




INSY7213 A1



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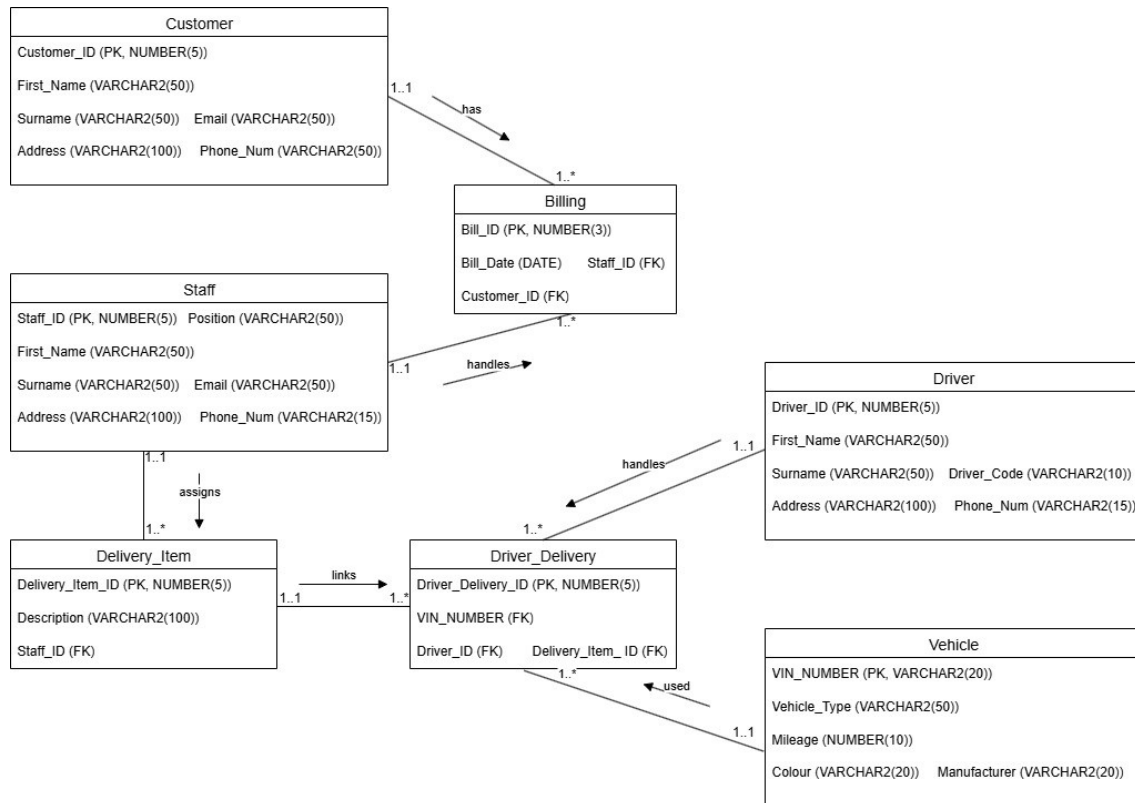
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Question 1



My assumptions for the ERD:

Different entities (Customers, Staff, Billing, Delivery_Items, Drivers, Vehicles, Driver_Deliveries) are represented by the flat files. To eliminate repetition, I normalized to 3NF (for instance, distinguishing between drivers and staff since the former have distinct variables like DRIVER_CODE and the latter do not share responsibilities like "Logistics" and "CRM").

Foreign keys and Primary keys:

For Primary Keys (PKs), use the provided IDs (for example, Customer_ID as NUMBER(5)). Assuming they are distinct and automatically produced if required, import them precisely as is. References for billing Two instances of foreign keys (FKs) are Customer (Customer_ID) and Staff (Staff_ID). Employee References for Delivery Items (Staff_ID, presuming employees assign or handle items). Driver_Deliveries References Vehicle (VIN_NUMBER), Driver (Driver_ID), and Delivery Items (DELIVERY_ITEM as DELIVERY_ITEM_ID). No extra connections beyond those that are suggested (for instance, there is no direct connection between the delivery and the client; deliveries are presumed to be monitored using Billing and Items for efficiency monitoring).

