ADV DATABASE

OUR DATABASE

As the cornerstone of modern healthcare management, our Hospital Management Database represents a sophisticated and comprehensive solution meticulously engineered to optimize administrative, medical, and logistical workflows within healthcare institutions. Developed with precision on the MySQL platform and structured with the InnoDB storage engine, our database is purpose-built to meet the unique requirements of hospitals.

INTRODUCTION TO HOSPITA

1. Patient Management:
• **Purpose:** Pivotal for managing patient data, covering personal details, medical histories, and contacts.
• **Relations:** Patient data is linked to appointments, treatment plans, and, when needed, room allocations.

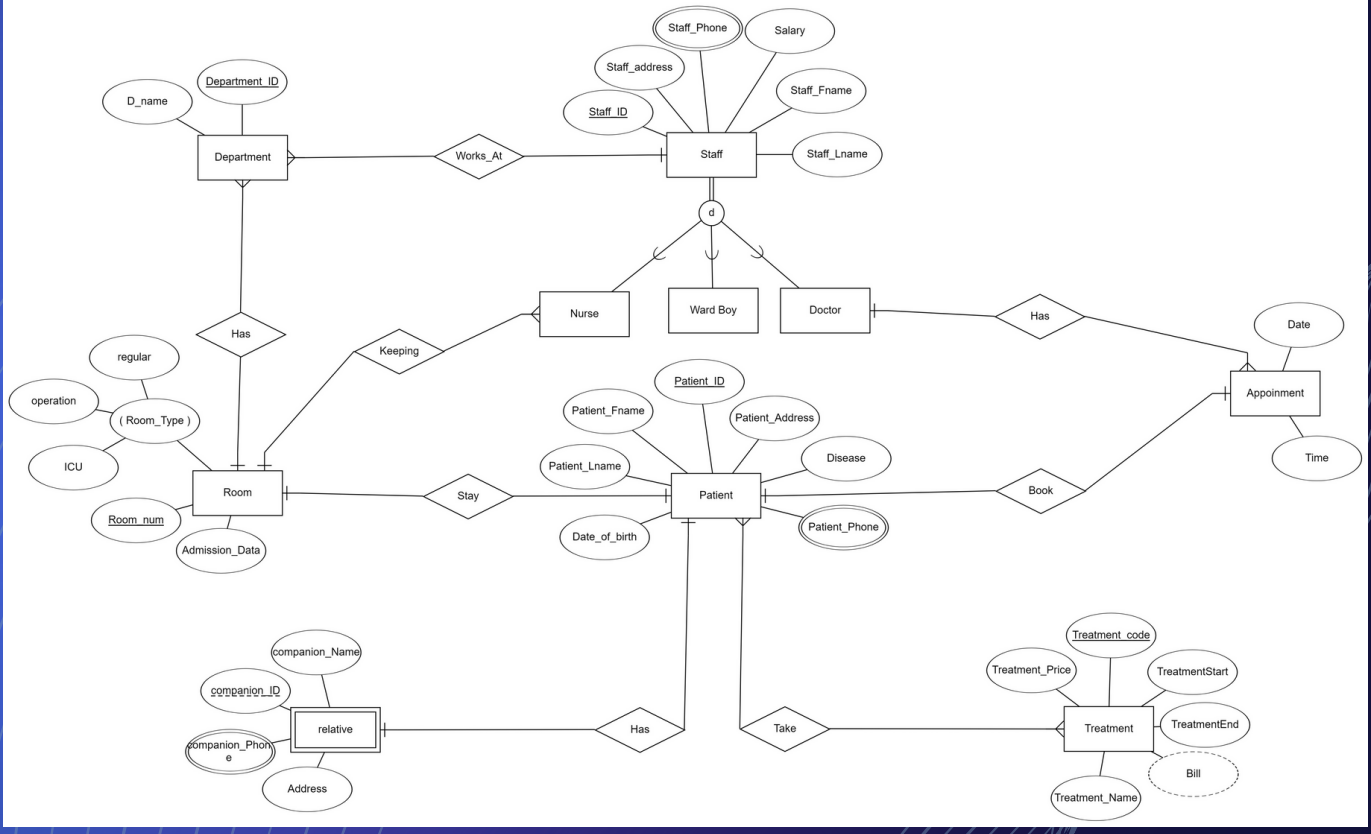
2. Medical Staff and Specializations:
• **Purpose:** Facilitates the organization of information about medical professionals, including specialization and department affiliations.
• **Relations:** Establishes connections between doctors, departments, and their roles in the healthcare ecosystem.

