EXAM PAPERS PRACTICE

10.3 Database design and normalisation

Name: _____

Class: _____

Date: _____

Time: **608 minutes**

Marks: **422 marks**

Comments:

Q1.

Employees at a bank use client computers to access data that is stored on a database server.

The database server uses software to query and modify data stored in a database on hard disk drives. It returns the results of these queries to the clients over the bank's computer network.

The performance of the system is unsatisfactory: the time-delay between a client sending a query to the server and the client receiving the results is unacceptably long.

Explain how the performance of the system might be improved. You should consider the following factors that might be affecting the performance:

- the hardware of the server
- the design of the computer network
- the database and software running on the server.

In your answer you will be assessed on your ability to follow a line of reasoning to produce a coherent, relevant and structured response.

(Total 12 marks)

Q2.

Athletes, who are members of teams, compete in running events, which are held at fixtures throughout the year.

For example, athlete 15 might compete in the Girls' 1500m Under 18 race in the fixture at Marsten on 12 September 2018.

A relational database is used to store the details of which athletes enter each event at each fixture. The relations used in the database are shown in **Figure 1**.

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Figure 1

Athlete(<u>AthleteID</u>, Surname, Forename, DateOfBirth, Gender, TeamName)

EventType(<u>EventTypeID</u>, Gender, Distance, AgeGroup)

Fixture(<u>FixtureID</u>, FixtureDate, LocationName)

EventAtFixture(<u>FixtureID, EventTypeID</u>)

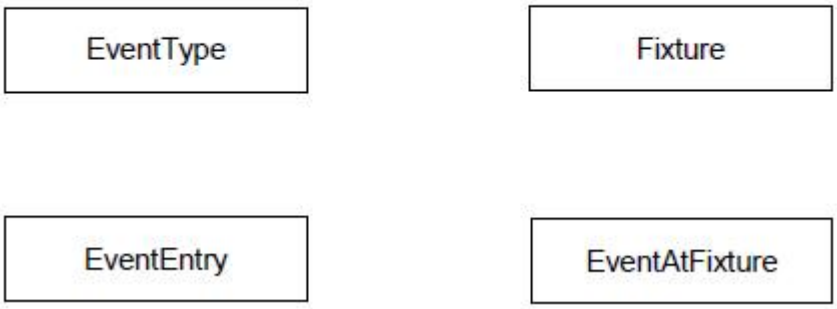
EventEntry(<u>FixtureID, EventTypeID, AthleteID</u>)

- Each Athlete, EventType and Fixture is identified by a unique identity number, for example AthleteID for athletes.
- An EventType is a type of event, such as Boys' 100m Under 15 race.
- If an athlete wants to take part in an event at a particular fixture, then an entry is created in the EventEntry relation to represent this.

(a) **Figure 2** shows an incomplete entity-relationship diagram for part of the database.

Draw lines on **Figure 2** to show the degree of any **three** relationships that exist between the four entities shown.

Figure 2



(2)

(b) **Figure 3** shows an SQL statement that is intended to make a table to represent the Athlete relation. The statement contains some errors.

Figure 3

```
CREATE TABLE Athlete (
   PRIMARY KEY AthleteID,
   VARCHAR(50) Surname,
   VARCHAR(30) Forename,
   DATE DateOfBirth,
   VARCHAR(6) Gender,
   VARCHAR(30) TeamName
)
```

You may assume that all of the data types used in **Figure 3** are valid and the field lengths are appropriate.

State **two** errors that have been made.

Error 1: _____

_____

_____

Error 2: _____

_____

_____

(2)

(c) State **two** reasons why database designs, such as this one, are usually normalised.

Reason 1: _____

_____

_____

Reason 2: _____

_____

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_____

(2)

Figure 1 is repeated below.

Figure 1 (repeated)

Athlete(AthleteID, Surname, Forename, DateOfBirth, Gender, TeamName)

EventType(EventTypeID, Gender, Distance, AgeGroup)

Fixture(FixtureID, FixtureDate, LocationName)

EventAtFixture(FixtureID, EventTypeID)

EventEntry(FixtureID, EventTypeID, AthleteID)

A list is to be produced of the names of all athletes who are competing in the fixture that is taking place on 17/09/18. The list must include the Surname, Forename and DateOfBirth of these athletes and no other details. The list should be presented in alphabetical order by Surname.

(d) Write an SQL query to produce the list.

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(5)

(Total 11 marks)

Q3.

A garage services and repairs cars. It uses a relational database to keep track of the jobs that customers have booked for it to carry out. The database includes jobs that have been completed and jobs that are waiting to be done.

The details of the jobs that the garage does, together with the parts that it stocks and uses are stored in the database using the four relations shown in **Figure 1**.

Figure 1

Job (JobID, CarRegNo, JobDate, InGarage, JobDuration)
Car (CarRegNo, Make, Model, OwnerName, OwnerEmail, OwnerTelNo)
Part (PartID, Description, Price, QuantityInStock)

PartUsedForJob (JobID, PartID, QuantityUsed)

- Each car has a unique CarRegNo.
- A type of car can be uniquely identified by the combination of its Make and Model. Different Makes may use the same Model name and a particular manufacturer (Make) will produce several different car Models.
- A booking made for a car on a particular date counts as one job, regardless of how many different tasks are completed upon it.
- A job might require the use of any number of parts, including zero.
- Some of the details are stored in the database as soon as a booking is made and others are only added when a job has been completed.

The attribute JobID is the Entity Identifier (Primary Key) of the Job relation.

(a) If the JobID attribute were not included in the Job relation, which other attribute or attributes that are currently in the relation could probably be used as an Entity Identifier (Primary Key) instead?

_____

(1)

It has been suggested that the owner details (OwnerName, OwnerEmail, OwnerTelNo) should not be stored in the Car relation and that a new relation should be created to store owner details separately from car details.

(b) Explain why storing the owner details separately would improve the design of the database.

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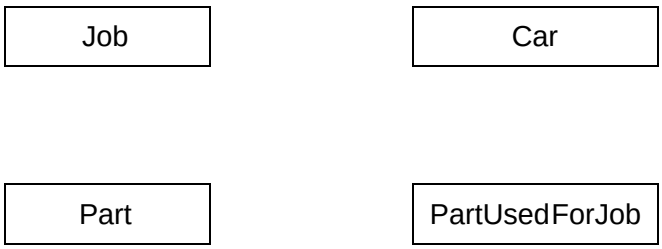
(2)

(c) On the incomplete Entity-Relationship diagram below show the degree of any **three** relationships that exist between the entities.



(2)

When an appointment is made for a job, this is represented in the Job relation. At the time of booking, the InGarage attribute is set to False and the JobDuration attribute is set to 0:00. When the car arrives at the garage the value of the InGarage attribute is changed to True. When the job is finished the value of the JobDuration attribute is updated to indicate how long the job took and details of the parts used are recorded in the database.

The Job with JobID 206 has been completed. The job took 1 hour 30 minutes (1:30) and

used two of the parts with PartID 12.

(d) Write the SQL commands that are required to record the amount of time that the job took in the database.

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(3)

(e) Write the SQL commands that are required to record in the database the fact that two of the parts with PartID 12 were used.

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(2)

Figure 1 is repeated below.

Job (JobID, CarRegNo, JobDate, InGarage, JobDuration)

Car (CarRegNo, Make, Model, OwnerName, OwnerEmail, OwnerTelNo)

Part (PartID, Description, Price, QuantityInStock)

PartUsedForJob (JobID, PartID, QuantityUsed)

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A mechanic needs to produce a list of all of the parts used on the job with JobID 93 for a customer.

This list must include the PartID, Description, Price (each) and QuantityUsed of each part, and no other details. The parts in the list should be ordered by PartID with the parts with the lowest PartIDs nearest to the top of the list.

(f) Write an SQL query to produce the list.

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(5)

There are restrictions on which parts can be fitted to which cars. For example:

- The driver's door mirror with PartID 104 can only be fitted to one particular make and model of car.
- The ignition switch with PartID 27 can be fitted to any model of car for one particular make as the maker uses the same ignition switch in all models.
- The tyre with PartID 97 can be fitted to a wide range of cars of different makes and models as it is a standard size.

If the information about which parts could be fitted to which makes and models of cars were represented in the database, it could be used to help a mechanic identify the correct parts to use for a job.

(g) Explain how the database design could be modified to represent which makes and models of car a part can be fitted to.

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(3)

(Total 18 marks)

Q4.

A company is building an e-commerce website. The website will display details of the products that the company sells and allow customers to place orders. Customers must

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register on the website before they can place an order and each order can be for one or more different products.

The product, customer and order details will be stored in a relational database.

It was originally proposed that the following three relations were required:

Product(<u>ProductNumber</u>, ProductPrice, ProductDescription, QuantityInStock)

Order(<u>OrderNumber</u>, OrderDate, CustomerID, OrderingComputerIPAddress, ProductNumber, Quantity)

Customer(<u>CustomerID</u>, CustomerName, Address, Postcode, EmailAddress, PaymentCardNumber)

The computer programmer identified a problem with the Order relation and stated that it should be divided up into two separate relations:

Order(<u>OrderNumber</u>, OrderDate, CustomerID, OrderingComputerIPAddress)

OrderLine(<u>OrderNumber, ProductNumber</u>, Quantity)

(a) Describe the problem that the programmer identified with the original Order relation and explain what the cause of this problem was.

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(2)

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(b) Complete the Entity-Relationship diagram below to show the degree of any **three** relationships that exist between the entities in the improved database design.

Customer	Product
Order	OrderLine

(3)

A web page is required that will display a summary of the products that are on a particular order.

The summary must include only the ProductNumber, ProductDescription, ProductPrice and the Quantity of the product that has been ordered. These must be displayed in ascending order of ProductDescription.

(c) Write an SQL query that will find the data needed to produce the order summary web page for order number 97.

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(5)

(Total 10 marks)

Q5.

A parcel delivery company uses a relational database to store information about the deliveries that it makes. These details include information about each customer who sends a parcel, the individual parcels being delivered and pricing details.