The screenshot displays the MySQL Workbench interface with the 'Output' tab active, showing a list of actions performed during a database setup. The actions include creating tables, inserting data, and performing billing calculations. The 'Navigator' pane on the left shows the database structure for 'cheetah'.

Database Structure (Navigator):

- cheetah
 - Tables
 - billing
 - customer
 - delivery_item
 - driver
 - driver_deliveries
 - staff
 - vehicle
 - Views
 - Stored Procedures
 - Functions

Action Output (Output Tab):

Time	Action	Message	Duration / Fetch
9 23:32:10	DROP TABLE IF EXISTS Staff	0 row(s) affected	0.016 sec
10 23:32:10	DROP TABLE IF EXISTS Customer	0 row(s) affected	0.015 sec
11 23:32:10	CREATE TABLE Customer (customer_id INT PRIMARY KEY, first_name VARCHAR(50) NOT NULL, surname VA...	0 row(s) affected	0.015 sec
12 23:32:10	CREATE TABLE Staff (staff_id INT PRIMARY KEY, first_name VARCHAR(50) NOT NULL, surname VA...	0 row(s) affected	0.032 sec
13 23:32:10	CREATE TABLE Vehicle (vin_number VARCHAR(20) PRIMARY KEY, vehicle_type VARCHAR(50), milea...	0 row(s) affected	0.021 sec
14 23:32:10	CREATE TABLE Driver (driver_id INT PRIMARY KEY, first_name VARCHAR(50) NOT NULL, surname ...	0 row(s) affected	0.016 sec
15 23:32:10	CREATE TABLE Delivery_item (delivery_item_id INT PRIMARY KEY, description VARCHAR(100), staff...	0 row(s) affected	0.046 sec
16 23:32:10	CREATE TABLE Driver_Deliveries (driver_delivery_id INT PRIMARY KEY, vin_number VARCHAR(20)...	0 row(s) affected	0.063 sec
17 23:32:10	CREATE TABLE Billing (bill_id INT PRIMARY KEY, customer_id INT NOT NULL, staff_id INT NOT NU...	0 row(s) affected	0.047 sec
18 23:32:10	USE cheetah	0 row(s) affected	0.000 sec
19 23:32:10	INSERT INTO Customer VALUES (11011,'Bob','Smith','18 Water rd','087727521','bobs@beat.com'), (11012,Sa...	15 row(s) affected Records: 15 Duplicates: 0 Warnings: 0	0.015 sec
20 23:32:11	INSERT INTO Staff VALUES (51011,'Sally','Du Toit','Logistics','0825698547','18 Main rd','sdu@beat.com'), (510...	10 row(s) affected Records: 10 Duplicates: 0 Warnings: 0	0.000 sec
21 23:32:11	INSERT INTO Vehicle VALUES (12A5585854,'Cutaway van chassis','115352','RED','MAN'), (12A51858542,...	20 row(s) affected Records: 20 Duplicates: 0 Warnings: 0	0.000 sec
22 23:32:11	INSERT INTO Driver VALUES (81011,'Buthelesi','Marshall','C1','0725698547','18 Leopard creek'), (81012,'Tina'...	5 row(s) affected Records: 5 Duplicates: 0 Warnings: 0	0.016 sec
23 23:32:11	INSERT INTO Delivery_item VALUES (71011,'House relocation','51011'), (71012,'Delivery of specialized consi...	5 row(s) affected Records: 5 Duplicates: 0 Warnings: 0	0.000 sec
24 23:32:11	INSERT INTO Driver_Deliveries VALUES (91011,'12A5585854','81011','71011'), (91012,'12A3585543','81012...	5 row(s) affected Records: 5 Duplicates: 0 Warnings: 0	0.000 sec
