CISC7203 – Database and Data Mining Technologies
Hospital Management System Database

Group 52

April 14, 2025

A. Short Description of the Chosen Domain

The **Hospital Management System (HMS)** is designed for the **University of Nigeria Teaching Hospital, Enugu (UNTH)** to automate all healthcare operations. The system centralizes critical healthcare data, ensuring efficient communication between departments and improving patient care coordination. The Database is a comprehensive relational database designed to manage all operational aspects of a modern healthcare facility. This system serves as the centralized repository for patient information, medical staff records, appointment scheduling, treatment documentation, prescription management, and financial transactions.

Entity Sets

The database comprises seven core entities that model the hospital's operations:

- **Patient**(Patient_ID, Full_Name, Gender, Birth_Date, Phone_Number, Home_Address, ID_Card_Number)
- **Doctor**(Doctor_ID, Doctor_Name, Gender, Department_Name, Professional_Title, Specialty, Contact_Number, Email_Address)
- **Department**(Department_Name, Location, Phone_Number)
- **Appointment**(Appointment_ID, Patient_ID, Doctor_ID, Appointment_Date, Reason, Status)
- **MedicalRecord**(Record_ID, Doctor_ID, Patient_ID, Diagnosis, Treatment, Record_Date)
- **Prescription**(Prescription_ID, Appointment_ID, Medication_Name, Dosage, Frequency, Duration)
- **Billing**(Billing_ID, Appointment_ID, Amount, Billing_Date, Payment_Status, Payment_Method)

Primary and Foreign Key Relationships

The database schema implements the following key relationships between entities:

- **Primary Keys** (Underlined):
  - Patient.Patient_ID
  - Doctor.Doctor_ID
  - Department.Department_Name
  - Appointment.Appointment_ID

  - MedicalRecord.Record_ID
  - Prescription.Prescription_ID
  - Billing.Billing_ID

- **Foreign Key Relationships**:
  - Doctor.Department_Name → Department.Department_Name
  - Appointment.Patient_ID → Patient.Patient_ID
  - Appointment.Doctor_ID → Doctor.Doctor_ID
  - MedicalRecord.Patient_ID → Patient.Patient_ID
  - MedicalRecord.Doctor_ID → Doctor.Doctor_ID
  - Prescription.Appointment_ID → Appointment.Appointment_ID
  - Billing.Appointment_ID → Appointment.Appointment_ID

Entity Explanations

- **Patient**: This entity stores comprehensive demographic and contact information for individuals receiving medical care. It serves as the foundation for all healthcare services, containing essential details like full name, gender, birth date, contact information, and government-issued identification. The Patient entity enables accurate patient identification and supports medical history tracking across multiple visits.
- **Doctor**: Contains complete professional details of healthcare providers practicing at the facility. This entity records each doctor's specialization, departmental affiliation, professional title, and contact information. It supports physician scheduling, departmental staffing, and ensures patients are treated by qualified specialists appropriate for their medical conditions.
- **Department**: Represents the various clinical and administrative divisions within the hospital. Each department has a unique name, physical location, and contact number. This entity facilitates resource allocation, organizational structure management, and helps patients and staff locate specific services within the facility.
- **Appointment**: Manages all scheduled consultations between patients and doctors. This critical entity coordinates healthcare delivery by recording appointment dates/times, reasons for visits, and current status (scheduled, completed, or cancelled). It serves as the central hub connecting patients, doctors, and medical services.
- **MedicalRecord**: Documents official diagnosis and treatment plans for each patient encounter. This entity provides the legal record of care, supports continuity of treatment across multiple visits, and ensures compliance with medical documentation standards. Each record includes precise diagnosis information and prescribed treatments.
- **Prescription**: Records all medications prescribed to patients, including detailed administration instructions. This entity ensures accurate medication management by specifying drug names, dosages, frequency of use, and treatment duration. It helps prevent medication errors and supports pharmacy operations.
- **Billing**: Tracks all financial transactions associated with medical services rendered. This entity records payment amounts, dates, status (paid, pending, cancelled), and payment methods (cash, card, insurance). It supports revenue cycle management, insurance claims processing, and financial reporting.

B. Database Schema Design

Relationship Definitions

The database models the following explicit relationships between entities:

- **Patient to Appointment Relationship**:
  - Type: One-to-Many (1:N)
  - Description: Each patient may have multiple scheduled appointments over time, while each appointment belongs to exactly one patient.
  - Business Rule: A patient must exist in the system before any appointments can be scheduled for them. When a patient record is deleted, all associated appointments are automatically removed (cascade delete).
- **Doctor to Appointment Relationship**:
  - Type: One-to-Many (1:N)
  - Description: A doctor may handle numerous appointments with different patients, while each appointment is conducted by exactly one doctor.
  - Business Rule: Doctors can only see patients during properly scheduled appointment times. When a doctor leaves the hospital (record deleted), all their future appointments are automatically cancelled (cascade delete).
- **Doctor to Department Relationship**:
  - Type: Many-to-One (N:1)
  - Description: Multiple doctors may belong to the same department, while each doctor is assigned to exactly one department.
  - Business Rule: All doctors must be affiliated with an existing department. Department names cannot be changed if doctors are assigned to them.
- **Patient to MedicalRecord Relationship**:
  - Type: One-to-Many (1:N)
  - Description: A patient accumulates multiple medical records over time, while each record documents one specific encounter.
  - Business Rule: Medical records cannot exist without an associated patient. If a patient record is deleted, all their medical history is also removed (cascade delete).
- **Appointment to Prescription Relationship**:
  - Type: One-to-Many (1:N)
  - Description: A single appointment may result in multiple prescribed medications, while each prescription is linked to exactly one appointment.
  - Business Rule: Prescriptions require a valid medical consultation (appointment). If an appointment is cancelled, any associated prescriptions are automatically voided (cascade delete).
- **Appointment to Billing Relationship**:

- Type: One-to-One (1:1)
- Description: Each appointment generates exactly one billing record, and each billing record corresponds to exactly one appointment.
- Business Rule: All completed appointments must have associated billing records. Bills cannot be created without a corresponding appointment.

Constraints & Business Rules

- **Primary Key Constraints**: All entities have a designated primary key field that uniquely identifies each record. These fields cannot contain null values and must be unique across all records in the table.
- **Foreign Key Constraints**: All relationship connections are enforced through foreign keys that reference primary keys in related tables. These ensure referential integrity across the database.
- **Attribute Constraints**:
  - Appointment.Status must be one of: 'Scheduled', 'Completed', or 'Cancelled'
  - Billing.Payment_Status must be one of: 'Paid', 'Pending', or 'Cancelled'
  - Billing.Payment_Method must be one of: 'Cash', 'Card', or 'Insurance'
  - Patient.Gender and Doctor.Gender must be one of: 'Male', 'Female', or 'Other'
  - All date fields must contain valid dates (Birth_Date, Appointment_Date, etc.)
- **Data Integrity Rules**:
  - Each doctor must be associated with exactly one department
  - Each appointment must be linked to exactly one doctor and one patient
  - Medical records require both a doctor and patient association
  - Prescriptions must be linked to valid appointments
  - Bills must be generated for every completed appointment
  - Phone numbers and email addresses must follow standard formatting
- **Optional Fields**:
  - Patient: Phone_Number, Home_Address, and ID_Card_Number may be null
  - Doctor: Contact_Number and Email_Address may be null
  - MedicalRecord: Treatment details may be null if diagnosis only

C. Database Diagrams

Entity-Relationship Diagram

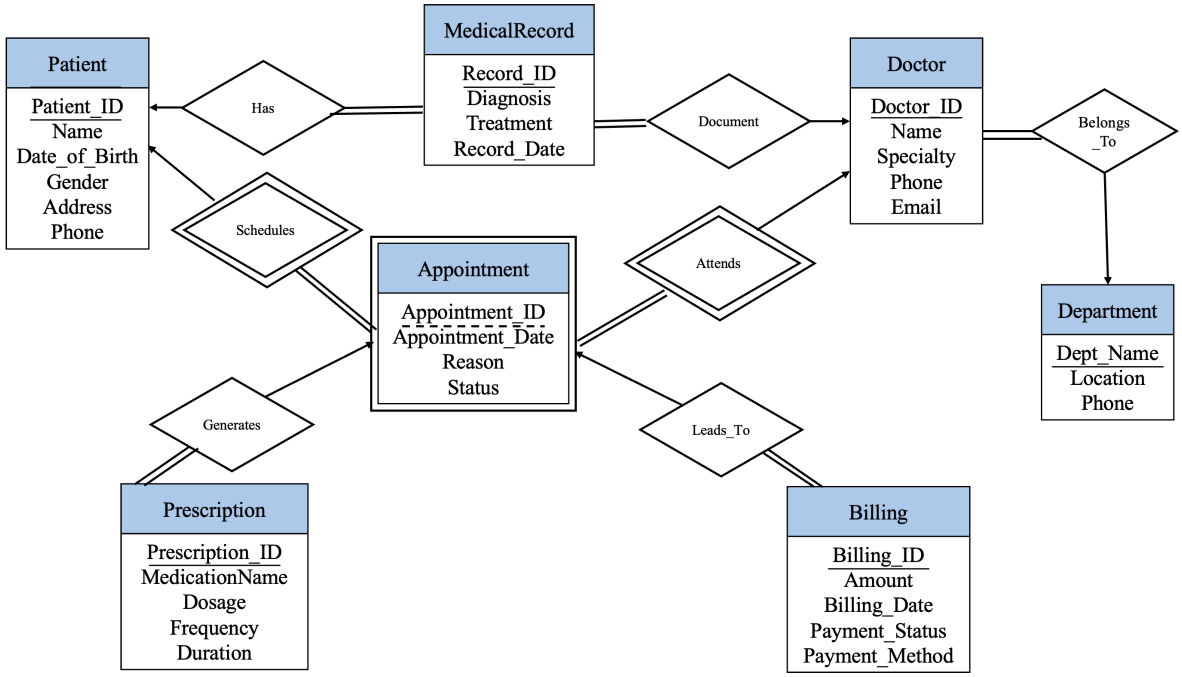

Figure 1: **Complete Entity-Relationship Diagram showing all seven entities with their attributes (in ovals) and relationships (diamonds). Primary keys are underlined, and cardinality is shown with (1:N, N:1, or 1:1) notation.**