The company offers three different service speeds, which are "Express", "Standard" and "Economy". The price that is charged for delivering a parcel depends upon the service speed selected and the weight of the parcel (to the nearest gram). For each service speed, parcel prices are split into bands for a range of weights. For example, for the "Express" service, the price bands are as follows:

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Minimum Weight (g)	Maximum Weight (g)	Price
0	249	£1.99
250	499	£2.99
500	999	£3.99
1000	4999	£4.99
5000	19999	£9.99

Similar price bands, but with different prices, exist for the "Standard" and "Economy" services.

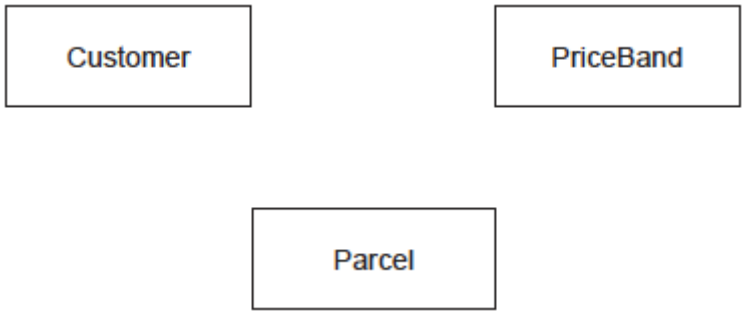
The details are stored using the three relations in the figure.

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

PriceBand(ServiceSpeed, MinWeight, MaxWeight, Price)

Parcel(ParcelID, ServiceSpeed, Weight, DateSent, CustomerID, RecipientName, HouseNumber, Street, Town, County, Postcode)

(a) On the incomplete Entity-Relationship diagram below, show the degree of the three relationships that exist between the entities.



(2)

(b) The price that is charged for an "Express" delivery, weighing between 1000 and 4999 grams is to be increased to £5.99. Complete the SQL statements below to make this update.

```
UPDATE ____________________________________________________
SET ________________________________________________________
WHERE ______________________________________________________
____________________________________________________________
```

(4)

(c) Write a query that will list all of the parcels sent by the customer whose **CustomerID** is 109.

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For each parcel, the list should include the **DateSent**, the **Postcode** that the parcel was sent to, the **ServiceSpeed** that was used and the **Price** charged, and no other details.

The list should be presented in order, with the parcel sent the longest time ago at the top of the list and the parcel sent most recently at the bottom.

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(6)

The figure is repeated below to help you answer part **(d)**.

Customer(<u>CustomerID</u>, Title, Forename, Surname)
PriceBand(<u>ServiceSpeed, MinWeight</u>, MaxWeight, Price)
Parcel(<u>ParcelID</u>, ServiceSpeed, Weight, DateSent, CustomerID, RecipientName, HouseNumber, Street, Town, County, Postcode)

(d) The **Street**, **Town** and **County** parts of a recipient's address can all be identified from the **Postcode**.

This means that the Parcel relation is not normalised and contains redundant data.

Redesign the Parcel relation, and create any new relations that you think are necessary, to eliminate this redundancy from the database to produce a normalised design.

Use the same notation that has been used in the figure when answering this question part. Make sure that you underline the attribute(s) that make up the primary key in each relation.

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(3)

(Total 15 marks)

Q6.

A school enters Year 12 and Year 13 students for AS and A Level qualifications.

Each qualification is identified uniquely by a combination of a subject name and level, e.g. 'Computing' and 'A Level'. A qualification with the same name can exist at both AS Level

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and A Level.

Qualifications are split up into modules. Each module is identified by a code, e.g. 'COMP3'. No two modules can have the same code, even if they are in different qualifications. A module also has a name and a number of UMS points associated with it.

Each student who is being entered for modules has their Forename, Surname, Centre Number and Candidate Number recorded. Taken together, the Centre Number and Candidate Number uniquely identify a student.

When a student is entered for a module their Centre Number, Candidate Number and the Exam Session that the entry is for (e.g. 'summer 2015') are recorded, together with the information necessary to identify which module the entry is for. A student who is unhappy with their result can re-sit a module in a later session.

(a) Develop a **normalised** design for a relational database to store the information described above.

List the names of **all** of the relations together with the attributes that each will contain.

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

To help you, the Student relation has already been defined.

Student (CentreNumber, CandidateNumber, Forename, Surname)

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(5)

(b) The primary key in the Student relation is made up of two attributes, as no one attribute can uniquely identify a student.

What name is given to this type of key?

_____

(1)

(Total 6 marks)

Q7.

David runs a beauty salon. He uses a database management system (DBMS) to store the information that he needs to manage his business. This information includes customer contact details, staff names, the treatments that the salon offers (for example, 'spray tan') and appointments that customers have made for treatments. A separate appointment

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must be made for each treatment.

The details are stored in a database using the following four relations:

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

Staff(<u>StaffID</u>, Forename, Surname, IsQualified)

Treatment(<u>TreatmentName</u>, Price, TimeTaken, NeedsQualification)

Appointment(<u>CustomerID, TreatmentName, ApDate, ApTime</u>, StaffID)

- The IsQualified attribute for a member of staff stores one of the values True or False, to indicate if the member of staff is fully qualified or not.
- The NeedsQualification attribute for a treatment stores True or False, to indicate if the treatment can only be given by a qualified member of staff.
- The TimeTaken attribute for a treatment is the number of minutes (a whole number) that the treatment takes.

(a) On the incomplete Entity-Relationship diagram below, show the degree of any **three** relationships that exist between the entities.

(2)

(b) Complete the following Data Definition Language (DDL) statement to create the Treatment relation, including the key field.

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```
CREATE TABLE Treatment
(_____________________________________________________
_____________________________________________________
_____________________________________________________
_____________________________________________________
_____________________________________________________
_____________________________________________________)
```

(3)

(c) David wants to send e-mail advertisements to all his customers who had a 'Luxury Manicure' treatment in 2014.

To send the e-mail, the customers' e-mail addresses, forenames and surnames are needed.

Write an SQL query to retrieve the e-mail address, forename and surname of each customer to whom e-mails should be sent.

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(6)

(Total 11 marks)

Q8.

A government agency is responsible for storing information about vehicles and their owners. Each vehicle that is driven must be registered with this agency. Vehicles must be insured to be driven, so the agency also keeps a record of vehicle insurance policies.

Details of the vehicles, owners and insurance policies are stored in a relational database using the following three relations:

```
Vehicle(RegistrationNumber, OwnerID, Manufacturer,
Model, Colour, EngineSize, DateRegistered)

Owner(OwnerID, Title, Forename, Surname, HouseNumber, Street, Town,
Postcode)

Insurance(PolicyNumber, RegistrationNumber, DateStarted, PolicyType,
ExcessAmount)
```

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In this system, the following restrictions apply to some attributes:

- RegistrationNumber: a mixture of exactly 7 letters and numbers, eg MA11FXB
- EngineSize: a whole number value representing the capacity of the engine, eg 1597
- PolicyType: can be either ‘Comprehensive’ or ‘Third Party’ and nothing else
- ExcessAmount: a monetary value, eg 100

(a) Complete the following Data Definition Language (DDL) statement to create the Insurance table, including the key field.

```
CREATE TABLE Insurance (
```

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_____)

(3)

(b) The owner of the vehicle with registration number DF24JUT has had his car repainted so that its colour is now pink.

Complete this SQL statement to update the data in the Vehicle table to reflect this change.

```
UPDATE_____

SET _____

WHERE _____
```

(2)

(c) A police officer is following a car with registration number AB72XHC. She wants to use the computerised system to check some details about the car and its owner.

Write an SQL query that could be used to retrieve the Model and Colour of the car and the Forename and Surname of the car's owner.

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(4)

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(d) The police officer requests the information using a hand held terminal that connects to the Internet. She types the vehicle registration number into a form on a secure webpage and the details about the car and owner are then displayed in the web browser on the terminal.

A server-side script is used to search for the required information.

(i) Explain what a server-side script is.

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_____

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(2)

(ii) The server-side script includes the statement:

```
RegNo = Request("RegistrationNumber")
```

Explain what this statement does when executed.

_____

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(2)

(iii) The server-side script includes the statement:

```
Response.Write("Owner is " + Forename + " " + Surname)
```

Explain what this statement does when executed.

_____

_____

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_____

(2)

The definitions of the three relations in the database are repeated here.

```
Vehicle(RegistrationNumber, OwnerID, Manufacturer,
Model, Colour, EngineSize, DateRegistered)

Owner(OwnerID, Title, Forename, Surname, HouseNumber,
Street, Town, Postcode)