25 23:32:11	INSERT INTO Billing VALUES (800,11011,51011,2022-09-06), (801,11012,51013,2022-09-07), (802,11014.5...	21 row(s) affected Records: 21 Duplicates: 0 Warnings: 0	0.000 sec
26 23:32:49	DROP TABLE IF EXISTS Driver_Deliveries	0 row(s) affected	0.032 sec
27 23:32:49	DROP TABLE IF EXISTS Billing	0 row(s) affected	0.031 sec
28 23:32:49	DROP TABLE IF EXISTS Delivery_item	0 row(s) affected	0.015 sec
29 23:32:49	DROP TABLE IF EXISTS Vehicle	0 row(s) affected	0.016 sec
30 23:32:49	DROP TABLE IF EXISTS Driver	0 row(s) affected	0.016 sec
31 23:32:49	DROP TABLE IF EXISTS Staff	0 row(s) affected	0.015 sec
32 23:32:49	DROP TABLE IF EXISTS Customer	0 row(s) affected	0.016 sec
33 23:32:49	CREATE TABLE Customer (customer_id INT PRIMARY KEY, first_name VARCHAR(50) NOT NULL, suma...	0 row(s) affected	0.015 sec
34 23:32:49	CREATE TABLE Staff (staff_id INT PRIMARY KEY, first_name VARCHAR(50) NOT NULL, surname VA...	0 row(s) affected	0.031 sec
35 23:32:49	CREATE TABLE Vehicle (vin_number VARCHAR(20) PRIMARY KEY, vehicle_type VARCHAR(50), milea...	0 row(s) affected	0.032 sec
36 23:32:49	CREATE TABLE Driver (driver_id INT PRIMARY KEY, first_name VARCHAR(50) NOT NULL, surname ...	0 row(s) affected	0.015 sec
37 23:32:49	CREATE TABLE Delivery_item (delivery_item_id INT PRIMARY KEY, description VARCHAR(100), staff...	0 row(s) affected	0.047 sec
38 23:32:49	CREATE TABLE Driver_Deliveries (driver_delivery_id INT PRIMARY KEY, vin_number VARCHAR(20)...	0 row(s) affected	0.063 sec
39 23:32:49	CREATE TABLE Billing (bill_id INT PRIMARY KEY, customer_id INT NOT NULL, staff_id INT NOT NU...	0 row(s) affected	0.062 sec
40 23:32:49	USE cheetah	0 row(s) affected	0.000 sec
41 23:32:49	INSERT INTO Customer VALUES (11011,'Bob','Smith','18 Water rd','087727521','bobs@beat.com'), (11012,Sa...	15 row(s) affected Records: 15 Duplicates: 0 Warnings: 0	0.000 sec
42 23:32:49	INSERT INTO Staff VALUES (51011,'Sally','Du Toit','Logistics','0825698547','18 Main rd','sdu@beat.com'), (510...	10 row(s) affected Records: 10 Duplicates: 0 Warnings: 0	0.000 sec
43 23:32:49	INSERT INTO Vehicle VALUES (12A5585854,'Cutaway van chassis','115352','RED','MAN'), (12A51858542,...	20 row(s) affected Records: 20 Duplicates: 0 Warnings: 0	0.000 sec
44 23:32:49	INSERT INTO Driver VALUES (81011,'Buthelesi','Marshall','C1','0725698547','18 Leopard creek'), (81012,'Tina'...	5 row(s) affected Records: 5 Duplicates: 0 Warnings: 0	0.000 sec
45 23:32:49	INSERT INTO Delivery_item VALUES (71011,'House relocation','51011'), (71012,'Delivery of specialized consi...	5 row(s) affected Records: 5 Duplicates: 0 Warnings: 0	0.000 sec
46 23:32:49	INSERT INTO Driver_Deliveries VALUES (91011,'12A5585854','81011','71011'), (91012,'12A3585543','81012...	5 row(s) affected Records: 5 Duplicates: 0 Warnings: 0	0.000 sec
47 23:32:49	INSERT INTO Billing VALUES (800,11011,51011,2022-09-06), (801,11012,51013,2022-09-07), (802,11014.5...	21 row(s) affected Records: 21 Duplicates: 0 Warnings: 0	0.000 sec