3. Treatment and Healthcare Services:
• **Purpose:** Manages healthcare services, treatments, codes, and costs.
• **Relations:** Relates patient treatment plans to specific medical treatments for a comprehensive record.

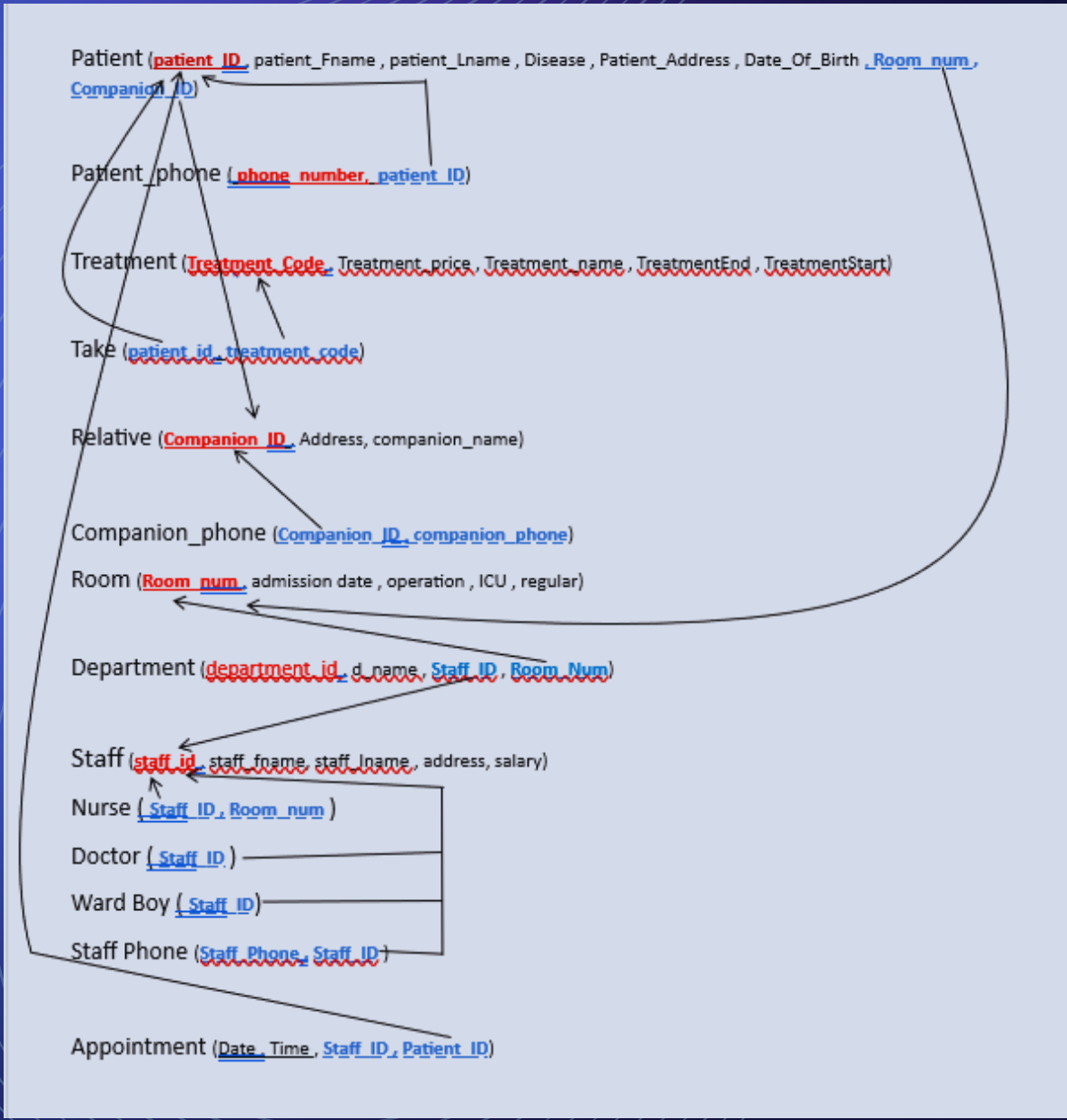
4. Facility Logistics:
• **Purpose:** Optimizes room management, staff allocations, and department-specific requirements.
• **Relations:** Links patient admissions to rooms, associates staff with designated rooms, and aligns rooms with departmental needs.

