

# **DBMS MINOR PROJECT**

**COURSE CODE:MC-209**

**MATHEMATICS AND COMPUTING**

**B.TECH 3<sup>rd</sup> SEMESTER**



**DELHI TECHNOLOGICAL UNIVERSITY**

**DEPARTMENT APPLIED MATHEMATICS**

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## **Acknowledgment**

We are deeply grateful to Ms. Himani Pokhriyal for her invaluable mentorship and guidance throughout the course of our Hospital Management System project. This endeavor would not have been possible without her expertise, dedication, and encouragement. Ms. Pokhriyal's insightful feedback, patient guidance, and support provided us with the knowledge and confidence to navigate the challenges of this project, allowing us to refine our skills and better understand the intricacies of hospital management systems.

From the initial stages of planning to the final implementation, Ms. Pokhriyal's expertise helped us in making informed decisions, understanding complex requirements, and overcoming technical challenges. Her thorough approach to teaching and her readiness to offer assistance whenever needed created a supportive learning environment that encouraged us to give our best and strive for excellence.

Thank you, ma'am, for your invaluable contributions to our project and for your unwavering support. It has been a privilege to work under your guidance, and we are honored to have had the opportunity to learn from you.

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# **Abstract**

The Hospital Management System (HMS) is designed to streamline and automate the processes within a hospital, ensuring efficient management of patient records, appointments, medical histories, staff, and resources. The system leverages a Database Management System (DBMS) to securely store, manage, and retrieve hospital-related data, providing an integrated platform for healthcare providers to manage essential functions and improve patient care quality.

The primary objective of the HMS is to enable seamless coordination between departments, reduce paperwork, and minimize human errors by centralizing data access. This system includes modules for patient registration, doctor and staff management, appointments, billing, inventory management, and reports generation. By adopting relational databases and enforcing database integrity and security constraints, the system ensures data consistency, confidentiality, and quick access for authorized users.

The HMS aims to facilitate real-time data processing, allowing medical professionals and administrative staff to perform their duties more effectively. In addition, it provides scalability to accommodate future growth and integration with other healthcare systems. The Hospital Management System thus serves as a comprehensive tool for improving operational efficiency, data accuracy, and patient satisfaction within a hospital setting.

# Introduction

The **Hospital Management System (HMS)** project, developed by Lokesh Godara and Krrishnav, is designed to streamline and automate the essential processes within a hospital environment. Efficient management of patient records, scheduling, billing, and other administrative tasks is vital to delivering high-quality healthcare. This system provides a centralized platform that reduces paperwork, minimizes human error, and enhances coordination among departments, ultimately improving the patient experience.

Built with a focus on data integrity, security, and ease of use, the HMS incorporates key modules such as patient registration, doctor and staff management, appointment scheduling, billing, and inventory management. By using Database Management System (DBMS) principles, we have ensured that critical data is securely stored and readily accessible for authorized personnel. This system allows healthcare providers to retrieve and manage information quickly, enabling them to focus more on patient care.

In developing this project, we applied essential DBMS concepts, including normalization and transaction management, to ensure efficient data handling and high performance. The Hospital Management System is thus an effective tool for improving operational efficiency and enhancing the quality of care within a hospital.

No. Of Experiments	Name of Experiment	Date	Signature
1	System Design of the Project, along with its E-R Diagram	6/08/2024	
2	Implement the following DDL statements: a. Create b. Create table with constraints (NOT NULL, UNIQUE, DEFAULT, CHECK, PRIMARY KEY, FOREIGN KEY) c. Alter Table: i. Add column ii. Drop column iii. Add/drop constraint iv. Rename column d. Drop Table	13/08/24	
3	Implement the following DML statements: a. Insert b. Update c. Delete d. Truncate	20/08/24	
4	Implement the following SELECT statements: a. Simple SELECT statement b. Where clause+ IN/NOT IN c. Aggregate functions d. Group by + Having e. Order by f. Views g. Inbuilt Functions (e.g., Date)	27/08/24	

5	Implement and perform Nested Queries along with Joins (Inner join, Outer join, Left join, Right join)	3/09/24	
6	Introduction to PL/SQL. Create a PL/SQL block and implement the following: a. Variables	10/09/24	
	b. Packages c. Procedures d. Functions		
7	Perform Exception handling in a PL/SQL block.	8/10/24	
8	Project Report with Code and Screenshots	13/10/24	
9	Implement Triggers in SQL.	22/10/24	
10	Implement the following transaction statements: a. Commit b. Rollback c. Savepoint	22/10/24	

# 1. System design of the Project, along with its E-R Diagram

## **Synopsis of Hospital Management System**

**Project Title:** Hospital Management System (HMS)

**Objective:** The primary objective of this Hospital Management System (HMS) is to create a comprehensive database solution that manages the daily operations and administrative tasks of a hospital. This system aims to improve the efficiency and accuracy of various processes, including patient registration, appointment scheduling, medical records management, billing, and staff management.

**Introduction:** In the modern healthcare environment, hospitals face challenges such as managing patient data, scheduling appointments, and ensuring seamless communication among healthcare providers. The Hospital Management System seeks to address these challenges by providing a centralized platform that streamlines operations, enhances patient care, and optimizes resource management. **Key Features:**

### **1. Patient Registration:**

- Collect and store patient information, including personal details, medical history, and contact information.
- Assign a unique patient ID for easy identification.

### **2. Appointment Scheduling:**

- Allow patients to book appointments with doctors online.
- Manage appointment availability and send reminders to patients.

### **3. Medical Records Management:**

- Maintain electronic medical records (EMRs) for each patient.
- Facilitate easy access to patient history, diagnoses, treatments, and prescriptions.

### **4. Billing and Invoicing:**

- Automate the billing process for medical services rendered.
- Generate invoices and manage payment records.

## 5. Staff Management:

- Manage doctor, nurse, and administrative staff information.
- Track staff schedules, availability, and performance.

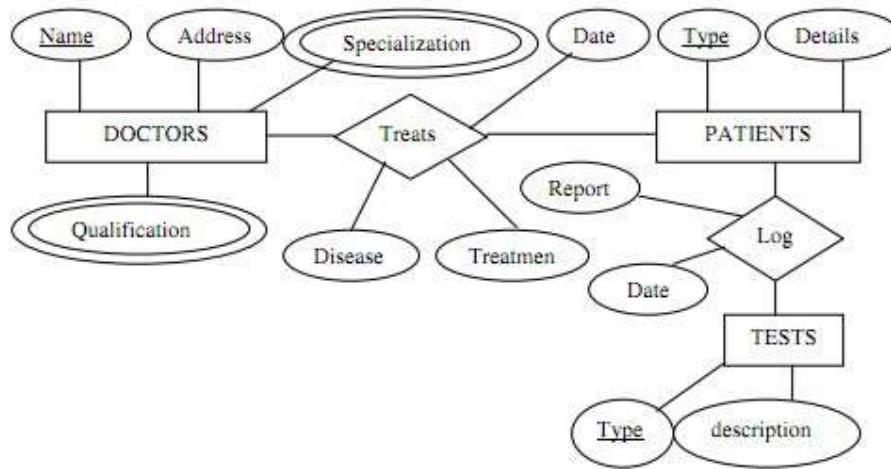
## 6. Reporting:

- Generate reports on patient statistics, financials, and operational efficiency.
- Provide insights to aid decision-making and improve services.

