University
Mohammed VI
Polytechnic

College of Computing

Deliverable # 4: Normalization and SQL Implementation

Data Management Course

UM6P College of Computing

Professor: Karima Echihabi **Program:** Computer Engineering

Session: Fall 2025

Team Information

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Repository Link	https://github.com/therealzaini/DMG_LAB2_LEO_FL_BERNABEU

1 Normalization:

All the queries are subject to BCNF, since we have trivial functional dependencies in every relation, *ie.* every primary key determines every column.

2 Queries:

Query 1:

```sql
SELECT IID, CIN, FullName, Birth, Sex, BloodGroup, Phone
FROM Patient
ORDER BY FullName;
```

IID	CIN	FullName	Birth	Sex	BloodGroup	Phone
4	RA901234	Amina El Fassi	1985-01-30	F	AB +	0645678901
2	KA789012	Fatima Ezzahra Belhaj	1992-07-12	F	O +	0623456789
5	TA567890	Karim Alaoui	1990-09-15	M	A -	0656789012
3	NA345678	Mehdi Benjelloun	1975-11-08	M	B +	0634567890
1	BE123456	Youssef El Amrani	1988-03-25	M	A +	0612345678
NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 1: Query 1

Query 2:

```sql
SELECT DISTINCT I.Type
FROM Insurance I;
```

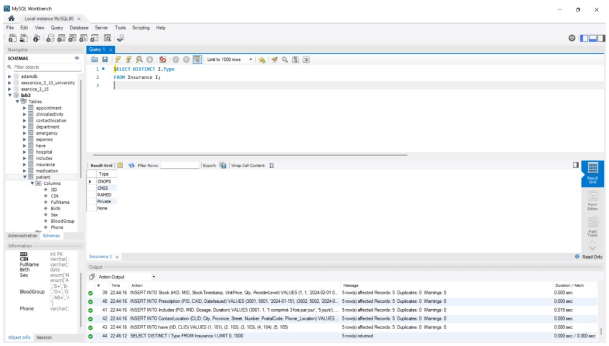

Figure 2: Query 2

Query 3:

```sql
select W.staff_id
from work_in W
where W.DEP_ID in (select D.DEP_id
                                    from hospital H,department D
                                    where H.HID=D.HID And
                                H.city="rabat")
```

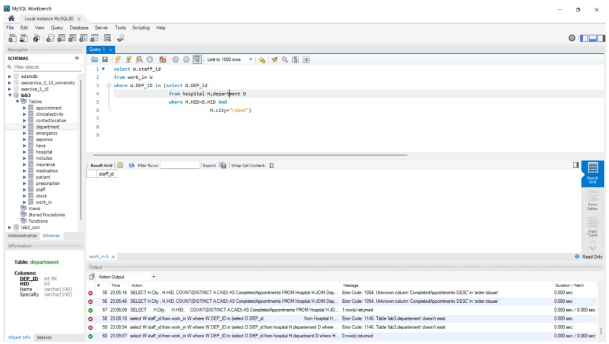

Figure 3: Query 3

Query 4:

```sql
SELECT a.CAID, a.Reason, a.Status, ca.Date, ca.Time,
       p.FullName AS PatientName, s.Name AS StaffName, d.Name AS DepartmentName
FROM Appointment a
JOIN ClinicalActivity ca ON a.CAID = ca.CAID
JOIN Patient p ON ca.IID = p.IID
JOIN Staff s ON ca.STAFF_ID = s.STAFF_ID
JOIN Department d ON ca.DEP_ID = d.DEP_ID
WHERE a.Status = 'Scheduled'
  AND ca.Date BETWEEN CURDATE() AND DATE_ADD(CURDATE(), INTERVAL 7 DAY)
ORDER BY ca.Date, ca.Time;
```

Query 5:

```sql
SELECT C.DEP_ID , COUNT(A.CAID)
FROM Appointment A
JOIN ClinicalActivity C ON A.CAID = C.CAID
GROUP BY C.DEP_ID;
```