Insurance(PolicyNumber, RegistrationNumber,
DateStarted, PolicyType, ExcessAmount)
```

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(e) The database is to be extended to store information about vehicle safety certificates. Each year, a vehicle must be taken to a garage where it will be tested. If the vehicle passes the test, a certificate will be issued. Each certificate will have a unique Certificate Number. Certificates will last for 12 months so the date that a certificate is issued must be recorded, as must the name of the garage that issued the certificate.

The database must keep a record of all the certificates that have been issued for each vehicle. For a particular vehicle this will include the current certificate together with any certificates that have been issued in the past.

Explain how you would change the design of the database so that the information about safety certificates can be stored.

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(3)

(Total 18 marks)

Q9.

A company sells furniture to customers of its store. The store does not keep the furniture in stock. Instead, a customer places an order at the store and the company then orders the furniture required from its suppliers. When the ordered furniture arrives at the store a member of staff telephones or e-mails the customer to inform them that it is ready for collection. Customers often order more than one type of furniture on the same order, for example a sofa and two chairs.

Details of the furniture, customers and orders are to be stored in a relational database using the following four relations:

Furniture(<u>FurnitureID</u>, FurnitureName, Category, Price, SupplierName)

CustomerOrder(<u>OrderID</u>, CustomerID, Date)

CustomerOrderLine(<u>OrderID, FurnitureID</u>, Quantity)

Customer(<u>CustomerID</u>, CustomerName, EmailAddress, TelephoneNumber)

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(a) These relations are in Third Normal Form (3NF).

What does this mean and why is it important that the relations in a relational database are in Third Normal Form?

Meaning: _____

_____

_____

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(2)

Why important: _____

_____

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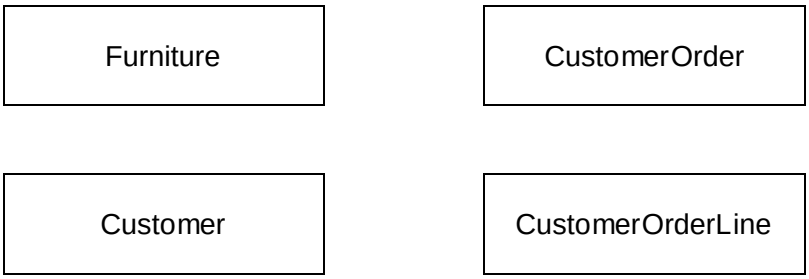
_____

(2)

(b) On the incomplete Entity-Relationship diagram below show the degree of any **three** relationships that exist between the entities.



(3)

(c) Complete the following Data Definition Language (DDL) statement to create the Furniture relation, including the key field.

CREATE TABLE Furniture (

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)

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(3)

(d) A fault has been identified with the product that has FurnitureID number 10765. The manager needs a list of the names and telephone numbers of all of the customers who have purchased this item of furniture so that they can be contacted. This list should contain no additional details and must be presented in alphabetical order of the names of the customers.

Write an SQL query that will produce the list.

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(6)

(e) The system requirements have changed. When an order is placed the system must now record the name of the sales person who took the order.

Place **one** tick next to the correct SQL command below that should be used to update the structure of the database so that this information can be recorded.

Command	Correct? (Tick one)
ALTER TABLE	
CREATE FIELD	
INSERT COLUMN	

(1)

(Total 17 marks)

Q10.

A library uses a database management system (DBMS) to store details of the books that it stocks, its members and the loans that it has made. These details are stored in a database using the following three relations:

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Book(<u>BookID</u>, Title, Author, Publisher)

Member(<u>MemberID</u>, Surname, Forename, HouseNumber, StreetName, Town, County, Postcode, DateOfBirth, EmailAddress)

Loan(<u>MemberID, BookID, LoanDate</u>, DueBackDate, Returned)

The library does not stock more than one copy of the same book.

(a) The key in the Loan relation is made up of three attributes.

What is the name given to a key that is made up of multiple attributes?

_____

(1)

(b) The relations in this database have been fully normalised.

State **two** properties that the relations in a fully normalised database must have.

Property 1: _____

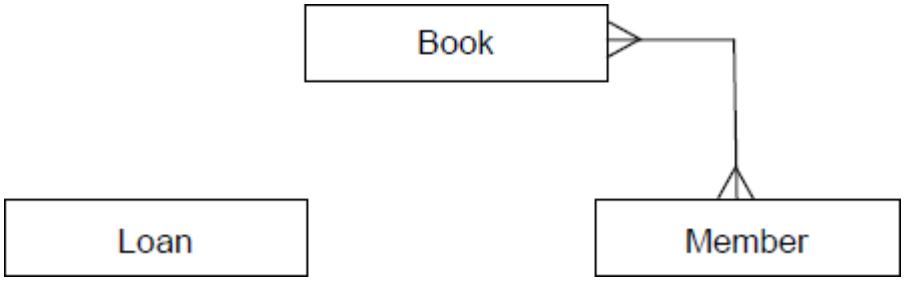
_____

Property 2: _____

_____

(2)

(c) Complete the Entity-Relationship diagram below to show the degree of the **two** missing relationships between the entities.



(2)

(d) The library is holding a 'meet the author' event at which members will be able to meet the author Lucas Bailey. The librarian wants to send e-mails to all of the library members who have read any of his books to invite them to the event.

Write an SQL query to retrieve the EmailAddress, Forename and Surname of the people to whom e-mails should be sent.

```
SELECT

FROM


WHERE
```

(5)

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(e) A new book is to be added to the library stock. The book details are:

- BookID: 837023
- Author: Karen Matu
- Title: Kenyan Safari
- Publisher: African Travel Guides

Write the SQL commands that will add this book into the database.

INSERT INTO _____

VALUES _____

_____

(2)

The definitions of the three relations in the database at the beggining of this question are repeated here so that you can answer Question **(f)** on this page without having to turn back.

Book(<u>BookID</u>, Title, Author, Publisher)

Member(MemberID, Surname, Forename, HouseNumber, StreetName, Town, County, Postcode, DateOfBirth, EmailAddress)

Loan(MemberID, BookID, LoanDate, DueBackDate, Returned)

(f) The system requirements have changed. The library now needs to be able to stock more than one copy of the same book. Two different copies of the same book will have the same BookID.

Explain how the database design could be modified to meet this new requirement, whilst ensuring that the database remains normalised.

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(3)

(g) The DBMS organises the data in the database in files using hashing.

(i) Why is hashing used?

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(1)

(ii) In the context of storing data in a file, explain what a *hash function* is.

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(2)

(iii) Collisions can occur when hashing is used.

In this context, explain what a *collision* is and how one might be dealt with.

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(2)

(Total 20 marks)

Q11.

A company is building an e-commerce website. The website will display details of the products that the company sells and allow customers to place orders. Customers must register on the website before they can place an order and each order can be for one or more different products.

The product, customer and order details will be stored in a relational database. It was originally proposed that the following three relations were required:

Product(<u>ProductNumber</u>, ProductPrice, ProductDescription, QuantityInStock)

Order(<u>OrderNumber</u>, OrderDate, CustomerID, OrderingComputerIPAddress, ProductNumber, Quantity)

Customer(<u>CustomerID</u>, CustomerName, Address, Postcode, EmailAddress, PaymentCardNumber)

EXAM PAPERS PRACTICE

The computer programmer identified a problem with the Order relation and stated that it should be divided up into two separate relations:

Order(<u>OrderNumber</u>, OrderDate, CustomerID, OrderingComputerIPAddress)

OrderLine(<u>OrderNumber, ProductNumber</u>, Quantity)

(a) Describe the problem that the programmer identified with the original Order relation and explain what the cause of this problem was.

_____

_____

_____

_____

(2)

(b) Complete the Entity-Relationship diagram below to show the degree of any **three** relationships that exist between the entities.

Customer	Product
Order	OrderLine

(3)

(c) Complete the following Data Definition Language (DDL) statement to create the Product relation, including the key field.

CREATE TABLE Product

(_____

_____

_____

_____

_____

_____

_____)

(3)

(d) The individual web pages that describe each product will be generated dynamically using server-side scripting.

Explain what a *server-side script* is.

_____

_____

_____

_____

(2)

(e) The definitions of the four relations in the database are repeated here so that you can answer the questions on these pages without having to turn back in the question booklet.

Product(<u>ProductNumber</u>, ProductPrice, ProductDescription, QuantityInStock)

Order(<u>OrderNumber</u>, OrderDate, CustomerID, OrderingComputerIPAddress)

OrderLine(<u>OrderNumber, ProductNumber,</u> Quantity)

EXAM PAPERS PRACTICE

Customer(CustomerID, CustomerName, Address, Postcode, EmailAddress, PaymentCardNumber)

A customer can add a product to an order by loading the product's web page, typing the quantity of the product required into a text box and then pressing the order button on the page. The web browser then sends the ProductNumber and Quantity to the web server.

After the user has pressed the order button, the CGI script shown below is executed.

Line No

```
1.  ProdNum = Request("ProductNumber")
2.  SaleQuant = Request("Quantity")
3.  ProdDetails = ExecuteSQL("SELECT ProductPrice
        FROM Product WHERE ProductNumber = " + ProdNum)
4.  ItemPrice = ProdDetails.GetField("ProductPrice")
5.  TotalPrice = ItemPrice * SaleQuant
6.  Response.Write ("Total Price is " + TotalPrice)
```

(i) Explain the purpose of lines *1.* and *2.* of the CGI script:

```
ProdNum = Request("ProductNumber")
SaleQuant = Request("Quantity")
```

_____

_____

(2)

(ii) Explain the purpose of line *3.* of the CGI script:

```
ProdDetails = ExecuteSQL("SELECT ProductPrice
        FROM Product WHERE ProductNumber = " + ProdNum)
```

_____

_____

_____

(2)

(iii) Explain the purpose of line 6. of the CGI script:

