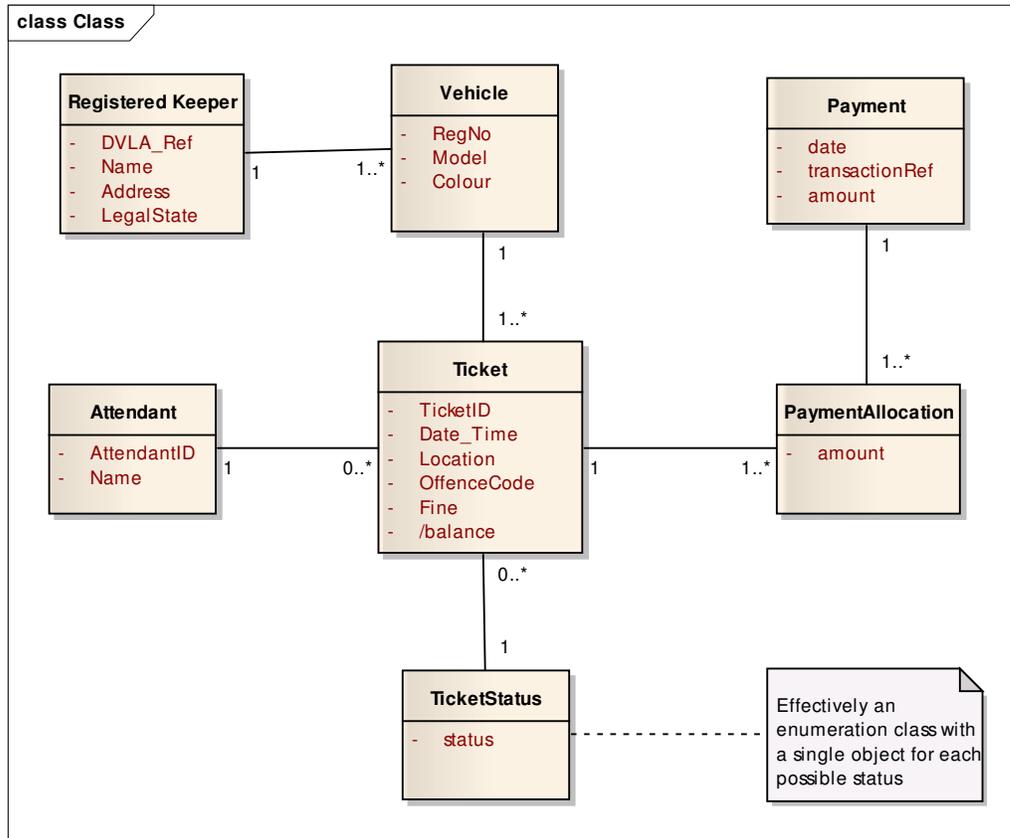
Use case diagram:
[Note: Typically you would have produced a use case diagram similar to this in a previous question based on the same scenario.]
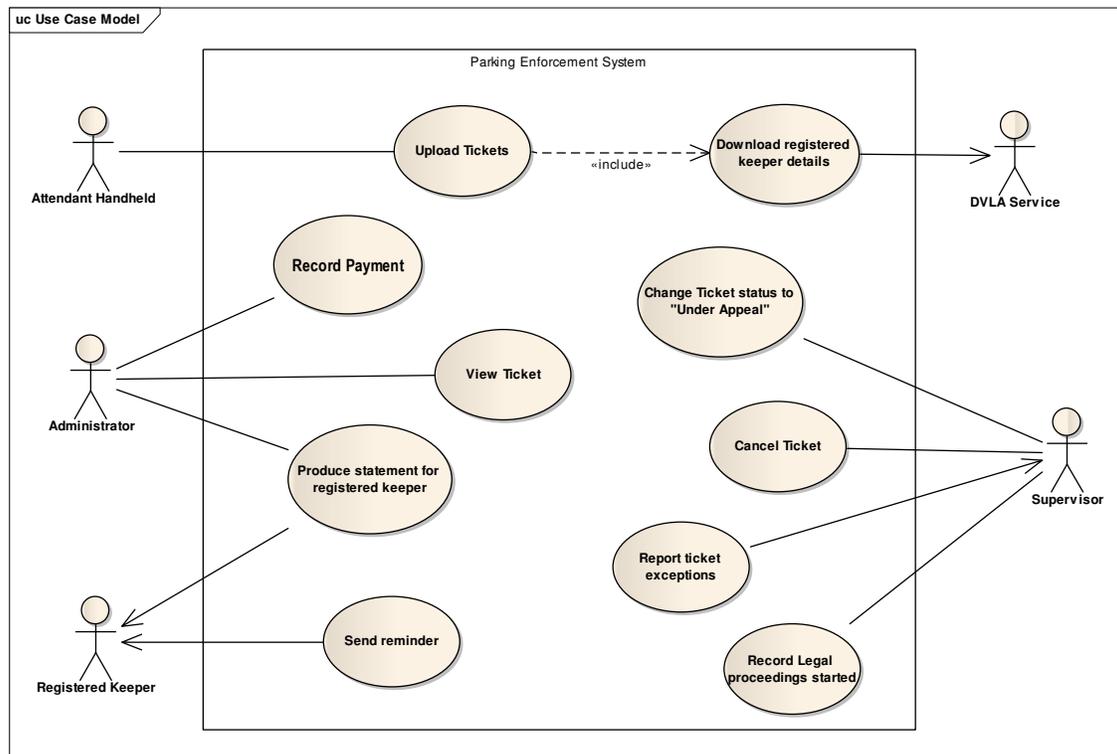
Class Diagram:
[Note: Typically you would have produced a class diagram similar to this in a previous question based on the same scenario.]