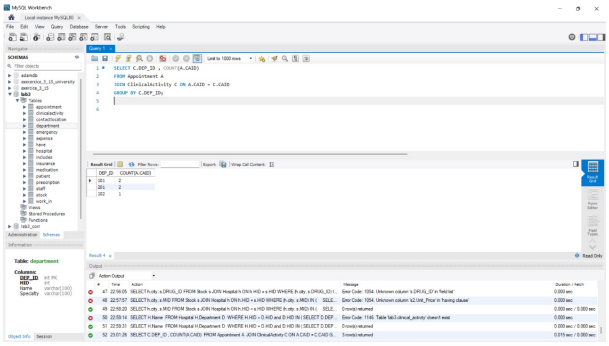

Figure 4: Query 5

Query 6:

```sql
SELECT
    H.HID,
    H.Name AS HospitalName,
    AVG(S.UnitPrice) AS AvgUnitPrice
FROM Stock S
JOIN Hospital H ON S.HID = H.HID
GROUP BY H.HID, H.Name;
```

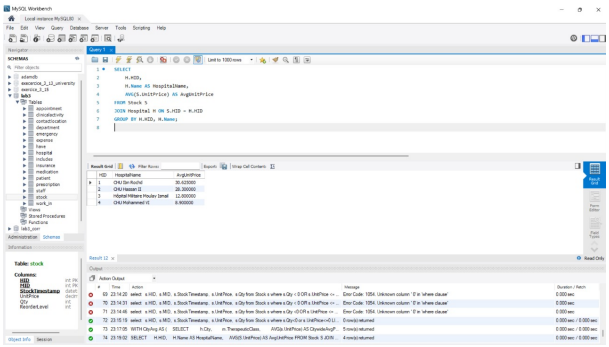

Figure 5: Query 6

Query 7:

```sql
SELECT H.Name
FROM Hospital H,Department D
WHERE H.HID = D.HID and D.HID IN ( SELECT D.DEP_ID
                                   FROM Department D, ClinicalActivity C, Emergency E
                                   WHERE D.DEP_ID = C.DEP_ID and C.CAID = E.CAID
                                   GROUP BY D.DEP_ID
                                   HAVING COUNT(E.CAID)>20);
```

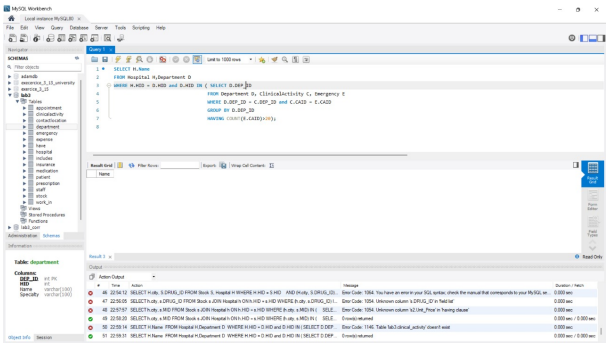

Figure 6: Query 7

Query 8:

```sql
select M.MID,M.name
```

```
from Medication M,stock S
where S.MID=M.MID AND
M.therapeuticClass = "Antibiotic" AND
S.unitprice <200
```

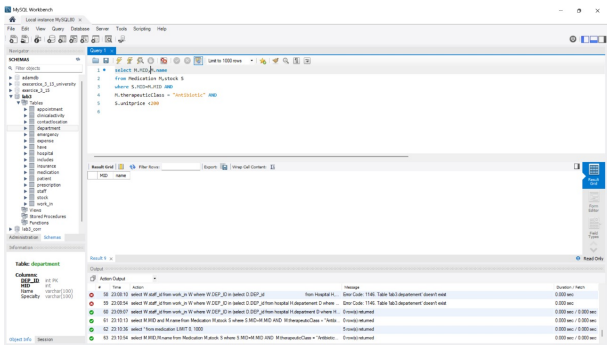

Figure 7: Query 8

Query 9:

```
WITH RankedMedications AS (
    SELECT
        h.HID,
        h.Name AS HospitalName,
        m.Drug_ID,
        m.Name AS MedicationName,
        m.Class,
        s.UnitPrice,
        ROW_NUMBER() OVER (PARTITION BY h.HID ORDER BY s.UnitPrice DESC) as price_rank
    FROM Hospital h
    JOIN Stock s ON h.HID = s.HID
    JOIN Medication m ON s.Drug_ID = m.Drug_ID
    WHERE s.UnitPrice IS NOT NULL
)
SELECT
    HID,
    HospitalName,
    Drug_ID,
    MedicationName,
    Class,
    UnitPrice
FROM RankedMedications
WHERE price_rank <= 3
ORDER BY HID, price_rank;
```