```
Response.Write ("Total Price is " + TotalPrice)
```

_____

_____

_____

(1)

(f) A web page is required that will display a summary of the products that are on a particular order.

The summary must include only the ProductNumber, ProductDescription, ProductPrice and the Quantity of the product that has been ordered. These must be displayed in ascending order of ProductNumber.

EXAM PAPERS PRACTICE

Write an SQL query that will find the data needed to produce the order summary web page for order number 4013.

_____

_____

_____

_____

_____

_____

_____

(5)

(Total 20 marks)

Q12.

The council of a large city wants to reduce the number of cars owned by the city's residents. The council is planning to introduce a car share club. The club will own cars, which will be parked in designated parking areas across the city when not hired out. The club members will be able to hire a car via the Internet, by e-mail or by phone. Members can book a car for one or more hours, or one or more days, up to a maximum of three weeks. Members pay a fixed monthly membership fee. They are also billed for the amount of time the car is hired plus a mileage charge. If a member returns a car late to the designated parking area, there will be a penalty charge for each additional hour.
Each car has a built-in computer with mobile phone technology to provide a communication link to the booking centre. Each member will receive a membership card which contains an RFID (Radio Frequency Identification) tag and the member is issued with a PIN (Personal ID Number).

(a) When a resident of the town wants to join the car share club, they are required to provide the following details:
– Credit card number
– Full Name and Address (as registered against their credit card)
– Driving Licence Number
– E-mail address
– Mobile telephone number

The monthly fee plus hire charges are automatically added to the member's credit card.
A statement of charges is available for the member to download from the Internet.

(i) What other details are required to be stored about the member so that the member can only access their own statement of charges?

_____

(2)

The details held about each Parking Area are:

– A 3-character unique Location Code
– Name of Parking Area, such as "Station"
– Post Code of Parking Area

EXAM PAPERS PRACTICE

The details held about each car are:

– Car Registration Number
– Designated Parking Area

At the time of booking, the member will be asked to provide the following details:

– Member ID
– Pick-up point (from which parking area)
– Hire start date and time
– Hire end date and time

The booking centre allocates a car from the chosen parking area to the member and issues the member with a booking reference code.

Choosing suitable attribute identifiers, complete the relations making sure that the primary key attribute(s) are underlined.

(ii) Member (_____

_____) **(1)**

(iii) ParkingArea (_____

_____) **(1)**

(iv) Car (_____

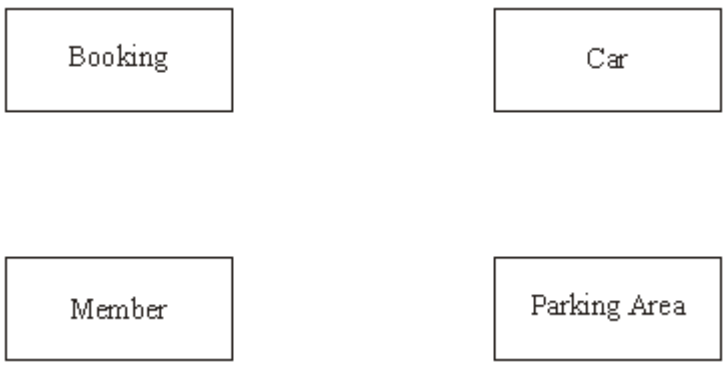
_____) **(1)**

(v) Booking (_____

_____)

EXAM PAPERS PRACTICE

(b) Complete the entity-relationship diagram for the entities below:



(3)

(c) Using SQL commands SELECT, FROM, WHERE, ORDER BY, write an SQL statement to query the database tables to produce a list of bookings for the month of December 2007. The results of the query are to be in member ID order.

_____

_____

_____

_____

(4)

(Total 15 marks)

Q13.

When people who own cats go on holiday, they can leave their cats in a cattery to be looked after. In one such cattery, each cat is assigned its own cage.

The cattery uses a relational database to manage the data about the cats which it looks after.

(a) What is a relational database?

_____

(1)

Cat, **Booking** and **CatOwner** are three of the relations used for this database.

Cat(CatCode, CatName, CatOwnerID, Notes)

Booking(CatCode, DateIn, CageNumber, NumberOfNights)

CatOwner(CatOwnerID, Title, Forename, Surname, Address, PostCode, ContactNumber)

CatCode and **DateIn** form a composite primary key in the relation **Booking**.

(b) (i) What is a composite primary key?

_____

(1)

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(ii) Why is a composite primary key needed in the relation **Booking**?

_____

(1)

(c) (i) Define the term foreign key.

_____

(1)

(ii) Identify the foreign key in the relation **Cat**.

_____

(1)

(d) The following shows parts of these three tables.

Cat Table

CatCode	CatName	CatOwnerID	Notes

...			
C1789	Ginger	O0987	...
C1790	Jerry	O0987	...
C1791	Prickles	O0988	...
C1792	Tabitha	O0989	...
C1793	Squidge	O0990	...
C1794	Jerry	O0990	...

CatOwner Table

CatOwnerID	Title	Forename	Surname	Address	PostCode	Contact Number
					...	...
O0987	Dr	James	Watson	...	NP123GU	0177654932
O0988	Rev	Phil	Clarke	...	NP157DF	01787254322
O0989	Mrs	Jenny	Murray	...	NP171KL	01797883345
O0990	Mr	Dai	Roberts	...	NP171KL	01797233433
				...	...	...

Booking Table

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CatCode	DateIn	CageNumber	NumberOf Nights
...			
C1790	12/01/08	23	14
C1792	12/01/08	12	7
C1789	13/01/08	9	8
C1791	15/01/08	37	15
C1792	12/02/08	12	7
...			

The cat in cage 9 becomes sick, the vet is called and the staff are sufficiently concerned that they decide to contact the owner. Complete the QBE grid to find the name of the cat, its owner's name and the contact telephone number.

Attribute	CageNumber				
Table	Booking				
Criteria					

(4)

(Total 9 marks)

Q14.

A chef keeps her recipes on a single-table database system**. Figure 1** shows the Recipe Table.

Figure 1

Recipe ID	Dish	Recipe Ingredients (including quantity)	Preparation Time	Cooking Time	Number of Servings	Cooking Instructions
1	Hummus	250g chickpeas 6 cloves garlic 50ml lemon juice 340g tahini	20 minutes	2 hours	8	Cook chickpeas until soft. Puree in food processor. Add remainder of ingredients, mix well.
2	Feta Salad	400g tomatoes 250g feta cheese 1 cucumber 50g olives 45ml vinaigrette	15 minutes	none	4	Mix all salad ingredients together. Season with salt and pepper. Dress with vinaigrette.
3	Casserole	500g chickpeas 400g tomatoes 450g potatoes	10 minutes	2 hours	4	Cook chickpeas until nearly soft. Add cubed potatoes and tomatoes.....
: :	: :	: :	: :	: :	: :	: :

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The chef's only supplier provides her with an on-line price list for her ingredients. **Figure 2** shows the PriceList Table.

Figure 2

FoodItemID	FoodItemName	PackSize	Price
Tom001	Tomatoes	400g	£0.55
Chi002	Chickpeas	250g	£0.75

Cuc003	Cucumber	single	£0.50
:	:	:	:

(a) (i) Which of the above two tables is **not** in First Normal Form? _____ **(1)**

(ii) Why? _____

_____ **(1)**

(b) The chef would like to be able to cost the ingredients for her dishes and is asking you to help her design a database which would allow the costing of dishes without retyping any of the pricelist details.

Database theory states that database tables should be *fully normalised*

(i) What does fully normalised mean?

_____

_____ **(2)**

(ii) Why is it desirable that tables are fully normalised?

_____

_____ **(1)**

(c) When the data in **Figure 1** and **Figure 2** are stored in a fully normalised relational database, three relations, **Recipe, FoodItem** and **RecipeIngredient** are needed. For each of these, complete the relations, making sure the primary key attribute(s) are underlined.

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(i) Recipe(_____

_____) **(1)**

(ii) FoodItem (_____

_____) **(1)**

(iii) RecipeIngredient(_____

_____) **(4)**

(d) Using the SQL commands SELECT, FROM, WHERE, ORDER BY and any others that you consider appropriate, write the SQL statement to list all the ingredients and their quantities required for Feta Salad. The results table should also show the pack size of the food item and the associated price. The list should be in alphabetical

order of ingredient.

_____

_____

_____

_____

_____

(5)
(Total 16 marks)

Q15.

The following are parts of three tables in a relational database for a book loan system.

Member

MemberID	Surname	Forename	TelephoneNumber
...	...	...	...
IV270023	**Smith**	**Gerald**	**01234 567890**
IV270024	**Smith**	**Wendy**	**01234 567890**