Relational Schema Diagram

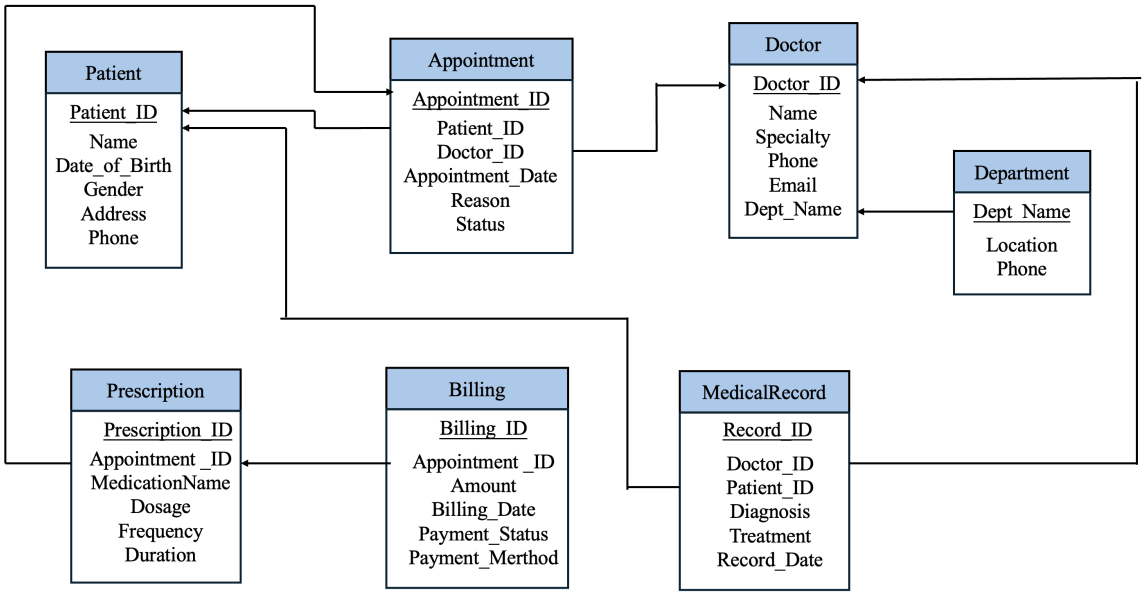

Figure 2: **Relational Schema Diagram showing all tables with their columns, data types, primary keys (marked with PK), and foreign key relationships (marked with FK arrows).**