Query 10:

```
SELECT
    D.DEP_ID,
```

```
    D.Name AS DepartmentName,
    SUM(A.Status = 'Scheduled') AS ScheduledCount,
    SUM(A.Status = 'Completed') AS CompletedCount,
    SUM(A.Status = 'Cancelled') AS CancelledCount
FROM Department D
LEFT JOIN ClinicalActivity CA ON D.DEP_ID = CA.DEP_ID
LEFT JOIN Appointment A ON CA.CAID = A.CAID
GROUP BY D.DEP_ID, D.Name;
```

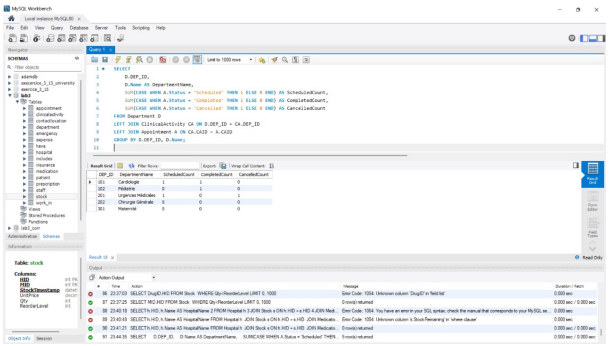

Figure 8: Query 10

Query 11:

```
SELECT P.IID, P.FullName
FROM Patient P
WHERE P.IID NOT IN (
SELECT CA.IID
FROM ClinicalActivity CA
JOIN Appointment A ON CA.CAID = A.CAID
WHERE A.Status = 'Scheduled'
AND CA.Date BETWEEN CURDATE() AND DATE_ADD(CURDATE(), INTERVAL 30
DAY)
);
```

IID	FullName
1	Youssef El Amrani
2	Fatima Ezzahra Belhaj
3	Mehdi Benjelloun
4	Amina El Fassi
5	Karim Alaoui
NULL	NULL

Figure 9: Query 11

Query 12:

```sql
SELECT
    S.STAFF_ID,
    COUNT(A.CAID) AS Total_Appts,
/* Here we are going to calculate the percentage share of
appointments in their hospital so we will need to compute the
total appoitments of the hospital */
    100 * COUNT(A.CAID) /
    (
        SELECT COUNT(A2.CAID)
        FROM Appointment A2
        JOIN ClinicalActivity C2 ON A2.CAID = C2.CAID
        JOIN Department D2 ON C2.DEP_ID = D2.DEP_ID
        WHERE D2.HID =
        (
        /* Find the hospital of that staff member */
            SELECT D3.HID
            FROM ClinicalActivity C3
            JOIN Department D3 ON C3.DEP_ID = D3.DEP_ID
            WHERE C3.STAFF_ID = S.STAFF_ID
        )
    ) AS PercentageShare

FROM Staff S
JOIN ClinicalActivity C ON C.STAFF_ID = S.STAFF_ID
JOIN Appointment A ON A.CAID = C.CAID
GROUP BY S.STAFF_ID;
```

Query 13:

```sql
SELECT DrugID,HID
FROM Stock
WHERE Qty<ReorderLevel;
```

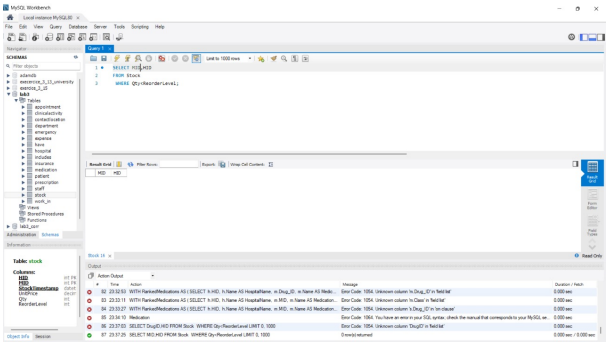

Figure 10: Query 13

Query 14:

```sql
SELECT h.HID, h.Name AS HospitalName
FROM Hospital h
 JOIN Stock s ON h.HID = s.HID
 JOIN Medication m ON s.MID = m.MID
 WHERE m.TherapeuticClass = 'Antibiotic'
 AND s.qty > 0
 GROUP BY h.HID, h.Name
 HAVING COUNT(DISTINCT m.MID) = (
 SELECT COUNT(DISTINCT MID)
 FROM Medication
 WHERE TherapeuticClass = 'Antibiotic'
 );
```