Use Case Description

The following use case description is for the "Record Fine Payment". Not all conditions and scenarios are listed, only those required by the question.

Use Case	Record Fine Payment	Scope	IT System
Actor(s)	Administrator	**Goal Level**	User
Pre-conditions	Actor is logged into application;		
Post-conditions	A new payment is recorded on the system; One or several fines are updated to either be completely or partially paid off		

Main Success Scenario
1. The actor enters the first TicketID from the remittance stub   2. The system displays information about the registered owner and the specified ticket including vehicle details *and a list of any other outstanding fines by vehicle*   3. The actor enters the amount paid which matches the outstanding balance   4. The system displays the updated fine details (same information as step 2)   5. The actor closes the use case

Alternate flows

…
 3a: The payment is not for the full outstanding balance
     3a1: the actor enters the partial payment amount
    Return to step 4
 …

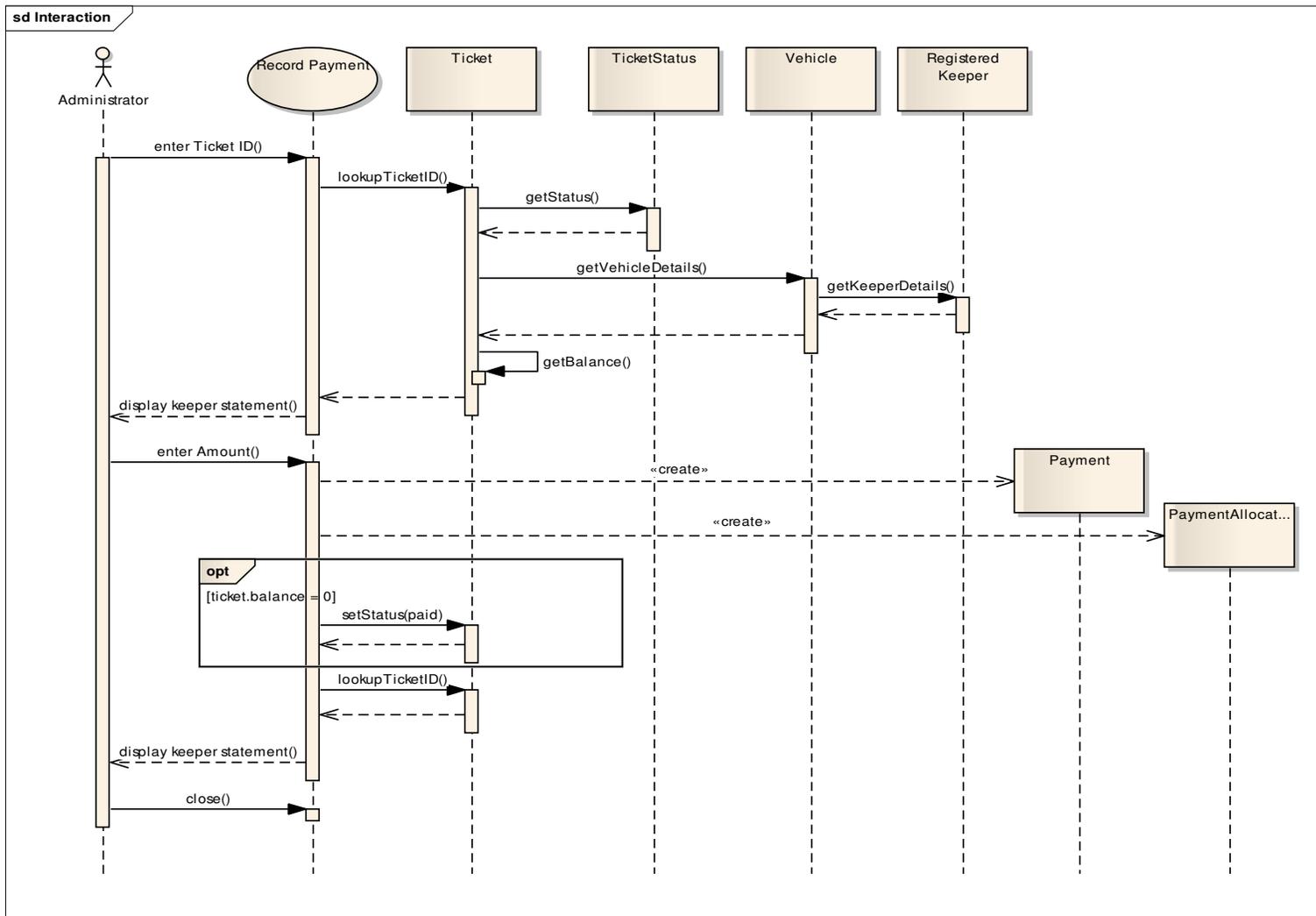| Main Scenario	The payment relates to a single ticket and clears the outstanding balance - [ticket.balance = £0& status = 'paid']
Scenario 1	The payment relates to a single ticket but is only a part payment - [ticket.balance> £0& status is unchanged]
Scenario n etc.	*Not relevant to this question*

