The topic we selected for our database project is Crime Investigation Database Management System.

The **Crime Investigation Management System** is designed to streamline and organize information related to law enforcement and criminal investigation processes. This database manages crucial aspects of a crime investigation, including the details of police stations, officers, vehicles, complaints, FIRs (First Information Reports), victims, suspects, criminals, evidence, hearings, and case statuses.

The ER diagram represents the database schema for a criminal investigation system. Below is a summarized explanation of its components and relationships:

Entities and Attributes

Police_Officer
Attributes: officer_id, officer_name, role.
Represents officers involved in investigations.

Investigation_Team
Attributes: team_id, formation_date.
Represents teams of officers handling cases.

Police_Station
Attributes: station_id, station_name, address, contact_number.
Represents the stations managing teams and resources.

Case
Attributes: case_id, case_type, description.
Represents a legal investigation.

Victim
Attributes: victim_id, name, contact_number.
Represents individuals impacted by a crime.
Suspect

Attributes: suspect_id, name, date_of_birth.
Represents individuals suspected of crimes.

Evidence
Attributes: evidence_id, type, collected_by.
Represents physical or digital evidence in cases.

Witness
Attributes: witness_id, name, contact_number.
Represents witnesses testifying in cases.

Hearing
Attributes: hearing_id, court_id, verdict.
Represents court sessions for cases.

Court
Attributes: court_id, court_name, address.
Represents judicial institutions where hearings occur.

Case_Status
Attributes: status_id, status_description, date_updated. Represents updates on the progress of cases.

Station_Vehicle
Attributes: vehicle_id, license_plate.
Represents vehicles managed by police stations.
GD (General Diary)
Attributes: gd_id, date_recorded, description.
Represents diary entries filed by complainants.

Complainant
Attributes: complainant_id, name, contact_number, address, email.
Represents individuals reporting incidents.

Criminal
Attributes: criminal_id, name, alias, date_of_birth.
Represents individuals proven guilty of crimes.

FIR (First Information Report)
Attributes: fir_id, date_recorded, description.
Represents formal reports filed by complainants.

Junction Tables

1. Case_Victim

- Case to Case_Victim: One Case can have many Victims (1:N relationship).
- Victim to Case_Victim: One Victim can be associated

with many Cases (1:N relationship).

2. Case_Suspect

Case to Case_Suspect: One Case can have many Suspects (1:N relationship).

- Suspect to Case_Suspect: One Suspect can be involved in many Cases (1:N relationship).

3. Case_Police_Officer

- Case to Case_Police_Officer: One Case can have many Police Officers (1:N relationship).
- Police Officer to Case_Police_Officer: One Police Officer can be assigned to many Cases (1:N relationship).

4. Suspect_Hearing

- Suspect to Suspect_Hearing: One Suspect can have many Hearings (1:N relationship).
- Hearing to Suspect_Hearing: One Hearing can involve many Suspects (1:N relationship).

5. Criminal_Hearing

- Criminal to Criminal_Hearing: One Criminal can be involved in many Hearings (1:N relationship). - Hearing to Criminal_Hearing: One Hearing can involve many Suspects (1:N relationship).

6. Case_Witness

- Case to Case_Witness: One Case can have many Witnesses (1:N relationship).
- Witness to Case_Witness: One Witness can be

associated with many Cases (1:N relationship).

Relationships

1. Police_Officer

- employed in → Police Station:

A Police Station has multiple Police Officers (1:N).

- drives → Station_Vehicle:
  A Police Officer can drive one Station Vehicles (1:1).
- Part of → Investigation Team:

  An investigation team has multiple Police Officers (1:N).

2. Investigation_Team

- investigates → Case:
  An Investigation Team can investigate multiple Cases (1:N) , connected via the investigates.
- updates → Case_Status:
  An investigation team can update case Status in multiple times (1:N), connected via updates case.

3. Case

- Evidence →part of Case:
  A Case can involve multiple Evidence items (1:N).,

connected via part of.

- About case → Hearing:
  A Case can have multiple Hearings (1:N).
  A Hearing relates to exactly one Case (1:N).
- linked to → Victim:
  A Case can involve multiple Victims (1:N).
  A Victim can be involved in multiple Cases (1:N), connected via the Case_Victim junction table.
- linked to → Suspect:
  A Case can have multiple Suspects (1:N).
  A Suspect can be involved in multiple Cases (1:N), connected via the Case_Suspect junction table.
- assigned to → Police_Officer:
  A Case can have multiple Police Officers assigned (1:N).
  A Police Officer can be assigned to multiple Cases (1:N), connected via the Case_Police_Officer junction table.

4. Hearing

- is in → Court:
  A Hearing takes place in one Court (1:N).
  A Court can host multiple Hearings (1:N).
- involves → Suspect:
  A Hearing can involve multiple Suspects (1:N), connected via the Suspect_Hearing junction table. A Suspect can appear in multiple Hearings (1:N), connected via the Suspect_Hearing junction table.
- involves → Criminal:
  A Hearing can involve multiple Criminals (1:N), connected via the Criminal_Hearing junction

table. A Criminal can appear in multiple Hearings (1:N), connected via the Criminal_Hearing junction table.

5. Suspect

- appears in → Suspect_Hearing:
  A Suspect can appear in multiple Hearings (1:N), connected via the Suspect_Hearing junction table. A Hearing can involve multiple Suspects (1:N), connected via the Suspect_Hearing junction table.

6. Witness

- testifies in → Case:
  A Witness can testify in multiple Cases (1:N), connected via the Case_Witness junction table. A Case can have multiple Witnesses (1:N), connected via the Case_Witness junction table.

7. Criminal

- appears in → Criminal_Hearing:
  A Criminal can appear in multiple Hearings (1:N), connected via the Criminal_Hearing junction table. A Hearing can involve multiple Criminals (1:N), connected via the Criminal_Hearing junction table.

8. Station_Vehicle

- driven by → Police_Officer:
  A Station Vehicle can be driven by one Police Officer (1:1).

9. GD (General Diary)

- written by → Complainant:
  A GD is filed by one Complainant (1:1).
  A Complainant may file multiple GDs (1:N).

