Hospital Management Database Design and Analysis Report

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# 1. Introduction

This technical report presents a comprehensive analysis of a hospital management system's database design. The project includes an Entity-Relationship Diagram (ERD), logical relational mapping, normalization, table creation scripts, and a set of SQL queries to demonstrate data manipulation and retrieval. The aim is to design a consistent, normalized, and efficient database structure to manage data related to doctors, patients, nurses, departments, rooms, appointments, and payments.

# 2. ERD Analysis

The Entity-Relationship Diagram (ERD) captures the essential entities in the hospital domain: Doctors, Patients, Appointments, Payments, Rooms, Departments, and Nurses. It defines their attributes and the relationships between them. Key relationships include:  
- Doctors are assigned to Departments.  
- Appointments connect Doctors with Patients.  
- Payments are associated with Appointments.  
- Rooms are linked to Departments.  
- Nurses are assigned to Departments and have contact information.  
Each entity includes primary keys and relevant attributes such as names, IDs, and statuses.

# 3. Mapping and Normalization

The ERD has been mapped to relational tables through the process of logical design. All entities were converted into tables with appropriate foreign keys to reflect relationships. Normalization was applied up to the Third Normal Form (3NF) to eliminate redundancy and ensure data integrity.  
- 1NF: Atomic values and unique rows.  
- 2NF: Removed partial dependencies by ensuring full functional dependency on the primary key.  
- 3NF: Eliminated transitive dependencies.  
Composite keys were used where appropriate, such as in Phone tables and Room-Department mapping.

# 4. Tables Overview

The SQL script contains table creation commands for the following:  
- Doctors: Includes doctor\_id, name, specialization, and location info.  
- Patients: Contains demographic info and patient\_id.  
- Appointments: Links doctors and patients with date and reason.  
- Payments: Tracks payment\_id, method, status, and amount.  
- Rooms and Departments: Organized with availability and capacity.  
- Nurses: Defined by name, gender, and department assignment.  
Foreign keys and constraints are used to maintain referential integrity.

# 5. SQL Queries Analysis

The file ends with a series of SELECT queries that demonstrate data retrieval:  
- Joining tables such as Doctors and Appointments to extract relevant information.  
- Filtering results using WHERE conditions.  
- Grouping and aggregating data with GROUP BY.  
These queries validate the database design by showing how information can be queried effectively.

# 6. Observations and Recommendations

The design covers essential hospital functions. Some potential improvements include:  
- Adding indexes for performance enhancement on large tables.  
- Including more constraint checks for data validation.  
- Enhancing user roles and permissions to manage access.  
- Creating views for common queries and reports.

# 7. Conclusion

This report outlined the process of designing, implementing, and analyzing a hospital management database system. The project demonstrates solid use of ER modeling, normalization, SQL scripting, and query design. It serves as a foundational structure that can be extended with features such as medical records, inventory, and user access control.