### Technologies Used:

- **Database Management System:** MySQL

**Conclusion:** The Hospital Management System will significantly enhance the efficiency of hospital operations, improve patient experience, and ensure accurate management of medical records. By implementing a robust database solution, the system will facilitate better healthcare delivery, ultimately leading to improved patient outcomes.

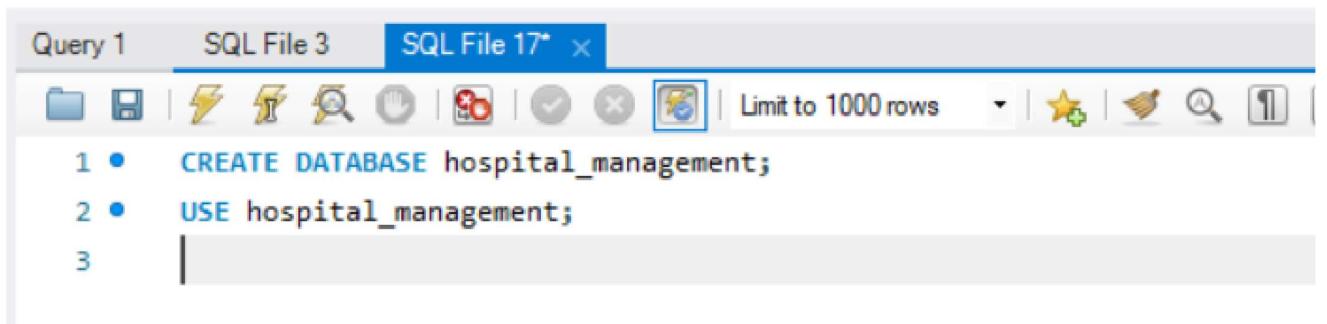


**2.** Implement the following DDL statements: a. Create  
b. Create table with constraints (NOT NULL, UNIQUE, DEFAULT, CHECK, PRIMARY KEY, FOREIGN KEY) c.

Alter Table:

i. Add column ii. Drop column iii. Add/drop constraint iv. Rename column d. Drop Table

a. Create



```
Query 1          SQL File 3          SQL File 17* x
 1 •  CREATE DATABASE hospital_management;
 2 •  USE hospital_management;
 3
```

b. Create table with constraints (NOT NULL, UNIQUE, DEFAULT, CHECK, PRIMARY KEY, FOREIGN KEY)

c. Alter Table:

i. Add column

Query 1    SQL File 3    SQL File 17\* x

CREATE TABLE Patients ( patient\_id INT PRIMARY KEY, patient\_name VARCHAR(100) NOT NULL, age INT CHECK (age > 0), gender VARCHAR(10), phone VARCHAR(15) UNIQUE, disease VARCHAR(100), date\_of\_admission DATE DEFAULT (CURRENT\_DATE()) );

Query 1    SQL File 3    SQL File 17\* x

ALTER TABLE Patients ADD doctor\_assigned VARCHAR(100);

## ii. Drop column

patients patients patients patients patients doctors doctors doctors x

ALTER TABLE Patients DROP COLUMN disease;

## iii. Add/drop constraint

### Add a NOT NULL constraint on doctor\_assigned

Query 1    SQL File 3    SQL File 17\* x

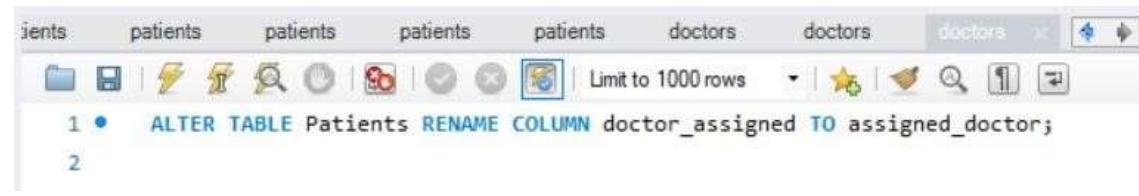
ALTER TABLE Patients MODIFY doctor\_assigned VARCHAR(100) NOT NULL;

### Drop the NOT NULL constraint

Query 1    SQL File 3    SQL File 17\* x

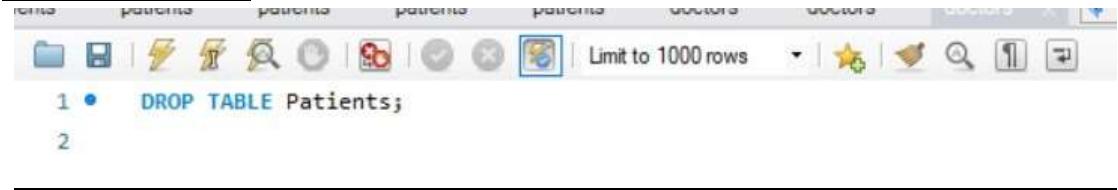
ALTER TABLE Patients ADD doctor\_assigned VARCHAR(100);

***iv. Rename column***



```
ALTER TABLE Patients RENAME COLUMN doctor_assigned TO assigned_doctor;
```

***d. Drop Table***



```
DROP TABLE Patients;
```

### **3. Implement the following DML statements:**

- a. Insert**
  - b. Update**
  - c. Delete**
  - d. Truncate**

**a. Insert**

The screenshot shows the MySQL Workbench interface with two tabs open:

- Query 1:** Contains the following SQL code:

```
1 • INSERT INTO Patients (patient_id, patient_name, age, gender, phone, disease, date_of_admission) VALUES (1, 'John Doe', 30, 'Male', '1234567890', 'Fever', '2024-10-05');
```
- Query 2:** Contains the following SQL code:

```
1 • SELECT * FROM patients;
```

Below the queries, the "Result Grid" pane displays the data from the "patients" table. The table has the following columns: patient\_id, patient\_name, age, gender, phone, disease, and date\_of\_admission. The data row is as follows:

patient_id	patient_name	age	gender	phone	disease	date_of_admission	doctor_id
1	John Doe	30	Male	1234567890	Fever	2024-10-05	NULL

### b. Update

The screenshot shows the MySQL Workbench interface with two tabs: 'patients' and 'patients 1'. The top tab contains the following SQL code:

```
1 • UPDATE Patients
2     SET disease = 'COVID-19'
3     WHERE patient_id = 1;
4
5
```

The bottom tab contains the following SQL code:

```
1 • SELECT * FROM hospital_management.patients;
```

Below the tabs is a 'Result Grid' window displaying the updated patient data:

patient_id	patient_name	age	gender	phone	disease	date_of_admission	doctor
1	John Doe	30	Male	1234567890	COVID-19	2024-10-05	NULL
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL

The 'Result Grid' window has a sidebar with icons for 'Result Grid', 'Form Editor', and 'Revert'.