5. Staff Information:
• **Purpose:** Consolidates essential information about hospital staff, including doctors, nurses, and support staff.
• **Relations:** Establishes connections between staff, their roles, and departments for a cohesive staffing structure.

THE ERD


Staff_Phone
Salary
Staff_address
Staff_Fname
Staff_ID
Staff_Lname
Department_ID
D_name
Department
Works_At
Staff
d
Nurse
Ward Boy
Doctor
Has
Date
Appoinment
Time
Has
Keeping
regular
operation
(Room_Type)
ICU
Room
Room_num
Admission_Data
Stay
Patient_ID
Patient_Fname
Patient_Address
Patient_Lname
Disease
Patient
Date_of_birth
Patient_Phone
Book
companion_Name
companion_ID
companion_Phone
Address
relative
Has
Take
Treatment_code
Treatment_Price
TreatmentStart
TreatmentEnd
Treatment
Bill
Treatment_Name

LOGICAL MODEL



PATIENT ENTITY:

- Normalization:
  - Extracted the multivalued attribute phone_number into a separate table for better normalization and to avoid redundancy.
  - Ensured the date_of_birth attribute is in the proper date format for consistency.
- Optimization:
  - Improved data integrity by using a foreign key reference for the treatment_code.

TREATMENT ENTITY:

- Normalization:
  - Simplified the structure by removing the derived attribute bill and calculating it when needed.
- Optimization:
  - Maintained the many-to-many relationship "Take" with the Patient entity.

ROOM ENTITY:

- Normalization:
  - Ensured Patient_ID is a foreign key referencing the Patient entity, establishing a clear relationship.
  - Normalized Room_Type into a separate table for better management.
- Optimization:
  - Maintained the 1-to-many relationship with the Patient entity, allowing a patient to stay in multiple rooms.