10. FIR (First Information Report)

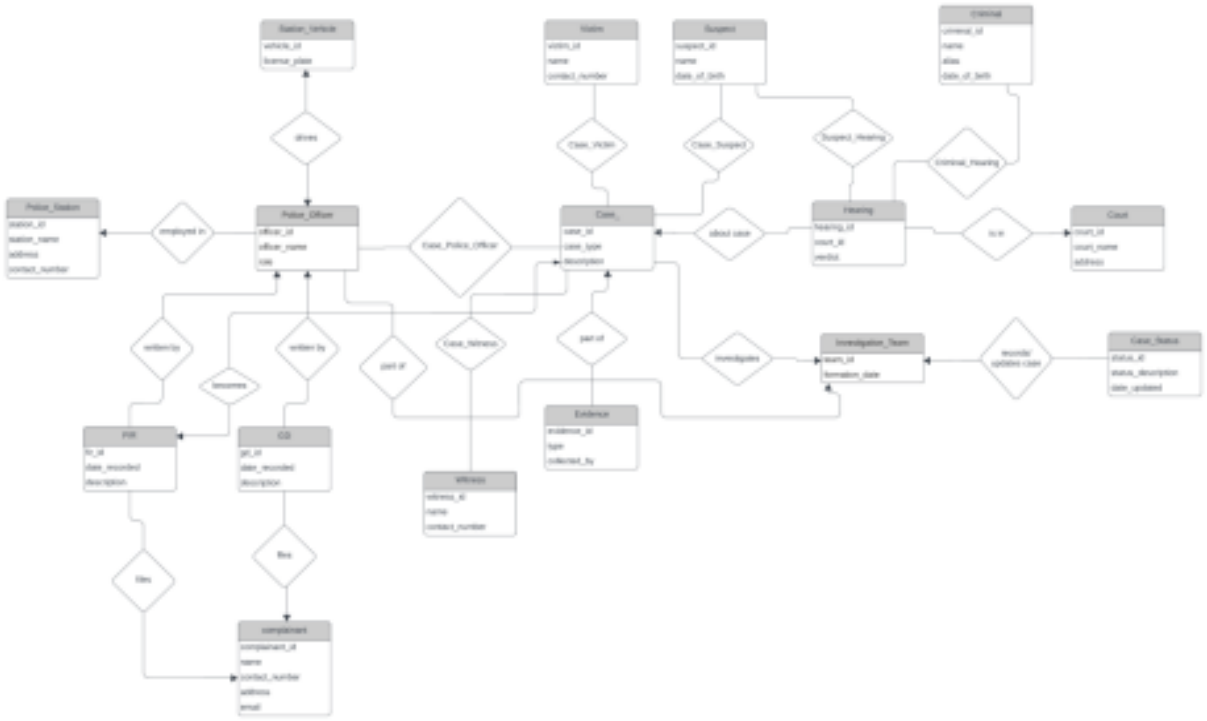
- written by → Complainant:
  An FIR is filed by one Complainant (1:1).
  A Complainant may file multiple FIRs (1:N).
- leads to → Case:
  An FIR leads to exactly one Case (1:1).
  A Case originates from one FIR (1:1).

11. Complainant

- files → GD and FIR:

A complainant can file multiple GDs and FIRs (1:N).

ER Diagram of Crime Investigation System Database :



Schema diagram of the Crime Investigation System Database:

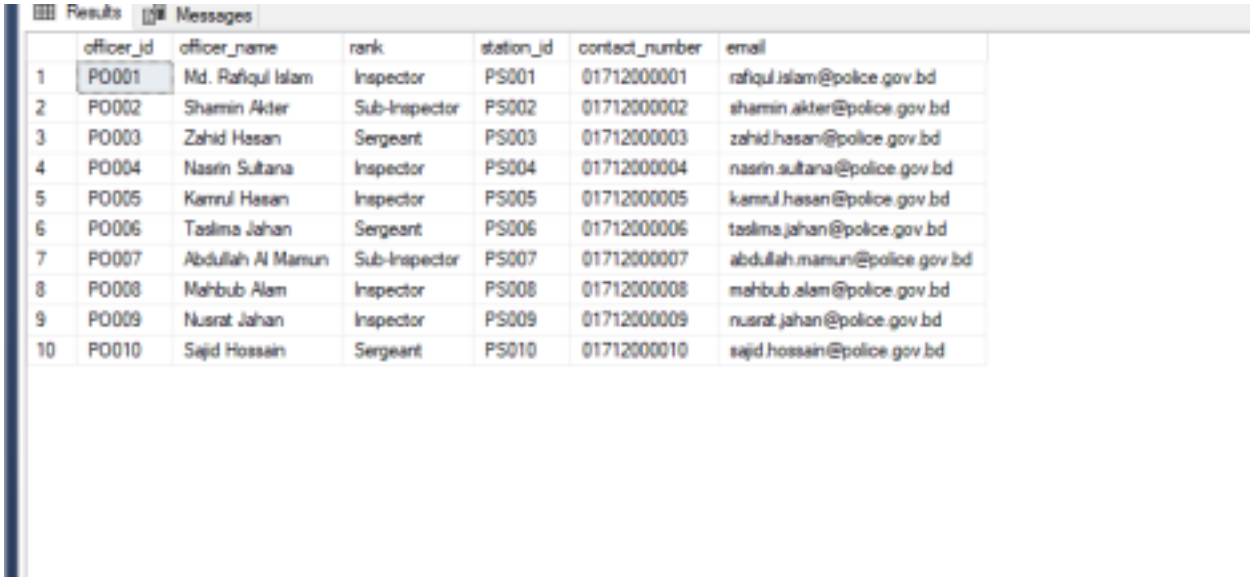
SQL Queries for the database –

```
--1.  Retreieve  all  cases  from  the
database. SELECT * FROM Case_
```