Question

Produce an interaction diagram (i.e. Sequence or Communication diagram) for the "Record Payment" use case.

The diagram **SHOULD** allow for both the main success scenario (single ticket, full payment) and the alternative scenario where only a part payment has been received against a single ticket.

Note: You are NOT required to model any other scenarios, such as payment of multiple tickets being allocated against a single payment or where the payer is not the known keeper; no additional marks will be gained for doing so.

(14 Marks)

Sample Answer and marking scheme

sd Interaction

Administrator — enter Ticket ID() → Record Payment
Record Payment — lookupTicketID() → Ticket
Ticket — getStatus() → TicketStatus
Ticket — getVehicleDetails() → Vehicle
Vehicle — getKeeperDetails() → Registered Keeper
Ticket — getBalance()
Record Payment — display keeper statement() → Administrator
Administrator — enter Amount() → Record Payment
«create» → Payment
«create» → PaymentAllocat...

opt [ticket.balance = 0]
setStatus(paid)

lookupTicketID()
display keeper statement()
close()

Element	Marks	Notes
Lifeline objects	1 for Actor 1for Use Case 0.5 for other objects (max 3 marks) 0.5 for correct creates (max 1 mark) **[total 5 marks]**	*Actor may be specifically named or just called 'Actor'* *Control, Boundary objects (or both) acceptable in place of Use Case* *Ticket, Vehicle, Keeper, Payment, Ticket Status & PaymentAllocation* *Payment and Payment Allocation should not exist at start (allow for absence of dotted lifeline at start if object placed at top depending on style)*
Use Case consistency	2 for reflecting use case sequence **[total 2 marks]**	*Actor<>Use Case Messages and returns match use case steps*
Messages	0.5 per message (max 4 marks) **[total 4 marks]**	*Messages should be placed correctly and clear in their purpose*
Scenario Coverage	1 for fragment 1 for effect **[total 2 marks]**	*May be an alt or potentially an opt fragment at a suitable level* *Should reflect coverage of both scenarios*
General	1 for clear flow **[Total 1 mark]**	*It should be possible to follow the sequences through the diagram*

(Total 14 marks)

This marking scheme refers specifically to a Sequence diagram. If a Communication (aka collaboration) diagram is produced then marks should be awarded for equivalent elements as below