### c. Delete

The screenshot shows the MySQL Workbench interface with two tabs: 'patients' and 'patients 1'. The top tab contains the following SQL code:

```
1     DELETE FROM Patients WHERE patient_id = 1;
2
```

#### d. Truncate

Query 1    SQL File 3    SQL File 17\*    patients    patients    patients x

1    TRUNCATE TABLE Patients;

2

This screenshot shows the MySQL Workbench interface with a single query window. The query is a simple TRUNCATE TABLE command targeting the 'Patients' table.

Query 1    SQL File 3    SQL File 17\*    patients    patients    patients    patients x

1 •    SELECT \* FROM hospital\_management.patients;

This screenshot shows the MySQL Workbench interface with a single query window. The query is a standard SELECT \* FROM table command for the 'patients' table.

Result Grid | Filter Rows: | Edit: | Export/Import: | v

patient_id	patient_name	age	gender	phone	disease	date_of_admission	doctor_assigne
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL

patients 1 x    Apply Revert

This screenshot shows the MySQL Workbench interface with a result grid window. The grid displays the structure of the 'patients' table with all columns and a single row containing NULL values. A 'Result Grid' button is highlighted in blue.

Query 1    SQL File 3    SQL File 17\*    patients    patients    patients x

1 •    SELECT \* FROM hospital\_management.patients;

Result Grid | Filter Rows: | Edit: | Export/Import: | v

patient_id	patient_name	age	gender	phone	disease	date_of_admission	doctor_assigne
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL

This screenshot shows the MySQL Workbench interface with a result grid window. The grid displays the structure of the 'patients' table with all columns and a single row containing NULL values.

Output			
#	Time	Action	Message
1	13:10:40	SELECT * FROM patients LIMIT 0, 1000	0 row(s) returned
2	13:11:47	INSERT INTO Patients (patient_id, patient_name, age, gender, phone, disease, date_of_admission) VALUES ('1', 'John Doe', 25, 'Male', '9876543210', 'COVID-19', '2022-01-01')	1 row(s) affected
3	13:11:58	INSERT INTO Patients (patient_id, patient_name, age, gender, phone, disease, date_of_admission) VALUES ('2', 'Jane Smith', 28, 'Female', '9876543211', 'COVID-19', '2022-01-01')	Error Code: 1062. Duplicate entry '1' for key 'patients.PRIMARY'
4	13:12:52	SELECT * FROM table_name LIMIT 0, 1000	Error Code: 1146. Table 'hospital_management.table_name' doesn't exist
5	13:13:02	SELECT * FROM patients LIMIT 0, 1000	0 row(s) returned
6	13:13:54	UPDATE Patients SET disease = 'COVID-19' WHERE patient_id = 1	1 row(s) affected Rows matched: 1 Changed: 1 Warnings: 0
7	13:14:30	SELECT * FROM hospital_management.patients LIMIT 0, 1000	1 row(s) returned
8	13:15:04	DELETE FROM Patients WHERE patient_id = 1	1 row(s) affected
9	13:15:45	SELECT * FROM hospital_management.patients LIMIT 0, 1000	0 row(s) returned
10	13:16:14	TRUNCATE TABLE Patients	0 row(s) affected

- 4- Implement the following SELECT statements:**
- a. Simple SELECT statement**
  - b. Where clause+ IN/NOT IN**
  - c. Aggregate functions**
  - d. Group by + Having**
  - e. Order by**
  - f. Views**
  - g. Inbuilt Functions (e.g., Date)**

**a. Simple SELECT statement**

**b. Where clause + IN/NOT IN:**

The screenshot shows the MySQL Workbench interface. The top navigation bar includes tabs for 'Query 1' (selected), 'SQL File 3', 'SQL File 17\*', 'patients', 'patients', 'patients', and 'patients'. Below the toolbar, a query window displays the following SQL code:

```
1 • SELECT patient_name, disease
2   FROM Patients
3 WHERE disease IN ('Fever', 'COVID-19');
4
5
```

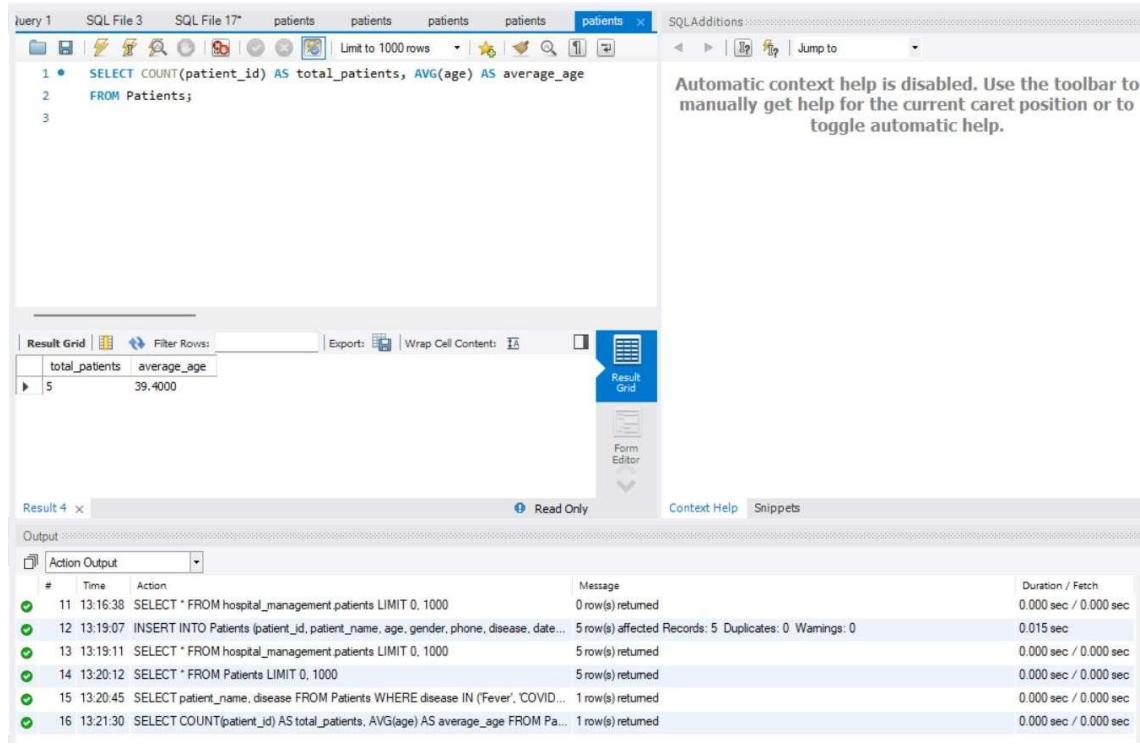
The results are shown in a 'Result Grid' tab, which contains the following data:

patient_name	disease
Chris Lee	COVID-19

On the right side of the interface, there is a sidebar titled 'SQLAdditions' with the message: 'Automatic context help is disabled. Use the toolbar to manually get help for the current caret position or to toggle automatic help.' A vertical toolbar on the right has icons for 'Result Grid' (selected), 'Form Editor', and 'Table Editor'.