Results | Messages

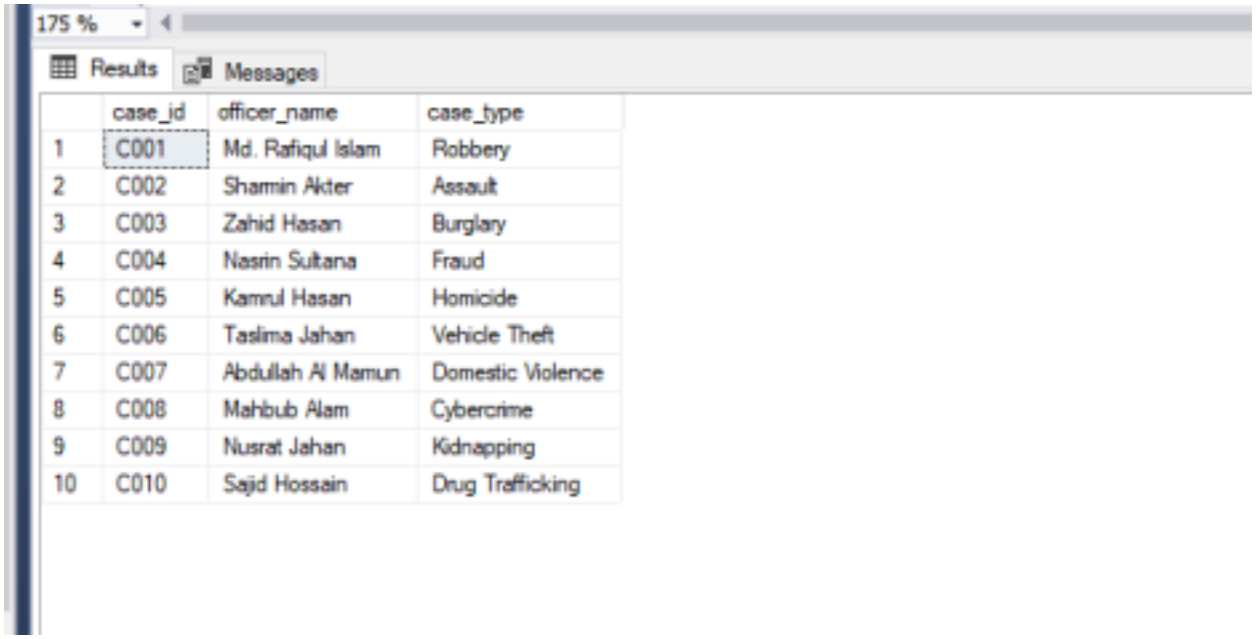
	case_id	fir_id	case_type	description	start_date	end_date	case_status_id	hearing_id	evidence_id
1	C001	FIR001	Robbery	Robbery at a jewelry store in Dhaka	2024-11-01	2024-11-20	CS001	H001	E001
2	C002	FIR002	Assault	Assault incident in a market in Chittagong	2024-11-02	2024-11-18	CS002	H002	E002
3	C003	FIR003	Burglary	Burglary at a residential area in Sylhet	2024-11-03	2024-11-17	CS003	H003	E003
4	C004	FIR004	Fraud	Fraudulent transactions in Rajshahi	2024-11-04	2024-11-25	CS004	H004	E004
5	C005	FIR005	Homicide	Homicide case in Khulna	2024-11-05	2024-11-30	CS005	H005	E005
6	C006	FIR006	Vehicle Theft	Vehicle theft in Barishal	2024-11-06	2024-11-20	CS006	H006	E006
7	C007	FIR007	Domestic V...	Domestic violence case in Mymensingh	2024-11-07	2024-11-19	CS007	H007	E007
8	C008	FIR008	Cybercrime	Cybercrime involving data breach	2024-11-08	2024-11-21	CS008	H008	E008
9	C009	FIR009	Kidnapping	Kidnapping case in Comilla	2024-11-09	2024-11-22	CS009	H009	E009
10	C010	FIR010	Drug Traffi...	Drug trafficking case in Gazipur	2024-11-10	2024-11-23	CS010	H010	E010

```
--2. Retreieve all police officers from the
database

SELECT * FROM Police_Officer
```



	officer_id	officer_name	rank	station_id	contact_number	email
1	PO001	Md. Rafiqul Islam	Inspector	PS001	01712000001	rafiqul.islam@police.gov.bd
2	PO002	Sharmin Akter	Sub-Inspector	PS002	01712000002	sharmin.akter@police.gov.bd
3	PO003	Zahid Hasan	Sergeant	PS003	01712000003	zahid.hasan@police.gov.bd
4	PO004	Nasrin Sultana	Inspector	PS004	01712000004	nasrin.sultana@police.gov.bd
5	PO005	Kamrul Hasan	Inspector	PS005	01712000005	kamrul.hasan@police.gov.bd
6	PO006	Taslima Jahan	Sergeant	PS006	01712000006	taslima.jahan@police.gov.bd
7	PO007	Abdullah Al Mamun	Sub-Inspector	PS007	01712000007	abdullah.mamun@police.gov.bd
8	PO008	Mahbub Alam	Inspector	PS008	01712000008	mahbub.alam@police.gov.bd
9	PO009	Nusrat Jahan	Inspector	PS009	01712000009	nusrat.jahan@police.gov.bd
10	PO010	Sajid Hossain	Sergeant	PS010	01712000010	sajid.hossain@police.gov.bd

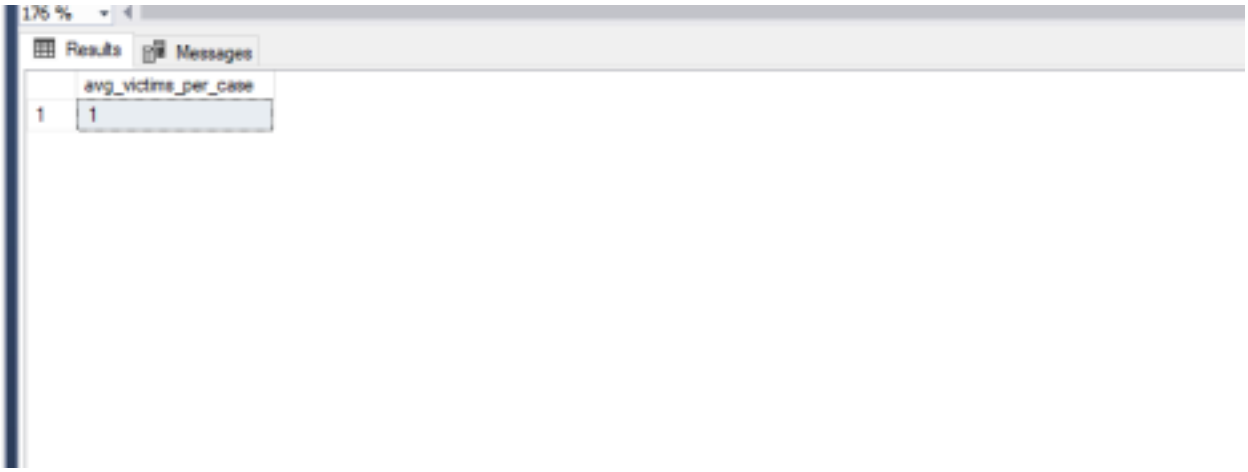
```
--3. List all cases with their assigned officer names:

SELECT Case_.case_id , police_officer.officer_name,Case_.case_type
FROM  police_officer,  case_,  Case_Police_Officer
WHERE Case_Police_Officer.case_id = case_.case_id
AND Case_Police_Officer.officer_id = police_officer.officer_id;
```