IV280016	**Pope**	**Anne**	**01234 465987**
IV280017	**Patel**	**Arwen**	**01234 657980**
...	...		...

EXAM PAPERS PRACTICE

Book

BookID	Title	Author	Value
...	...	...	...
1457X	**Travels with my Family**	**A M MacIntyre**	**£13.50**
14582	**Travels with my Family**	**AM MacIntyre**	**£13.50**
15635	**By Bicycle to Bangor**	**A M MacIntyre**	**£14.75**
16370	**Walking in Wonderland**	**BG O'Connor**	**£15.99**
...	...	...	...

Loan

BookID	MemberID	DateOut	DateIn	DateReturned
...	...	...	...	...
1457X	**IV270023**	**07/12/06**	**28/12/06**	**22/12/06**
16370	**IV270024**	**07/12/06**	**28/12/06**	**22/12/06**
15635	**IV270024**	**07/12/06**	**28/12/06**	**22/12/06**
...	...		...	...

(a) How are relationships between entities implemented with relational database software?

_____

(1)

(b) Give the primary key for the entity Loan.

_____

(2)

(c) The Book table has an index on the attribute Author. Why is indexing used?

_____

(1)

(d) The last digit of the BookID is used for validation. What type of validation control is this an example of?

_____

(1)

(Total 5 marks)

EXAM PAPERS PRACTICE

Q16.

The network manager of a college has to ensure that all software on college computers is installed legally.

(a) Which law is the network manager following?

_____

(1)

Some software is bought with a site licence for use on any number of college computers whereas other software is bought with a multi-user licence for installation on a specified number of college computers. The network manager wants to set up a relational database to keep details of software licences and which college computers have which software installed. She has identified the following details she wants to store about each software package:

- Software name
- Version
- Software ID (ten alphanumeric characters), unique

- Supplier
- Date purchased
- Expiry date
- Number of computers licenced

When any software is installed on a college computer, she wants to store the following details:

- Computer ID of the computer on which the software is to be installed (six alphanumeric characters)
- Date of software installation
- Staff ID who requested the software (3 letters) for this computer

(b) The two entities **SoftwareLicence** and **SoftwareInstallation** have been identified.

Draw an Entity-Relationship diagram for the above entities.

(3)

(c) Complete the following Data Definition Language (DDL) statements to create the fully normalised tables necessary to implement the database, including all key fields.

(i) CREATE TABLE SoftwareLicence

(_____

_____

_____

_____

_____

_____

_____)

(3)

(ii) CREATE TABLE SoftwareInstallation

(_____

_____

_____

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_____

_____

_____

_____)

(4)

(d) The network manager wants a list of each computer and what software is installed on it. Using the SQL commands SELECT, FROM, WHERE, ORDER BY and any others that you consider appropriate, write an SQL statement to query the database tables for a list of computers with software name and version installed.

_____

_____

_____

_____

_____

(4)

(Total 15 marks)

Q17.

Sam starts work at a small business selling garden tools and equipment by mail order. Four of the employees in the business have their own stand-alone computers.

- Mary takes the order and enters it into her computer. She records the customer's name and address, plus the item(s) ordered. She prints out a copy and gives it to Renie.

- Renie takes the items off the shelves and packs the order. She records, on her computer, the customer's name and address, and the items despatched. She notes any item that is out of stock; these will have to follow in a later despatch. She prints off a copy of these details to give to Hassan.

- Hassan produces the invoice. He records, on his computer, the customer's name and address and the items despatched with prices. He adds a handling charge and puts the invoice into an envelope ready for posting to the customer. He gives a copy invoice to James.

- James is the accountant. He records, on his computer, the customer's name and address, the invoice amount and whether it has been paid or not.

(a) This system has disadvantages. Explain **two** of these.

1. _____

_____

2. _____

_____

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(4)

(b) Sam suggests that if the computers were networked, they could share files. If the computers were networked, why is it unlikely that they could share files as they are set up currently?

_____

_____

(2)

(c) The company decide to start again and create a relational database. Sam starts talking about *attributes, primary keys* and *foreign keys.*

(i) Define an attribute.

_____

(1)

(ii) Define a primary key.

_____

(1)

(iii) Define a foreign key.

_____

(1)

(d) Initially Sam thinks that four tables are needed

1. Customer table
2. Stock table containing details of each item of stock
3. Order table containing general details of each order
4. OrderLine table containing details of each item ordered for a particular order

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Table:	Customer		Stock		Order		OrderLine
To include these fields	Surname Firstname Address 1 Town PostCode Telephone Number CustomerID		PartNumber Description UnitPrice NumberInStock		OrderNumber DateOfOrder CustomerID		OrderNumber OrderLineNumber PartNumber Quantity

(i) What would be the most suitable primary key for the table Customer?

_____

(1)

(ii) What would be the most suitable primary key for the table OrderLine?

_____

(1)

(iii) Name a foreign key in the table OrderLine.

_____

(1)

(iv) Mr Jeremiah Smith telephoned Mary. He said that he had mislaid his copy of his latest order and asked her to remind him what he had ordered. Mary asked him if he could remember the date he made the order, and he told her it had been 23rd April 2006. If Mary were using a relational database, set up to include the tables as described above, she could run a query to list the items. Complete the QBE grid required to produce this list.

Field	Surname	FirstName	DateOfOrder		
Table					
Show					
Criteria					

(6)

(Total 18 marks)

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Q18.

A computer technician in a school is asked to keep up-to-date details of the hardware equipment the school owns (known as an inventory). The school management require the following details to be stored for each item of hardware:

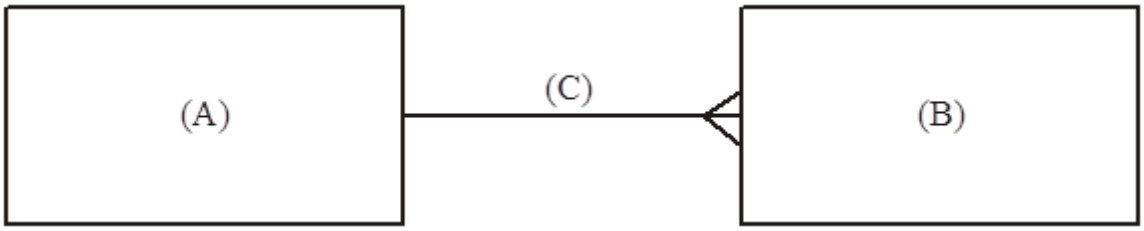
- description
- make
- model
- inventory reference number (20 alphanumeric characters)
- date of purchase
- purchase price
- room where item is kept.

If an item is loaned, the following details must be stored:

- location details of where the item will be located
- the initials of the person responsible for its return
- the dates of removal and return.

(a) The **two** entities **HardwareItem** and **EquipmentLoan** have been identified.

(i) Complete the diagram below.



A _____

B _____

C _____

(2)

(ii) Name this type of diagram.

_____

(1)

(b) Complete the following Data Definition Language (DDL) statements to create the fully normalised tables necessary to implement the database.

CREATE TABLE HardwareItem

(_____

_____

_____

_____

_____

_____

_____)

CREATE TABLE EquipmentLoan

(_____

_____

_____

_____

_____

_____

_____)

(6)

(c) Using the SQL commands SELECT, FROM, WHERE, ORDER BY and any others that you consider appropriate, write an SQL statement to query the database tables

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for the description, inventory reference number and date of removal of those items of equipment that have been loaned since a given date. The results of this query should be displayed in such a way as to make it easy to see how many times each item was loaned.

_____

_____

_____

_____

_____

(6)

(Total 15 marks)

Q19.

A head of department in a school wishes to store data on her pupils' module results for AS and A-level Computing. The data requirements are defined as follows:

- each pupil has their forename(s) and surname recorded;
- each pupil is assigned a unique candidate number;
- each module is identified by a module code;
