Moroccan National Health Services (MNHS)

Data Management Course

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Team Information

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Prepared as part of the Data Management Project.

Normalization

- Validate each relation against BCNF.

1. **Patient:**
   The relation is in BCNF because the determinants `IID` and `CIN` are superkeys.
2. **ContactLocation:**
   The relation is in BCNF because the determinant `CLID` is a superkey.
3. **Staff:**
   The relation is in BCNF because the determinant `STAFF_ID` is a superkey.
   N.B: The same applies for the relations in the ISA hierarchy.
4. **Hospital:**
   The relation is in BCNF because the determinant `HID` is a superkey.
5. **Department:**
   The relation is in BCNF because the determinants `HID` and `DEPT_ID` are superkeys.
6. **Insurance:**
   The relation is in BCNF because the determinant `InsId` is a superkey.
7. **ClinicalActivity:**
   The relation is in BCNF because the determinants `STAFF_ID`, `IID`, `DEPT_ID`, `ExpID`, and `CAID` are superkeys.
   N.B: The same applies for the relations in the ISA hierarchy.
8. **Expense:**
   The relation is in BCNF because the determinants `ExpID`, `CAID`, and `InsID` are superkeys.
9. **Prescription:**
   The relation is in BCNF because the determinants `CAID` and `PID` are superkeys.
10. **Medication:**
    The relation is in BCNF because the determinant `DrugID` is a superkey.
11. **Stock:**
    The relation is in BCNF because the composed determinant (`HID`, `Drug_ID`, `StockStamp`) is a superkey.
12. **Prescription-Medication Relationship:**
    The relation is in BCNF because the composed determinant (`Drug_ID`, `PID`) is a superkey.
13. **Patient-ContactLocation:**
    The relation is in BCNF because the composed determinant (`IID`, `CLID`) is a superkey.
14. **Patient_Insurance (Covers):**
    The relation is in BCNF because the composed determinant (`IID`, `InsId`) is a superkey.
15. **Staff_Department:**
    The relation is in BCNF because the composed determinant (`STAFF_ID`, `DEPT_ID`) is a superkey.

- Verify lossless joins and dependency preservation after decomposition.

  Note: All the relations of the schema are in BCNF initially. Hence, no decompositions are needed and consequently, all of the relations are *lossless-join* and *dependency preserving*.

DDL: Schema Creation.

- Create tables for MNHS entities (use exact names and keys from the logical schema):
- Define primary and foreign keys and constraints (NOT NULL, UNIQUE).

```
create database lab5 ;
use lab5 ;
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),
    Email VARCHAR(100)
);

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 NOT NULL,
    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),
    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)
);
```

- Alter a table to add an attribute (e.g., add Email to Patient).

```
ALTER TABLE Patient ADD COLUMN Email VARCHAR(100);
```

```
UPDATE Patient
SET Email = 'Sara.ElAmrani@gmail.com'
WHERE IID = 1;

UPDATE Patient
SET Email = 'Youssef.Benali@gmail.com'
WHERE IID = 2;

UPDATE Patient
SET Email = 'Oussama.ElHilali@gmail.com'
WHERE IID = 3;

UPDATE Patient
SET Email = 'Sara.Essallami@gmail.com'
WHERE IID = 4;

UPDATE Patient
SET Email = 'Youness.ElHachimi@gmail.com'
WHERE IID = 5;

UPDATE Patient
SET Email = 'Rayan.Cherki@gmail.com'
WHERE IID = 10;
```

DML: Data Manipulation.

