0 1 . 1 The SQL query in **Figure 4** has been written to produce a list of all of the vets who work at the surgery in the town of Torquay. Some errors have been made in the query.

Figure 4

```
SELECT VetForename, VetSurname
FROM Surgery, Vet
WHERE Town = Torquay
```

Describe **two** errors that have been made in the query. You should **not** give the omission of a semi-colon (;) as one of the errors.

[2 marks]

Error 1:

Error 2:

0 2 . 1   Write an SQL query that will retrieve from the database the list of all properties that the buyer with BuyerID 23 might be interested in buying. The properties should:

- be in the buyer's desired area
- have at least the minimum number of bedrooms the buyer requires
- cost no more than the maximum price that the buyer is prepared to pay.

The list of properties returned should only include, for each property, the following details:

- the PropertyID
- the street that the property is on
- the number of bedrooms that the property has
- the asking price for the property.

The list should be ordered with the most expensive property at the top of the list and the least expensive at the bottom of the list.

[5 marks]

0 3   A warehouse stores products that are waiting to be delivered to supermarkets. The products are packed onto pallets. For example, a pallet might hold 120 boxes of washing powder. All of the products on one pallet are of the same type.

The individual products on the pallets could be identified by labelling them individually with barcodes or by attaching RFID (radio-frequency identification) tags to them.

Each barcode/RFID tag would store a representation of a ProductID number that uniquely identifies the type of product (eg 102546 might represent a specific brand and box size of washing powder) together with an ItemID number that is unique to the specific item (eg box number 1 of the washing powder, box number 2 of the washing powder etc).

Figure 9 shows an example of five boxes of washing powder loaded onto a pallet and their ProductID and ItemID values.

Figure 9

ProductID: 102546 ItemID: 1	ProductID: 102546 ItemID: 2	ProductID: 102546 ItemID: 3	ProductID: 102546 ItemID: 4	ProductID: 102546 ItemID: 5

Figure 10 shows an excerpt from the simple database table that stores the details of the products that the warehouse has in stock.

Figure 10

ProductID	Description	QuantityInStock
102546	Washing Powder 1kg box	10 000
398352	Baked Beans 455g tin	1450
293820	Large Dishcloths	300

Some pallets delivered to the warehouse will be of products that already exist in the database table. Other deliveries will be of pallets of items that don't exist in the table because the warehouse has not stocked them before.

0 3 . 1 Describe how an RFID reader would read the ProductID and ItemID values from RFID tags as pallets are delivered and explain how this data could be used to update the database table that stores details of the products that the warehouse has in stock.

You should include in your description references to the type(s) of SQL statements (eg INSERT, SELECT, UPDATE) that could be used and their purpose, but you do **not** need to write any SQL code.

[6 marks]

0 4   A sports centre uses a relational database to store information about its facilities
(such as the swimming pool) and the bookings that have been made to use them.

Figure 3 shows the structure of the relations in the database.

Figure 3

Facility(FacilityID, Description, MaxPeople, PricePerHour)

FacilityForSport(Sport, FacilityID)

Booking(FacilityID, BookingDate, StartTime, EndTime, CustomerID)

Customer(CustomerID, Forename, Surname, EmailAddress)

- The Facility relation stores the different facilities available at the sports centre.
  Each one is identified by a unique number and has a brief description. For
  example, the facility with FacilityID 1 has the description 'Outdoor Pitch A'.
  PricePerHour is the price of hiring a facility for 1 hour. For example, the facility with
  FacilityID 1 has a price per hour of £17.50.

- The FacilityForSport relation identifies which facilities are suitable for which sports.
  For example, the facility with FacilityID 1 is suitable for football, rugby and hockey
  and would therefore require three separate records in this relation.

- The Booking relation stores the bookings that have been made. Bookings must
  start and end either on the hour, at quarter past, half past or quarter to the hour.
  A customer can make bookings for more than one facility for the same time. For
  example, a badminton club secretary might book both of the indoor sports halls for
  the same time. However, each facility can only be booked by one customer at any
  one time.

- The Customer relation stores the details of customers who have made bookings.

0 4 . 1   The entity identifier (primary key) for the Booking relation is a composite entity
identifier, consisting of these three attributes:

FacilityID, BookingDate, StartTime

An alternative entity identifier could have been chosen, composed of different
attributes.

Shade **one** lozenge to indicate which of the following groups of attributes would form
a valid alternative entity identifier for the Booking relation.