MySQL Workbench

MyAssignmentDB x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHMAS

Filter objects

cheetah

Tables

billing

customer

delivery_item

driver

driver_deliveries

staff

vehicle

Views

Stored Procedures

Functions

sys

Administration Schemas

Information

Schema: cheetah

SQL File 2

Limit to 1000 rows

169 (816,11012,51019,'2022-09-07'),

170 (817,11014,51015,'2022-11-10'),

171 (818,11112,51012,'2022-12-09'),

172 (819,11013,51014,'2022-12-09'),

173 (820,11116,51019,'2022-12-09'),

174

175 SHOW TABLES;

Result Grid

Filter Rows

Export

Wrap Cell Contents

Tables_in_cheetah

billing

customer

delivery_item

driver

driver_deliveries

staff

vehicle

Result 1 x

Output

Action Output

Time Action Message Duration / Fetch

46 23:32:43 INSERT INTO Driver_Deliveries VALUES (91011,'12A55858541',81011,71011), (91012,'12A35858543',8101... 5 row(s) affected Records: 5 Duplicates: 0 Warnings: 0 0.000 sec

47 23:32:43 INSERT INTO Billing VALUES (800,11011,51011,2022-09-06), (801,11012,51013,2022-09-07), (802,11014... 21 row(s) affected Records: 21 Duplicates: 0 Warnings: 0 0.000 sec

48 23:34:59 SHOW TABLES 7 row(s) returned 0.000 sec / 0.000 sec

Object Info Session

19°C Clear

MySQL Workbench

MyAssignmentDB x

File Edit View Query Database Server Tools Scripting Help

Navigator

SCHMAS

Filter objects

cheetah

Tables

billing

customer

delivery_item

driver

driver_deliveries

staff

vehicle

Views

Stored Procedures

Functions

sys

Administration Schemas

Information

Schema: cheetah

SQL File 2

Limit to 1000 rows

169 (816,11012,51019,'2022-09-07'),

170 (817,11014,51015,'2022-11-10'),

171 (818,11112,51012,'2022-12-09'),

172 (819,11013,51014,'2022-12-09'),

173 (820,11116,51019,'2022-12-09'),

174

175 SELECT * FROM Customer LIMIT 10;

Result Grid

Filter Rows

Edit

Export/Import

Wrap Cell Contents

Fetch rows

customer_id first_name surname address phone_num email

11011 Bob Smith 18 Water rd 087277521 bobos@sat.com

11012 Sam Hendricks 22 Water rd 0863257857 sam@ncom.co.za

11013 Larry Clark 101 Summer lane 0834567891 larc@ncom.co.za

11014 Jeff Jones 55 Mountain way 0612547895 j@sat.co.za

11015 Andre Kerk 5 Main rd 0827238521 akerk@ncom.co.za

11016 Wayne Smith 13 Water rd 087277522 ws@sat.com

11017 John Hendricks 29 Water rd 0863257851 jhen@ncom.co.za

11018 Sally Clark 111 Summer lane 0834567892 sallyc@ncom.co.za

11019 Bridget Bitterhour 125 Mountain way 0612547896 bb@sat.co.za

11111 Nicole Kerk 175 Main rd 0827238529 nk@ncom.co.za

Customer 2 x

Output

Action Output

Time Action Message Duration / Fetch

47 23:32:43 INSERT INTO Billing VALUES (800,11011,51011,2022-09-06), (801,11012,51013,2022-09-07), (802,11014... 21 row(s) affected Records: 21 Duplicates: 0 Warnings: 0 0.000 sec

48 23:34:59 SHOW TABLES 7 row(s) returned 0.000 sec / 0.000 sec

49 23:35:40 SELECT * FROM Customer LIMIT 10 10 row(s) returned 0.000 sec / 0.000 sec