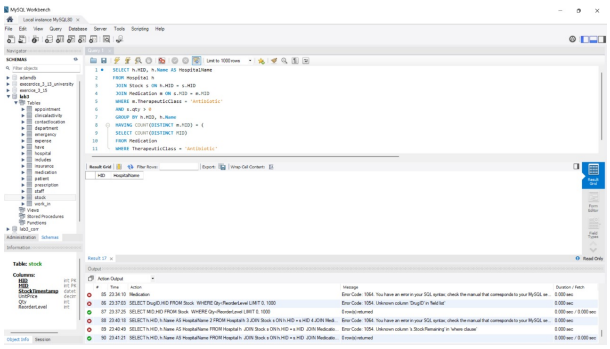

Figure 11: Query 14

Query 15:

```sql
WITH CityAvg AS (
    SELECT
        h.City,
        m.TherapeuticClass,
        AVG(s.UnitPrice) AS CitywideAvgPrice
    FROM Stock s
    JOIN Hospital h ON s.HID = h.HID
    JOIN Medication m ON s.MID = m.MID
    GROUP BY h.City, m.TherapeuticClass
),
HospitalAvg AS (
    SELECT
        h.HID,
        h.Name AS HospitalName,
        h.City,
        m.TherapeuticClass,
        AVG(s.UnitPrice) AS HospitalAvgPrice
    FROM Stock s
    JOIN Hospital h ON s.HID = h.HID
    JOIN Medication m ON s.MID = m.MID
    GROUP BY h.HID, h.Name, h.City, m.TherapeuticClass
)
```

```sql
SELECT
    ha.HospitalName,
    ha.City,
    ha.TherapeuticClass,
    ha.HospitalAvgPrice,
    CASE
        WHEN ha.HospitalAvgPrice > ca.CitywideAvgPrice THEN 1
        ELSE 0
    END AS AboveCitywideAvg
FROM HospitalAvg ha
JOIN CityAvg ca
    ON ha.City = ca.City
   AND ha.TherapeuticClass = ca.TherapeuticClass
ORDER BY ha.HospitalName, ha.TherapeuticClass;
```

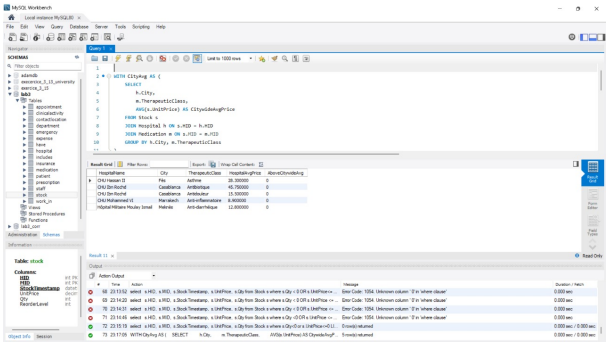

Figure 12: Query 15

Query 16:

```sql
SELECT
P.IID,
P.FullName,
MIN(CA.Date) AS NextAppointmentDate
FROM Patient P
LEFT JOIN ClinicalActivity CA ON P.IID = CA.IID
LEFT JOIN Appointment A ON CA.CAID = A.CAID
WHERE A.Status = 'Scheduled'
AND CA.Date >= CURDATE()
GROUP BY P.IID, P.FullName;
```

	IID	FullName	NextAppointmentDate

Figure 13: Query 16

Query 17:

```sql
SELECT
```

```
    P.IID,
    P.FullName
FROM Patient P
JOIN ClinicalActivity CA ON P.IID = CA.IID
JOIN Emergency E ON CA.CAID = E.CAID
GROUP BY P.IID, P.FullName
HAVING
    COUNT(*) >= 2
    AND MAX(CA.Date) >= CURDATE() - INTERVAL 14 DAY;
```