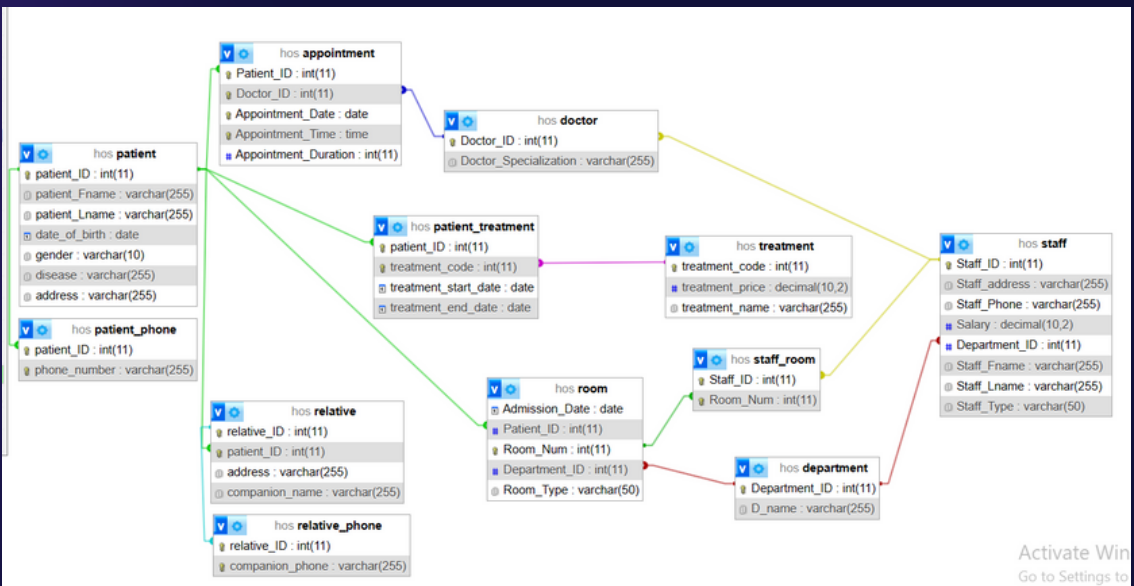
DOCTOR-APPOINTMENT RELATIONSHIP:

- Normalization:
  - Ensured proper date and time formats for the Date and Time attributes.
- Optimization:
  - Maintained the 1-to-many relationship indicating a doctor can have multiple appointments.

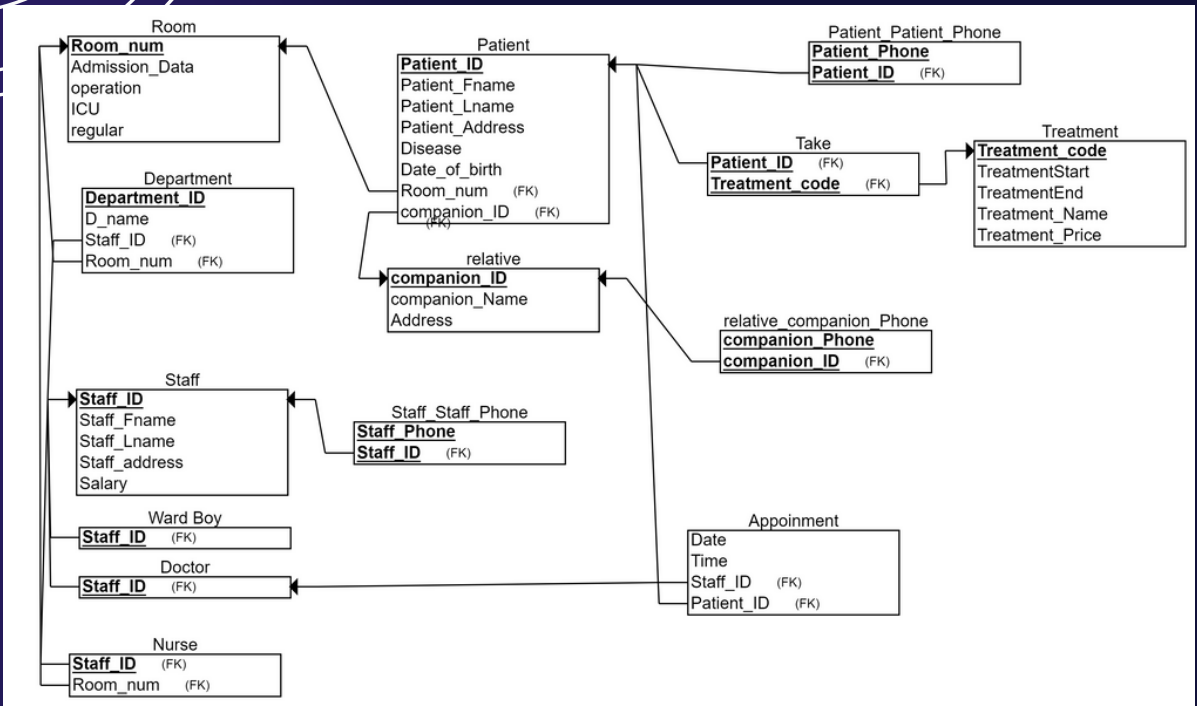
STAFF ENTITY:

- Normalization:
  - Extracted the multivalued attribute Staff_Phone into a separate table.
  - Ensured data integrity by using a foreign key reference for the Department_ID.
  - Represented the Staff_Type (Ward Boy, Doctor, Nurse) using a foreign key referencing a table of staff roles.
- Optimization:
  - Maintained the disjoint relationships (Ward Boy, Doctor, Nurse) within the Staff entity.

THE SCHEMA



THE LOGICAL SCHEMA



QUERIES

CREATION

```
Table structure for table `appointment`
--
CREATE TABLE `appointment` (
 `Patient_ID` int(11) NOT NULL,
 `Doctor_ID` int(11) NOT NULL,
 `Appointment_Date` date NOT NULL,
 `Appointment_Time` time NOT NULL,
 `Appointment_Duration` int(11) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `appointment` (`Patient_ID`, `Doctor_ID`, `Appointment_Date`,
`Appointment_Time`, `Appointment_Duration`) VALUES
(1, 1, '2023-01-15', '08:00:00', 30),
(1, 2, '2023-01-16', '09:30:00', 45),
(2, 2, '2023-01-17', '11:00:00', 60),
(2, 3, '2023-01-18', '08:30:00', 30),
(3, 1, '2023-01-20', '11:30:00', 60),
(3, 3, '2023-01-19', '10:00:00', 45),
(4, 1, '2023-01-21', '09:00:00', 30),
(4, 2, '2023-01-22', '10:30:00', 45),
(5, 2, '2023-01-23', '12:00:00', 60),
(5, 3, '2023-01-24', '09:30:00', 30),
(6, 1, '2023-01-26', '12:30:00', 60),
(6, 3, '2023-01-25', '11:00:00', 45),
(7, 1, '2023-01-27', '10:00:00', 30),
(7, 2, '2023-01-28', '11:30:00', 45),
(8, 2, '2023-01-29', '01:00:00', 60),
(8, 3, '2023-01-30', '10:30:00', 30),
(9, 1, '2023-02-02', '12:30:00', 60),
(9, 3, '2023-02-01', '11:00:00', 45),
(10, 1, '2023-02-03', '10:00:00', 30),
(10, 2, '2023-02-04', '11:30:00', 45);
```

CREATION

```
CREATE TABLE `department` (
 `Department_ID` int(11) NOT NULL,
 `D_name` varchar(255) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `department` (`Department_ID`, `D_name`) VALUES
(1, 'Department 1'),
(2, 'Department 2'),
(3, 'Department 3');
```

CREATION

```
CREATE TABLE `doctor` (
 `Doctor_ID` int(11) NOT NULL,
 `Doctor_Specialization` varchar(255) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `doctor` (`Doctor_ID`, `Doctor_Specialization`) VALUES
(1, 'General Medicine'),
(2, 'Pediatrics'),
(3, 'Cardiology');
```