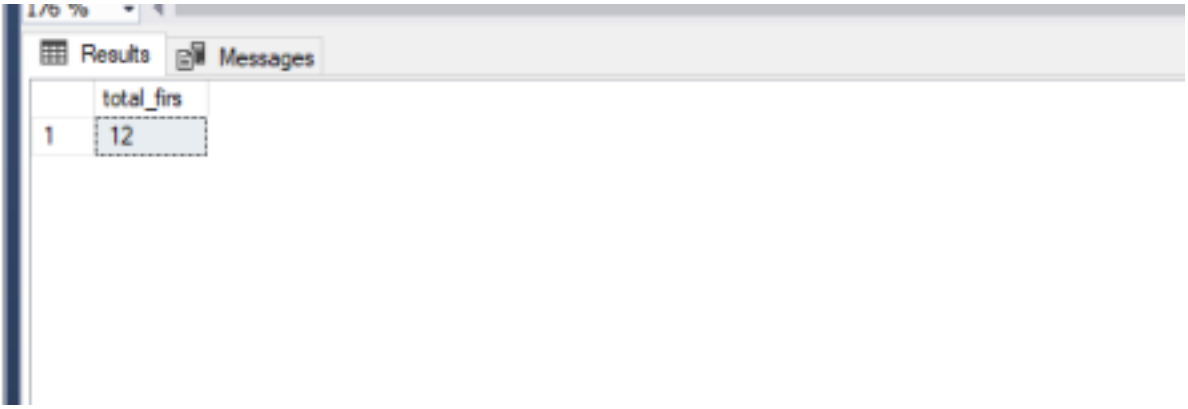
	case_id	officer_name	case_type
1	C001	Md. Rafiqul Islam	Robbery
2	C002	Sharmin Akter	Assault
3	C003	Zahid Hasan	Burglary
4	C004	Nasrin Sultana	Fraud
5	C005	Kamrul Hasan	Homicide
6	C006	Taslima Jahan	Vehicle Theft
7	C007	Abdullah Al Mamun	Domestic Violence
8	C008	Mahbub Alam	Cybercrime
9	C009	Nusrat Jahan	Kidnapping
10	C010	Sajid Hossain	Drug Trafficking

Aggregate Functions

```
--4.Calculate the Average Number of Victims Involved in
Cases

SELECT            AVG(victim_count)           AS
avg_victims_per_case FROM (
  SELECT  case_id,  COUNT(victim_id)  AS  victim_count
FROM Case_Victim
 GROUP BY case_id
) AS case_victims;
```



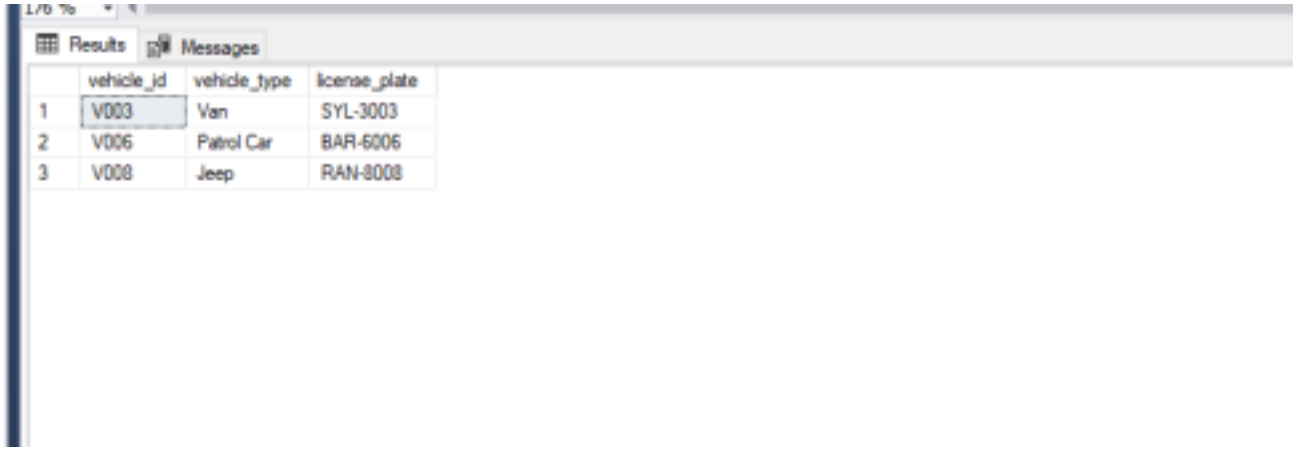

```
--5. Count the total number of FIRs:

SELECT COUNT(*) AS total_firs
FROM FIR;
```



Set Operations

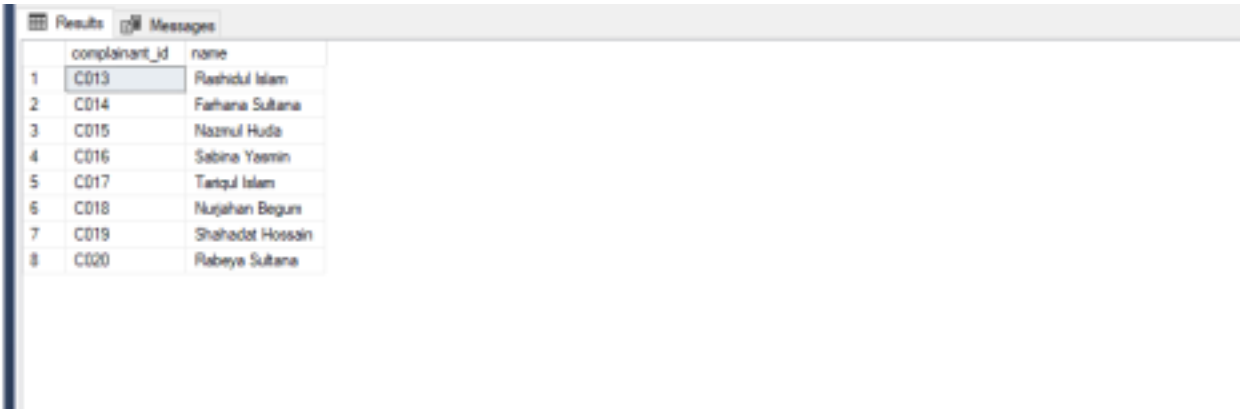
```
--6. List all vehicles that are unavailable or
```

```
not assigned to a station:

SELECT vehicle_id, vehicle_type, license_plate
FROM Station_vehicle
WHERE        availability_status        =
'Unavailable' UNION
SELECT vehicle_id, vehicle_type, license_plate
FROM Station_vehicle
WHERE station_id IS NULL;
```



	vehicle_id	vehicle_type	license_plate
1	V003	Van	SYL-3003
2	V006	Patrol Car	BAR-6006
3	V008	Jeep	RAN-8008