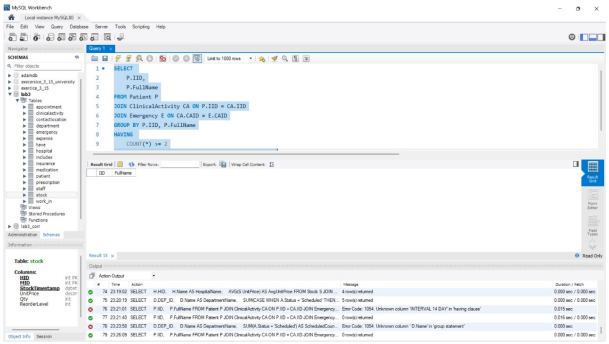

Figure 14: Query 17

Query 18:

```
SELECT H.City,H.HID,COUNT(DISTINCT A.CAID) AS CompletedAppointments
FROM Hospital H
JOIN Department D ON D.HID = H.HID
JOIN ClinicalActivity C ON C.DEP_ID = D.DEP_ID
JOIN Appointment A ON A.CAID = C.CAID
WHERE A.Status = 'Completed'
  AND C.Date < '2025-08-16'
GROUP BY H.City, H.HID
ORDER BY H.City, CompletedAppointments DESC;
```

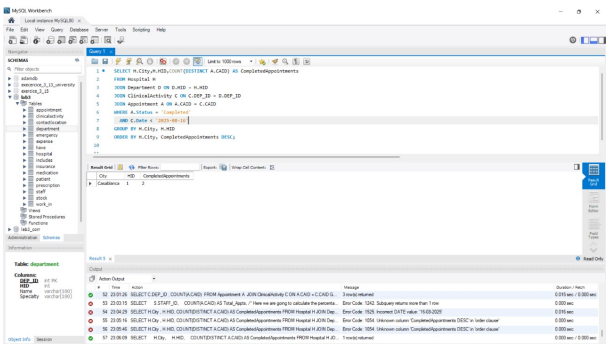

Figure 15: Query 18

Query 19:

```sql
SELECT h.city, s.MID
FROM Stock s
JOIN Hospital h ON h.HID = s.HID
WHERE (h.city, s.MID) IN (
    SELECT h2.city, s2.MID
    FROM Stock s2
    JOIN Hospital h2 ON h2.HID = s2.HID
    GROUP BY h2.city, s2.MID
    HAVING (MAX(s2.UnitPrice) - MIN(s2.UnitPrice)) / MIN(s2.UnitPrice) > 0.3
);
```

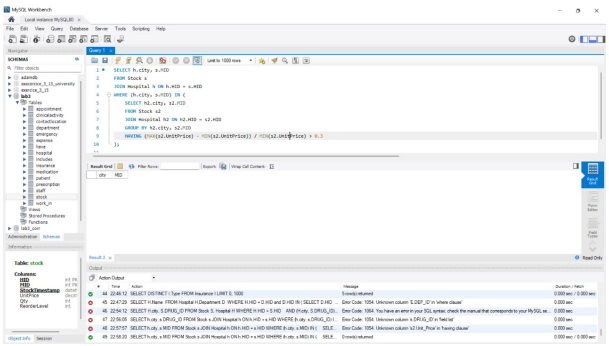

Figure 16: Query 19

Query 20:

```sql
select
 s.HID,
 s.MID,
 s.StockTimestamp,
 s.UnitPrice,
 s.Qty
from Stock s
where s.Qty<0 or s.UnitPrice<=0;
```

