

4 A relational database, SHIPPING, stores data about the ships in a company and the containers that are carried on the ships.

The database has the following tables:

```
CONTAINER(ContainerID, Type, Weight, OwnerName, ShipID)

SHIP(ShipID, Type, Capacity, ShipName)
```

(a) Describe the relationship between the two tables. Refer to the primary and foreign keys in your answer.

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(b) The table CONTAINER needs an additional field to store the data for the last inspection date.

Write a Structured Query Language (SQL) script to add **one** field to the table CONTAINER to store the date of last inspection of the container, for example 08/07/2019.

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(c) Write an SQL script to return the number of containers stored in the database for the ship with the name Caledonia.

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(d) Describe the purpose of a developer interface in a Database Management System (DBMS).

[2]

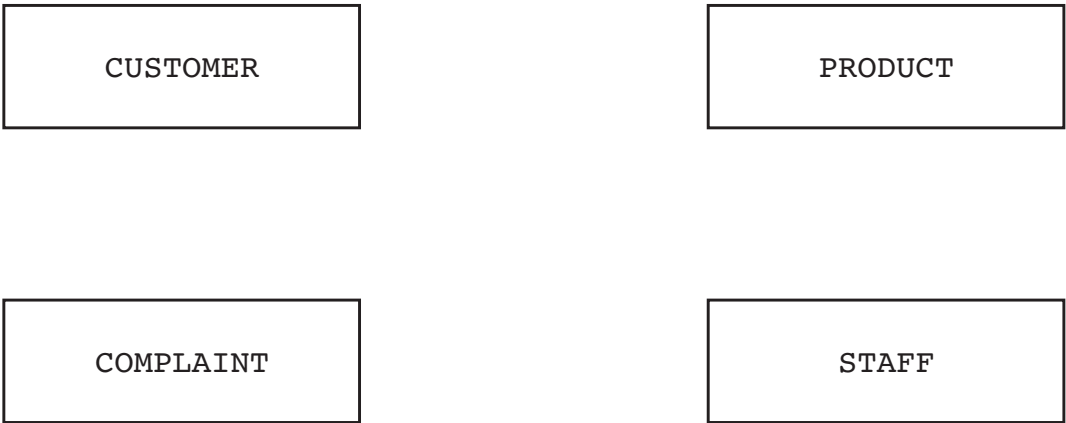
5 A company creates a relational database to store data about its customers.

The database, `REVIEWS`, stores data about the customers, products, complaints and staff.

The database has four tables:

```
CUSTOMER(CustomerID, CustomerFirstName, CustomerLastName, CustomerEmail)
PRODUCT(ProductID, ProductName, ProductDetail, Price, Rating)
COMPLAINT(ComplaintID, ProductID, CustomerID, ComplaintDetails, StaffID)
STAFF(StaffID, StaffFirstName, StaffLastName, Department, RemoteWorker)
```

(a) Complete the entity-relationship (E-R) diagram for the database `REVIEWS`.



[3]

(b) Some example data from the STAFF table is shown.

StaffID	StaffFirstName	StaffLastName	Department	RemoteWorker
1	Ralph	Jura	E	Yes
2	Luca	Emcee	A	Yes
3	Darwin	Acula	F	No

Write a Structured Query Language (SQL) script to define the table `STAFF`.

[4]

(c) Products are given a rating between 1 and 10 inclusive.

Write an SQL script to return only the `ProductID`, `ProductName` and `ComplaintDetails` for all products with a rating of 5 or less. The results need to be displayed in descending order of rating.

(d) A Database Management System (DBMS) is used to maintain and manage the database.

Describe **two** ways in which the DBMS can be used to ensure the security of the customer data.

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[4]

Question 6 starts on the next page.

5 A company builds and sells furniture to customers. The company stores data about customers, their payment cards and their furniture orders in a database.