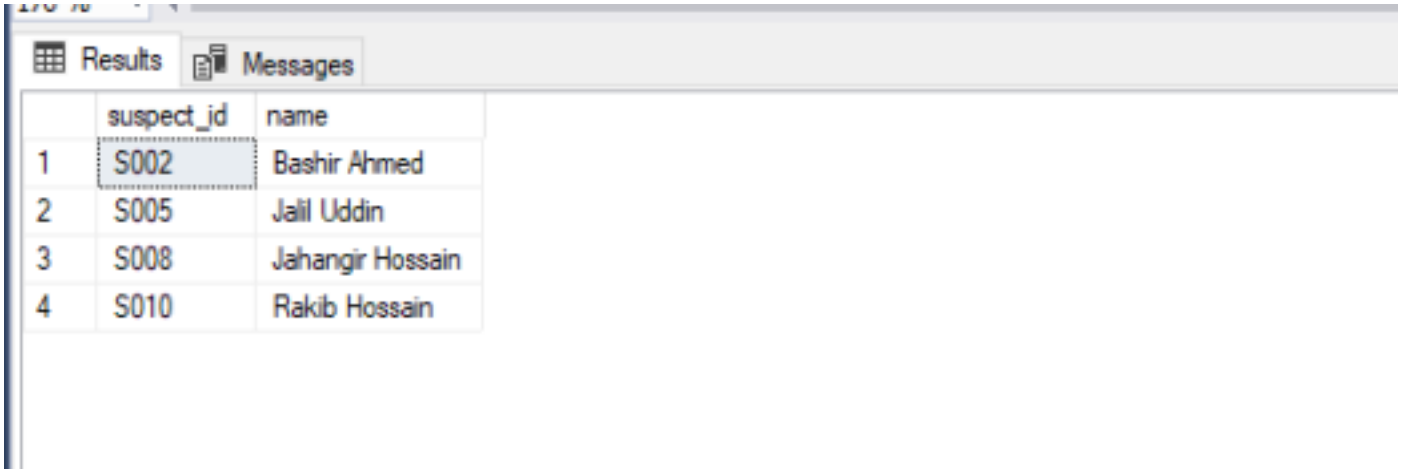
```
--7. Find all complainants who have not filed
any FIR.
SELECT complainant_id, name
FROM Complainant
WHERE complainant_id NOT IN (
 SELECT complainant_id
 FROM FIR
);
```



	complainant_id	name
1	C013	Rashidul Islam
2	C014	Farhana Sultana
3	C015	Nazmul Huda
4	C016	Sabina Yasmin
5	C017	Tariqul Islam
6	C018	Nurjahan Begum
7	C019	Shahadat Hossain
8	C020	Rabeya Sultana

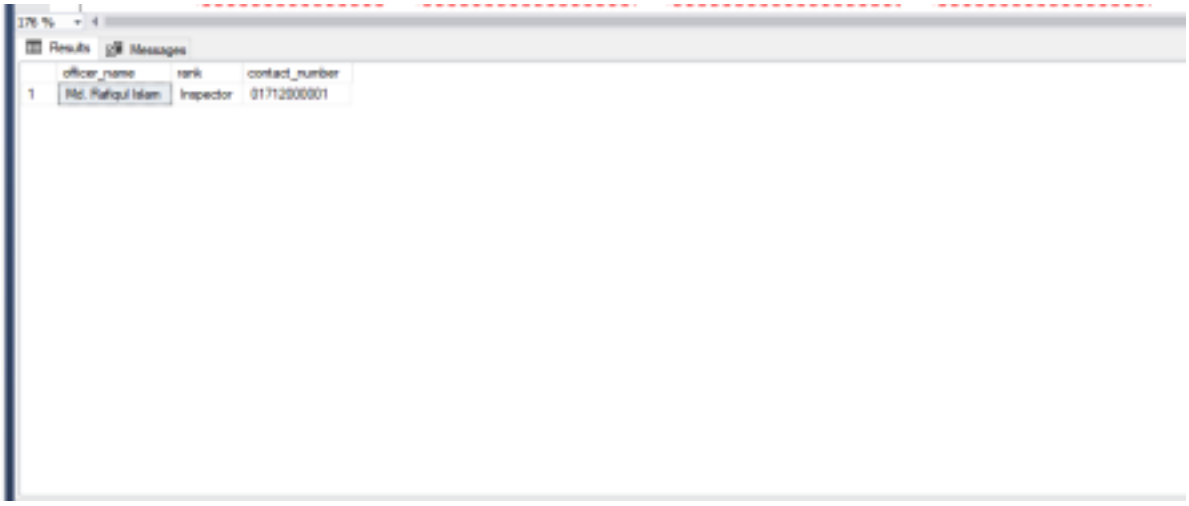
String Operation

```
--8.Find suspects who have not been found
guilty.

SELECT s.suspect_id, s.name
FROM Suspect s, Suspect_Hearing sh, Hearing h
WHERE s.suspect_id = sh.suspect_id
 AND sh.hearing_id = h.hearing_id
 AND s.suspect_id NOT IN (
 SELECT sh.suspect_id
 FROM Suspect_Hearing sh, Hearing h
 WHERE sh.hearing_id = h.hearing_id
 AND h.verdict LIKE '%Guilty%'
 );
```

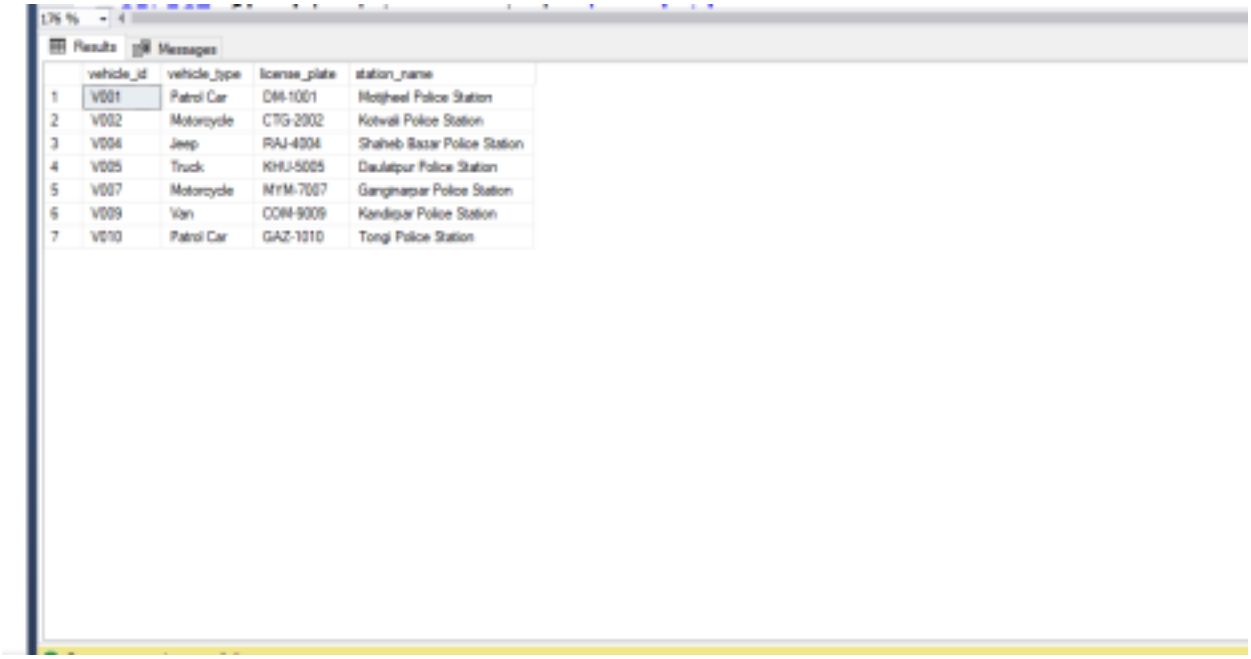


	suspect_id	name
1	S002	Bashir Ahmed
2	S005	Jalil Uddin
3	S008	Jahangir Hossain
4	S010	Rakib Hossain

```
-- 9. Retrieve all police officers from "Dhaka,
Bangladesh".
SELECT officer_name, rank, contact_number
FROM Police_Officer
WHERE station_id IN (
 SELECT station_id
 FROM Police_Station
 WHERE address LIKE '%Dhaka%'
);
```