- Insert at least 5 sample rows per table.

```
INSERT INTO Hospital VALUES
(1,'Benguerir Central Hospital','Benguerir','Marrakech-Safi'),
(2,'Casablanca University
   Hospital','Casablanca','Casablanca-Settat'),
(3,'Rabat Military Hospital','Rabat','Rabat-Sale-Kenitra'),
(4,'Fes Regional Hospital','Fes','Fes-Meknes'),
(5,'Agadir General Hospital','Agadir','Souss-Massa'),
(6,'Casablanca Private Hospital','Casablanca','Casablanca-Settat');

INSERT INTO Department VALUES
(10,1,'Cardiology','Heart Care'),
(20,2,'Radiology','Imaging'),
(30,3,'Pediatrics','Child Health'),
(40,4,'Neurology','Brain & Nerves'),
(50,5,'Orthopedics','Bones & Joints');

```

```sql
INSERT INTO Patient VALUES
(1,'CIN123','Sara El
   Amrani','1999-04-10','F','A+','0612345678','Sara.ElAmrani@gmail.com'),
(2,'CIN456','Youssef
   Benali','1988-09-22','M','O-','0606070899','Youssef.Benali@gmail.com'),
(3,'CIN789','Oussama El
   Hilali','2006-01-05','M','B+','0648698748','Oussama.ElHilali@gmail.com'),
(4,'CIN321','Sara
   Essallami','2002-06-14','F','AB-','0698877665','Sara.Essallami@gmail.com')
(5,'CIN654','Youness El
   Hachimi','2006-12-30','M','A-','0635179266','Youness.ElHachimi@gmail.com')
(10,'CIN955','Rayan
   Cherki','2000-03-12','M','A+','0611223344','Rayan.Cherki@gmail.com');

INSERT INTO Staff VALUES
(501,'Dr. Amina Idrissi','Active'),
(502,'Technician Omar Lahlou','Active'),
(503,'Dr. Yassine Chraibi','Active'),
(504,'Nurse Fatima Zahra El Hilali','Active'),
(505,'Dr. Hicham Boufetal','Retired'),
(506,'Dr. Fatima Alami','Active'),
(507,'Nurse Hassan Karim','Active'),
(508,'Dr. Mehdi Benjelloun','Active'),
(509,'Technician Leila Mansouri','Active');

INSERT INTO Work_in VALUES
(501,10),(502,20),(503,30),(504,40),(505,50),
(506,10),(507,10),(508,20),(509,20);



INSERT INTO ClinicalActivity VALUES
(1001,1,501,10,'2025-10-10','10:00:00'),
(1002,2,502,20,'2025-10-12','11:00:00'),
(1003,3,503,30,'2025-10-15','09:30:00'),
(1004,4,504,40,'2025-10-18','14:15:00'),
(1005,2,505,50,'2025-11-05','16:45:00'),
(1006,1,501,10,CURRENT_DATE + INTERVAL 2 DAY,'09:00:00'),
(1007,2,501,10,'2025-10-11','09:00:00'),
(1008,3,501,10,'2025-10-11','10:00:00'),
(1009,4,501,10,'2025-10-11','11:00:00'),
(1010,5,501,10,'2025-10-11','12:00:00'),
(1011,1,501,10,'2025-10-12','08:00:00'),
(1012,2,501,10,'2025-10-12','09:00:00'),
(1013,3,501,10,'2025-10-12','10:00:00'),
(1014,4,501,10,'2025-10-12','11:00:00'),
(1015,5,501,10,'2025-10-12','12:00:00'),
(1016,1,501,10,'2025-10-13','08:00:00'),
(1017,2,501,10,'2025-10-13','09:00:00'),
(1018,3,501,10,'2025-10-13','10:00:00'),
```

```
(1019,4,501,10,'2025-10-13','11:00:00'),