Relational Schema Diagram with MYSQL Workbench

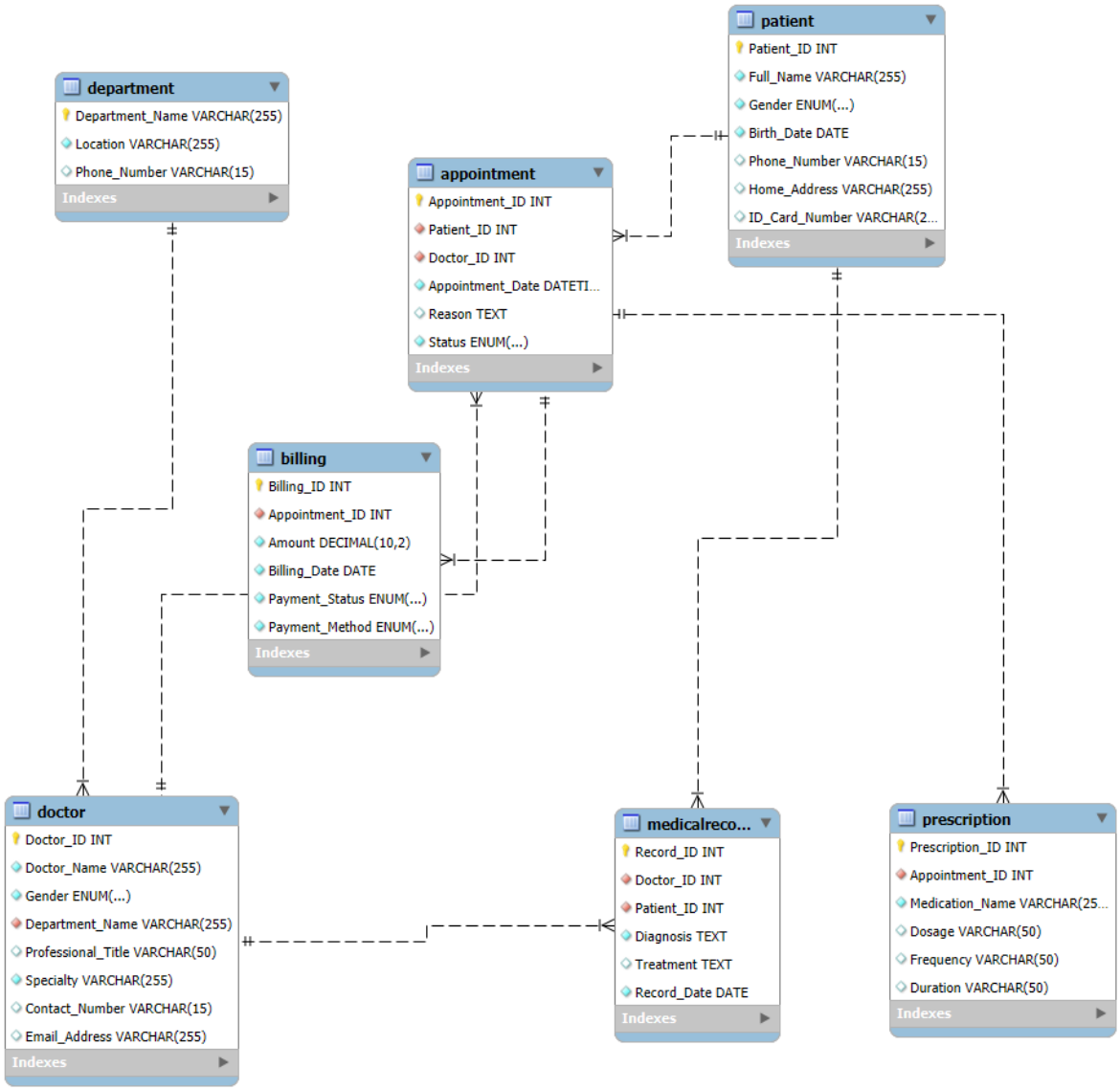

Figure 3: **Relational Schema Diagram showing all tables with their columns, data types, primary keys (marked with PK), and foreign key relationships (marked with FK arrows).**

D. Database Implementation

```
-- DEPARTMENT TABLE CREATION
CREATE TABLE Department (
    Department_Name VARCHAR(255) PRIMARY KEY,
    Location VARCHAR(255) NOT NULL,
    Phone_Number VARCHAR(15)
);

-- PATIENT TABLE CREATION
CREATE TABLE Patient (
```

```
    Patient_ID INT PRIMARY KEY AUTO_INCREMENT,
    Full_Name VARCHAR(255) NOT NULL,
    Gender ENUM('Male', 'Female', 'Other') NOT NULL,
    Birth_Date DATE NOT NULL,
    Phone_Number VARCHAR(15),
    Home_Address VARCHAR(255),
    ID_Card_Number VARCHAR(20)
);

-- DOCTOR TABLE CREATION
CREATE TABLE Doctor (
    Doctor_ID INT PRIMARY KEY AUTO_INCREMENT,
    Doctor_Name VARCHAR(255) NOT NULL,
    Gender ENUM('Male', 'Female', 'Other') NOT NULL,
    Department_Name VARCHAR(255) NOT NULL,
    Professional_Title VARCHAR(50),
    Specialty VARCHAR(255) NOT NULL,
    Contact_Number VARCHAR(15),
    Email_Address VARCHAR(255),
    FOREIGN KEY (Department_Name) REFERENCES Department(Department_Name)
);

-- APPOINTMENT TABLE CREATION
CREATE TABLE Appointment (
    Appointment_ID INT PRIMARY KEY AUTO_INCREMENT,
    Patient_ID INT NOT NULL,
    Doctor_ID INT NOT NULL,
    Appointment_Date DATETIME NOT NULL,
    Reason TEXT,
    Status ENUM('Scheduled', 'Completed', 'Cancelled') NOT NULL DEFAULT 'Scheduled',
    FOREIGN KEY (Patient_ID) REFERENCES Patient(Patient_ID) ON DELETE CASCADE,
    FOREIGN KEY (Doctor_ID) REFERENCES Doctor(Doctor_ID) ON DELETE CASCADE
);

-- MEDICAL RECORD TABLE CREATION
CREATE TABLE MedicalRecord (
    Record_ID INT PRIMARY KEY AUTO_INCREMENT,
    Doctor_ID INT NOT NULL,
    Patient_ID INT NOT NULL,
    Diagnosis TEXT NOT NULL,
    Treatment TEXT,
    Record_Date DATE NOT NULL,
    FOREIGN KEY (Doctor_ID) REFERENCES Doctor(Doctor_ID) ON DELETE CASCADE,
    FOREIGN KEY (Patient_ID) REFERENCES Patient(Patient_ID) ON DELETE CASCADE
);

-- PRESCRIPTION TABLE CREATION
CREATE TABLE Prescription (
    Prescription_ID INT PRIMARY KEY AUTO_INCREMENT,
    Appointment_ID INT NOT NULL,
    Medication_Name VARCHAR(255) NOT NULL,
    Dosage VARCHAR(50),
    Frequency VARCHAR(50),
    Duration VARCHAR(50),
    FOREIGN KEY (Appointment_ID) REFERENCES Appointment(Appointment_ID) ON DELETE
    CASCADE
);

-- BILLING TABLE CREATION
```

```sql
CREATE TABLE Billing (
    Billing_ID INT PRIMARY KEY AUTO_INCREMENT,
    Appointment_ID INT NOT NULL,
    Amount DECIMAL(10, 2) NOT NULL,
    Billing_Date DATE NOT NULL,
    Payment_Status ENUM('Paid', 'Pending', 'Cancelled') NOT NULL DEFAULT 'Pending',
    Payment_Method ENUM('Cash', 'Card', 'Insurance') NOT NULL,
    FOREIGN KEY (Appointment_ID) REFERENCES Appointment(Appointment_ID)
);
```