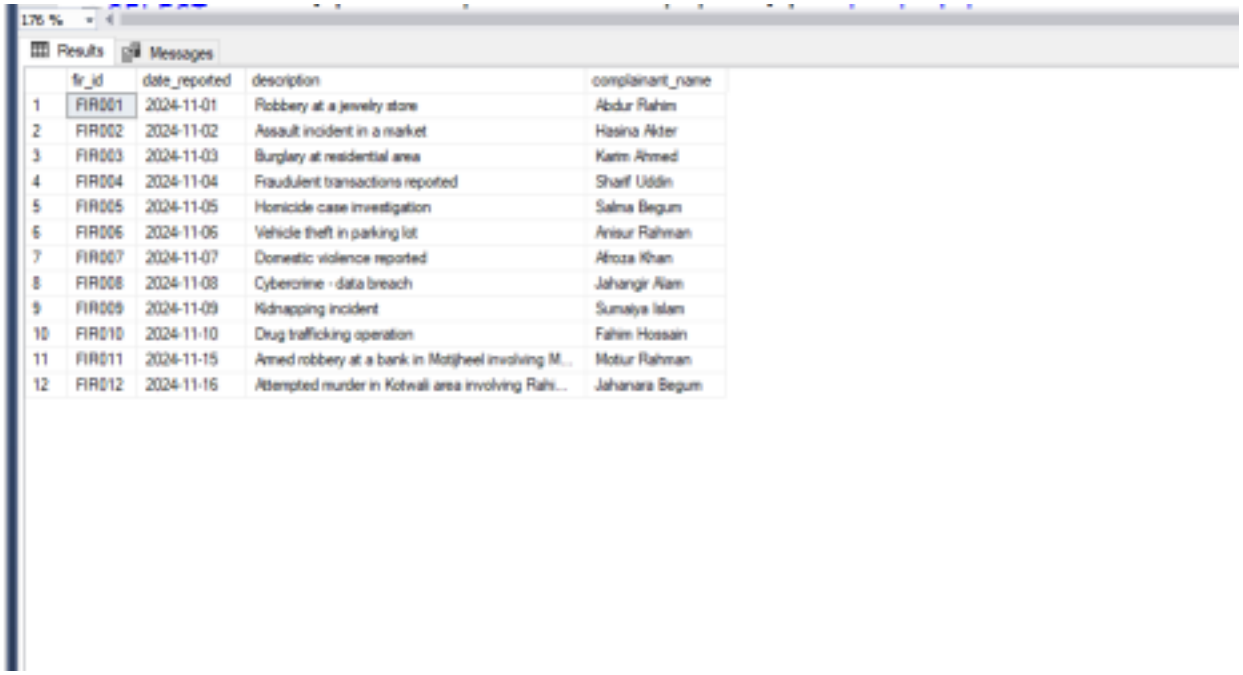

```
-- 10. Find all available vehicles and their station names

SELECT sv.vehicle_id, sv.vehicle_type, sv.license_plate, ps.station_name
FROM Station_vehicle sv, Police_Station ps WHERE sv.station_id = ps.station_id AND sv.availability_status = 'Available';
```



vehicle_id	vehicle_type	license_plate	station_name
V001	Patrol Car	DM-1001	Motijheel Police Station
V002	Motorcycle	CTG-2002	Kotwali Police Station
V004	Jeep	RAJ-4004	Shaheb Bazar Police Station
V005	Truck	KHU-5005	Daulatpur Police Station
V007	Motorcycle	MYM-7007	Gangnarpar Police Station
V009	Van	COM-9009	Kandirpar Police Station
V010	Patrol Car	GAZ-1010	Tongi Police Station

Normal different queries

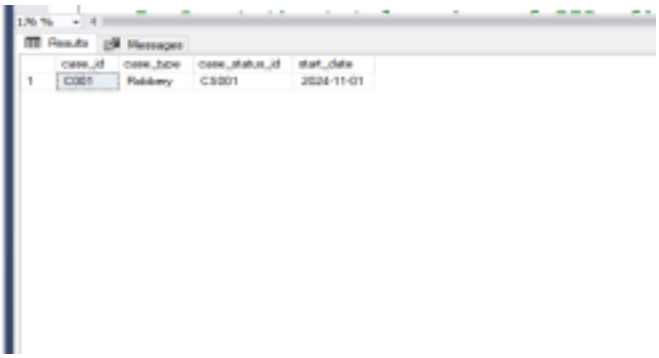
```sql
-- 11. List all FIRs along with the name of the complainant.
SELECT fir_id, date_reported, description, (SELECT name
 FROM Complainant
   WHERE Complainant.complainant_id = FIR.complainant_id) AS complainant_name
FROM FIR;
```



Results | Messages

	fir_id	date_reported	description	complainant_name
1	FIR001	2024-11-01	Robbery at a jewelry store	Abdur Rahim
2	FIR002	2024-11-02	Assault incident in a market	Hasina Akter
3	FIR003	2024-11-03	Burglary at residential area	Karim Ahmed
4	FIR004	2024-11-04	Fraudulent transactions reported	Sharif Uddin
5	FIR005	2024-11-05	Homicide case investigation	Salma Begum
6	FIR006	2024-11-06	Vehicle theft in parking lot	Anisur Rahman
7	FIR007	2024-11-07	Domestic violence reported	Afroza Khan
8	FIR008	2024-11-08	Cybercrime - data breach	Jahangir Alam
9	FIR009	2024-11-09	Kidnapping incident	Sumaiya Islam
10	FIR010	2024-11-10	Drug trafficking operation	Fahim Hossain
11	FIR011	2024-11-15	Armed robbery at a bank in Motijheel involving M...	Motiur Rahman
12	FIR012	2024-11-16	Attempted murder in Kotwali area involving Rahi...	Jahanara Begum

```sql
-- 12. Retrieve the details of all cases involving a specific victim ("Rahim Uddin").

SELECT c.case_id, c.case_type, c.case_status_id, c.start_date
FROM Case_ c, Case_Victim cv, Victim v
WHERE c.case_id = cv.case_id
 AND cv.victim_id = v.victim_id
 AND v.name = 'Rahim Uddin';
```



```sql
-- 13. Count the total number of FIRs filed by each complainant.
SELECT complainant_id,
  (SELECT name FROM Complainant WHERE complainant_id = FIR.complainant_id) AS complainant_name,
 COUNT(*) AS total_firs
FROM FIR
GROUP BY complainant_id;
```