CREATION

```
CREATE TABLE `patient` (
 `patient_ID` int(11) NOT NULL,
 `patient_Fname` varchar(255) DEFAULT NULL,
 `patient_Lname` varchar(255) DEFAULT NULL,
 `date_of_birth` date DEFAULT NULL,
 `gender` varchar(10) DEFAULT NULL CHECK (`gender` in ('Male','Female')),
 `disease` varchar(255) DEFAULT NULL,
 `address` varchar(255) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `patient` (`patient_ID`, `patient_Fname`, `patient_Lname`, `date_of_birth`,
`gender`, `disease`, `address`) VALUES
(1, 'John', 'Doe', '1990-01-15', 'Male', 'Fever', '123 Main St'),
(2, 'Jane', 'Smith', '1985-05-22', 'Female', 'Headache', '456 Oak St'),
(3, 'Bob', 'Johnson', '1982-11-10', 'Male', 'Back Pain', '789 Pine St'),
(4, 'Alice', 'Williams', '1992-03-08', 'Female', 'Flu', '111 Elm St'),
(5, 'Charlie', 'Brown', '1988-07-17', 'Male', 'Allergies', '222 Birch St'),
(6, 'Eve', 'Davis', '1980-09-30', 'Female', 'Cough', '333 Cedar St'),
(7, 'Tom', 'Miller', '1975-12-05', 'Male', 'Sprained Ankle', '444 Pine St'),
(8, 'Ben', 'Johnson', '1978-08-20', 'Male', 'Migraine', '555 Oak St'),
(9, 'Jack', 'Taylor', '1983-06-25', 'Male', 'Stomachache', '666 Elm St'),
(10, 'Emily', 'Wilson', '1995-04-18', 'Female', 'Sinusitis', '777 Birch St');
```

CREATION

```
CREATE TABLE `patient_phone` (
 `patient_ID` int(11) NOT NULL,
 `phone_number` varchar(255) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `patient_phone` (`patient_ID`, `phone_number`) VALUES
(1, '01112345678'),(1, '01298765432'),(2, '01587654321'),(3, '01023456789'),
(3, '01187654321'),(4, '01234567890'),(5, '01598765432'),(6, '01123456789'),
(7, '01087654321'),(8, '01298765432'),(9, '01523456789'),(10, '01187654321');
```

CREATION

```
CREATE TABLE `patient_treatment` (
 `patient_ID` int(11) NOT NULL,
 `treatment_code` int(11) NOT NULL,
 `treatment_start_date` date DEFAULT NULL,
 `treatment_end_date` date DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `patient_treatment` (`patient_ID`, `treatment_code`,
`treatment_start_date`, `treatment_end_date`) VALUES
(1, 1, '2023-01-16', '2023-01-30'),(2, 2, '2023-01-18', '2023-02-02'),
(3, 3, '2023-01-20', '2023-02-10'),(4, 4, '2023-01-22', '2023-02-05'),
(5, 5, '2023-01-24', '2023-02-15'),(6, 1, '2023-01-26', '2023-02-20'),
(7, 2, '2023-01-28', '2023-02-25'),(8, 3, '2023-01-30', '2023-02-28'),
(9, 4, '2023-02-01', '2023-03-05'),(10, 5, '2023-02-03', '2023-03-10');
```

CREATION

```
CREATE TABLE `relative` (
 `relative_ID` int(11) NOT NULL,
 `patient_ID` int(11) DEFAULT NULL,
 `address` varchar(255) DEFAULT NULL,
 `companion_name` varchar(255) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `relative` (`relative_ID`, `patient_ID`, `address`, `companion_name`)
VALUES
(1, 1, '456 Side St', 'Mary Doe'),(2, 2, '789 Back St', 'Michael Smith'),
(3, 3, '222 Alley St', 'Sarah Johnson'),(4, 4, '333 Loop St', 'David Williams'),
(5, 5, '444 Crescent St', 'Emma Brown')(6, 6, '555 Cross St', 'Alex Davis'),
(7, 7, '666 Parallel St', 'Olivia Miller'),
(8, 8, '777 Diagonal St', 'Daniel Johnson'),
(9, 9, '888 Zigzag St', 'Sophia Taylor'),
(10, 10, '999 Intersection St', 'Matthew Wilson');
```