Listing 1: **Script1Gr52.sql** - Complete Database Creation Script

E. Sample Data Population

```sql
-- DEPARTMENT DATA (7 records)
INSERT INTO Department VALUES
('Cardiology', 'Building A, Floor 2', '08051122334'),
('Neurology', 'Building B, Floor 3', '08062233445'),
('Pediatrics', 'Building C, Ground Floor', '08073344556'),
('Orthopedics', 'Building D, Floor 1', '08084455667'),
('Radiology', 'Building E, Basement', '08095566778'),
('Dermatology', 'Building F, Floor 4', '08106677889'),
('Gastroenterology', 'Building G, Floor 5', '08117788990');

-- PATIENT DATA (7 records)
INSERT INTO Patient VALUES
(10001, 'Chinonso Ugwu', 'Male', '1985-06-15', '08031234567', '45 Owerri Street', '
    A12345678'),
(10002, 'Adaobi Nwankwo', 'Female', '1990-03-22', '08149876543', '12 Aba Road', '
    B23456789'),
(10003, 'Chidinma Okoro', 'Female', '1978-11-10', '09023456789', '8 Akwa Ibom Avenue',
     'C34567890'),
(10004, 'Emeka Okafor', 'Male', '1982-07-25', '08065432109', '10 Awka Road', '
    D45678901'),
(10005, 'Amara Eze', 'Female', '1995-02-14', '08176543210', '5 Onitsha Lane', '
    E56789012'),
(10006, 'Ifeanyi Nnamdi', 'Male', '1970-09-18', '08087654321', '3 Enugu Crescent', '
    F67890123'),
(10007, 'Chioma Obi', 'Female', '1988-12-03', '09098765432', '15 Aba Close', '
    G78901234');

-- DOCTOR DATA (7 records)
INSERT INTO Doctor VALUES
(20001, 'Dr. Obinna Eze', 'Male', 'Cardiology', 'Consultant', 'Cardiologist', '
    08034567890', 'obinna.eze@unth.edu'),
(20002, 'Dr. Ngozi Okonkwo', 'Female', 'Neurology', 'Senior Consultant', 'Neurologist'
    , '08056789012', 'ngozi.okonkwo@unth.edu'),
(20003, 'Dr. Chinedu Okafor', 'Male', 'Orthopedics', 'Consultant', 'Orthopedic Surgeon
    ', '08067890123', 'chinedu.okafor@unth.edu'),
(20004, 'Dr. Ada Nwosu', 'Female', 'Pediatrics', 'Senior Registrar', 'Pediatrician', '
    08078901234', 'ada.nwosu@unth.edu'),
(20005, 'Dr. Uche Ogbonna', 'Male', 'Radiology', 'Consultant', 'Radiologist', '
    08089012345', 'uche.ogbonna@unth.edu'),
(20006, 'Dr. Chinwe Ani', 'Female', 'Dermatology', 'Consultant', 'Dermatologist', '
    08090123456', 'chinwe.ani@unth.edu'),
(20007, 'Dr. Ekene Okeke', 'Male', 'Gastroenterology', 'Senior Consultant', '
    Gastroenterologist', '08101234567', 'ekene.okeke@unth.edu');
```

```
-- APPOINTMENT DATA (7 records)
INSERT INTO Appointment VALUES
(30001, 10001, 20001, '2023-11-01 10:00:00', 'Hypertension follow-up', 'Completed'),
(30002, 10002, 20002, '2023-11-02 11:30:00', 'Chronic headaches evaluation', '
    Completed'),
(30003, 10003, 20003, '2023-11-03 14:00:00', 'Knee pain assessment', 'Scheduled'),
(30004, 10004, 20004, '2023-11-04 09:15:00', 'Child wellness checkup', 'Completed'),
(30005, 10005, 20005, '2023-11-05 13:45:00', 'X-ray for suspected fracture', '
    Scheduled'),
(30006, 10006, 20006, '2023-11-06 16:00:00', 'Skin rash examination', 'Completed'),
(30007, 10007, 20007, '2023-11-07 10:30:00', 'Stomach pain diagnosis', 'Scheduled');

-- MEDICAL RECORD DATA (7 records)
INSERT INTO MedicalRecord VALUES
(40001, 20001, 10001, 'Hypertension Stage 1', 'Prescribed Amlodipine 5mg daily', '
    2023-11-01'),
(40002, 20002, 10002, 'Migraine with aura', 'Recommended lifestyle changes and pain
    management', '2023-11-02'),
(40003, 20003, 10003, 'Osteoarthritis of knee', 'Suggested physiotherapy and joint
    supplements', '2023-11-03'),
(40004, 20004, 10004, 'Pediatric viral infection', 'Advised rest and fluids', '
    2023-11-04'),
(40005, 20005, 10005, 'Suspected wrist fracture', 'Ordered X-ray imaging', '2023-11-05
    '),
(40006, 20006, 10006, 'Contact dermatitis', 'Prescribed topical corticosteroids', '
    2023-11-06'),
(40007, 20007, 10007, 'Acute gastritis', 'Recommended antacids and dietary changes', '
    2023-11-07');

-- PRESCRIPTION DATA (7 records)
INSERT INTO Prescription VALUES
(50001, 30001, 'Amlodipine', '5mg tablet', 'Once daily', '30 days'),
(50002, 30002, 'Sumatriptan', '50mg tablet', 'As needed for migraine', '10 doses'),
(50003, 30003, 'Ibuprofen', '400mg tablet', 'Every 8 hours with food', '7 days'),
(50004, 30004, 'Paracetamol', '120mg/5ml suspension', '5ml every 6 hours', '5 days'),
(50005, 30005, 'Diclofenac', '50mg tablet', 'Twice daily after meals', '10 days'),
(50006, 30006, 'Hydrocortisone', '1% cream', 'Apply to affected area twice daily', '14
     days'),
(50007, 30007, 'Omeprazole', '20mg capsule', 'Once daily before breakfast', '28 days')
    ;

-- BILLING DATA (7 records)
INSERT INTO Billing VALUES
(60001, 30001, 5000.00, '2023-11-01', 'Paid', 'Insurance'),
(60002, 30002, 7500.00, '2023-11-02', 'Paid', 'Card'),
(60003, 30003, 12000.00, '2023-11-03', 'Pending', 'Cash'),
(60004, 30004, 3000.00, '2023-11-04', 'Paid', 'Insurance'),
(60005, 30005, 10000.00, '2023-11-05', 'Pending', 'Cash'),
(60006, 30006, 8000.00, '2023-11-06', 'Paid', 'Insurance'),
(60007, 30007, 15000.00, '2023-11-07', 'Pending', 'Card');
```