The database, FURNITURE, has the following tables:

```
CUSTOMER(CustomerID, Name, Phone)

CUSTOMER_CARD_DATA(CardID, CustomerID, CardType, CardNumber, EndDate)

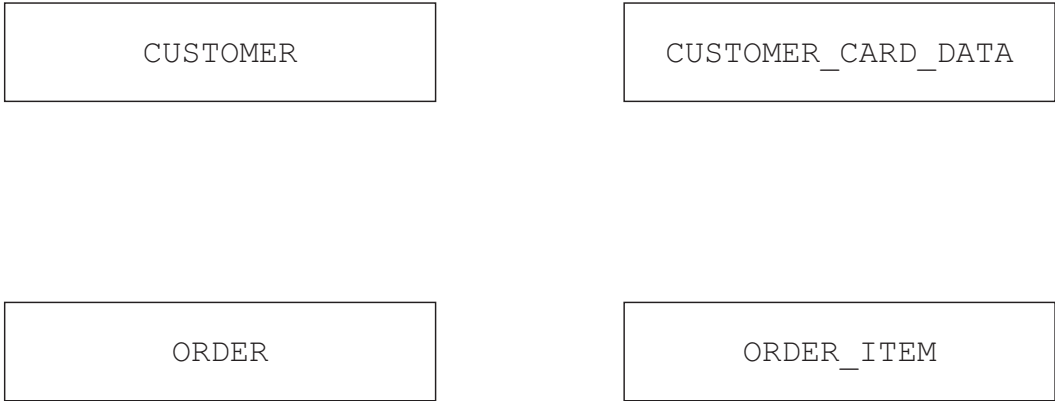
ORDER(OrderID, CustomerID, TotalCost, Paid, OrderDate, Complete)

ORDER_ITEM(OrderItemID, OrderID, Type, Height, Width, Depth, Details)
```

The primary keys are underlined in each table.

The attribute Complete in the table ORDER stores the Boolean value TRUE if the order has been built and FALSE if the order has not been built.

(a) Complete the entity-relationship (E-R) diagram for the database.



[3]

(b) Identify one attribute in the table CUSTOMER_CARD_DATA that could be a candidate key.

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(c) Identify two tables in the database that contain one or more foreign keys.
Give one attribute that is a foreign key in each table.

	Table	Foreign key
1		
2		

[2]

- (d)** Explain the reasons why the data in the table `ORDER_ITEM` cannot be stored in the table `ORDER`.

[3]

- (e) Write an Structured Query Language (SQL) script to output the customer ID, the customer's name and the total cost of the customer's orders that have **not** been paid.

The output of the total cost must have an appropriate title.

[4]

- 6** A shop sells pens to customers. Customers place an order with the shop and collect the items the next day. The shop uses a database to store the information about the orders.

The database contains the following tables:

CUSTOMER(CustomerID, CustomerName, Email)

ORDER(OrderID, CustomerID, Date, Collected)

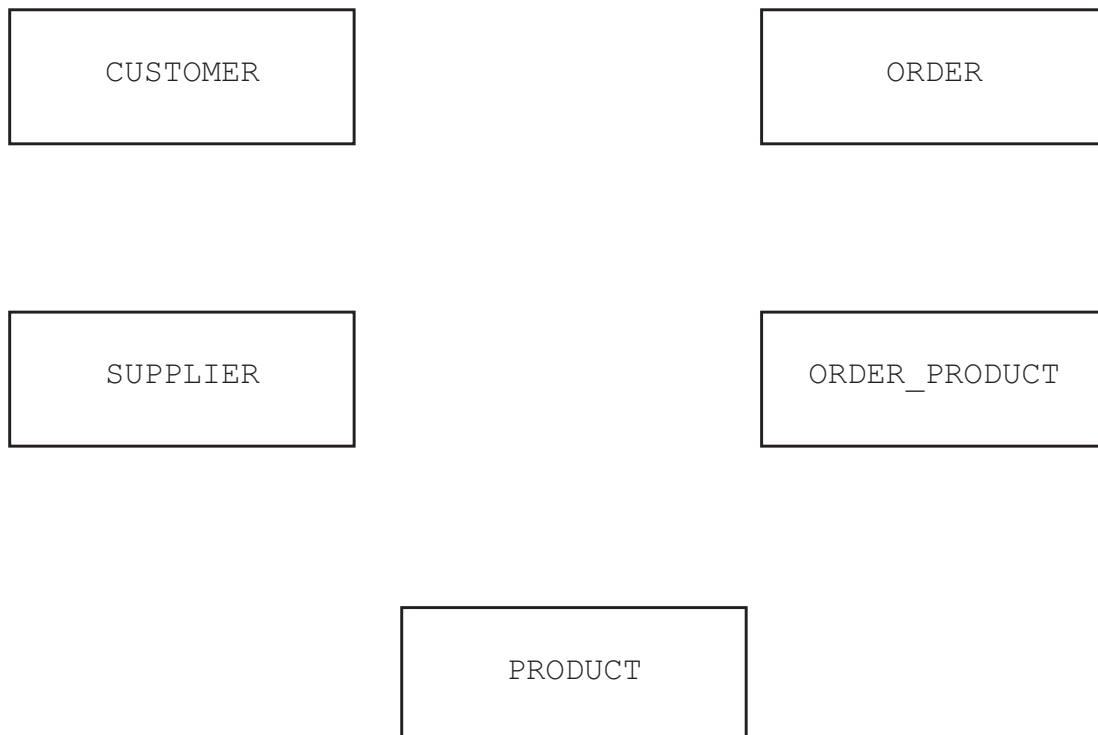
ORDER_PRODUCT(OrderID, ProductID, Quantity)

PRODUCT(ProductID, ProductName, QuantityInBox, Cost, SupplierID)

SUPPLIER(SupplierID, SupplierName, SupplierEmail)

The primary keys are underlined.