(1020,5,501,10,'2025-10-13','12:00:00'),
(1021,1,501,10,'2025-10-14','08:00:00'),
(1022,2,501,10,'2025-10-14','09:00:00'),
(1023,3,501,10,'2025-10-14','10:00:00'),
(1024,4,501,10,'2025-10-14','11:00:00'),
(1025,5,501,10,'2025-10-14','12:00:00'),
(1026,1,501,10,'2025-10-15','08:00:00'),
(1027,2,501,10,'2025-10-15','09:00:00'),
(4001,1,501,10,'2025-10-20','10:00:00'),
(4002,2,501,10,'2025-10-21','11:00:00'),
(4003,3,501,10,'2025-10-22','09:00:00'),
(4004,4,501,10,'2025-10-23','14:00:00'),
(4005,5,501,10,'2025-10-24','15:00:00'),
(4014,1,506,10,'2025-10-28','08:00:00'),
(4015,2,506,10,'2025-10-29','09:00:00'),
(1050,10,501,10,'2025-11-25','12:00:00');

INSERT INTO Appointment VALUES
(1001,'Routine check-up','Scheduled'),
(1002,'Follow-up imaging','Completed'),
(1003,'Pediatric surgery','Scheduled'),
(1004,'Neurology consultation','Cancelled'),
(1005,'Orthopedic check','Completed'),
(1006,'Follow-up check','Scheduled'),
(4001,'Cardiology Follow-up','Scheduled'),
(4002,'Heart Check','Completed'),
(4003,'Cardiac Test','Scheduled'),
(4004,'Consultation','Completed'),
(4005,'Routine Check','Scheduled'),
(1050,'General check-up','Scheduled');

INSERT INTO Emergency VALUES
(1001,2,'Discharged'),
(1002,3,'Admitted'),
(1003,1,'Transferred'),
(1004,4,'Deceased'),
(1005,2,'Admitted');

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

INSERT INTO Expense VALUES
(2001,1,1001,450.00),
(2002,2,1002,800.00),
(2003,3,1003,300.00),
(2004,4,1004,1000.00),
(2005,5,1005,120.00);

INSERT INTO Medication VALUES
```

```
(301,'Paracetamol','Tablet','500mg','Paracetamol','Analgesic','Pfizer'),
(302,'Amoxicillin','Capsule','250mg','Amoxicillin','Antibiotic','Sanofi'),
(303,'Ibuprofen','Tablet','400mg','Ibuprofen','NSAID','Bayer'),
(304,'Aspirin','Tablet','100mg','Acetylsalicylic
   Acid','Antiplatelet','GSK'),
(305,'Brufen','Syrup','100ml','Dextromethorphan','Cough
   Suppressant','Novartis');
INSERT INTO Stock VALUES
(1,301,'2025-10-10 09:00:00',15.00,100,10),
(2,302,'2025-10-11 10:30:00',25.50,80,15),
(3,303,'2025-10-12 11:15:00',20.00,120,10),
(4,304,'2025-10-13 14:45:00',10.00,60,5),
(5,305,'2025-10-14 16:00:00',30.00,90,10);

INSERT INTO ContactLocation VALUES
(1,'Benguerir','Marrakech-Safi','Neighborhood
   Daoudiate','12','43150','0523445566'),
(2,'Casablanca','Casablanca-Settat','Belvedere','45','20300','0522345678'),
(3,'Rabat','Rabat-Sale-Kenitra','Rue de
   Paris','33','10000','0537665544'),
(4,'Fes','Fes-Meknes','Avenue Hassan II','88','30000','0535654321'),
(5,'Kelaa des Seraghna','Marrakech-Safi','Avenue
   Ennour','21','43000','0528899977');

INSERT INTO Have VALUES
(1,1),
(2,2),
(3,3),
(4,4),
(5,5);
```