Listing 2: **Script2Gr52.sql** - Complete Data Insertion Script

F. Hospital Management System Database Queries with Results

1. Department Table

```
SELECT * FROM Department;
```

Department_Name	Location	Phone_Number
Cardiology	Building A, Floor 2	08051122334
Dermatology	Building F, Floor 4	08106677889
Gastroenterology	Building G, Floor 5	08117788990
Neurology	Building B, Floor 3	08062233445
Orthopedics	Building D, Floor 1	08084455667
Pediatrics	Building C, Ground Floor	08073344556
Radiology	Building E, Basement	08095566778

2. Patient Table

```
SELECT * FROM Patient;
```

Patient_ID	Full_Name	Gender	Birth_Date	Phone_Number	Home_Address	ID_Card_Number
10001	Chinonso Ugwu	Male	1985-06-15	08031234567	45 Owerri St	A12345678
10002	Adaobi Nwankwo	Female	1990-03-22	08149876543	12 Aba Road	B23456789
10003	Chidinma Okoro	Female	1978-11-10	09023456789	8 Akwa Ibom Ave	C34567890
10004	Emeka Okafor	Male	1982-07-25	08065432109	10 Awka Road	D45678901
10005	Amara Eze	Female	1995-02-14	08176543210	5 Onitsha Lane	E56789012
10006	Ifeanyi Nnamdi	Male	1970-09-18	08087654321	3 Enugu Cres	F67890123
10007	Chioma Obi	Female	1988-12-03	09098765432	15 Aba Close	G78901234

3. Doctor Table

```
SELECT * FROM Doctor;
```

Doctor_ID	Doctor_Name	Gender	Department_Name	Professional_Title	Specialty	Contact_Number	Email_Address
20001	Dr. Obinna Eze	Male	Cardiology	Consultant	Cardiologist	08034567890	obinna.eze@unth.edu

Doctor_ID	Doctor_Name	Gender	Department_Name	Professional_Title	Specialty	Contact_Number	Email_Address
20002	Dr. Ngozi Okonkwo	Female	Neurology	Senior Consultant	Neurologist	08056789012	ngozi.okonkwo@unth.edu
20003	Dr. Chinedu Okafor	Male	Orthopedics	Consultant	Orthopedic Surgeon	08067890123	chinedu.okafor@unth.edu
20004	Dr. Ada Nwosu	Female	Pediatrics	Senior Registrar	Pediatrician	08078901234	ada.nwosu@unth.edu
20005	Dr. Uche Ogbonna	Male	Radiology	Consultant	Radiologist	08089012345	uche.ogbonna@unth.edu
20006	Dr. Chinwe Ani	Female	Dermatology	Consultant	Dermatologist	08090123456	chinwe.ani@unth.edu
20007	Dr. Ekene Okeke	Male	Gastroenterology	Senior Consultant	Gastroenterologist	08101234567	ekene.okeke@unth.edu