CREATION

```
CREATE TABLE `relative_phone` (
 `relative_ID` int(11) NOT NULL,
 `companion_phone` varchar(255) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `relative_phone` (`relative_ID`, `companion_phone`) VALUES
(1, '01011111111'),(2, '01122222222'),(3, '01233333333'),(4, '01544444444'),
(5, '01055555555'),(6, '01166666666'),(7, '01277777777'),(8, '01588888888'),
(9, '01099999999'),(10, '01110101010');
```

CREATION

```
CREATE TABLE `room` (
 `Admission_Date` date DEFAULT NULL,
 `Patient_ID` int(11) DEFAULT NULL,
 `Room_Num` int(11) NOT NULL,
 `Department_ID` int(11) DEFAULT NULL,
 `Room_Type` varchar(50) DEFAULT 'Regular'
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `room` (`Admission_Date`, `Patient_ID`, `Room_Num`, `Department_ID`,
`Room_Type`) VALUES
('2023-01-15', 1, 101, 1, 'room'),
('2023-01-18', 2, 102, 2, 'operation theatre'),
('2023-01-20', 3, 103, 3, 'ICU'),
('2023-01-22', 4, 104, 1, 'room'),
('2023-01-24', 5, 105, 2, 'operation theatre'),
('2023-01-26', 6, 106, 3, 'ICU'),
('2023-01-28', 7, 107, 1, 'room'),
('2023-01-30', 8, 108, 2, 'room');
```

CREATION

```
CREATE TABLE `staff` (
 `Staff_ID` int(11) NOT NULL,
 `Staff_address` varchar(255) DEFAULT NULL,
 `Staff_Phone` varchar(255) NOT NULL,
 `Salary` decimal(10,2) DEFAULT 0.00,
 `Department_ID` int(11) DEFAULT NULL,
 `Staff_Fname` varchar(255) NOT NULL,
 `Staff_Lname` varchar(255) NOT NULL,
 `Staff_Type` varchar(50) DEFAULT NULL CHECK (`Staff_Type` in ('Ward Boy','Doctor','Nurse'))
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `staff` (`Staff_ID`, `Staff_address`, `Staff_Phone`, `Salary`, `Department_ID`,
`Staff_Fname`, `Staff_Lname`, `Staff_Type`) VALUES
(1, '123 Main St', '555-1234', 80000.00, 1, 'John', 'Doe', 'Doctor'),
(2, '456 Oak St', '555-5678', 75000.00, 1, 'Jane', 'Smith', 'Doctor'),
(3, '789 Pine St', '555-9876', 70000.00, 1, 'Bob', 'Johnson', 'Doctor'),
(4, '111 Elm St', '555-1111', 60000.00, 2, 'Alice', 'Williams', 'Nurse'),
(5, '222 Birch St', '555-2222', 55000.00, 2, 'Charlie', 'Brown', 'Nurse'),
(6, '333 Cedar St', '555-3333', 50000.00, 2, 'Eve', 'Davis', 'Nurse'),
(7, '444 Pine St', '555-4444', 45000.00, 3, 'Tom', 'Miller', 'Ward Boy'),
(8, '555 Oak St', '555-5555', 40000.00, 3, 'Ben', 'Johnson', 'Ward Boy'),
(9, '666 Elm St', '555-6666', 35000.00, 3, 'Jack', 'Taylor', 'Ward Boy'),
(10, '777 Birch St', '555-7777', 30000.00, 2, 'Emily', 'Wilson', 'Nurse');
```

CREATION

```
CREATE TABLE `staff_room` (
 `Staff_ID` int(11) NOT NULL,
 `Room_Num` int(11) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `staff_room` (`Staff_ID`, `Room_Num`) VALUES
(1, 101),(2, 102),(3, 103),(4, 104),(5, 105),(6, 106),(7, 107),(8, 108);
```

CREATION

```
CREATE TABLE `treatment` (
 `treatment_code` int(11) NOT NULL,
 `treatment_price` decimal(10,2) DEFAULT 0.00,
 `treatment_name` varchar(255) DEFAULT NULL
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci;
```