- each module has a given maximum number of marks available;
- each module is available each year at a winter and/or summer session;
- each pupil's module result is a number of marks between 0 and the maximum for that module;
- each pupil may resit a module several times, the best results being used to calculate the overall grade.

A single table, ResultsTable, was constructed initially in a relational database. **Figure 1** shows the structure of this table and a few entries.

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Figure 1

Pupil Forenames	Pupil Surname	Candidate Number	Module Code	Exam Session	Module Mark	Level	Total Mark	Grade
Ali	Patel	1234	CPT1	W04	54	AS	187	C
			CPT1	S04	74	A	318	D
			CPT2	S04	63			
			CPT3	S04	50			
			CPT4	W05	43			
			CPT2	S05	60			
			CPT5	S05	43			
			CPT6	S05	45			

Marie Anne	Frost	1357	CPT1 CPT2 CPT3 CPT4 CPT4 CPT5 CPT6	W04 S04 S04 W05 S05 S05 S05	97 86 72 50 72 75 98	AS A	255 500	A A
John Mark	Smith	2345	CPT1 CPT1 CPT2 CPT3	W05 S05 S05 S05	65 60 72 32	AS	169	D
Ali :	Patel :	7315 :	: :	: :	: :	: :	: :	: :

(a) Which of the column heading(s) in ResultsTable would be suitable as a primary key?

_____

(1)

(b) What makes this table **not** in First Normal Form?

_____

_____

(1)

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(c) When the data in Figure 1 is stored in a fully-normalised relational database, **three** relations, **Pupil**, **ModuleResult** and **PupilGrade** are used. For each of these, complete the relations making sure the primary key attribute(s) are underlined.

(i) Pupil (_____)

(2)

(ii) ModuleResult (_____

_____)

(2)

(iii) PupilGrade (_____

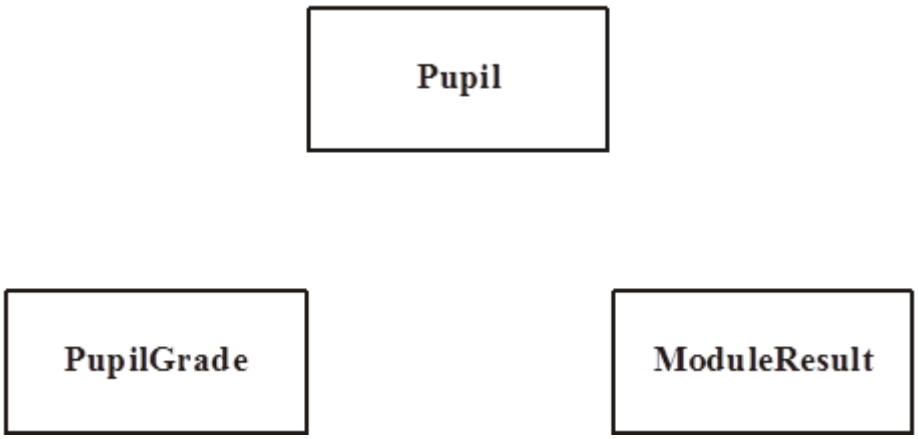
_____)

(2)

(d) Complete the partial Entity-Relationship diagram in **Figure 2** to show the degree of

two relationships which exist between the given entities.

Figure 2



(2)

(e) Using the SQL commands SELECT, FROM, WHERE, ORDER BY and any others that you consider appropriate, write an SQL statement to query the database tables for the pupil forenames, surname and A-level grades in descending order of total mark.

_____

_____

_____

_____

_____

(5)

(Total 15 marks)

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Q20.

An Examination Board records total entries by centre and subject for its examinations for June 2005 in an un-normalised relational database table as shown in the figure below. The data requirements specify that

- a subject offered for examination by the Examination Board has at most one Examination Board Subject Officer;
- an Examination Board Subject Officer may be a subject officer for more than one subject offered for examination by the Examination Board;
- Centre Number and SubjectID are unique.

CentreNo	Centre Name	Centre Address	SubjectID	Subject Name	ExamBoard SubjectOfficer Name	NumberOf Candidates Entered
2345	Broad Street Grammar School	Walton Road,Niver,Yorkshire	4400 5500 6600	Spanish AS Chemistry AS Physics AS	Miss Smith Mr Minns Dr Jowett	20 62 45
2346	Bash Street Comprehensive	French Lane,Therm,Oxfordshire	4400 7700 8800 9900	Spanish AS Maths AS Biology AS Computing AS	Miss Smith Mr Walton Mrs Brown Ms Jones	10 35 21 21
2347	St Trinians Girls School	Wallingbrook,Essex	3310 4410 5520	History A2 Spanish A2 Chemistry A2	Dr George Miss Smith Mr Minns	23 11 23
2348	GreyFriars	Bunter Road,Warton,Devon	8821 8855	Biology A2 French AS	Mrs Brown Miss Smith	18 18
. . .						
9567	Kings College	The Lane, Witherton, Northumberland	2222 3320 5511	German AS Chinese AS Arabic AS	Ms Hilter Mrs Cheng Mr Abdulla	20 2 1

The relation for this table is as follows

ExamBoardEntryNumbers(CentreNo. CentreName, CentreAddress, SubjectID, SubjectName, ExamBoardSubjectOfficerName, NumberOfCandidatesEntered)

(a) What makes this table un-normalised?

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_____

_____

(1)

(b) When the data in the figure above is stored in a fully-normalised relational database three relations Centre, **CentreEntryNumber and Subject are used. For each of these** complete the relations making sure that the primary key attribute(s) are underlined.

(i) Centre (_____)

(2)

(ii) CentreEntryNumber (_____)

(2)

(iii) Subject (_____)

(2)

(c) (i) Complete the entity-relationship diagram for the entities **Centre** and **CentreEntryNumber.**

Centre	CentreEntryNumber

(1)

(ii) Complete the entity-relationship diagram for the entities **Centre** and **Subject**.

Centre	Subject

(1)

(d) Problems with particular entries are also logged in the relational database. These problems are reported in e-mails sent to the Examination Board by the Examination Officer responsible for a centre's examination entries. The Examination Board may communicate a response via e-mail. The relational database includes two extra fully-normalised relations **ExaminationOfficer** and **Problem** for this purpose.

ExaminationOfficer(CentreNo, ExamOfficerSurname, Title, EMailAddress)

Problem(ProblemId, DateReported, ProblemDescription, CentreNo, ReplySent)

Using the SQL commands

SELECT, FROM, WHERE, ORDER BY

and any other commands which are considered appropriate, write an SQL statement to query the database tables for the surname and centre number of all Examination Officers who have reported a problem before 1st March 2005 and the corresponding description of the problem.
The result of the query is to be ordered in ascending order of CentreNo.

_____

_____

_____

_____

_____

_____

(5)

(e) Name the type of package which would be most suitable to use with the database or on its own for creating a mail merge operation to send personalised letter attachments with each e-mail.

_____

(1)

(Total 15 marks)

Q21.

(a) When setting up a relational database, entities, *attributes* and relations must be

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determined. A relational database is to be set up to hold details about sailing holidays.

(i) A relational database is more than a collection of tables. How are relationships implemented in a relational database?

_____

_____

(2)

(ii) What is an attribute?

_____

(1)

(b) (i) What is the purpose of data validation?

_____

(1)

(ii) Give **one** example of a typical built-in validation control that might be applied to a sailing holiday database.

_____

(1)

(Total 5 marks)

Q22.

A file in a library has 100 records with the following record structure.

ISBN, Title, Author, Keywords

The system uses 8 bit ASCII to code characters. All fields in these records are fixed length strings.

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ISBN is a 10 digit code. Title is 30 bytes long. Author is 25 bytes and Keywords is 200 bytes long.

What should be the primary key for these records? _____

Justify your choice.

_____

_____

(Total 2 marks)

Q23.

A local Adult Education Centre uses a relational database to manage its day and evening classes. Two relations(tables) are used.

Class (ClassID, Subject, Level, Day, Time, LecturerID)

Lecturer (LecturerID, Subject1, Subject2, Name, Address, PhoneNumber)

(a) (i) What is a primary key?

_____

_____

(1)

(ii) Suggest a suitable primary key for the relation Lecturer.

_____

(1)

(b) (i) What is meant by a foreign key?

_____

_____

(1)

(ii) Name the attribute which is the foreign key in the relation Class.

_____

(1)

(Total 4 marks)

Q24.

A department of local government responsible for recreation and the environment has printed leaflets of scenic walking routes in its area. The table below shows details which are recorded in an un-normalised relational database table. The data requirements specify that

- A leaflet references one or more routes.
- A route is referenced in at most one leaflet.

EXAM PAPERS PRACTICE

LeafletID	Leaflet Name	Leaflet Cost	Quantity In Stock	RouteID	Route Name	Route Area	Route Description
1	Wendover Hills	£1.10	1000	1 2 3	Chequers Monument Clock Tower	Ellesborough Ellesborough Wendover	Relatively hilly Flat Flat
2	Halton Woods	£1.20	2000	4 5 6	East Halton West Halton Middle Halton	Halton Halton Halton	Hilly Relatively flat Flat
3	Penn	£1.00	1500	7 8	Penn Woods Penn Village	Penn Penn	Relatively hilly Flat
4	Bierton	£1.00	800	9 10	Canal Bierton Village	Bierton Bierton	Flat but muddy Flat