- Update a patient's phone number and a hospital's region.

```
UPDATE Patient
SET Phone = '0606070899'
WHERE IID = 2;

UPDATE Hospital
SET Region = 'Dakhla-Oued Ed-Dahab'
WHERE HID = 5;
```

- Delete a scheduled appointment that was cancelled.

```

SET SQL_SAFE_UPDATES = 0;

DELETE FROM Appointment WHERE Status = 'Cancelled';

SET SQL_SAFE_UPDATES = 1;
```

Queries.

The following queries should be executed on the MNHS schema created.

1. Select all patients ordered by last name.

```
SELECT *
FROM Patient
ORDER BY
    SUBSTRING(
        FullName,
        LENGTH(FullName) - INSTR(REVERSE(FullName), ' ') + 2,
        LENGTH(FullName)
        );
```

IID	CIN	FullName	Birth	Sex	BloodGroup	Phone	Email
1	CIN123	Sara El Amrani	1999-04-10	F	A+	0612345678	Sara.ElAmrani@gmail.com
2	CIN456	Youssef Benali	1988-09-22	M	O-	0678912345	Youssef.Benali@gmail.com
10	CIN955	Rayan Cherki	2000-03-12	M	A+	0611223344	Rayan.Cherki@gmail.com
4	CIN321	Sara Essallami	2002-06-14	F	A-	0698877665	Sara.Essallami@gmail.com
5	CIN654	Youness El Hachimi	2006-12-30	M	A-	0635179266	Youness.ElHachimi@gmail.com
3	CIN789	Oussama El Hilali	2006-01-05	M	B+	0648698748	Oussama.ElHilali@gmail.com

2. List distinct insurance types.

```
SELECT Type
FROM Insurance;
```

```
+---------+
| Type    |
+---------+
| CNOPS   |
| CNSS    |
| RAMED   |
| Private |
| None    |
+---------+
```

3. Retrieve staff who work in hospitals located in Rabat.

```
SELECT STAFF_ID, FullName
FROM Staff
WHERE STAFF_ID IN (
    SELECT STAFF_ID
    FROM Work_in
    WHERE DEP_ID IN (
        SELECT DEP_ID
        FROM Department
```

```
        WHERE HID IN (
            SELECT HID
            FROM Hospital
            WHERE City = 'Rabat'
        )
    )
);
```

	STAFF_ID	FullName
▶	503	Dr. Yassine Chraibi
*	NULL	NULL

4. Find all appointments that are scheduled within the next seven days.

```
SELECT a.*
FROM Appointment a
JOIN ClinicalActivity c ON a.CAID = c.CAID
WHERE c.Date >= CURRENT_DATE
  AND c.Date < CURRENT_DATE + INTERVAL '7 day'
  AND a.Status = 'Scheduled';
```

CAID	Reason	Status
105	Follow-up check	Scheduled
107	Follow-up imaging	Scheduled
109	Initial Assessment	Scheduled
1006	Follow-up check	Scheduled

5. Count the number of appointments per department.

```
SELECT d.Name, COUNT(a.CAID)
FROM Department d
JOIN ClinicalActivity c ON d.DEP_ID = c.DEP_ID
JOIN Appointment a ON c.CAID = a.CAID
GROUP BY d.DEP_ID, d.Name;
```

Name	COUNT(a.CAID)
Cardiology	18
Radiology	10
Pediatrics	5
Neurology	4
Orthopedics	6

6. Compute the average unit price of medications per hospital.

```
SELECT AVG(UnitPrice), HID
FROM Stock
GROUP BY HID;
```

	AVG(UnitPrice)	HID
▶	15.000000	1
	25.500000	2
	20.000000	3
	10.000000	4
	30.000000	5

7. List hospitals with more than twenty emergency admissions.

```
SELECT
    h.HID,
    h.Name,
    h.City,
    h.Region,
    COUNT(e.CAID) AS EmergencyAdmissions
FROM
    Hospital h
    JOIN Department d ON (h.HID = d.HID)
    JOIN ClinicalActivity ca ON (d.DEP_ID = ca.DEP_ID)
    JOIN Emergency e ON (ca.CAID = e.CAID)
WHERE
    e.Outcome = 'Admitted'
GROUP BY
```

```
    h.HID,
    h.Name,
    h.City,
    h.Region
HAVING
    COUNT(e.CAID) > 20
ORDER BY
    EmergencyAdmissions DESC;
```

HID	Name	City	Region	EmergencyAdmissions
1	Benguerir Central Hospital	Benguerir	Marrakech-Safi	22

8. Find medications in the therapeutic class Antibiotic where the unit price is below two hundred.

```
SELECT
    M.MID,
    M.Name,
    M.TherapeuticClass,
    S.UnitPrice,
    S.HID
FROM Medication AS M
JOIN Stock AS S ON M.MID = S.MID
WHERE M.TherapeuticClass = 'Antibiotic' AND S.UnitPrice < 200;
```

MID	Name	TherapeuticClass	UnitPrice	HID
302	Amoxicillin	Antibiotic	25.50	2
302	Amoxicillin	Antibiotic	25.50	2
302	Amoxicillin	Antibiotic	25.50	2
310	Amoxiclav	Antibiotic	45.00	2