4. Appointment Table

```
SELECT * FROM Appointment;
```

Appointment_ID	Patient_ID	Doctor_ID	Appointment_Date	Reason	Status
30001	10001	20001	2023-11-01 10:00:00	Hypertension follow-up	Completed
30002	10002	20002	2023-11-02 11:30:00	Chronic headaches evaluation	Completed
30003	10003	20003	2023-11-03 14:00:00	Knee pain assessment	Scheduled
30004	10004	20004	2023-11-04 09:15:00	Child wellness checkup	Completed
30005	10005	20005	2023-11-05 13:45:00	X-ray for suspected fracture	Scheduled
30006	10006	20006	2023-11-06 16:00:00	Skin rash examination	Completed
30007	10007	20007	2023-11-07 10:30:00	Stomach pain diagnosis	Scheduled

5. MedicalRecord Table

```
SELECT * FROM MedicalRecord;
```

Record_ID	Patient_ID	Doctor_ID	Diagnosis	Treatment	Record_Date
40001	10001	20001	Hypertension Stage 1	Prescribed Amlodipine 5mg daily	2023-11-01

Record_ID	Patient_ID	Doctor_ID	Diagnosis	Treatment	Record_Date
40002	10002	20002	Migraine with aura	Recommended lifestyle changes and pain management	2023-11-02
40003	10003	20003	Osteoarthritis of knee	Suggested physiotherapy	2023-11-03
40004	10004	20004	Pediatric viral infection	Advised rest and fluids	2023-11-04
40005	10005	20005	Suspected wrist fracture	Ordered X-ray imaging	2023-11-05
40006	10006	20006	Contact dermatitis	Prescribed topical corticosteroids	2023-11-06
40007	10007	20007	Acute gastritis	Recommended antacids and dietary changes	2023-11-07

6. Prescription Table

```
SELECT * FROM Prescription;
```

Prescription_ID	Appointment_ID	Medication_Name	Dosage	Frequency	Duration
50001	30001	Amlodipine	5mg tablet	Once daily	30 days
50002	30002	Sumatriptan	50mg tablet	As needed for migraine	10 doses
50003	30003	Ibuprofen	400mg tablet	Every 8 hours with food	7 days
50004	30004	Paracetamol	120mg/5ml	5ml every 6 hours	5 days
50005	30005	Diclofenac	50mg tablet	Twice daily after meals	10 days
50006	30006	Hydrocortisone	1% cream	Apply to affected area twice daily	14 days
50007	30007	Omeprazole	20mg capsule	Once daily before breakfast	28 days

7. Billing Table

```
SELECT * FROM Billing;
```

Billing_ID	Appointment_ID	Amount	Billing_Date	Payment_Status	Payment_Method
60001	30001	5000.00	2023-11-01	Paid	Insurance
60002	30002	7500.00	2023-11-02	Paid	Card
60003	30003	12000.00	2023-11-03	Pending	Cash
60004	30004	3000.00	2023-11-04	Paid	Insurance
60005	30005	10000.00	2023-11-05	Pending	Cash
60006	30006	8000.00	2023-11-06	Paid	Insurance
60007	30007	15000.00	2023-11-07	Pending	Card

G. Database Queries with Results

1. **A query to retrieve the names of patients with pending payments, the names of the doctors who attended to them, the appointment dates, the reasons for their visits, and their next appointment dates.**

```
    SELECT
    p.Full_Name AS Patient,
    d.Doctor_Name AS Doctor,
    DATE_FORMAT(a.Appointment_Date, '%Y-%m-%d') AS Appointment_Date,
    a.Reason AS Visit_Reason,
    (SELECT MIN(a2.Appointment_Date)
     FROM Appointment a2
     WHERE a2.Patient_ID = p.Patient_ID
     AND a2.Appointment_Date > CURRENT_DATE()) AS Next_Appointment_Date
FROM
    Patient p
JOIN
    Appointment a ON p.Patient_ID = a.Patient_ID
JOIN
    Doctor d ON a.Doctor_ID = d.Doctor_ID
JOIN
    Billing b ON a.Appointment_ID = b.Appointment_ID
WHERE
    b.Payment_Status = 'Pending'
ORDER BY
    p.Full_Name, a.Appointment_Date
LIMIT 0, 1000;
```

Expected Result:

Table 8: Patients with Pending Payments and Appointment Details

Patient	Doctor	Appointment_Date	Visit_Reason	Next_Appointment_Date
Amara Eze	Dr. Uche Ogbonna	2023-11-05	X-ray for suspected fracture	NULL
Chidinma Okoro	Dr. Chinedu Okafor	2023-11-03	Knee pain assessment	NULL
Chioma Obi	Dr. Ekene Okeke	2023-11-07	Stomach pain diagnosis	NULL