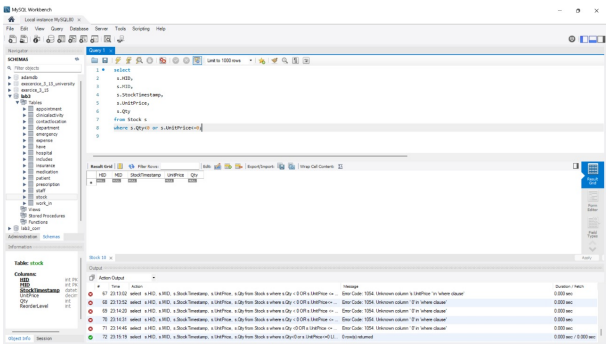

Figure 17: Query 20

3 DDL:

DDL 1:

```sql
CREATE TABLE Patient (
  IID INT PRIMARY KEY,
  CIN VARCHAR(10) UNIQUE NOT NULL,
  FullName VARCHAR(100) NOT NULL,
  Birth DATE,
  Sex ENUM('M', 'F') NOT NULL,
  BloodGroup ENUM('A+', 'A-', 'B+', 'B-', 'O+', 'O-', 'AB+', 'AB-'),
  Phone VARCHAR(15)
);

CREATE TABLE Hospital (
  HID INT PRIMARY KEY,
  Name VARCHAR(100) NOT NULL,
  City VARCHAR(50) NOT NULL,
  Region VARCHAR(50)
);

CREATE TABLE Department (
  DEP_ID INT PRIMARY KEY,
  HID INT,
  Name VARCHAR(100) NOT NULL,
  Specialty VARCHAR(100),
  FOREIGN KEY (HID) REFERENCES Hospital(HID)
);

CREATE TABLE Staff (
  STAFF_ID INT PRIMARY KEY,
  FullName VARCHAR(100) NOT NULL,
  Status ENUM('Active', 'Retired') DEFAULT 'Active'
);

CREATE TABLE Work_in (
  STAFF_ID INT,
  Dep_ID INT,
  PRIMARY KEY (STAFF_ID, Dep_ID),
  FOREIGN KEY (STAFF_ID) REFERENCES Staff(STAFF_ID),
  FOREIGN KEY (Dep_ID) REFERENCES Department(DEP_ID)
);

CREATE TABLE ClinicalActivity (
  CAID INT PRIMARY KEY,
  IID INT NOT NULL,
  STAFF_ID INT NOT NULL,
  DEP_ID INT NOT NULL,
  Date DATE NOT NULL,
  Time TIME,
  FOREIGN KEY (IID) REFERENCES Patient(IID),
```

```sql
  FOREIGN KEY (STAFF_ID) REFERENCES Staff(STAFF_ID),
  FOREIGN KEY (DEP_ID) REFERENCES Department(DEP_ID)
);

CREATE TABLE Appointment (
  CAID INT PRIMARY KEY,
  Reason VARCHAR(100),
  Status ENUM('Scheduled', 'Completed', 'Cancelled') DEFAULT 'Scheduled',
  FOREIGN KEY (CAID) REFERENCES ClinicalActivity(CAID)
);

CREATE TABLE Emergency (
  CAID INT PRIMARY KEY,
  TriageLevel INT CHECK (TriageLevel BETWEEN 1 AND 5),
  Outcome ENUM('Discharged', 'Admitted', 'Transferred', 'Deceased'),
  FOREIGN KEY (CAID) REFERENCES ClinicalActivity(CAID)
);

CREATE TABLE Insurance (
  InsID INT PRIMARY KEY,
  Type ENUM('CNOPS', 'CNSS', 'RAMED', 'Private', 'None') NOT NULL
);

CREATE TABLE Expense (
  ExpID INT PRIMARY KEY,
  InsID INT,
  CAID INT UNIQUE NOT NULL,
  Total DECIMAL(10,2) NOT NULL CHECK (Total >= 0),
  FOREIGN KEY (InsID) REFERENCES Insurance(InsID),
  FOREIGN KEY (CAID) REFERENCES ClinicalActivity(CAID)
);

CREATE TABLE Medication (
  MID INT PRIMARY KEY,
  Name VARCHAR(100) NOT NULL,
  Form VARCHAR(50),
  Strength VARCHAR(50),
  ActiveIngredient VARCHAR(100),
  TherapeuticClass VARCHAR(100),
  Manufacturer VARCHAR(100)
);

CREATE TABLE Stock (
  HID INT,
  MID INT,
  StockTimestamp DATETIME DEFAULT CURRENT_TIMESTAMP,
  UnitPrice DECIMAL(10,2) CHECK (UnitPrice >= 0),
  Qty INT DEFAULT 0 CHECK (Qty >= 0),
  ReorderLevel INT DEFAULT 10 CHECK (ReorderLevel >= 0),
  PRIMARY KEY (HID, MID, StockTimestamp),
  FOREIGN KEY (HID) REFERENCES Hospital(HID),
  FOREIGN KEY (MID) REFERENCES Medication(MID)
```

```
);

CREATE TABLE Prescription (
  PID INT PRIMARY KEY,
  CAID INT UNIQUE NOT NULL,
  DateIssued DATE NOT NULL,
  FOREIGN KEY (CAID) REFERENCES ClinicalActivity(CAID)
);

CREATE TABLE Includes (
  PID INT,
  MID INT,
  Dosage VARCHAR(100),
  Duration VARCHAR(50),
  PRIMARY KEY (PID, MID),
  FOREIGN KEY (PID) REFERENCES Prescription(PID),
  FOREIGN KEY (MID) REFERENCES Medication(MID)
);

CREATE TABLE ContactLocation (
  CLID INT PRIMARY KEY,
  City VARCHAR(50),
  Province VARCHAR(50),
  Street VARCHAR(100),
  Number VARCHAR(10),
  PostalCode VARCHAR(10),
  Phone_Location VARCHAR(15)
);

CREATE TABLE have (
  IID INT,
  CLID INT,
  PRIMARY KEY (IID, CLID),
  FOREIGN KEY (IID) REFERENCES Patient(IID),
  FOREIGN KEY (CLID) REFERENCES ContactLocation(CLID)
);
```