• •							

•							
56	Chesham Bois	£1.00	900	141 142	East Woods West Woods	Chesham Chesham	Hilly and muddy Hilly and muddy

The relation for this table is as follows

LeafletRoutes(LeafletId, LeafletName, LeafletCost, QuantityInStock,

RouteID, RouteName, RouteArea, RouteDescription)

(a) What makes this table un-normalised?

_____

_____

(1)

(b) When the data in the table above is stored in a fully-normalised relational database, two relations **Leaflet** and **Route** are used. For **each** of these, complete the relations making sure that the primary key attribute(s) are underlined.

(i) **Leaflet**(_____

_____)

(2)

(ii) **Route**(_____

_____)

(3)

EXAM PAPERS PRACTICE

(c) Complete the entity-relationship diagram for the entities **Leaflet** and **Route**.

(1)

(d) Problems with particular routes are logged in the relational database. These problems are reported in e-mails sent by people walking the routes for which leaflets are available. The relational database includes two extra fully-normalised relations **Person** and **Problem** for this purpose.

Person(PersonId, Surname, Title, EMailAddress)

Problem(ProblemId, DateReported, ProblemDescription, RouteId, PersonId, ReplySent)

Using the SQL commands

and any others which are considered appropriate, write an SQL statement to query the database tables for all surnames and e-mail addresses of people who have reported a problem before 1st January 2004 and the corresponding RouteIds. The result of the query is to be ordered in ascending order of RouteId.

_____

_____

_____

_____

_____

_____

(6)

(e) Name the **type** of package which would be most suitable to use with the database or on its own for creating:

(i) a mail merge operation to send personalised letter attachments with each e-mail;

_____

(1)

(ii) the design of the leaflets in a printer-ready form;

_____

(1)

(iii) a simple accounting record of leaflet sales.

EXAM PAPERS PRACTICE

_____

(1)

(Total 16 marks)

Q25.

A hospital stores details of its wards, patients and their medical condition in a database in a way that will allow information about these details to be extracted.
The data requirements are defined as follows.

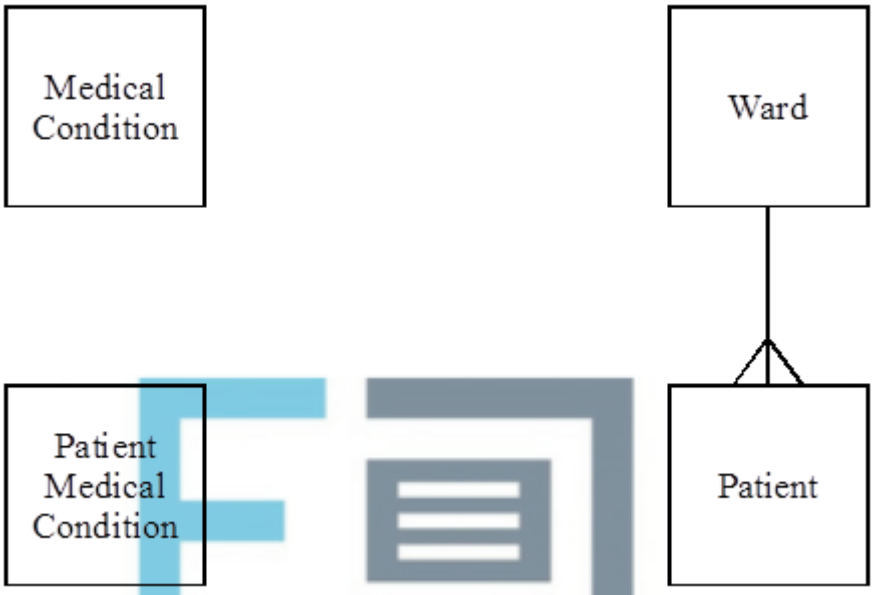
- Each patient is assigned a patient number (unique), surname, forename, address, date of birth and gender.
- Each ward has a number of beds.
- Each ward is assigned a ward name (unique), name of the nurse in charge and the number of beds it possesses.
- Each medical condition that the hospital can treat is recorded.
- Each medical condition is assigned a medical condition number (unique), name and the recommended standard treatment.
- Each patient may suffer from one or more medical conditions.
- A particular medical condition may be attributed to more than one patient.
- The medical conditions of each patient are recorded.

- Each ward has zero or more patients.
- A patient can be assigned to only one ward at any one time.
- Each ward may have patients with different medical conditions.

Four entities for the hospital database are

Ward, Patient, MedicalCondition, PatientMedicalCondition

(a) Using the partially complete entity relationship diagram shown in the figure below, as an aid, show the degree of **three** more relationships which exist between the given entities.



(3)

(b) Using the following format

TableName(<u>PrimaryKey</u>, Non-keyAttributeI, Non-keyAttribute2, etc)

describe tables, stating all attributes, for the following entities underlining the primary key in each case.

(i) Ward _____

(1)

(ii) Patient _____

_____

(2)

(iii) MedicalCondition _____

(1)

(iv) PatientMedicalCondition _____

(2)

(c) Using the SQL commands **SELECT, FROM, WHERE,** write an SQL statement to query the database tables for the forename, surname and medical condition number of all patients in Victoria ward.

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_____

_____

_____

_____

_____

_____

(3)

(Total 12 marks)

Q26.

A **file** of 80 records has the following record structure.

ProductID, ProductDescription, QuantityInStock

ProductID is a four-byte integer, ProductDescription is a fifty-six byte fixed length string, QuantityInStock is a four-byte integer.

Suggest a suitable primary key for this file. Justify your choice.

_____

_____

_____

_____

(Total 2 marks)

EXAM PAPERS PRACTICE

Q27.

Customers placing orders with ABC Ltd for ABC's products have their orders recorded by ABC in a database.

The data requirements for the database system are defined as follows:

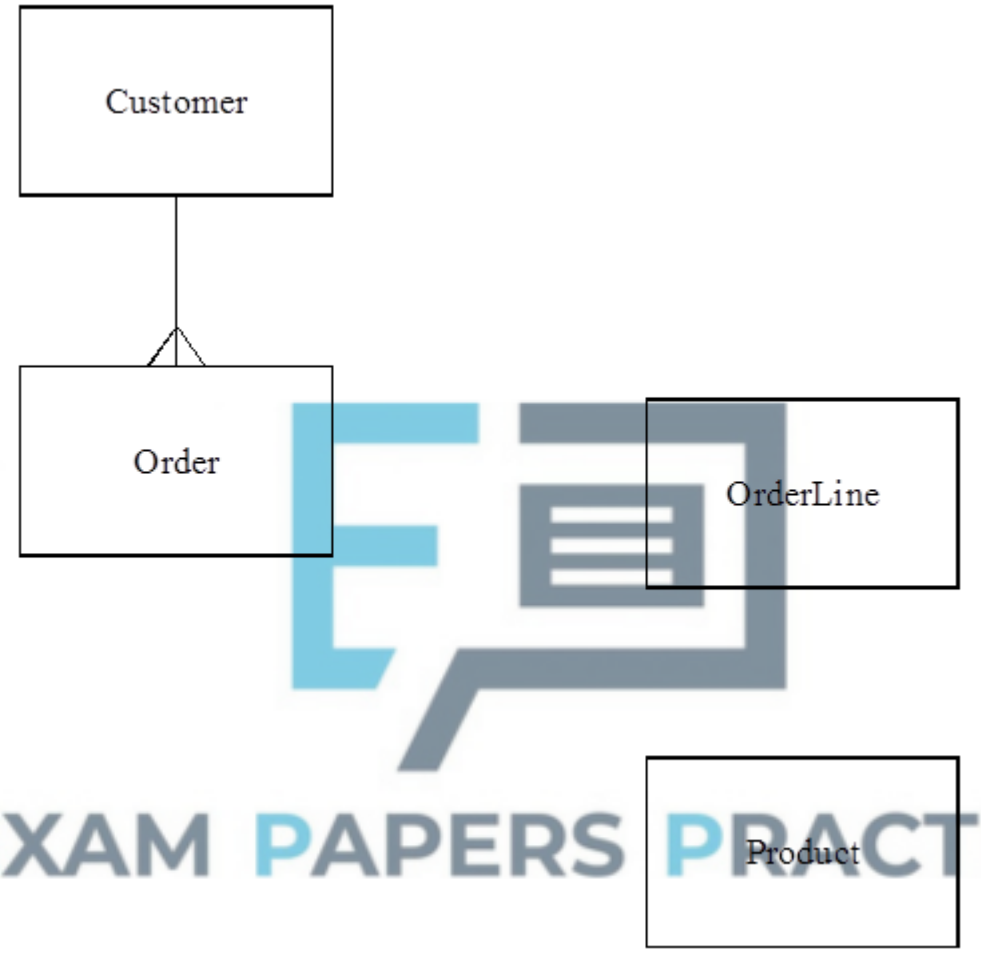
- Each product is assigned a unique product code, ProductId and has a product description.
- The quantity in stock of a particular product is recorded.
- Each customer is assigned a unique customer code, CustomerId and has their name, address and telephone number recorded.
- An order placed by a customer will be for one or more products.
- ABC Ltd assigns a unique code to each customer order, ABCOrderNo.
- A customer placing an order must supply a code, CustomerorderNo, which the customer uses to identify the particular order.
- A customer may place one or more orders.
- Each new order from a particular customer will have a different customer order code but two different customers may use, independently, the same values of customer order code.
- Whether an order has been despatched or not will be recorded.
- A particular order will contain one or more lines.
- Each line is numbered, the first is one, the second is two, and so on.

- Each line will reference a specific product and specify the quantity ordered.
- A specific product reference will appear only once in any particular order placed with ABC Ltd.

After normalisation the database contains four tables based on the entities:

Customer, Product, Order, OrderLine

(a) **Figure 1** below is a partially complete entity-relationship diagram. Show the degree of **three** more relationships which exist between the given entities.



EXAM PAPERS PRACTICE

Figure 1

(3)

(b) Using the following format:

TableName(Primary Key, Non-key Attribute1, Non-key Attribute2, etc)

describe tables, stating all attributes, for the following entities underlining the primary key in each case.

(i) Product _____

_____

(2)

(ii) Customer _____

_____

(2)

(iii) Order _____

_____

(3)

(iv) OrderLine _____

_____

(4)

(c) Using the SQL commands SELECT, FROM, WHERE, ORDER BY, write an SQL statement to query the database tables for all customer names where the orders have been despatched. The result of the query is to be ordered in ascending order of ABCOrderNo.

_____

_____

_____

_____

_____

_____

(6)

(Total 20 marks)

Q28.

(a) Data communication involves sending and receiving data. This can be either serial or parallel transmission. What is meant by:

EXAM PAPERS PRACTICE

(i) serial transmission of data;_____

_____

(1)

(ii) parallel transmission of data?_____

_____

(1)

(b) Explain the term *baud rate* in the context of data transmission.

_____

_____

(1)

(c) A computer system uses even parity. The most significant bit is used as a parity bit. The ASCII code of the character '&' is decimal number 38.

(i) What would be the 8-bit binary pattern transmitted if the character '&'is sent?

_____

(2)

(ii) Asynchronous data transmission is used if one character is sent at a time. One start bit marks the beginning of a character and two stop bits mark the end of a character.
What would be the bit pattern if the character '&'is sent using asynchronous data transmission?

_____

(1)
(Total 6 marks)

Q29.

Players, in a national lottery, show their selection of different numbers by placing marks on an entry form similar to the one shown in **Figure 1.** The entry form is then inserted into a machine at the point of sale and the numbers are read.

EXAM PAPERS PRACTICE

National Lottery Entry Form

Which draw?					
	– 1 –	– 2 –	– 3 –	– 4 –	– 5 –
Wed ——	– 6 –	– 7 –	– 8 –	– 9 –	–10–
	–11–	–12–	–13–	–14–	–15–
Sat ——	–16–	–17–	–18–	–19–	–20–
	–21–	–22–	–23–	–24–	–25–
Both ——	–26–	–27–	–28–	–29–	–30–
	–31–	–32–	–33–	–34–	–35–
	–36–	–37–	–38–	–39–	–40–
	–41–	–42–	–43–	–44–	–45–
	–46–	–47–	–48–	–49–	

EXAM PAPERS PRACTICE