### c. Aggregate Functions (e.g., COUNT, AVG):

sql



The screenshot shows a SQL query window with the following content:

```
Query 1 SQL File 3 SQL File 17* patients patients patients patients patients
1 •  SELECT COUNT(patient_id) AS total_patients, AVG(age) AS average_age
2   FROM Patients;
3
```

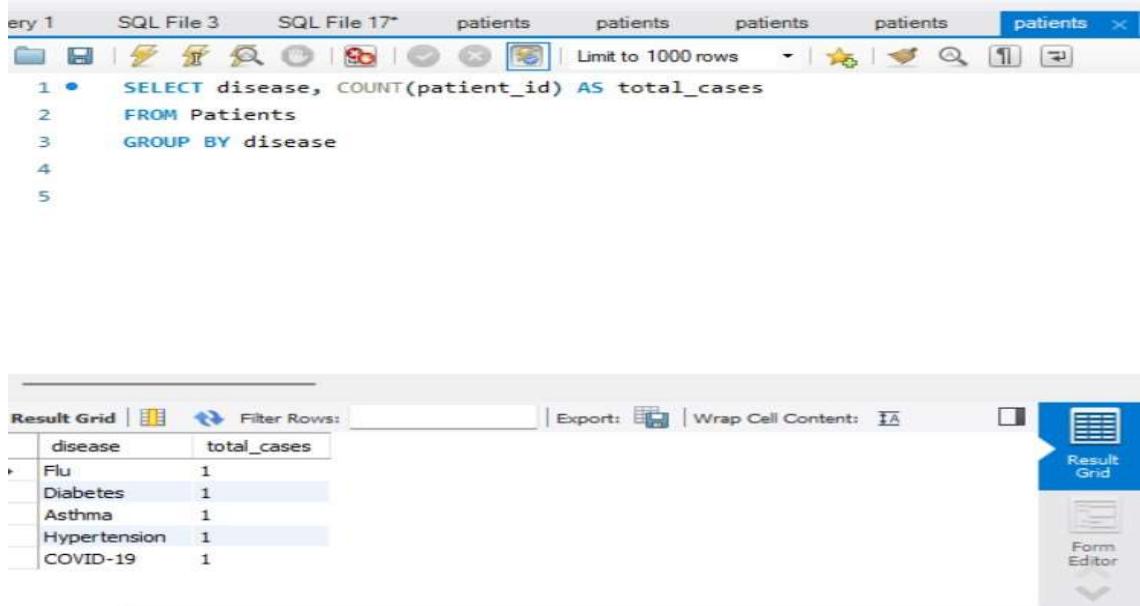
The results grid displays the output of the query:

total_patients	average_age
5	39,4000

Below the results grid, the message pane shows the following log entries:

#	Time	Action	Message	Duration / Fetch
11	13:16:38	SELECT * FROM hospital_management.patients LIMIT 0, 1000	0 row(s) returned	0.000 sec / 0.000 sec
12	13:19:07	INSERT INTO Patients (patient_id, patient_name, age, gender, phone, disease, date...)	5 row(s) affected Records: 5 Duplicates: 0 Warnings: 0	0.015 sec
13	13:19:11	SELECT * FROM hospital_management.patients LIMIT 0, 1000	5 row(s) returned	0.000 sec / 0.000 sec
14	13:20:12	SELECT * FROM Patients LIMIT 0, 1000	5 row(s) returned	0.000 sec / 0.000 sec
15	13:20:45	SELECT patient_name, disease FROM Patients WHERE disease IN ('Fever', 'COVID...')	1 row(s) returned	0.000 sec / 0.000 sec
16	13:21:30	SELECT COUNT(patient_id) AS total_patients, AVG(age) AS average_age FROM Pa...	1 row(s) returned	0.000 sec / 0.000 sec

### d. Group By + Having



The screenshot shows a SQL query window with the following content:

```
Query 1 SQL File 3 SQL File 17* patients patients patients patients patients
1 •  SELECT disease, COUNT(patient_id) AS total_cases
2   FROM Patients
3   GROUP BY disease
4
5
```

The results grid displays the output of the query:

disease	total_cases
Flu	1
Diabetes	1
Asthma	1
Hypertension	1
COVID-19	1

### e. Order By

Query 1    SQL File 3    SQL File 17\*    patients    patients    patients    patients    patients    pat

```
1 •   SELECT * FROM PatientInfo;
2
```

Result Grid | Filter Rows: Export: Wrap Cell Content: □

	patient_name	age	disease
▶	John Doe	45	Flu
	Jane Smith	32	Diabetes
	Mike Johnson	28	Asthma
	Emma Davis	54	Hypertension
	Chris Lee	38	COVID-19

PatientInfo 8 × Read Only

Query 1    SQL File 3    SQL File 17\*    patients    patients    patients    patients    patients    patients

```
1 •   SELECT patient_name, age FROM Patients ORDER BY age DESC;
2
```

Result Grid | Filter Rows: Export: Wrap Cell Content: □

	patient_name	age
▶	Emma Davis	54
	John Doe	45
	Chris Lee	38
	Jane Smith	32
	Mike Johnson	28

