

2 A relational database, WORKEXPERIENCE, stores data about students and the companies where they complete work experience.

Students can complete multiple work experience placements but can only complete one placement at a time.

Students can complete more than one placement at the same company.

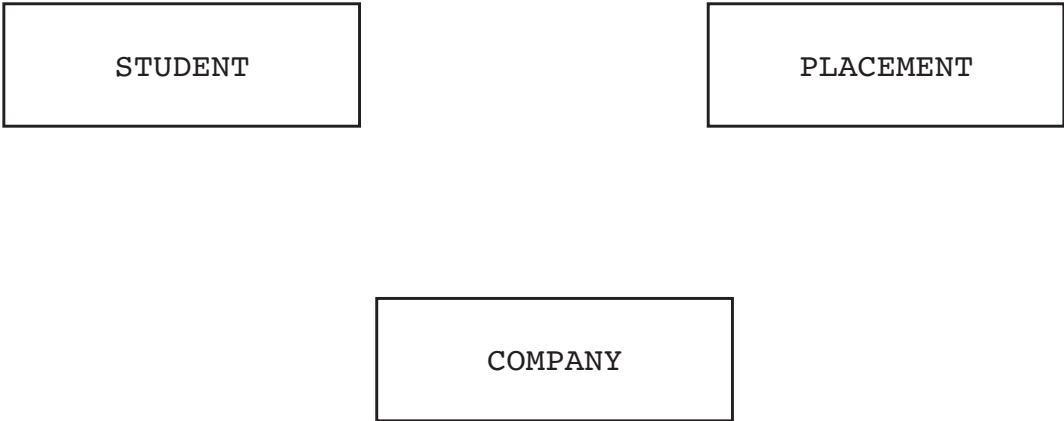
Part of the database is shown:

STUDENT(StudentID, FirstName, TelephoneNumber, UniversityName)

PLACEMENT(PlacementID, StudentID, CompanyID, StartDate, EndDate, Complete)

COMPANY(CompanyID, CompanyName, MaxStudentsPerPlacement)

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



[2]

(b) Explain why the database WORKEXPERIENCE is in Third Normal Form (3NF).

[2]

(c) Some example data from the `PLACEMENT` table is shown:

PlacementID	StudentID	CompanyID	StartDate	EndDate	Complete
PC001	LDEA01	MSCM	01/01/2023	12/07/2023	TRUE
PC002	LDEA01	MSCM	01/04/2024	08/05/2024	FALSE
PC003	ALAU02	NEAM	09/03/2020	10/03/2021	FALSE
PC004	LOLI75	GOUZ	07/06/2018	11/09/2018	TRUE

(i) Write a Structured Query Language (SQL) script to delete all placements that have been completed.

[2]

(ii) Write an SQL script to return the total number of placements completed by the student with ID `LDEA01` at the company with ID `NEAM`. The total should be given an appropriate name.

[4]

(d) The database tables are repeated here:

STUDENT(StudentID, FirstName, TelephoneNumber, UniversityName)

PLACEMENT(PlacementID, StudentID, CompanyID, StartDate, EndDate,
Complete)

COMPANY(CompanyID, CompanyName, MaxStudentsPerPlacement)

Explain what is meant by referential integrity, and how it applies to this database.

[3]

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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..... [2]

(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]

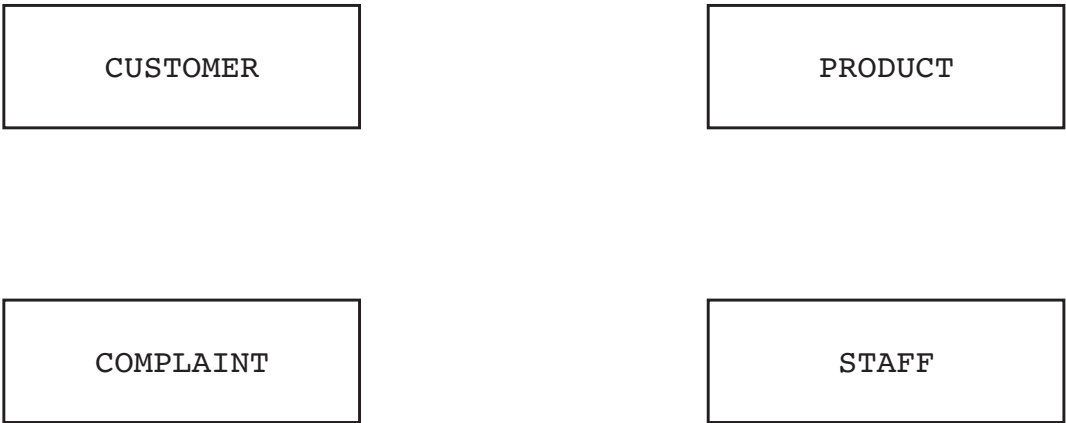
5 A company creates a relational database to store data about its customers.