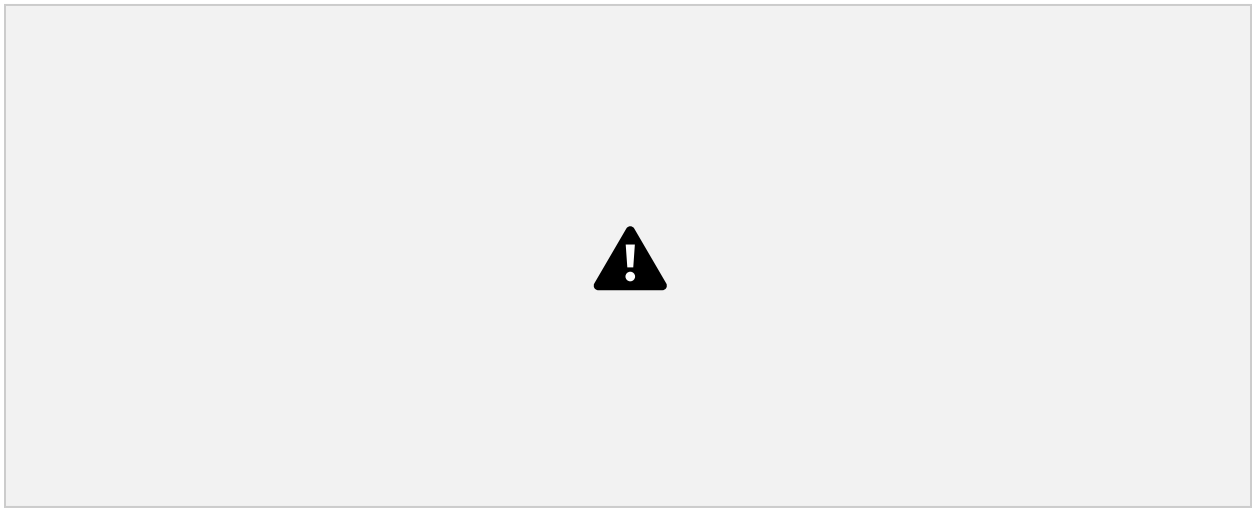
176 %

Results | Messages

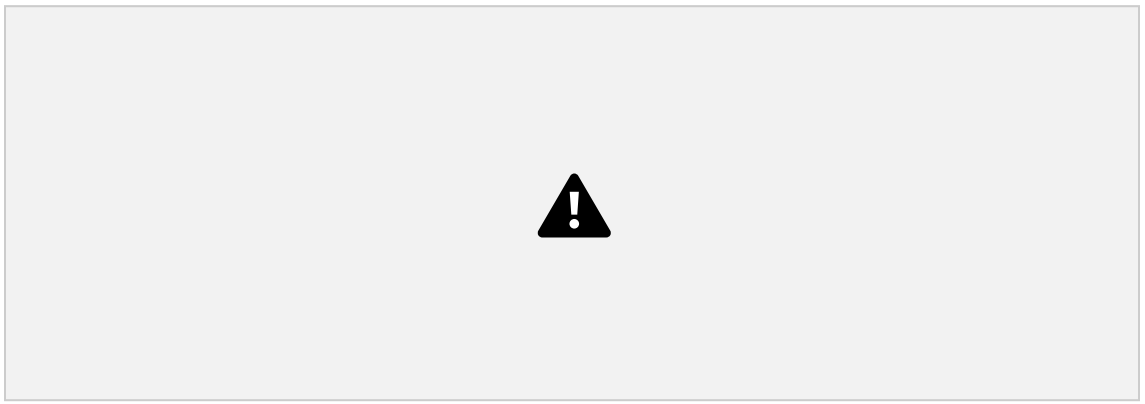
	complainant_id	complainant_name	total_firs
1	C001	Abdur Rahim	1
2	C002	Hasina Akter	1
3	C003	Karim Ahmed	1
4	C004	Shafi Uddin	1
5	C005	Selina Begum	1
6	C006	Anisur Rahman	1
7	C007	Afroza Khan	1
8	C008	Jahangir Alam	1
9	C009	Sumaiya Islam	1
10	C010	Fahim Hossain	1
11	C011	Motiur Rahman	1
12	C012	Jahanara Begum	1

```sql
-- 14. Find the list of cases assigned to an officer named "Shamim Ahmed".
```

```sql
SELECT c.case_id, c.case_type, c.start_date
FROM Case_ c, Case_Police_Officer cpo, Police_Officer po
WHERE c.case_id = cpo.case_id
 AND cpo.officer_id = po.officer_id
 AND po.officer_name = 'Sharmin Akter';
```



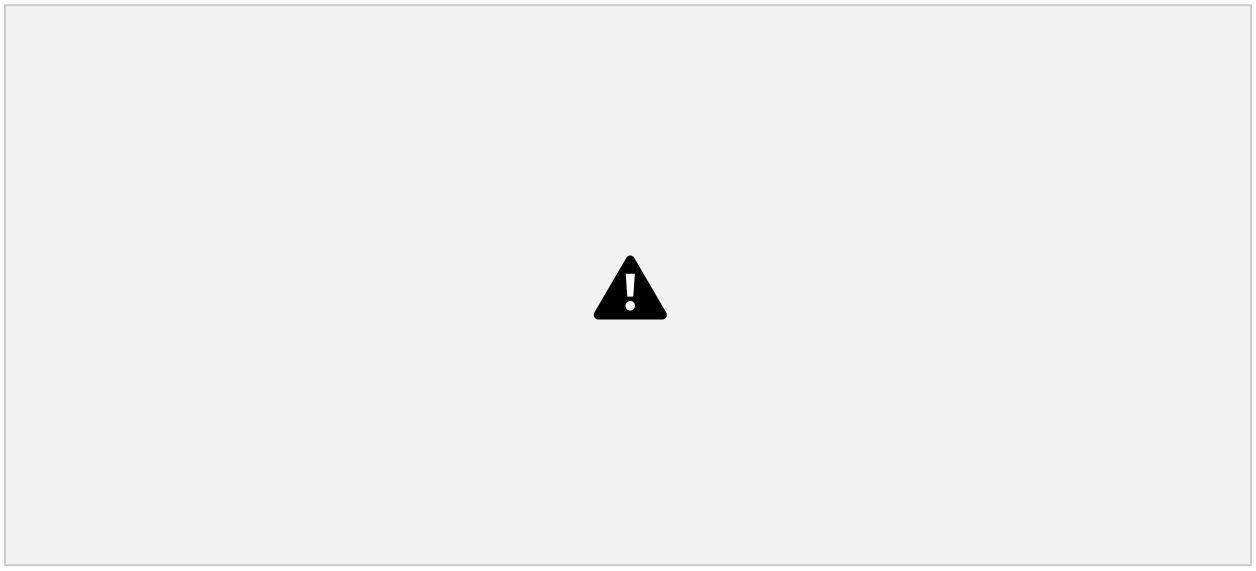
```sql
-- 15. find the police officer names
--who have been assigned to a robbery related case

SELECT
police_officer.officer_name,Case_.case_type   FROM
police_officer,  case_,  Case_Police_Officer  WHERE
case_.case_type = 'robbery'
AND        Case_Police_Officer.case_id        =
case_.case_id                                 AND
Case_Police_Officer.officer_id =
police_officer.officer_id;
```