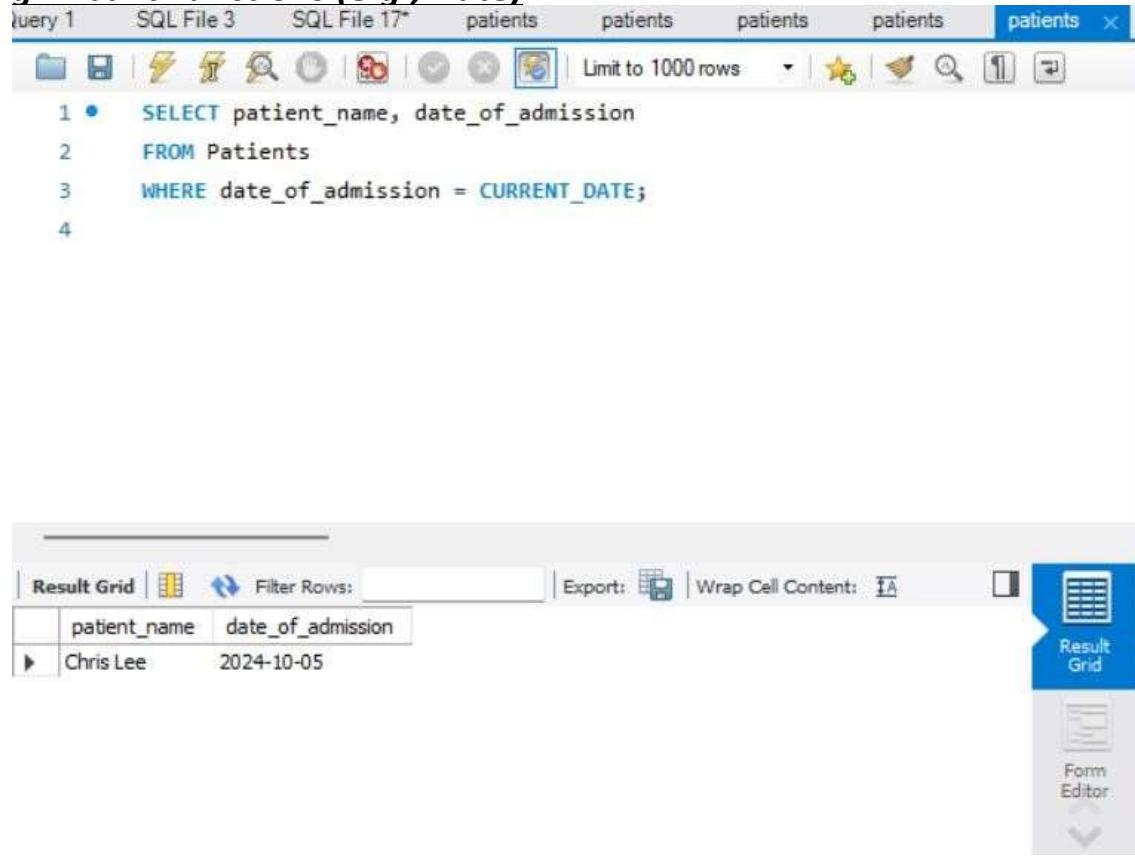
Patients 7 × Read Only

## f. Views

Query 1    SQL File 3    SQL File 17\*    patients    patients    patients    patients    patients    patients

```
1 •   CREATE VIEW PatientInfo AS
2     SELECT patient_name, age, disease FROM Patients;
3
```

### ***g. Inbuilt Functions (e.g., Date)***



The screenshot shows a MySQL Workbench interface. At the top, there are tabs for 'Query 1', 'SQL File 3', 'SQL File 17\*', and multiple 'patients' tabs. Below the tabs is a toolbar with various icons. The main area contains a numbered SQL query:

```
1 •  SELECT patient_name, date_of_admission
2   FROM Patients
3   WHERE date_of_admission = CURRENT_DATE;
4
```

Below the query is a results grid titled 'Result Grid'. It has columns for 'patient\_name' and 'date\_of\_admission'. One row is shown, containing 'Chris Lee' and '2024-10-05'. To the right of the grid is a sidebar with buttons for 'Result Grid' and 'Form Editor'.

	patient_name	date_of_admission
▶	Chris Lee	2024-10-05

### ***5- Implement and perform Nested Queries along with Joins (Inner join, Outer join, Left join, Right join)***

We have 2 tables named Patients and doctors

The screenshot shows two separate MySQL Workbench windows. The top window displays the results of the query `SELECT * FROM hospital_management.patients;`. The bottom window displays the results of the query `SELECT * FROM hospital_management.doctors;`. Both windows have a toolbar at the top with various icons for file operations, search, and export.

	patient_id	patient_name	age	gender	phone	disease	date_of_admission	doctor_id
▶	1	John Doe	45	Male	1234567890	Flu	2024-10-01	NULL
2	Jane Smith	32	Female	0987654321		Diabetes	2024-10-02	NULL
3	Mike Johnson	28	Male	1122334455		Asthma	2024-10-03	NULL
4	Emma Davis	54	Female	2233445566		Hypertension	2024-10-04	NULL
5	Chris Lee	38	Male	3344556677		COVID-19	2024-10-05	NULL
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

	doctor_id	doctor_name	specialization	phone
▶	1	Dr. Smith	Cardiologist	1234000000
2	Dr. Brown	Endocrinologist	1234000001	
3	Dr. Green	Pulmonologist	1234000002	
4	Dr. Taylor	General Physician	1234000003	
*	NULL	NULL	NULL	NULL

Add a `doctor_id` to the `Patients` Table (for relational queries)

We need to update the `Patients` table to include a reference to the `Doctors` table, linking patients to doctors using a foreign key.

```
1 ALTER TABLE Patients
2 ADD doctor_id INT,
3 ADD FOREIGN KEY (doctor_id) REFERENCES Doctors(doctor_id);
4
```

## Update Patient Records to Assign Doctors

```
1 • UPDATE Patients
2     SET doctor_id = 1 WHERE disease = 'Hypertension';
3 • UPDATE Patients
4     SET doctor_id = 2 WHERE disease = 'Diabetes';
5 • UPDATE Patients
6     SET doctor_id = 3 WHERE disease = 'Asthma';
7 • UPDATE Patients
8     SET doctor_id = 4 WHERE disease = 'Flu';
9 • UPDATE Patients
10    SET doctor_id = 4 WHERE disease = 'COVID-19';
11
12
```

## Nested Queries

```
patients patients patients patients patients doctors doctors
1 • SELECT patient_name, age, disease
2   FROM Patients
3   WHERE doctor_id = (SELECT doctor_id FROM Doctors WHERE specialization = 'Cardiologist');
4
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: | □ | Result Grid

patient_name	age	disease
Emma Davis	54	Hypertension

Form Editor

## Inner join

```
1 •  SELECT P.patient_name, P.age, P.disease, D.doctor_name, D.specialization
2   FROM Patients P
3   INNER JOIN Doctors D ON P.doctor_id = D.doctor_id;
4
```

	patient_name	age	disease	doctor_name	specialization
▶	John Doe	45	Flu	Dr. Taylor	General Physician
	Jane Smith	32	Diabetes	Dr. Brown	Endocrinologist
	Mike Johnson	28	Asthma	Dr. Green	Pulmonologist
	Emma Davis	54	Hypertension	Dr. Smith	Cardiologist
	Chris Lee	38	COVID-19	Dr. Taylor	General Physician

## Left join