DDL 3:

```
ALTER TABLE Patient
ADD Nationality VARCHAR(50);
```

4 DML queries:

DML 1:

```
-- Patient Table
INSERT INTO Patient (IID, CIN, FullName, Birth, Sex, BloodGroup,
```

```
Phone) VALUES
(1, 'BE123456', 'Youssef El Amrani', '1988-03-25', 'M', 'A+',
'0612345678'),
(2, 'KA789012', 'Fatima Ezzahra Belhaj', '1992-07-12', 'F', 'O+',
'0623456789'),
(3, 'NA345678', 'Mehdi Benjelloun', '1975-11-08', 'M', 'B+',
'0634567890'),
(4, 'RA901234', 'Amina El Fassi', '1985-01-30', 'F', 'AB+',
'0645678901'),
(5, 'TA567890', 'Karim Alaoui', '1990-09-15', 'M', 'A-',
'0656789012');

-- Hospital Table
INSERT INTO Hospital (HID, Name, City, Region) VALUES
(1, 'CHU Ibn Rochd', 'Casablanca', 'Casablanca-Settat'),
(2, 'CHU Hassan II', 'Fès', 'Fès-Meknès'),
(3, 'Hôpital Militaire Moulay Ismail', 'Meknès', 'Fès-Meknès'),
(4, 'CHU Mohammed VI', 'Marrakech', 'Marrakech-Safi'),
(5, 'Hôpital Al Farabi', 'Oujda', 'Oriental');

-- Department Table
INSERT INTO Department (DEP_ID, HID, Name, Specialty) VALUES
(101, 1, 'Cardiologie', 'Maladies cardiovasculaires'),
(102, 1, 'Pédiatrie', 'Soins aux enfants'),
(201, 2, 'Urgences Médicales', 'Médecine d''urgence'),
(202, 3, 'Chirurgie Générale', 'Chirurgie générale'),
(301, 4, 'Maternité', 'Gynécologie-obstétrique');

-- Staff Table
INSERT INTO Staff (STAFF_ID, FullName, Status) VALUES
(1001, 'Dr. Leila Berrada', 'Active'),
(1002, 'Dr. Ahmed Sefrioui', 'Active'),
(1003, 'Dr. Samira El Moutawakil', 'Active'),
(1004, 'Dr. Hassan Tazi', 'Retired'),
(1005, 'Dr. Nadia Bennis', 'Active');

-- Work_in Table
INSERT INTO Work_in (STAFF_ID, Dep_ID) VALUES
(1001, 101),
(1002, 201),
(1003, 102),
(1004, 202),
(1005, 301);

-- ClinicalActivity Table
INSERT INTO ClinicalActivity (CAID, IID, STAFF_ID, DEP_ID, Date, Time)
VALUES
(5001, 1, 1001, 101, '2024-01-15', '09:30:00'),
(5002, 2, 1002, 201, '2024-01-16', '14:15:00'),
(5003, 3, 1003, 102, '2024-01-17', '10:00:00'),
(5004, 4, 1001, 101, '2024-01-18', '11:45:00'),
(5005, 5, 1002, 201, '2024-01-19', '16:20:00');
```

```sql

-- Appointment Table
INSERT INTO Appointment (CAID, Reason, Status) VALUES
(5001, 'Consultation cardiaque', 'Completed'),
(5002, 'Contrôle annuel', 'Scheduled'),
(5003, 'Vaccination enfant', 'Completed'),
(5004, 'Suivi traitement', 'Scheduled'),
(5005, 'Examen pré-opératoire', 'Cancelled');

-- Emergency Table
INSERT INTO Emergency (CAID, TriageLevel, Outcome) VALUES
(5002, 2, 'Discharged'),
(5005, 1, 'Admitted'),
(5006, 3, 'Transferred'),
(5007, 4, 'Discharged'),
(5008, 1, 'Admitted');

-- Insurance Table
INSERT INTO Insurance (InsID, Type) VALUES