Views For The Database

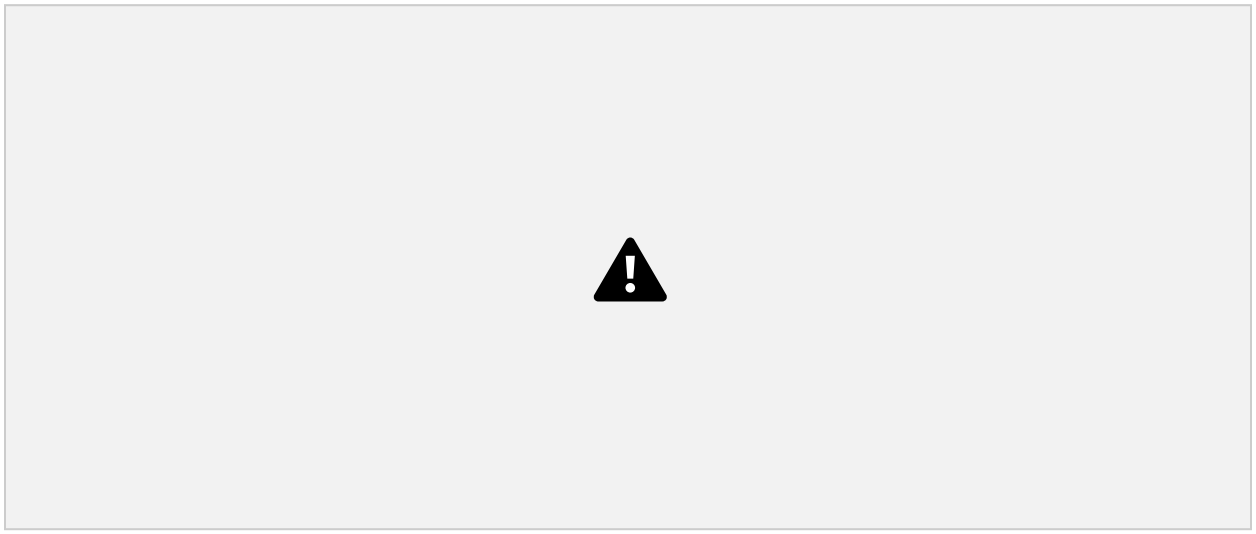
```sql
--View  1  :  FIRs  with  Complainant
Details CREATE VIEW FIRWithComplainants
```

```
AS
SELECT
 fir.fir_id,
 fir.date_reported,
 fir.description,
 c.name AS complainant_name
FROM
 FIR fir,
 Complainant c
WHERE
 fir.complainant_id = c.complainant_id;
```



```
--View 2 : Available Vehicles with Station
    Details CREATE VIEW AvailableVehicles AS
SELECT
 sv.vehicle_id,
 sv.vehicle_type,
 sv.license_plate,
 ps.station_name
FROM
 Station_Vehicle sv,
 Police_Station ps
WHERE
 sv.station_id = ps.station_id
```

```
    AND     sv.availability_status     =     'Available';
```



How Crime Investigation Database Management System addresses Complex Engineering Problem (CEP) according to Washington Accord:

Knowledge Profile K3,K5,K6

Problem Solving P1,P3,P7

Activities A1,A5

How Ks are addressed through the project and mapping among them ks, COs and POs :

Ks	**Attribute**	**How Ks are addressed through the project**	**COs**	**POs**
K3	Engineering Fundamentals	Relational Database Desi0gn , Data Integrity and Normalization **(1NF,2NF,3NF)**	CO2,CO3,CO4	1(a),2(b)

K5	Engineering Design	Relational Database Architecture (RDBMS) , Design Decisions **:** Primary and Foreign Keys , ACID (Atomicity, Consistency, Isolation, Durability) Compliance, Support for Complex Queries , Data Scalability , Indexing	CO3,CO5	1(a),3(c)
K6	Engineering Practice (Technology)	SQL for Data Manipulation and Queries , Microsoft SQL Server Management Studio, RDBMS Built-In Transaction Management, ERD (Entity-Relationship Diagram) Tools like Lucidchart or dbdiagram.io	CO1,CO2,CO5	5(e),3(c)

How Ps are addressed through the project and mapping among them Ps, COs and POs :

Ps	Attribute	How Ps are addressed through the project	COs	POs
P1	Depth of Knowledge Required	The work requires a study of database management principles, particularly **relational database design** (K3) and **normalization techniques**. Designing complex relationships between tables like FIRs, suspects, officers, and evidence requires theoretical knowledge of **database normalization** and **query optimization** (K5). Additionally, SQL queries and indexing strategies for large-scale data retrieval were studied (K6).	CO1, CO2, CO3	1(a),5(e), 2(b)

P3	Depth of Analysis Required	The work required an in-depth analysis of the database schema to handle complex relationships among entities such as FIRs, evidence, suspects, and officers. Advanced SQL queries and optimizations were analyzed to efficiently retrieve data for crime investigation reports.	CO2,CO5	2(b),3(c)
P7	Interdependence	**Sub-problems and Dependencies**: For example, assigning police officers to cases involves both case data and officer availability, and tracking evidence requires synchronization between case files, police officers, and the legal process. The system must handle these dependencies efficiently, demonstrating high interdependence between different data entities.	CO3,CO5	3(c),5(e)

How As are addressed through the project and mapping among them As, COs and POs :

As	Attribute	How As are addressed through the project	COs	POs
A1	Range of Resources Involved	The project involves a range of resources including **human resources** (Police Officers, Victims, and suspects), **hardware resources** (PC), **software resources** (database management system (Microsoft SQL Server) and **data resources** (crime reports, evidence data, suspect profiles, etc.). Efficient resource management and coordination were essential for maintaining system integrity and security.	CO1, CO3 ,CO5	5(e), 2(b), 3(c)

A5	Familiarity	The project involves handling and managing complex and rarely encountered scenarios in crime investigations**.** Managing diverse and unstructured data such as **evidence records**, **criminal profiles**, and witness statements. Designing a database capable of accommodating **dynamic workflows**, such asupdates from Court Hearings or evolving investigation requirements. Implementing advanced querying mechanisms to find information related to a case or FIR	CO3, CO5, CO6	2(b), 3(c), 6(f)