9. For each hospital list the top three most expensive medications.

```
SELECT DISTINCT
  H.HID,
    H.Name,
    M.Name,
    S1.UnitPrice
FROM Stock AS S1
JOIN Medication M ON S1.MID = M.MID
JOIN Hospital H ON S1.HID = H.HID
WHERE  S1.UnitPrice > 0
And (
    SELECT COUNT(DISTINCT S2.UnitPrice)
    FROM Stock AS S2
    WHERE S2.HID = S1.HID AND S2.UnitPrice > S1.UnitPrice  AND
       S2.UnitPrice > 0
```

```
) < 3
ORDER BY H.HID, S1.UnitPrice DESC;
```

HID	Name	Name	UnitPrice
1	Benguerir Central Hospital	Paracetamol	300.00
1	Benguerir Central Hospital	Paracetamol	200.00
1	Benguerir Central Hospital	Insulin	120.00
2	Casablanca University Hospital	Amoxiclav	45.00
2	Casablanca University Hospital	Atorvastatin	35.00
2	Casablanca University Hospital	Amoxicillin	25.50
3	Rabat Military Hospital	Ibuprofen	20.00
3	Rabat Military Hospital	Ventolin	18.00
4	Fes Regional Hospital	Metformin	25.00
4	Fes Regional Hospital	Aspirin	10.00
5	Agadir General Hospital	Insulin	120.00
5	Agadir General Hospital	Brufen	30.00
6	Casablanca Private Hospital	Paracetamol	35.00

10. For each department return counts of Scheduled Completed and Cancelled appointments in a single result.

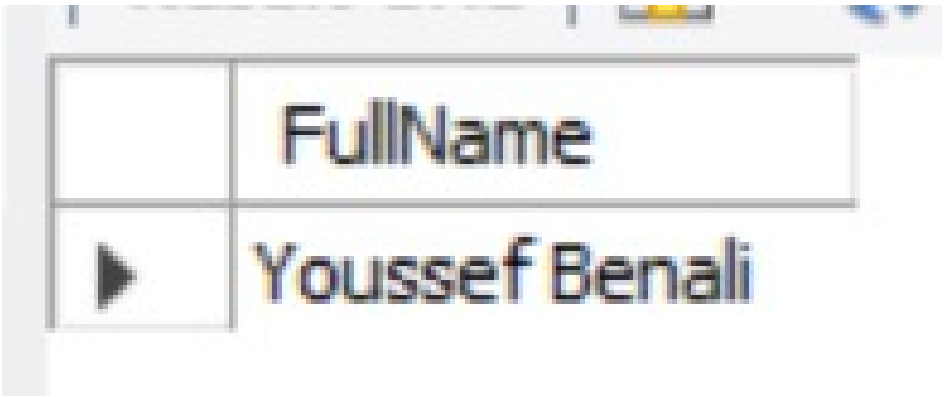
```
SELECT
    CA.DEP_ID AS Department,
    SUM(CASE WHEN A.Status = 'Scheduled' THEN 1 ELSE 0 END) AS
       Count_Scheduled,
    SUM(CASE WHEN A.Status = 'Completed' THEN 1 ELSE 0 END) AS
       Count_Completed,
    SUM(CASE WHEN A.Status = 'Cancelled' THEN 1 ELSE 0 END) AS
       Count_Cancelled
FROM Appointment A
JOIN ClinicalActivity CA ON A.CAID = CA.CAID
GROUP BY CA.DEP_ID;
```

```
+------------+-----------------+-----------------+-----------------+
| Department | Count_Scheduled | Count_Completed | Count_Cancelled |
+------------+-----------------+-----------------+-----------------+
|         10 |               6 |               2 |               0 |
|         20 |               0 |               1 |               0 |
|         30 |               1 |               0 |               0 |
|         50 |               0 |               1 |               0 |
+------------+-----------------+-----------------+-----------------+
```