(1, 'CNOPS'),
(2, 'CNSS'),
(3, 'RAMED'),
(4, 'Private'),
(5, 'None');

-- Expense Table
INSERT INTO Expense (ExpID, InsID, CAID, Total) VALUES
(7001, 1, 5001, 450.00),
(7002, 2, 5002, 1200.50),
(7003, 3, 5003, 300.00),
(7004, 4, 5004, 850.75),
(7005, 5, 5005, 1500.00);

-- Medication Table
INSERT INTO Medication (MID, Name, Form, Strength, ActiveIngredient,
TherapeuticClass, Manufacturer) VALUES
(1, 'Doliprane', 'Comprimé', '1000mg', 'Paracétamol', 'Antidouleur',
'Sanofi Maroc'),
(2, 'Amoxicilline', 'Gélule', '500mg', 'Amoxicilline', 'Antibiotique',
'Sothema'),
(3, 'Ventoline', 'Spray', '100mcg', 'Salbutamol', 'Asthme', 'GSK
Maroc'),
(4, 'Imodium', 'Comprimé', '2mg', 'Lopéramide', 'Anti-diarrhéique',
'Janssen Maroc'),
(5, 'Aspégic', 'Sachet', '500mg', 'Aspirine', 'Anti-inflammatoire',
'Sanofi Maroc');

-- Stock Table
INSERT INTO Stock (HID, MID, StockTimestamp, UnitPrice, Qty,
ReorderLevel) VALUES
(1, 1, '2024-02-01 09:00:00', 15.50, 200, 50),
(1, 2, '2024-02-01 10:15:00', 45.75, 150, 30),
```

```
(2, 3, '2024-02-01 11:30:00', 28.30, 100, 20),
(3, 4, '2024-02-01 14:45:00', 12.80, 300, 75),
(4, 5, '2024-02-01 16:00:00', 8.90, 250, 60);

-- Prescription Table
INSERT INTO Prescription (PID, CAID, DateIssued) VALUES
(3001, 5001, '2024-01-15'),
(3002, 5002, '2024-01-16'),
(3003, 5003, '2024-01-17'),
(3004, 5004, '2024-01-18'),
(3005, 5005, '2024-01-19');

-- Includes Table
INSERT INTO Includes (PID, MID, Dosage, Duration) VALUES
(3001, 1, '1 comprimé 3 fois par jour', '5 jours'),
(3002, 2, '1 gélule toutes les 8 heures', '7 jours'),
(3003, 3, '2 pulvérisations si nécessaire', '30 jours'),
(3004, 4, '1 comprimé après chaque selle', '3 jours'),
(3005, 5, '1 sachet 3 fois par jour', '5 jours');

-- ContactLocation Table
INSERT INTO ContactLocation (CLID, City, Province, Street, Number,
PostalCode, Phone_Location) VALUES
(101, 'Casablanca', 'Casablanca', 'Rue Mohamed Diouri', '45', '20000',
'0522314455'),
(102, 'Fès', 'Fès', 'Avenue Hassan II', '128', '30000', '0535732890'),
(103, 'Rabat', 'Rabat', 'Avenue Mohamed V', '67', '10000',
'0537721567'),
(104, 'Marrakech', 'Marrakech', 'Rue de la Koutoubia', '23', '40000',
'0524437890'),
(105, 'Tanger', 'Tanger', 'Boulevard Pasteur', '89', '90000',
'0539945678');

-- have Table
INSERT INTO have (IID, CLID) VALUES
(1, 101),
(2, 102),
(3, 103),
(4, 104),
(5, 105);
```

DML 2:

```
UPDATE Patient
SET Phone = "664-584-38"
WHERE PID = ...;

UPDATE Hospital
SET Region = "CASABLANCA-STAT"
WHERE HID = ...;
```

DML 3:

```
1 DELETE FROM Appointment
2 WHERE Status = "Scheduled/Cancelled";
```