[1 mark]

A   BookingDate, StartTime, EndTime   ⬭

B   FacilityID, BookingDate, EndTime   ⬭

C   FacilityID, StartTime, CustomerID   ⬭

D   FacilityID, BookingDate, EndTime, Sport   ⬭

0 4 . 2 A different design was originally proposed for the database. This design did not have the Customer relation and had the following design for the Booking relation:

Booking(FacilityID, BookingDate, StartTime, EndTime, Forename, Surname, EmailAddress)

Explain why this alternative design would have been rejected in favour of the design in **Figure 3**.

[2 marks]

0 4 . 3 Complete the following SQL statement to create the Facility relation specified in **Figure 3**, including the primary key.

[3 marks]

CREATE TABLE Facility (

)

Figure 3 is repeated below to help you answer Question **04.4** without having to turn back in the question paper.

Figure 3 (repeated)

Facility(<u>FacilityID</u>, Description, MaxPeople, PricePerHour)

FacilityForSport(<u>Sport</u>, <u>FacilityID</u>)

Booking(<u>FacilityID</u>, <u>BookingDate</u>, <u>StartTime</u>, EndTime, CustomerID)

Customer(<u>CustomerID</u>, Forename, Surname, EmailAddress)

| 0 | 4 |.| 4 |

A customer wants to book a facility that is suitable for playing basketball on the 15/06/2021 between 14:15 and 16:15

As part of the booking process, a query is needed to list all the existing bookings that would overlap with the new booking.

Write a query that will list all the bookings for facilities that are suitable for playing basketball and which would overlap with the booking that the customer wants to make.

For each booking which would overlap with the new booking only the FacilityID, StartTime and EndTime fields should be listed.

[7 marks]

0 5   A network of zoos uses a relational database system to store information about the animals that they have so that they can be matched up with animals at other zoos in a breeding programme.

Figure 5 shows the structure of the relations in the database.

Figure 5

Zoo(<u>ZooName</u>, Town, Country)

AnimalLocation(<u>AnimalID</u>, <u>ZooName</u>, <u>DateArrived</u>, DateLeft)

Animal(<u>AnimalID</u>, IndividualName, Species, DateOfBirth, Sex)

Match(<u>AnimalFemaleID</u>, <u>AnimalMaleID</u>, <u>DateOfMatch</u>, Successful)

- The Zoo relation stores details of the zoos that participate in the breeding programme. Each zoo is uniquely identified by its ZooName.

- The AnimalLocation relation identifies which zoos each animal has lived at. The zoo that the animal is currently at can be identified because the DateLeft attribute is set to 01/01/0001 to indicate that the animal has not left.

- The Animal relation stores details of the individual animals that are available to be matched with other animals for breeding. Each animal is identified by a unique number, the AnimalID. The individual name of the animal (eg 'Timothy') is also stored, together with the species of the animal (eg 'Red Panda'), its date of birth and its sex ('Male' or 'Female').

- The Match relation stores details of matches that have been made. The attributes AnimalFemaleID and AnimalMaleID refer to the AnimalID values of the two matched animals in the Animal relation.

0 5 . 1   Shade **one** lozenge to identify which of the properties below **does not have to be true** for a fully normalised database.

[1 mark]

A Each attribute in a relation is dependent on the primary key.   ⬭

B Each attribute in a relation is dependent only on the primary key; it is not also dependent on any other attribute in the relation.   ⬭

C The primary key in each relation consists of only one attribute.   ⬭

D There are no repeating groups (or equivalently each attribute is atomic).   ⬭

0 5 . 2   **Figure 6** is an incomplete entity-relationship diagram for part of the database shown in **Figure 5**.

Draw lines on **Figure 6** to indicate the degree of the **two** relationships between the three entities shown in the entity-relationship diagram.

[2 marks]

Figure 6

```
┌─────────────────┐              ┌─────────────────┐
│     Animal      │              │ AnimalLocation  │
└─────────────────┘              └─────────────────┘




            ┌─────────────────┐
            │       Zoo       │
            └─────────────────┘
```

0 5 . 3   Complete the following SQL statement to create the Animal relation, including the key field.

[3 marks]

CREATE TABLE Animal (_____

_____

_____

_____

_____

_____

_____

_____

_____)

0 5 . 4   **Figure 5** is repeated below to help you answer Question **05.4** without having to turn back in the question paper.

Figure 5 (repeated)

Zoo(<u>ZooName</u>, Town, Country)

AnimalLocation(<u>AnimalID</u>, <u>ZooName</u>, <u>DateArrived</u>, DateLeft)

Animal(<u>AnimalID</u>, IndividualName, Species, DateOfBirth, Sex)

Match(<u>AnimalFemaleID</u>, <u>AnimalMaleID</u>, <u>DateOfMatch</u>, Successful)

There is a requirement to identify all of the red pandas that were present at the zoo called 'Ashdale Park' at any time between 01/04/2020 and 31/05/2020, inclusive.