Object Info Session

19°C Clear

Google Chrome

23:35 2025/09/25

MySQL Workbench

MyAssignmentDB

File Edit View Query Database Server Tools Scripting Help

Navigator

Schemas

Filter objects

cheetah

Tables

billing

customer

delivery_item

driver

driver_deliveries

staff

vehicle

Views

Stored Procedures

Functions

sys

Administration Schemas

Information

Schema: cheetah

SQL File 2

Limit to 1000 rows

169 (816,11012,51019,'2022-09-07'),

170 (817,11014,51015,'2022-11-10'),

171 (818,11112,51012,'2022-12-09'),

172 (819,11013,51014,'2022-12-09'),

173 (820,11116,51019,'2022-12-09'),

174

175 SELECT * FROM Billing LIMIT 10;

Result Grid

bill_id	customer_id	staff_id	bill_date
800	11011	51011	2022-09-06
801	11012	51013	2022-09-07
802	11014	51015	2022-11-10
803	11015	51012	2022-12-09
804	11013	51014	2022-12-09
805	11111	51011	2022-09-06
806	11012	51013	2022-09-07
807	11014	51015	2022-11-10
808	11015	51012	2022-12-09
809	11113	51018	2022-12-09
810			

Output

Action Output

#	Time	Action	Message	Duration / Fetch
48	23:34:59	SHOW TABLES	7 row(s) returned	0.000 sec / 0.000 sec
49	23:35:40	SELECT * FROM Customer LIMIT 10	10 row(s) returned	0.000 sec / 0.000 sec
50	23:36:13	SELECT * FROM Billing LIMIT 10	10 row(s) returned	0.000 sec / 0.000 sec

Object Info Session

SQLAdditions

Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.

Result Grid

Form Editor

Field Types

Query State

Apply Context Help Snippets

15°C Clear

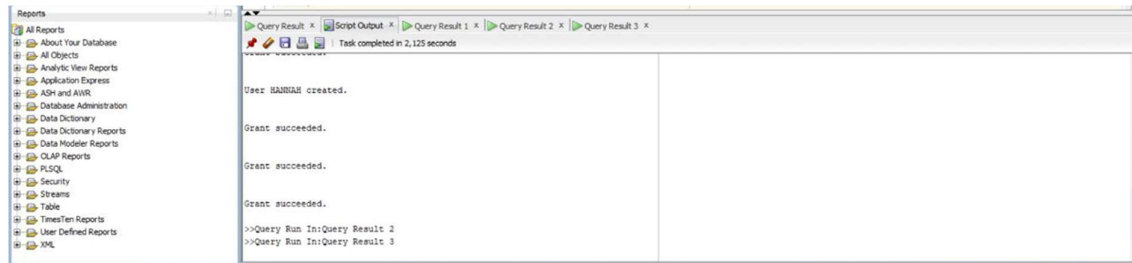
Search

23:36

2025/09/25

Question 3

3.1)