Figure 1

(a) Name the method being used to read the data.

_____

(1)

The data are transmitted to a central computer which allocates a unique transaction code. This code is relayed back to the point of sale where a machine prints the chosen numbers and a transaction code onto the ticket similar to the one shown in **Figure 2.**

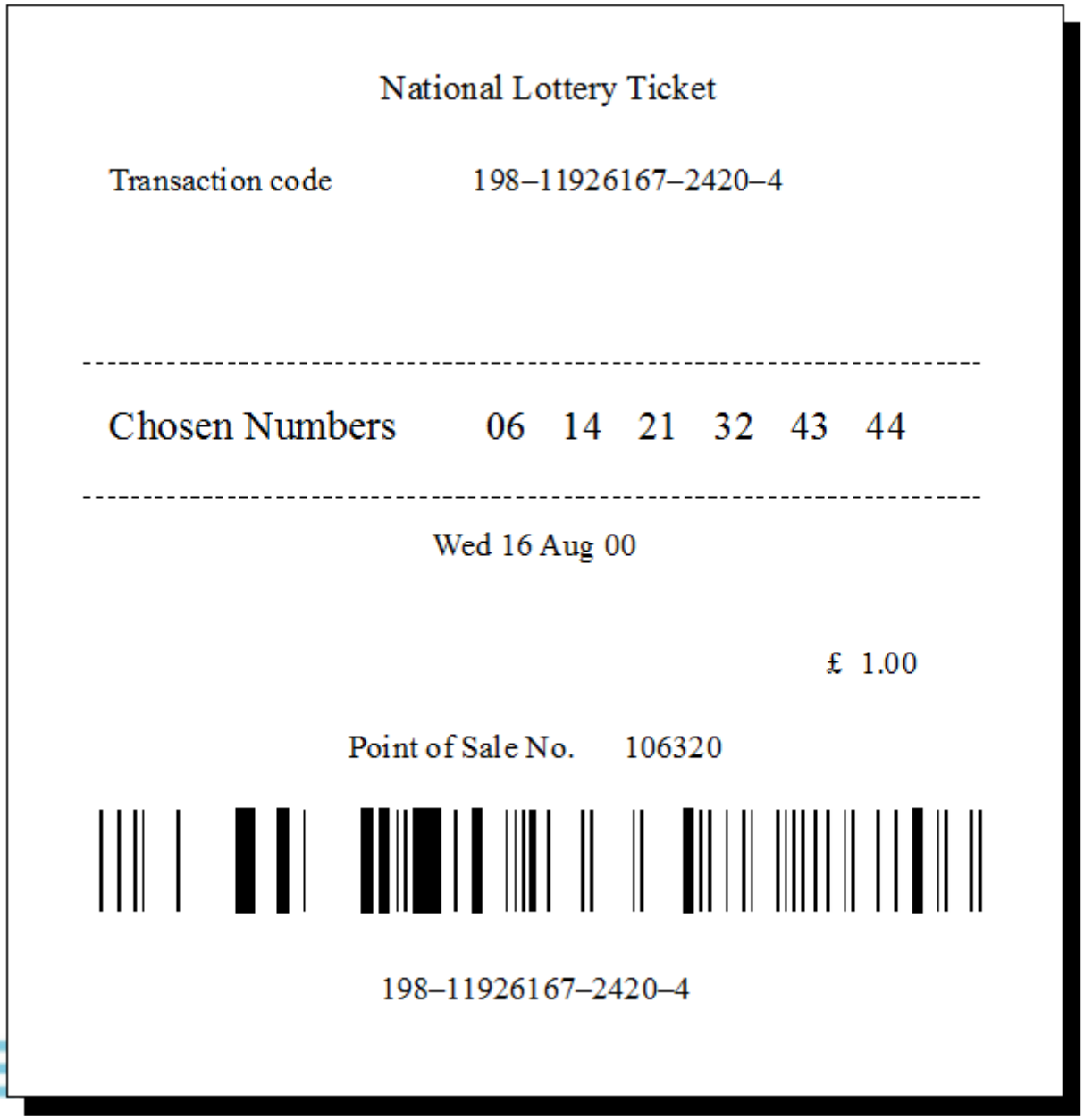


Figure 2

(b) Each transaction code includes a check digit. What is a check digit and why is it used?

_____

_____

_____

_____

_____

(2)

(c) Each transaction is recorded in a separate record. All transaction records for a particular lottery draw are stored in a single transaction file.

The transaction record includes the following fields:

Date of Purchase
Date of Draw
Point of Sale Identification Code
Transaction Code
Chosen Numbers

(i) What is meant by primary key?

_____

_____

(1)

(ii) Which of the above fields should be chosen as the primary key?

_____

(1)

(iii) What would be a suitable file organisation for the transaction file if it is required that the ticket(s) with the winning numbers is to be found? Justify your choice.

_____

_____

_____

_____

(2)

(iv) If individual records need to be accessed quickly what file organisation should be used? Justify your choice.

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_____

_____

_____

(2)

(d) After a draw, some lottery prize-winners can check their tickets at any lottery point of sale machine. State the processing steps required by the lottery's computer system to check if the ticket is a winning ticket.

_____

_____

_____

_____

_____

(4)

(Total 13 marks)

Q30.

A car showroom uses a computer system to record the purchase and sale of second-hand cars. The system has a customer file that contains details of the customers and a car file that contains details of the cars.

(a) Give a suitable key field for

(i) a customer record,

_____

(1)

(ii) a car record.

_____

(1)

(b) Give **six** additional fields that would be included in a customer record.

_____

_____

_____

_____

_____

_____

(3)

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(c) Give **six** additional fields that would be included in a car record.

_____

_____

_____

_____

_____

_____

(3)

(d) Explain how links could be established between the two files.

_____

_____

_____

(2)

(Total 10 marks)

Q31.

A theatrical agency finds theatrical work for its clients - actors and actresses - in theatre, television and film productions. The data requirements for a database for a theatrical agency are defined below.

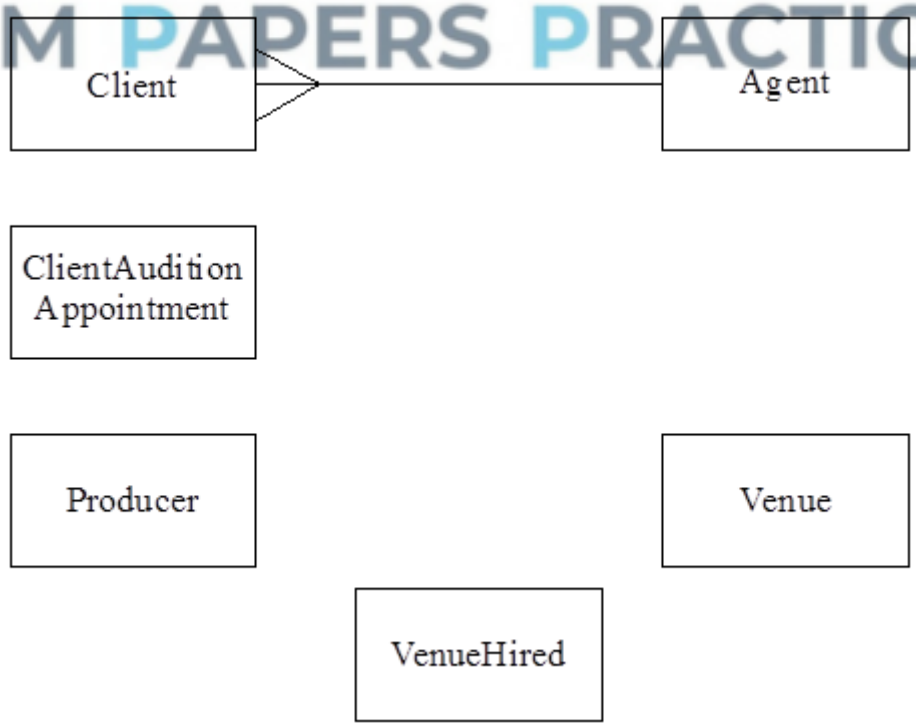
- Each client is assigned to one agent
- An agent is responsible for many clients.
- Each agent within the agency is assigned an identification number and has their name
- recorded.
- Each client is assigned an identification number and has their name recorded.
- Audition appointments are arranged between clients and producers.
- Each producer is assigned an identification number and has their name recorded.
- Auditions take place at venues that are hired by producers around the country.
- A particular venue may be hired by more than one producer and a producer may hire more than one venue.
- Each venue is assigned an identification number and has its name and address recorded.
- A producer never holds more than one audition per day.
- A client never attends more than one audition per day.
- A venue may not be hired more than once per day.
- The date and the time of a client's appointment for an audition are recorded.

Six entities for the theatrical agency database are:

Client, Agent, Producer, Venue, ClientAuditionAppointment, VenueHired

(a) Using the partially complete entity-relationship diagram as an aid, show the degree of **four** more relationships which exist between the given entities.

EXAM PAPERS PRACTICE



(4)

(b) A relational database is to be used to record the data. The table corresponding to the entity **Agent** is

Agent(AgentId, AgentName)

Using the following format

TableName(<u>PrimaryKey</u>, Non-KeyAttribute1, Non-KeyAttribute2, etc)

describe tables, stating all attributes, for the following entities. Underline the primary key in each case.

(i) Producer

_____

_____ **(1)**

(ii) Venue

_____

_____ **(1)**

(iii) Client

_____

_____

_____

_____ **(2)**

(iv) VenueHired

_____

_____

_____

_____ **(3)**

(v) ClientAuditionAppointment

_____

EXAM PAPERS PRACTICE

_____

_____

_____

(3)

(c) The contents of a result table with the column structure shown below are to be produced.

ClientId	ClientName	AgentId	AgentName
---	---	---	---
---	---	---	---
---	---	---	---

Using a structured query language (SQL) of the type **Select** ... **From** ... **Where** ..., show how the relevant data may be extracted from the tables in part (b) to produce the contents of this result table.

EXAM PAPERS PRACTICE

(6)

(Total 20 marks)

Q32.

A bookshop uses a relational database to store details of its stock on a computer system. Two entities associated with this database are book and publisher. The key field (identifier) for the publisher entity is the publisher's name and for the book entity is the ISBN (International Standard Book Number).

(a) What is meant by a relational database?

_____

_____

_____

_____

(2)

(b) State **four** attributes in addition to the ISBN and title associated with a book.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(c) Draw a diagram showing the relationship between the book entity and the publisher entity.

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(2)

(d) State another entity that could be related to either of these entities. State the relationship involved and the key field (identifier) for the entity.

_____

_____

_____

_____

_____

_____

(3)

(Total 11 marks)

Q33.

A club, AQA Wanderers, wishes to computerise the records of matches played by its first team so that it can generate statistics on its players. The data requirements are defined below.

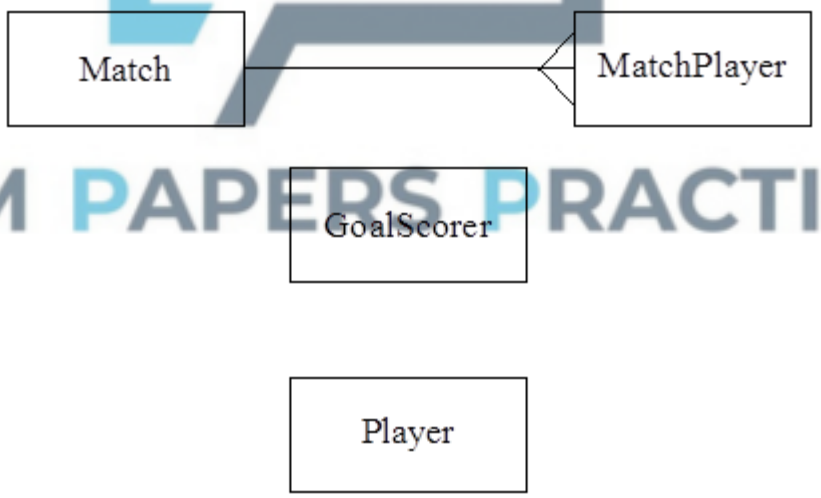
In a season, the club's first team plays against all opposition clubs' first teams from the same division of the league twice, once at home and once away from home. The date of each match, the start time, opposition team's name, whether home or away, goals for and goals against are recorded. Each AQA Wanderers' player has a player identification number and their surname, forenames, date of birth, contact telephone number are recorded.

For each match, fourteen players from a pool of twenty are selected as match players including three substitutes. The player identification numbers of the selected players are to be recorded for each match together with the identification number sewn on the shirt worn (range one to fourteen) so that a player's first team appearances may be analysed. The goal scorers of AQA Wanderers, if any, in each match must also be recorded together with the number of goals scored by each against the opposition. Players one to eleven start a match but may be substituted by players twelve to fourteen during the match. For any substitution of an AQA Wanderers' player by another during a match the player identification numbers of both are to be recorded.

Five entities for AQA Wanderers are

Player, MatchPlayer, Match, GoalScorer, Substitution

(a) Using a copy of the partially complete entity relationship diagram shown below as an aid show the degree of **five** more relationships which exist between the given entities.



EXAM PAPERS PRACTICE

(5)

(b) A relational database is to be used to record the data for one season so that statistics on individual players can be produced at the end of the season. Using the following format

TableName(<u>PrimaryKey</u>, Non-KeyAttributeI, Non-KeyAttribute2, etc)

describe tables, stating all attributes, for the following entities underlining the primary key in each case.

(i) Player

_____

_____

_____

_____

(2)

(ii) Match

_____

_____

_____

_____

(2)

(iii) GoalScorer

_____

_____

_____

_____

_____

(4)

(iv) MatchPlayer

_____

_____

_____

EXAM PAPERS PRACTICE

_____

(3)

(v) Substitution

_____

_____

_____

_____

_____

(4)

(Total 20 marks)

EXAM PAPERS PRACTICE