```
1 •  SELECT P.patient_name, P.age, P.disease, D.doctor_name, D.specialization
2   FROM Patients P
3   LEFT JOIN Doctors D ON P.doctor_id = D.doctor_id;
4
```

	patient_name	age	disease	doctor_name	specialization
▶	John Doe	45	Flu	Dr. Taylor	General Physician
	Jane Smith	32	Diabetes	Dr. Brown	Endocrinologist
	Mike Johnson	28	Asthma	Dr. Green	Pulmonologist
	Emma Davis	54	Hypertension	Dr. Smith	Cardiologist
	Chris Lee	38	COVID-19	Dr. Taylor	General Physician

## Right join

patients patients patients patients doctors doctors

```

1 •   SELECT P.patient_name, P.age, P.disease, D.doctor_name, D.specialization
2   FROM Patients P
3   RIGHT JOIN Doctors D ON P.doctor_id = D.doctor_id;
4

```

Result Grid | Filter Rows: Export: Wrap Cell Content: □

	patient_name	age	disease	doctor_name	specialization
▶	Emma Davis	54	Hypertension	Dr. Smith	Cardiologist
	Jane Smith	32	Diabetes	Dr. Brown	Endocrinologist
	Mike Johnson	28	Asthma	Dr. Green	Pulmonologist
	Chris Lee	38	COVID-19	Dr. Taylor	General Physician
	John Doe	45	Flu	Dr. Taylor	General Physician

Result Grid Form Editor

### Outer join

patients patients patients patients doctors doctors

```

1 •   SELECT P.patient_name, P.age, P.disease, D.doctor_name, D.specialization
2   FROM Patients P
3   LEFT JOIN Doctors D ON P.doctor_id = D.doctor_id
4   UNION
5   SELECT P.patient_name, P.age, P.disease, D.doctor_name, D.specialization
6   FROM Patients P
7   RIGHT JOIN Doctors D ON P.doctor_id = D.doctor_id;
8

```

Result Grid | Filter Rows: Export: Wrap Cell Content: □

	patient_name	age	disease	doctor_name	specialization
▶	John Doe	45	Flu	Dr. Taylor	General Physician
	Jane Smith	32	Diabetes	Dr. Brown	Endocrinologist
	Mike Johnson	28	Asthma	Dr. Green	Pulmonologist
	Emma Davis	54	Hypertension	Dr. Smith	Cardiologist
	Chris Lee	38	COVID-19	Dr. Taylor	General Physician

Result Grid Form Editor

## **6-Introduction to PL/SQL. Create a PL/SQL block**

**and implement the following:**

**a. Variables**

**b. Packages**

**c. Procedures**

**d. Functions**

### **a. Variables**



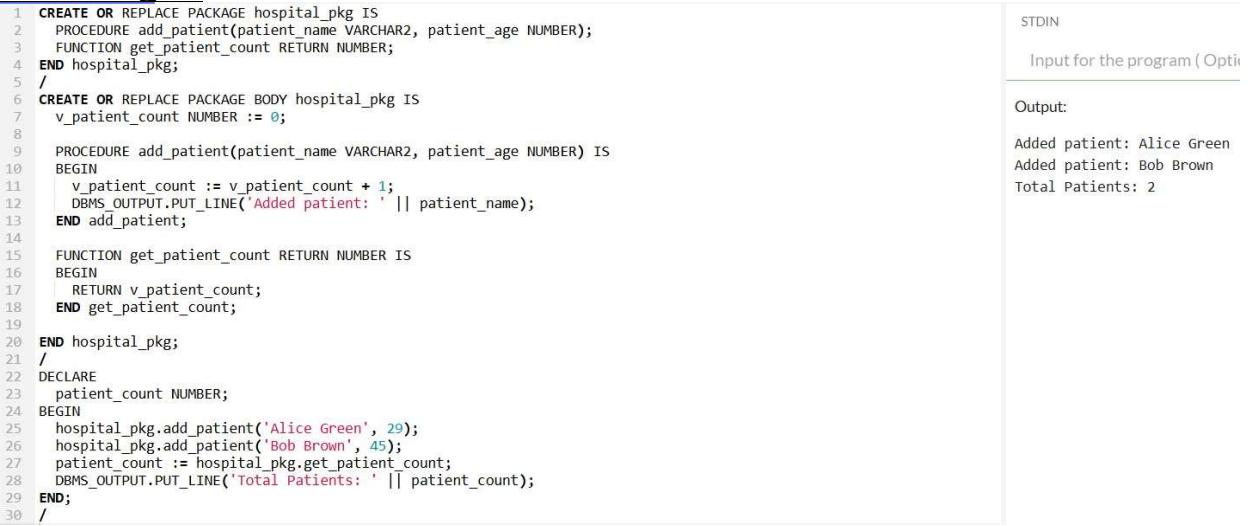
The screenshot shows the OneCompiler IDE interface. The left pane displays the SQL script `queries.sql`. The code is as follows:

```
1 DECLARE
2     patient_id NUMBER := 1001;
3     patient_name VARCHAR2(50) := 'John Doe';
4 BEGIN
5     DBMS_OUTPUT.PUT_LINE('Patient ID: ' || patient_id);
6     DBMS_OUTPUT.PUT_LINE('Patient Name: ' || patient_name);
7 END;
8 /
9 |
```

The right pane shows the execution results. The **STDIN** section has the placeholder "Input for the program (Opt)". The **Output** section displays the results of the `DBMS_OUTPUT.PUT_LINE` statements:

```
Patient ID: 1001
Patient Name: John Doe
```

### **b. Packages**



The screenshot shows the OneCompiler IDE interface. The left pane displays the PL/SQL package `hospital_pkg`. The code is as follows:

```
1 CREATE OR REPLACE PACKAGE hospital_pkg IS
2     PROCEDURE add_patient(patient_name VARCHAR2, patient_age NUMBER);
3     FUNCTION get_patient_count RETURN NUMBER;
4 END hospital_pkg;
5 /
6 CREATE OR REPLACE PACKAGE BODY hospital_pkg IS
7     v_patient_count NUMBER := 0;
8
9     PROCEDURE add_patient(patient_name VARCHAR2, patient_age NUMBER) IS
10        BEGIN
11            v_patient_count := v_patient_count + 1;
12            DBMS_OUTPUT.PUT_LINE("Added patient: " || patient_name);
13        END add_patient;
14
15     FUNCTION get_patient_count RETURN NUMBER IS
16        BEGIN
17            RETURN v_patient_count;
18        END get_patient_count;
19
20 END hospital_pkg;
21 /
22 DECLARE
23     patient_count NUMBER;
24 BEGIN
25     hospital_pkg.add_patient('Alice Green', 29);
26     hospital_pkg.add_patient('Bob Brown', 45);
27     patient_count := hospital_pkg.get_patient_count;
28     DBMS_OUTPUT.PUT_LINE('Total Patients: ' || patient_count);
29 END;
30 /
```

The right pane shows the execution results. The **STDIN** section has the placeholder "Input for the program (Opt)". The **Output** section displays the results of the package operations:

```
Added patient: Alice Green
Added patient: Bob Brown
Total Patients: 2
```

### **c. Procedures**

```
1 v DECLARE
2   patient_count NUMBER;
3 v BEGIN
4   patient_count := hospital_pkg.get_patient_count;
5   DBMS_OUTPUT.PUT_LINE('Total Patients: ' || patient_count);
6 END;
7 /
8
```

Statement processed.  
Total Patients: 0

#### **d. Functions**

```
1 v DECLARE
2   patient_count NUMBER;
3 v BEGIN
4   patient_count := hospital_pkg.get_patient_count;
5   DBMS_OUTPUT.PUT_LINE('Total Patients: ' || patient_count);
6 END;
7 /
8
```

Statement processed.  
Total Patients: 0

### **7-Perform Exception handling in a PL/SQL block.**

```

1 v DECLARE
2     patient_id NUMBER := 1;          -- Example patient ID
3     patient_name VARCHAR2(50);      -- Variable to hold patient name
4     age NUMBER := 0;                -- Example variable for division by zero
5     result NUMBER;
6 v BEGIN
7     -- Attempt to retrieve patient name
8     SELECT name INTO patient_name
9     FROM patients
10    WHERE id = patient_id;
11
12    -- Display patient name
13    DBMS_OUTPUT.PUT_LINE('Patient Name: ' || patient_name);
14
15    -- Example of division by zero to trigger an exception
16    result := 100 / age;
17    DBMS_OUTPUT.PUT_LINE('Result: ' || result);
18
19 v EXCEPTION
20     -- Handle the NO_DATA_FOUND exception
21     WHEN NO_DATA_FOUND THEN
22         DBMS_OUTPUT.PUT_LINE('Error: Patient with ID ' || patient_id || ' was not found.');
23
24
25 v EXCEPTION
26     -- Handle the NO_DATA_FOUND exception
27     WHEN NO_DATA_FOUND THEN
28         DBMS_OUTPUT.PUT_LINE('Error: Patient with ID ' || patient_id || ' was not found.');
29
30     -- Handle division by zero
31     WHEN ZERO_DIVIDE THEN
32         DBMS_OUTPUT.PUT_LINE('Error: Division by zero occurred.');
33
34
35     -- Handle any other exception
36     WHEN OTHERS THEN
37         DBMS_OUTPUT.PUT_LINE('An unexpected error occurred: ' || SQLERRM);
38 END;
39 /

```

Statement processed.  
Patient Name: Alice Green  
Error: Division by zero occurred.

-9

## Implement Triggers in SQL.

### Step 1: Create the Trigger

```

1  DELIMITER $$

2

3  • CREATE TRIGGER set_default_age
4    BEFORE INSERT ON Patients
5    FOR EACH ROW
6    BEGIN
7      IF NEW.age IS NULL THEN
8        SET NEW.age = 30;
9      END IF;
10   END$$

11

12  DELIMITER ;
13

```

## Step 2: Insert Data

```

Query 1 × SQL File 3* SQL File 17* patients patients patients patients patients doctors doctors
1 • INSERT INTO Patients (patient_id, patient_name, gender, phone, disease, date_of_admission)
2   VALUES (6, 'John Doe', 'Male', '1234567891', 'Flu', CURRENT_DATE());
3

```

```

Query 1 × SQL File 3* SQL File 17* patients patients patients patients patients doctors doctors
1 • INSERT INTO Patients (patient_id, patient_name, age, gender, phone, disease, date_of_admission)
2   VALUES (7, 'Jane Doe', NULL, 'Female', '0987654321', 'Cold', CURRENT_DATE());
3

```

## Step 3: Verify the Output

```

Query 1 × SQL File 3* SQL File 17* patients patients patients patients patients doctors doctors
1 • SELECT * FROM Patients WHERE patient_id IN (6, 7);
2

```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content: |

patient_id	patient_name	age	gender	phone	disease	date_of_admission	doctor_assigned	doctor_id
6	John Doe	30	Male	1234567891	Flu	2024-10-20	HULL	HULL
7	Jane Doe	30	Female	0987654321	Cold	2024-10-20	HULL	HULL
*	HULL	HULL	HULL	HULL	HULL	HULL	HULL	HULL

Result Grid | Form Editor

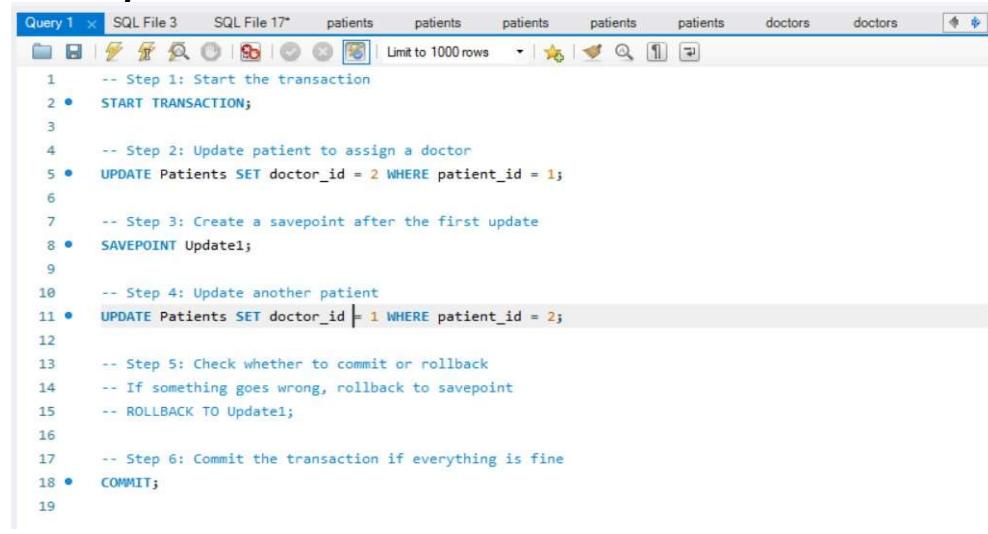
-10

Implement the following transaction statements:

- Commit
- Rollback
- Savepoint

**a. Commit**

**c. Savepoint**



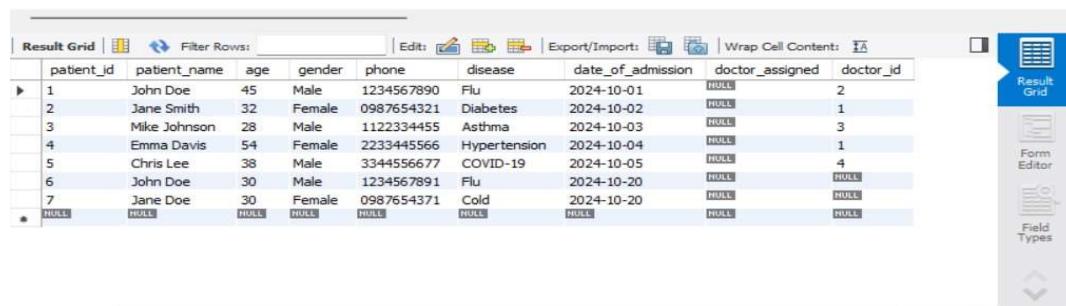
The screenshot shows a SQL Server Management Studio window titled 'Query 1'. The query editor contains the following SQL code:

```
1 -- Step 1: Start the transaction
2 • START TRANSACTION;
3
4 -- Step 2: Update patient to assign a doctor
5 • UPDATE Patients SET doctor_id = 2 WHERE patient_id = 1;
6
7 -- Step 3: Create a savepoint after the first update
8 • SAVEPOINT Update1;
9
10 -- Step 4: Update another patient
11 • UPDATE Patients SET doctor_id = 1 WHERE patient_id = 2;
12
13 -- Step 5: Check whether to commit or rollback
14 -- If something goes wrong, rollback to savepoint
15 -- ROLLBACK TO Update1;
16
17 -- Step 6: Commit the transaction if everything is fine
18 • COMMIT;
19
```



The screenshot shows a SQL Server Management Studio window titled 'Query 1'. The query editor contains the following SQL code:

```
1 • SELECT * FROM Patients;
```



The screenshot shows a SQL Server Management Studio window titled 'Result Grid'. The results of the previous query are displayed in a grid:

patient_id	patient_name	age	gender	phone	disease	date_of_admission	doctor_assigned	doctor_id
1	John Doe	45	Male	1234567890	Flu	2024-10-01	HULL	2
2	Jane Smith	32	Female	0987654321	Diabetes	2024-10-02	HULL	1
3	Mike Johnson	28	Male	1122334455	Asthma	2024-10-03	HULL	3
4	Emma Davis	54	Female	2233445566	Hypertension	2024-10-04	HULL	1
5	Chris Lee	38	Male	3344556677	COVID-19	2024-10-05	HULL	4
6	John Doe	30	Male	1234567891	Flu	2024-10-20	HULL	HULL
7	Jane Doe	30	Female	0987654371	Cold	2024-10-20	HULL	HULL
*	HULL	HULL	HULL	HULL	HULL	HULL	HULL	HULL

**b. Rollback**

Query 1 × SQL File 3 SQL File 17\* patients patients patients patients patients doctors doctors

ROLLBACK;

2

3

Query 1 × SQL File 3 SQL File 17\* patients patients patients patients patients doctors doctors

SELECT \* FROM Patients;

2

Result Grid | Filter Rows: \_\_\_\_\_ | Edit: | Export/Import: | Wrap Cell Content: |

	patient_id	patient_name	age	gender	phone	disease	date_of_admission	doctor_assigned	doctor_id
▶	1	John Doe	45	Male	1234567890	Flu	2024-10-01	NULL	2
	2	Jane Smith	32	Female	0987654321	Diabetes	2024-10-02	NULL	1
	3	Mike Johnson	28	Male	1122334455	Asthma	2024-10-03	NULL	3
	4	Emma Davis	54	Female	2233445566	Hypertension	2024-10-04	NULL	1
	5	Chris Lee	38	Male	3344556677	COVID-19	2024-10-05	NULL	4
	6	John Doe	30	Male	1234567891	Flu	2024-10-20	NULL	NULL
*	7	Jane Doe	30	Female	0987654371	Cold	2024-10-20	NULL	NULL
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Result Grid | Form Editor | Field Types

# Testing and Validation

In this project, “Hospital Management System,” testing and validation were essential steps to ensure the accuracy, efficiency, and reliability of the database and the system’s functionality. The following tests were conducted to validate each component:

## 1. Unit Testing

Each module of the database, including tables such as Patient, Appointment, MedicalRecord, and Staff, was tested individually to verify that they functioned correctly and stored data accurately. This involved inserting, updating, and deleting sample records to confirm each table’s response and data integrity.

- Example Test: Adding a new Patient record and verifying its successful insertion in the Appointment and MedicalRecord tables.
- Result: All tables were successfully populated and updated as per the requirements, with no data inconsistency observed.

## 2. Validation of Constraints

Constraints such as primary keys, foreign keys, and unique constraints were rigorously tested to ensure that they enforced data integrity and prevented duplicate or invalid entries.

- Example Test: Attempted insertion of a duplicate PatientID in the Patient table.
- Result: Duplicate entries were effectively prevented, validating the uniqueness constraint.

## 3. Transaction Testing

Transactions were tested using BEGIN TRANSACTION, COMMIT, and ROLLBACK to validate data handling during multiple operations. This ensured that data remained consistent in cases where some operations needed to be rolled back while others were committed.

- Example Test: Multiple inserts into the Appointment and MedicalRecord tables, followed by a rollback to test partial changes.
- Result: Rollbacks worked as expected, accurately reverting data to maintain integrity.

## 4. Validation of Queries and Reports

All SQL queries were tested to ensure they returned accurate and expected results. Complex queries used for generating reports, such as patient admission statistics or doctor assignment summaries, were checked for accuracy and efficiency.

- Example Test: Generating a report of patients currently admitted for inpatient care.

- Result: The queries returned accurate reports with the required details, confirming query correctness.

## 5. User Access Control Testing

Access control was tested to ensure that only authorized users could perform specific actions within the system. Permissions were verified for roles with select access, insert access, and full privileges.

- Example Test: Testing restricted access for a guest user attempting to modify data in the MedicalRecord table.
- Result: The access control system prevented unauthorized modifications, ensuring data security.

# Conclusion

The **Hospital Management System (HMS)** developed in this project provides a comprehensive solution for managing the complex and essential processes within a healthcare facility. By implementing this system, hospitals can streamline patient registration, appointment scheduling, medical records management, billing, and other administrative tasks, resulting in improved operational efficiency and enhanced patient care.

Throughout the project, database management concepts such as data integrity, constraints, transaction management, and access control were carefully applied to ensure that the system operates reliably and securely. The HMS enables healthcare providers to maintain accurate, up-to-date records and ensures that information is accessible only to authorized personnel, safeguarding patient confidentiality.

The project's testing and validation demonstrated the robustness of the system, ensuring data accuracy, reliability, and efficiency in handling hospital data. Additionally, the user-friendly design of the system allows healthcare staff to navigate the platform easily, reducing training time and minimizing human error.

In conclusion, this Hospital Management System stands as an effective tool for improving the quality of hospital administration. It not only reduces the workload of hospital staff but also contributes to a more seamless and efficient patient experience. Future enhancements, such as integration with other healthcare systems and telemedicine features, could further expand the capabilities of the system, adapting to the evolving needs of modern healthcare.