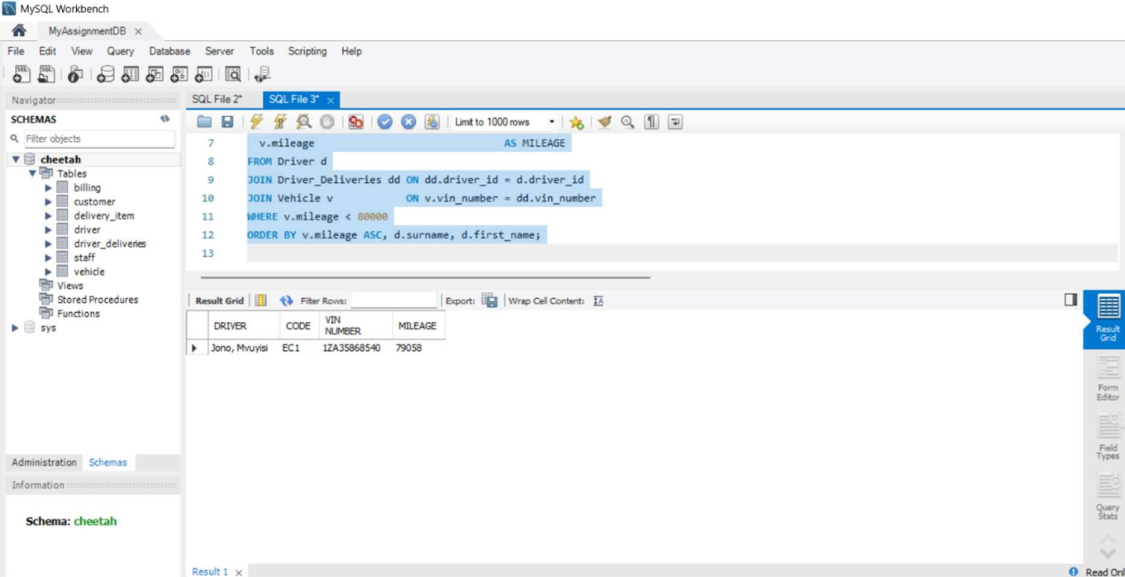


3.2) Separation of Duties

Separation of duties stops a single user from carrying out contradictory tasks that can result in fraud or unnoticed mistakes. Assigning Hannah insert access (INSERT ANY TABLE) and John read-only access (SELECT ANY TABLE) promotes responsibility, lowers risk, and upholds the least privilege principle (Bowman, 2021).

Question 4

4.1) Driver Report for Vehicles < 80,000 Mileage



The screenshot shows the MySQL Workbench interface. On the left, the 'SCHEMAS' pane displays a tree view for the 'cheetah' database, including tables like 'billing', 'customer', 'delivery_item', 'driver', 'driver_deliveries', 'staff', and 'vehicle'. The main editor window contains a SQL query:

```
7 v.mileage AS MILEAGE
8 FROM Driver d
9 JOIN Driver_Deliveries dd ON dd.driver_id = d.driver_id
10 JOIN Vehicle v ON v.vin_number = dd.vin_number
11 WHERE v.mileage < 80000
12 ORDER BY v.mileage ASC, d.surname, d.first_name;
```

Below the query editor, the 'Result Grid' shows the output of the query:

DRIVER	CODE	VIN NUMBER	MILEAGE
Jono, Mrcyisi	EC1	1ZA35868540	79058

The bottom status bar indicates 'Result 1 x' and 'Read Only'.

4.2) Flat File vs Relational

- Flat File: Stores all data in single tables or text files, no constraints, lots of duplication (Coronel, 2023).
- Relational: Organises data into linked tables using PK/FK, supports integrity, scalability, and fast querying (Coronel, 2023).
- Better for Cheetah Deliveries: Reduces redundancy (e.g. staff, customers stored once), ensures accurate billing/delivery linking, improves reporting for decision-making.

Question 5

5.1)

The screenshot shows a SQL IDE interface with a query editor and a result grid. The query is as follows:

```
6 s.surname,  
7 COUNT(b.bill_id) AS deliveries_processed  
8 FROM Staff s  
9 JOIN Billing b ON b.staff_id = s.staff_id  
10 GROUP BY s.staff_id, s.first_name, s.surname  
11 ORDER BY deliveries_processed DESC, s.surname, s.first_name  
12
```

The result grid displays the following data:

staff_id	first_name	surname	deliveries_processed
51012	Mark	Wright	4
51011	Sally	Du Toit	3
51015	Roberto	Henry	3
51013	Harry	Sheen	3
51014	Jabu	Xolani	3
51019	Shane	Mane	2
51018	Maxwell	Dube	1
51016	Pat	Durant	1
51111	Bob	Truth	1

5.2)

DECLARE: optional. Define variables/cursors used later.

BEGIN ... END: executable logic (queries, loops, prints).

EXCEPTION: optional error handling (e.g., “no row found”).

Mapping to MySQL: we’d use variables + stored procedures; errors are handled via handlers (DECLARE ... HANDLER).

5.3.1) A View is a saved SQL query that behaves like a virtual table. It simplifies access for managers they can query delivery counts without writing JOINS, ensuring consistent and secure reporting (Coronel, 2023).