11. List patients who have no scheduled appointments in the next thirty days.

```
SELECT
    P.FullName
FROM Patient P
WHERE P.IID NOT IN (
```

```
    SELECT DISTINCT C.IID
    FROM ClinicalActivity C
    JOIN Appointment A ON C.CAID = A.CAID
    WHERE A.Status = 'Scheduled'
    AND C.Date >= CURDATE()
    AND C.Date <= DATE_ADD(CURDATE(), INTERVAL 30 DAY)
);
```



12. For each staff member compute the total number of appointments and the percentage share of appointments in their hospital.

```
WITH HospitalAppointments AS (
    SELECT
        h.HID,
        COUNT(a.CAID) as TotalHospitalAppointments
    FROM
        Hospital h
        JOIN Department d ON (h.HID = d.HID)
        JOIN ClinicalActivity ca ON (d.DEP_ID = ca.DEP_ID)
        JOIN Appointment a ON (ca.CAID = a.CAID)
    GROUP BY
        h.HID
),
StaffAppointments AS (
    SELECT
        s.STAFF_ID,
        s.FullName,
        d.HID,
        COUNT(a.CAID) as StaffAppointmentCount
    FROM
        Staff s
        JOIN ClinicalActivity ca ON (s.STAFF_ID = ca.STAFF_ID)
        JOIN Appointment a ON (ca.CAID = a.CAID)
        JOIN Department d ON (ca.DEP_ID = d.DEP_ID)
    GROUP BY
        s.STAFF_ID, s.FullName, d.HID
)
SELECT
    sa.STAFF_ID,
```

```
    sa.FullName,
    sa.HID,
    h.Name as HospitalName,
    sa.StaffAppointmentCount,
    ha.TotalHospitalAppointments,
    CASE
        WHEN ha.TotalHospitalAppointments > 0 THEN
            ROUND((sa.StaffAppointmentCount * 100.0 /
               ha.TotalHospitalAppointments), 2)
        ELSE 0
    END as PercentageShare
FROM
    StaffAppointments sa
    JOIN HospitalAppointments ha ON (sa.HID = ha.HID)
    JOIN Hospital h ON (sa.HID = h.HID)
ORDER BY
    sa.HID, PercentageShare DESC;
```

STAFF_ID	FullName	HID	HospitalName	StaffAppointmentCount	TotalHospitalAppointments	PercentageShare
501	Dr. Amina Idrissi	1	Benguerir Central Hospital	14	18	77.78
506	Dr. Fatima Alami	1	Benguerir Central Hospital	2	18	11.11
504	Nurse Fatima Zahra El Hilali	1	Benguerir Central Hospital	1	18	5.56
507	Nurse Hassan Karim	1	Benguerir Central Hospital	1	18	5.56
502	Technician Omar Lahlou	2	Casablanca University Hospital	5	10	50.00
508	Dr. Mehdi Benjelloun	2	Casablanca University Hospital	2	10	20.00
505	Dr. Hicham Boufetal	2	Casablanca University Hospital	1	10	10.00
501	Dr. Amina Idrissi	2	Casablanca University Hospital	1	10	10.00
509	Technician Leila Mansouri	2	Casablanca University Hospital	1	10	10.00
503	Dr. Yassine Chraibi	3	Rabat Military Hospital	5	5	100.00
504	Nurse Fatima Zahra El Hilali	4	Fes Regional Hospital	3	4	75.00
501	Dr. Amina Idrissi	4	Fes Regional Hospital	1	4	25.00
505	Dr. Hicham Boufetal	5	Agadir General Hospital	5	6	83.33
501	Dr. Amina Idrissi	5	Agadir General Hospital	1	6	16.67

13. Show all drugs that are below ReorderLevel in at least one hospital and include the list of those hospitals.

```
SELECT
    m.MID,
    m.Name as MedicationName,
    m.TherapeuticClass,
    m.ActiveIngredient,
    s.ReorderLevel,
    h.HID,
    h.Name as HospitalName,
    h.City,
    s.Qty as CurrentStock,
    s.UnitPrice
FROM
    Medication m
    JOIN Stock s ON (m.MID = s.MID)
    JOIN Hospital h ON (s.HID = h.HID)
WHERE
    s.Qty < s.ReorderLevel
ORDER BY
```

```
19      m.MID, h.HID;
```