- (a)** Complete the entity-relationship (E-R) diagram for the database.



[4]

- (b)** A new product needs to be entered into the database. The product has the ID 002323, the product name 'Blue ball point 2mm', there are 50 in a box, the product costs \$5.00 and the supplier has the ID SFX223.

Write a Structured Query Language (SQL) script to enter the new product into the table PRODUCT.

[4]

- (c)** The attribute `Collected` in the table `ORDER` stores the Boolean value `TRUE` if the order has been collected and `FALSE` if the order has not been collected.

Write an SQL script to return the customer name for each customer that has orders they have not collected. Include the number of orders each customer has not collected with an appropriate title.

An example output might be:

CustomerName	NotCollected
Jack Wright	2
Lin Cho	1
Santaya Yui	1

[illegible]

(d) The shop uses a Database Management System (DBMS).

(i) One feature provided by a DBMS is a data dictionary.

The data dictionary stores the attribute names, table names, foreign keys and primary keys in the database.

Identify **three** other items stored in a data dictionary.

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(ii) The DBMS provides a developer interface.

Explain how a database designer can make use of the developer interface.

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2 A shop repairs electronic devices, for example mobile phones and tablet computers. The shop owner stores the data about the repairs using a file-based approach.

(a) Give **one** limitation of using a file-based approach to store the data **and** explain how a relational database addresses this limitation.

Limitation

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Explanation

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(b) The shop owner creates a relational database called `FIXIT`.

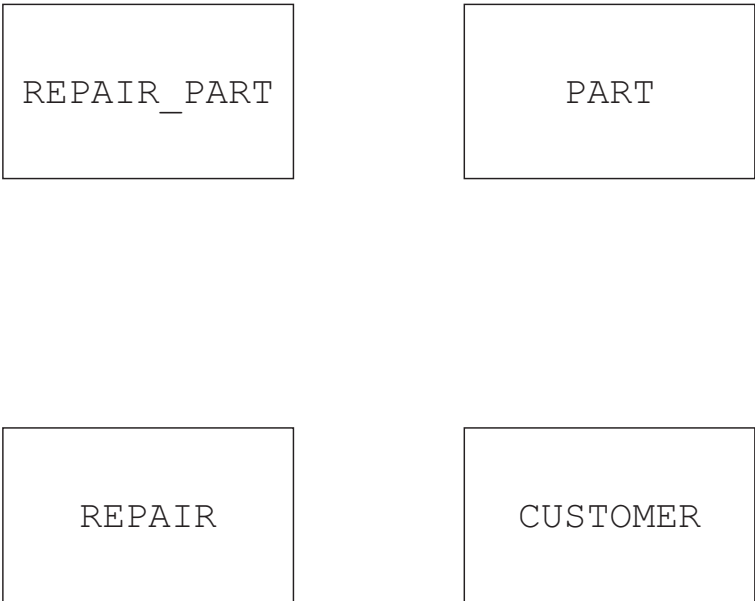
The database stores data about the customers and the devices for repair.

Some devices need new parts that are ordered from suppliers.

The database `FIXIT` is designed to include the following tables:

```
PART(PartID, Description, Price, SupplierID)
CUSTOMER(CustomerID, FirstName, LastName, ContactNumber)
REPAIR(RepairNumber, StartDate, EndDate, CustomerID, Device)
REPAIR_PART(PartID, RepairNumber, Quantity)
```

(i) Complete the entity-relationship (E-R) diagram for the given tables.



(ii) The table shows sample data for the table REPAIR_PART.

PartID	RepairNumber	Quantity
ACD128SA	0022	3
PPOR543DWW	0022	1
TR453	0023	1
PPOR543DWW	0023	2
WED5	0024	5

Write a Structured Query Language (SQL) script to define the table `REPAIR_PART`.

Include constraints (restrictions) on the data that can be entered into each field where appropriate.

[5]

(iii) Suppliers send invoices to the company for the parts that are used. A new table, INVOICE, stores the data about each invoice and whether it has been paid or not.

The design for the table INVOICE is shown:

```
INVOICE(InvoiceID, SupplierID, AmountDue, Paid, DatePaid)
```

The table shows sample data for the table INVOICE.