5.3.2) Create View

The screenshot shows a SQL execution log with the following entries:

```
56 23:53:35 USE cheetah 0 row(s) affected 0.000 sec  
57 23:53:35 CREATE OR REPLACE VIEW Staff_Delivery_Count AS SELECT s.staff_id, s.first_name, s.surname, CO... 0 row(s) affected 0.000 sec
```

Navigator: SCHEMAS

Filter objects

cheetah

- Tables
 - billing
 - customer
 - delivery_item
 - driver
 - driver_deliveries
 - staff
 - vehicle
- Views
 - staff_delivery_count
- Stored Procedures
- Functions
- sys

Administration Schemas

Information

Schema: cheetah

SQL File 2* SQL File 3* SQL File 4* SQL File 5*

Limit to 1000 rows

```
10 LEFT JOIN Billing b ON b.staff_id = s.staff_id
11 GROUP BY s.staff_id, s.first_name, s.surname;
12
13 SELECT *
14 FROM Staff_Delivery_Count
15 ORDER BY delivery_count DESC, surname, first_name;
16
```

Result Grid

staff_id	first_name	surname	delivery_count
51012	Mark	Wright	4
51011	Sally	Du Toit	3
51015	Roberto	Henry	3
51013	Harry	Sheen	3
51014	Jabu	Xolani	3
51019	Shane	Mane	2
51018	Maxwell	Dube	1
51016	Pat	Durant	1
51111	Bob	Truth	1
51017	Steve	Maritz	0

livery_Count 1 x

Read Only

Question 6

6.1) Implicit & Explicit Cursor Attributes

Implicit Cursor Example:

The screenshot shows the SQL Developer interface with the 'cheetah' schema selected in the Navigator. The SQL Editor contains the following code:

```
1 • USE cheetah;
2
3 • UPDATE Vehicle
4   SET colour = CONCAT(UCASE(LEFT(colour,1)), LCASE(SUBSTRING(colour,2)))
5   WHERE UPPER(colour) = 'SILVER';
6
7 • SELECT ROW_COUNT() AS rows_affected;
```

The 'Result Grid' at the bottom shows a single row with the column 'rows_affected' and the value '0'.

Explicit Cursor Example:

The screenshot shows the SQL Developer interface with the 'cheetah' schema selected. The SQL Editor contains the following code:

```
35 • CLOSE cur;
36 • END $$
37 • DELIMITER ;
38
39 • CALL List_Driver_Trips();
40
41
```

The 'Result Grid' at the bottom shows a single row with the column 'msg' and the value 'Driver Richard Smith (ID 81014) trips: 1'.

6.2) Sequence Example

The screenshot shows a SQL IDE interface with a schema named 'cheetah'. The 'Billing' table is selected in the left-hand 'SCHEMAS' pane. The main editor displays the following SQL script:

```
1 • USE cheetah;
2
3 -- Make sure Billing.bill_id auto-generates new IDs
4 • ALTER TABLE Billing
5   MODIFY bill_id INT NOT NULL AUTO_INCREMENT;
6
7 -- Insert a new bill WITHOUT specifying bill_id
```

The 'Result Grid' at the bottom shows a single row with the value '821' under the column 'new_bill_id'.

new_bill_id
821

The screenshot shows the same SQL IDE interface. The SQL script in the main editor is identical to the previous one, but the 'Result Grid' now displays a full record for the 'Billing' table:

```
1 • USE cheetah;
2
3 -- Make sure Billing.bill_id auto-generates new IDs
4 • ALTER TABLE Billing
5   MODIFY bill_id INT NOT NULL AUTO_INCREMENT;
6
7 -- Insert a new bill WITHOUT specifying bill_id
```

The 'Result Grid' shows a single row with the following values:

bill_id	customer_id	staff_id	bill_date
821	11011	51012	2025-09-26

References

Bowman, K., 2021. *Pathlock*. [Online]

Available at: https://pathlock.com/learn/separation-of-duties-security-ensuring-security-supports-sod/?utm_source=chatgpt.com

Coronel, C., 2023. *Database Systems: Design, Implementation, & Management*. s.l.:s.n.