MID	MedicationName	TherapeuticClass	ActiveIngredient	ReorderLevel	HID	HospitalName	City	CurrentStock	UnitPrice
301	Paracetamol	Analgesic	Paracetamol	10	1	Benguerir Central Hospital	Benguerir	5	15.00
302	Amoxicillin	Antibiotic	Amoxicillin	15	2	Casablanca University Hospital	Casablanca	12	25.50
303	Ibuprofen	NSAID	Ibuprofen	10	3	Rabat Military Hospital	Rabat	7	20.00
305	Brufen	Cough Suppressant	Dextromethorphan	10	5	Agadir General Hospital	Agadir	8	30.00
306	Metformin	Antidiabetic	Metformin	15	1	Benguerir Central Hospital	Benguerir	8	25.00
306	Metformin	Antidiabetic	Metformin	15	4	Fes Regional Hospital	Fes	4	25.00
307	Atorvastatin	Cholesterol	Atorvastatin	10	2	Casablanca University Hospital	Casablanca	3	35.00
308	Insulin	Diabetes	Insulin	5	1	Benguerir Central Hospital	Benguerir	2	120.00
308	Insulin	Diabetes	Insulin	5	5	Agadir General Hospital	Agadir	1	120.00
309	Ventolin	Asthma	Salbutamol	6	3	Rabat Military Hospital	Rabat	4	18.00
310	Amoxiclav	Antibiotic	Amoxicillin + Clav...	8	2	Casablanca University Hospital	Casablanca	6	45.00

14. Find hospitals that stock every antibiotic in the catalog.

```
WITH AntibioticMeds AS (
    SELECT MID
    FROM Medication
    WHERE TherapeuticClass = 'Antibiotic'
),
HospitalAntibioticCounts AS (
    SELECT
        i.HID,
        COUNT(DISTINCT i.MID) as AntibioticsStocked
    FROM Stock i
    JOIN AntibioticMeds am ON (i.MID = am.MID)
    WHERE i.Qty > 0
    GROUP BY i.HID
),
TotalAntibiotics AS (
    SELECT COUNT(*) as TotalAntibioticCount
    FROM AntibioticMeds
)
SELECT
    h.HID,
    h.Name as HospitalName,
    h.City,
    h.Region,
    hac.AntibioticsStocked,
    tac.TotalAntibioticCount
FROM Hospital h
JOIN HospitalAntibioticCounts hac ON (h.HID = hac.HID)
CROSS JOIN TotalAntibiotics tac
WHERE hac.AntibioticsStocked = tac.TotalAntibioticCount
ORDER BY h.HID;
```

HID	HospitalName	City	Region	AntibioticsStocked	TotalAntibioticCount
2	Casablanca University Hospital	Casablanca	Casablanca-Settat	2	2

15. For each hospital and drug class return the average unit price and flag whether it is above the citywide average for that class.

```sql
SELECT
    h.Name AS Hospital,
    m.TherapeuticClass,
    AVG(s.UnitPrice) AS AvgPrice,
    CASE
        WHEN AVG(s.UnitPrice) > (
            SELECT AVG(s2.UnitPrice)
            FROM Stock s2
            JOIN Medication m2 ON s2.MID = m2.MID
            WHERE m2.TherapeuticClass = m.TherapeuticClass
        ) THEN 'Above City Average'
        ELSE 'Below or Equal to City Average'
    END AS PriceFlag
FROM Stock s
JOIN Medication m ON s.MID = m.MID
JOIN Hospital h ON s.HID = h.HID
GROUP BY h.Name, m.TherapeuticClass;
```

```
+------------------------------+------------------+-----------+------------------------------+
| Hospital                     | TherapeuticClass | AvgPrice  | PriceFlag                    |
+------------------------------+------------------+-----------+------------------------------+
| Benguerir Central Hospital   | Analgesic        | 15.000000 | Below or Equal to City Average |
| Casablanca University Hospital | Antibiotic     | 25.500000 | Below or Equal to City Average |
| Rabat Military Hospital      | NSAID            | 20.000000 | Below or Equal to City Average |
| Fes Regional Hospital        | Antiplatelet     | 10.000000 | Below or Equal to City Average |
| Agadir General Hospital      | Cough Suppressant | 30.000000 | Below or Equal to City Average |
+------------------------------+------------------+-----------+------------------------------+
```