2. **Calculate the revenue contribution of each department as a percentage of the total hospital revenue.**

```
  SELECT
    dept.Department_Name,
    CONCAT(N\'{}, FORMAT(SUM(b.Amount), 2)) AS Total_Revenue,
    CONCAT(ROUND((SUM(b.Amount) * 100 / (SELECT SUM(Amount) FROM Billing WHERE
   Payment_Status = 'Paid')), 2), '%') AS Revenue_Percentage
FROM Department dept
LEFT JOIN Doctor d ON dept.Department_Name = d.Department_Name
LEFT JOIN Appointment a ON d.Doctor_ID = a.Doctor_ID
LEFT JOIN Billing b ON a.Appointment_ID = b.Appointment_ID
WHERE b.Payment_Status = 'Paid'
GROUP BY dept.Department_Name
ORDER BY Total_Revenue DESC;
```

Expected Result:

Table 9: Department Revenue Contribution

Department_Name	Total_Revenue	Revenue_Percentage
Dermatology	₦8,000.00	34.04%
Neurology	₦7,500.00	31.91%
Cardiology	₦5,000.00	21.28%
Pediatrics	₦3,000.00	12.77%

3. **Analyze the distribution of visit reasons across different age groups (e.g., 0-18, 19-35, 36-50, 51+).**

```
    SELECT
    CASE
        WHEN TIMESTAMPDIFF(YEAR, p.Birth_Date, CURDATE()) <= 18 THEN '0-18'
        WHEN TIMESTAMPDIFF(YEAR, p.Birth_Date, CURDATE()) BETWEEN 19 AND 35 THEN
    '19-35'
        WHEN TIMESTAMPDIFF(YEAR, p.Birth_Date, CURDATE()) BETWEEN 36 AND 50 THEN
    '36-50'
        ELSE '51+'
    END AS Age_Group,
    a.Reason AS Visit_Reason,
    COUNT(a.Appointment_ID) AS Count
FROM
    Appointment a
JOIN
    Patient p ON a.Patient_ID = p.Patient_ID
GROUP BY
    Age_Group, a.Reason
ORDER BY
    Age_Group, Count DESC;
```

Expected Result:

Table 10: Visit Reasons by Age Group

Age_Group	Visit_Reason	Count
19-35	Chronic headaches evaluation	1
19-35	X-ray for suspected fracture	1
36-50	Hypertension follow-up	1
36-50	Knee pain assessment	1
36-50	Child wellness checkup	1
36-50	Stomach pain diagnosis	1
51+	Skin rash examination	1

4. **Generate a detailed report of all prescriptions issued**

```
    SELECT
        p.Full_Name AS Patient,
        pr.Medication_Name AS Medication,
        pr.Dosage,
        pr.Frequency,
        pr.Duration,
```

```
    DATE_FORMAT(a.Appointment_Date, '%Y-%m-%d') AS Visit_Date,
    d.Doctor_Name AS Prescribed_By
FROM Prescription pr
JOIN Appointment a ON pr.Appointment_ID = a.Appointment_ID
JOIN Patient p ON a.Patient_ID = p.Patient_ID
JOIN Doctor d ON a.Doctor_ID = d.Doctor_ID
WHERE a.Appointment_Date BETWEEN '2023-11-01' AND '2023-11-07'
ORDER BY p.Full_Name, pr.Medication_Name;
```

Expected Result:

Table 11: Prescription Report

Patient	Medication	Dosage	Frequency	Duration	Visit_Date	Prescribed_by
Adaobi Nwankwo	Sumatriptan	50mg tablet	As needed for migraine	10 doses	2023-11-02	Dr. Ngozi Okonkwo
Amara Eze	Diclofenac	50mg tablet	Twice daily after meals	10 days	2023-11-05	Dr. Uche Ogbonna
Chidinma Okoro	Ibuprofen	400mg tablet	Every 8 hours with food	7 days	2023-11-03	Dr. Chinedu Okafor
Chinonso Ugwu	Amlodipine	5mg tablet	Once daily	30 days	2023-11-01	Dr. Obinna Eze
Emeka Okafor	Paracetamol	120mg/5ml suspension	5ml every 6 hours	5 days	2023-11-04	Dr. Ada Nwosu
Ifeanyi Nnamdi	Hydrocortisone	1% cream	Apply to affected area twice daily	14 days	2023-11-06	Dr. Chinwe Ani

5. **Generate a report that analyzes revenue based on the payment methods used in the hospital**

```
SELECT
    Payment_Method,
    COUNT(*) AS Transaction_Count,
    CONCAT(N\'{}, FORMAT(SUM(Amount), 2)) AS Total\_Amount,
    CONCAT(N\'{}, FORMAT(AVG(Amount), 2)) AS Average\_Amount,
    CONCAT(ROUND(COUNT(*)*100/(SELECT COUNT(*) FROM Billing), 0), '%') AS
Percentage
FROM Billing
GROUP BY Payment_Method
ORDER BY Total_Amount DESC;
```

Expected Result:

Table 12: Revenue Analysis by Payment Method

Payment_Method	Transaction_Count	Total_Amount	Average_Amount	Percentage
Card	2	₦22,500.00	₦11,250.00	29%
Cash	2	₦22,000.00	₦11,000.00	29%

Continued on next page

Table 12 – *Continued from previous page*

Payment_Method	Transaction_Count	Total_Amount	Average_Amount	Percentage
Insurance	3	₦16,000.00	₦5,333.33	43%