InvoiceID	SupplierID	AmountDue	Paid	DatePaid
000001	JK675	22.50	TRUE	01/01/2024
000002	WR443	358.99	FALSE	
000003	JK675	10.21	FALSE	

Write an SQL script to return the total amount due to the supplier with the ID of JK675 for all the invoices that have **not** currently been paid.

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(c) Complete the table by writing a definition for each of the database terms.

Term	Definition
Referential integrity	
Candidate key	
Tuple	

- 6** A company uses a relational database to store data about its customers, employees and the individual repair jobs that customers have booked.

- (a)** Explain the benefits of using a relational database instead of a file-based approach.

[3]

- (b)** The company decides which employees will work on each repair job. An employee can log into the database to access information about their repair jobs.

The database is normalised and includes these tables:

- **CUSTOMER** stores personal data about each customer
- **EMPLOYEE** stores personal data about each employee
- **LOGIN_DATA** stores the username and password for each employee
- **JOB** stores the data about each repair job
- **JOB_EMPLOYEE** stores the employees that are working on each repair job.

- (i) Identify each relationship between the database tables **and** explain how each relationship can be implemented in the normalised database.

[6]

- (ii) The database also has the table `INVOICE` that stores data about each invoice that is sent to a customer.

Example data from the table INVOICE is given.

InvoiceID	DateSent	Amount	Paid	JobID
29262	12/12/2023	105.20	Y	221
26765	11/11/2023	200.00	Y	315
13290	02/01/2024	50.00	Y	315
34090	05/02/2024	25.95	N	569

Write a Structured Query Language (SQL) script to return the total amount of all the invoices sent in the year 2023 that have been paid.

[3]

4 A company makes ice cream and sells it to shops.

The ice cream is made in batches: a large quantity of one type and flavour of ice cream that is then split into smaller quantities for sale.

The company’s owner has designed a relational database, ICECREAM, to store data about their ice cream and customers.

Some of the tables in the database are given. The database is not normalised.

```
BATCH(BatchID, Type, Flavour, Size, SellingPrice, EndDate)

CUSTOMER(CustomerID, CompanyName, EmailAddress, TelephoneNumber)

SALE(SaleID, BatchID, CustomerID, Quantity, Date)
```

(a) Identify **two** foreign keys in the table SALE **and** the table that each foreign key references.

Foreign key 1

Table name 1

Foreign key 2

Table name 2 [2]

(b) Write an SQL script to return the total quantity of ice cream sold to the customer with the ID of 0034E in the year 2023.

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(c) The table definition for `BATCH` is repeated here:

BATCH (BatchID, Type, Flavour, Size, SellingPrice, EndDate)

Sample data for the table BATCH is given:

BatchID	Type	Flavour	Size	SellingPrice	EndDate
KIV12	Plain	Vanilla	1	2.20	12/12/2024
RIC14	Plain	Chocolate	0.5	1.80	12/12/2024
TYL1	Non-dairy	Lemon	0.5	2.10	01/02/2025
FYV2	Non-dairy	Vanilla	0.25	1.50	02/02/2025
BIV13	Plain	Vanilla	1	2.20	02/02/2024

(i) Write an SQL script to define the table `BATCH`.

Include constraints (restrictions) on the data that can be entered into each field where appropriate.

..... [5]

(ii) The table BATCH is not normalised.

Normalise the database table BATCH.

Write the table definitions for your new tables.

Identify any primary and foreign keys in your tables.

Do **not** change or include the tables CUSTOMER and SALE.

[4]

(d) Complete the following table by defining each database term.

Database term	Definition
Entity	
Attribute	

[2]

(e) A Database Management System (DBMS) supports data integrity.

Explain how a DBMS supports data integrity.

[3]

4 An assessment board wants to store the marks students achieved in exams in a database named RECORDS.

Part of the database design includes these two tables:

```
EXAM(ExamID, Subject, Level, TotalMarks)

EXAM_QUESTION(ExamQuestionID, ExamID, QuestionNumber, Question, MaxMark)
```

(a) Identify the relationship between EXAM and EXAM_QUESTION.

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(b) Sample data for the table EXAM is shown:

ExamID	Subject	Level	TotalMarks
00956124	Computer Science	2	75
00956125	Computer Science	3	120
00956126	Mathematics	2	100
00956127	Mathematics	3	150
00956128	Physics	2	70
00956129	Physics	3	80

Write a Structured Query Language (SQL) script to define the table EXAM.

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(c) The table EXAM_QUESTION has been created but the foreign key has not been linked.

Write an SQL script to update EXAM_QUESTION and link the foreign key to EXAM.

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(d) The database also needs to store data about the students, the exams the students have taken and the marks the students achieved in each question of each exam.

Describe the additional tables that will need to be included in the database and explain how all the tables in the database will be linked.

[5]