The animals might still be at the zoo or may have moved to another zoo.

Write a query that will list all the red pandas that were at the zoo on any day between these dates.

For each red panda on the list, the animal's individual name and the date that the animal arrived at the zoo, and no other fields, should be listed.

[7 marks]

0 5 . 5   It is proposed that an additional attribute, ZooName, is added to the Animal relation.
This will store the name of the zoo that currently has the animal. No other changes
would be made to the database.

Describe **one advantage** and **one disadvantage** of adding this new attribute to the
relation.

[2 marks]

Advantage

Disadvantage

0 6 . 1   Develop a **fully normalised design** for a relational database to store the information required by the cinema. To help you, the Screen, Seat, Film and Showing relations have already been defined in **Figure 4**.

Figure 4

Screen(<u>ScreenNumber</u>, Capacity)

Seat(<u>SeatNumber, ScreenNumber</u>, SeatType)

Film(<u>FilmID</u>, FilmName, Duration, Certificate)

Showing(<u>ShowingID</u>, ScreenNumber, FilmID, ShowTime, ShowDate)

Using the format shown in **Figure 4** list the other **three** relations that will need to be created, together with the attributes that each relation will contain.

Underline the attribute(s) that will form the entity identifier (primary key) in each relation.

[5 marks]

0 6 . 2 The cinema had to be closed on the 29th March 2023 so that some maintenance could take place.

The SQL query in **Figure 5** was written to delete all of the showings on this date. Some errors were made in the query.

Figure 5

```
DELETE
FROM Showing, Film
WHERE ShowDate = 29/03/2023
```

Describe **two** errors that have been made in the query.

Do **not** refer to the use of semi-colons in your response.

[2 marks]

Error 1 _____

_____

_____

Error 2 _____

_____

_____

0 6 . 3 Describe an issue that could arise in the database if a query to delete all of the showings that had been scheduled to take place on the 29th March 2023 was executed.

[2 marks]

_____

_____

_____

_____

_____

_____

0 7   A shop that sells items through a website uses a relational database to store information about the products that it sells and the sales that it has made.

Figure 6 shows the structure of the relations in the database.

Figure 6

Product(<u>ProductID</u>, Description, QuantityInStock, SupplierID)

Sale(<u>SaleID</u>, CustomerID, SaleDate)

SaleLine(<u>SaleID, ProductID</u>, QuantitySold)

Customer(<u>CustomerID</u>, Forename, Surname, EmailAddress)

Supplier(<u>SupplierID</u>, SupplierName, SupplierEmail)

- The Product relation stores information about the products that the shop sells and who supplies them. Each type of product is identified by a unique number and has a brief description. For example, ProductID 1 has the Description 'A4 Ring Binder – Purple'. The QuantityInStock indicates how many of the product the shop currently has in stock.

- The Sale and SaleLine relations are used to record the details of the sale of products to a customer. Each sale is identified by a unique SaleID, which is a number.

- The Customer relation stores the details of customers who have registered on the website so that they can purchase products. Each customer is identified by a unique CustomerID, which is a number.

- The Supplier relation records the details of companies who supply the products to the shop. Each supplier is identified by a unique SupplierID, which is a number.

0 7 . 1   Shade **one** lozenge to indicate which of the listed assumptions has been made when the database was designed.

[1 mark]

A   A customer cannot be added to the database until a sale has been made to them.   ◯

B   Each product is only supplied by one supplier.   ◯

C   Each supplier only supplies one product.   ◯

D   Only one sale can be made to a customer on a particular date.   ◯

E   Two different products cannot be purchased as part of the same sale.   ◯

When a sale is made to a customer, three changes need to be made to the data in the database:

- a new record is created in the Sale table
- a new record is created in the SaleLine table for each different product that is part of the sale
- the records in the Product table are updated to reduce the QuantityInStock by the purchased quantity for each type of product that has been sold.

A sale is made on the 29/09/2024 to the Customer with CustomerID 48. The sale is for 3 of the products with ProductID 1. The sale is to be given the SaleID 4072.

0 7 . 2 Write an SQL query that will create the new record for sale 4072 in the Sale table.

[2 marks]

0 7 . 3 Write an SQL query that will update the QuantityInStock of the product with ProductID 1 when this sale is made. The value 3 should be subtracted from the current quantity in stock.

[3 marks]

0 7 . 4 The database system can be accessed by many users simultaneously.

Describe how timestamp ordering can be used to manage concurrent access to a database.

[3 marks]

0 7 . 5 The database described in **Figure 6** is fully normalised.

Describe **two** problems that can occur with databases that are **not** fully normalised.

[2 marks]

Problem 1

Problem 2