16. Return the next appointment date for each patient.

```sql
SELECT P.IID, P.FullName, CA.Date, A.Status
FROM Patient P
JOIN ClinicalActivity CA ON CA.IID = P.IID
JOIN Appointment A ON A.CAID = CA.CAID
WHERE A.Status = 'Scheduled'
AND CA.Date >= CURRENT_DATE()
ORDER BY CA.Date;
```

IID	FullName	Date	Status
5	Youness El Hachimi	2025-11-17	Scheduled
1	Sara El Amrani	2025-11-18	Scheduled
1	Sara El Amrani	2025-11-18	Scheduled
3	Oussama El Hilali	2025-11-21	Scheduled
10	Rayan Cherki	2025-11-25	Scheduled
4	Sara Essallami	2025-11-26	Scheduled
10	Rayan Cherki	2025-12-01	Scheduled

17. Among patients with at least two emergency visits list those whose latest emergency visit was within the last fourteen days.

```sql
SELECT CIN, FullName
FROM Patient
WHERE IID IN (
    SELECT IID
    FROM ClinicalActivity
    WHERE CAID IN (
        SELECT CAID
        FROM Emergency
    )
    GROUP BY IID
    HAVING COUNT(CAID) >= 2
    AND DATEDIFF(CURDATE(), MAX(Date)) <= 14
);
```

	CIN	FullName
▶	CIN456	Youssef Benali

18. For each city rank hospitals by the number of completed appointments in the last ninety days.

```sql
SELECT H.Name, H.City, COUNT(CA.Date) AS Completed
FROM Hospital H
JOIN Department D ON D.HID = H.HID
JOIN ClinicalActivity CA ON CA.DEP_ID = D.DEP_ID
JOIN Appointment A ON A.CAID = CA.CAID
WHERE A.status = 'Completed'
AND CA.Date >= CURRENT_DATE() - INTERVAL 90 DAY
GROUP BY H.Name, H.City
ORDER BY H.City,   CompletedDESC   ;
```

	Name	City	Completed
▶	Agadir General Hospital	Agadir	3
	Benguerir Central Hospital	Benguerir	5
	Casablanca University Hospital	Casablanca	8
	Fes Regional Hospital	Fes	2
	Rabat Military Hospital	Rabat	1

19. Within each city return medications whose hospital prices show a spread greater than thirty percent between minimum and maximum.

```sql
SELECT h.City,
       m.Name,
       MIN(s.UnitPrice),
       MAX(s.UnitPrice)
FROM Stock s
```

```
JOIN Hospital h ON s.HID = h.HID
JOIN Medication m ON s.MID = m.MID
GROUP BY h.City, m.MID, m.Name
HAVING (MAX(s.UnitPrice) - MIN(s.UnitPrice)) > 0.3 *
   MIN(s.UnitPrice);
```

```
+-----------+------------+-----------------+-----------------+
| City      | Name       | MIN(s.UnitPrice) | MAX(s.UnitPrice) |
+-----------+------------+-----------------+-----------------+
| Benguerir | Paracetamol |           15.00 |          300.00 |
+-----------+------------+-----------------+-----------------+
```

20. Data quality check on stock entries list rows with negative quantity or non positive unit price.

```
SELECT *
FROM Stock
WHERE Qty < 0
   OR UnitPrice <= 0;
```

HID	MID	StockTimestamp	UnitPrice	Qty	ReorderLevel
1	301	2025-10-10 07:00:00	-15.00	100	10
2	302	2025-10-11 11:30:00	25.50	-80	15
4	304	2025-10-13 14:45:00	-10.00	60	5
5	305	2025-10-14 16:00:00	30.00	-90	10
NULL	NULL	NULL	NULL	NULL	NULL