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]

(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)

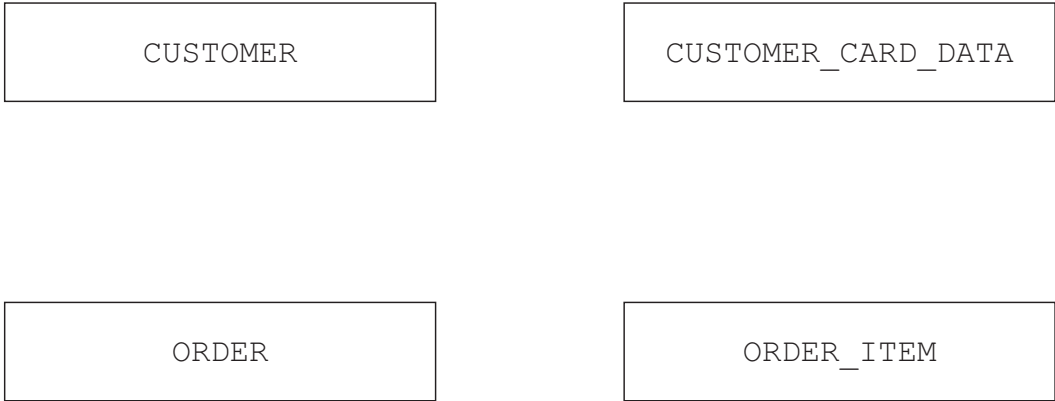
ORDER(OrderID, CustomerID, TotalCost, Paid, OrderDate, Complete)

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.

..... [1]

(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]

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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[3]

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

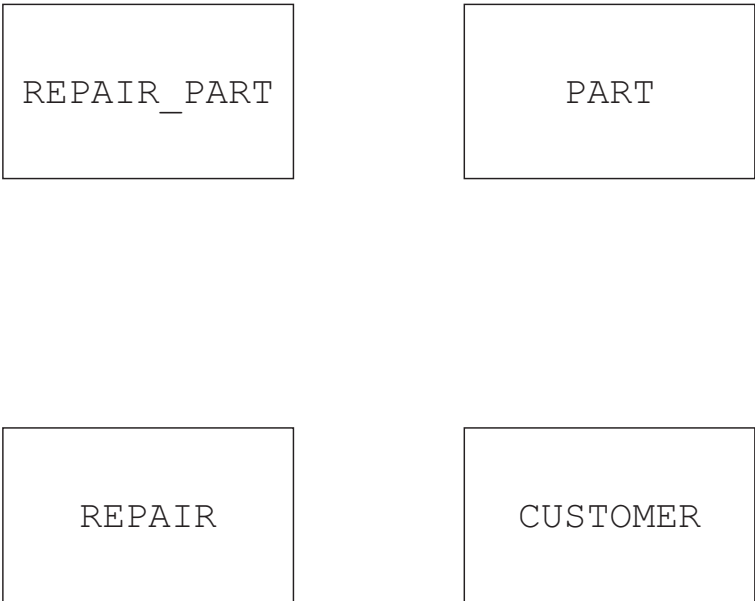
The database stores data about the customers and the devices for repair.

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]

- 6** A company is developing a website that will allow users to create an account and then play a quiz every day. The data about the users and the quizzes are stored in a database.

A user must select a unique username and enter a valid email address to create an account. All users must be over the age of 16. A new quiz is given to the users every day. Each quiz is stored in its own text file.

The database stores the filename of each quiz and the date it can be played. The user gets a score for each quiz they complete, which is stored in the database. The scores are used to give each user a rating, for example Gold.

- (a)** Create a 3-table design for this database normalised to Third Normal Form (3NF).

Give your table design in the format:

TableName(PrimaryKey, Field1, Field2, ...)

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- (b)** The company is using a Database Management System (DBMS) to set up the database.

Describe what is meant by the following DBMS features:

Data dictionary

Logical schema

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(c) The company has another database, FARMING, for a different game.

The database FARMING has a table named EVENT which is shown with some sample data.

PlayerID	EventID	Category	Points
000123	3	Build	100
000124	1	Grow	36
000123	4	Grow	22
000123	7	Create	158
000125	3	Grow	85
000125	4	Build	69

(i) The database FARMING has a second table created named PLAYER that has the primary key PlayerID.

The field PlayerID in EVENT needs to be set up as a foreign key to link to PlayerID in PLAYER.

Write a Structured Query Language (SQL) script to change the table definition for EVENT to link the foreign key to PLAYER.

[2]

(ii) Write an SQL script to return the number of events that each player has completed.

[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]