INSERTION

```
INSERT INTO `treatment` (`treatment_code`, `treatment_price`, `treatment_name`)
VALUES
(1, 100.00, 'Physical Therapy'),
(2, 150.00, 'MRI Scan'),
(3, 200.00, 'Cardiac Surgery'),
(4, 120.00, 'Dental Cleaning'),
(5, 180.00, 'Allergy Testing');
```

OPTIMIZATION & INDEXING

```
SELECT Room_Num, CONCAT(patient_fname," ", patient_lname) As 'Patient Name', gender, disease, CONCAT(staff_fname, " ", staff_lname) as "Nurse Name" , salary FROM room JOIN patient USING(Patient_ID) JOIN staff_room USING (Room_Num) JOIN staff using (Staff_ID) WHERE staff_type = 'Nurse' and salary > 50000;
```

Optimization used:

We initially only Selected the nesseary columns in the first step, then started by joing each 2 tables in a certain order with each other to the get the necessary data, the room table is first join to the patient table instead of joining the staff with staff room first so that we don't include rooms that don't have any patients that reduces the itermidate table sizes, then we move to the WHERE clause in which we ordered the condition so it beigns with the categorical value first and then the numeric and both of the staff_type and salary are INDEXED

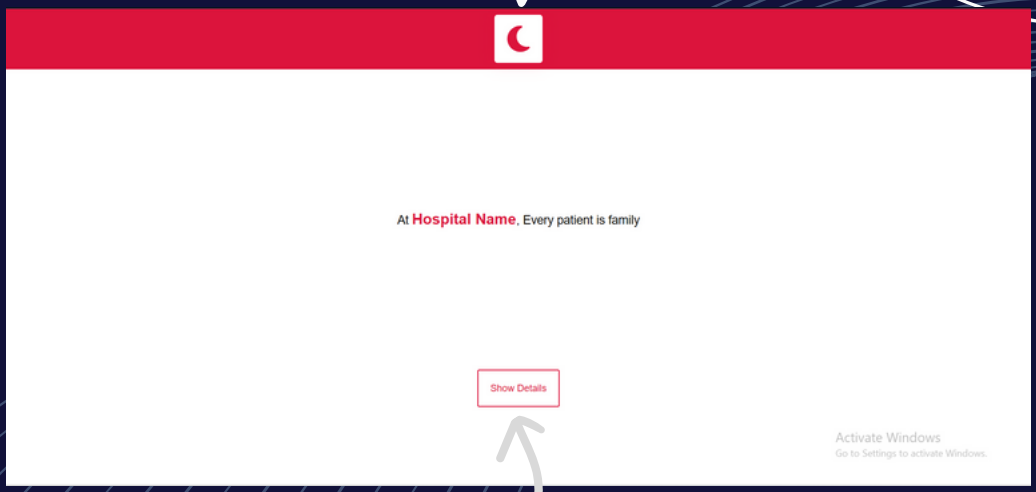
Room_Num	Patient Name	gender	disease	Nurse Name	salary
104	Alice Williams	Female	Flu	Alice Williams	60000.00
105	Charlie Brown	Male	Allergies	Charlie Brown	55000.00

Indexing:

```
CREATE INDEX `i1` ON staff(salary);
CREATE INDEX `i2` ON staff(Staff_Type);
```

GUI

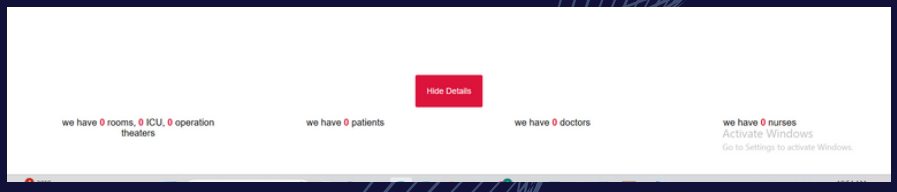
BUTTON 1

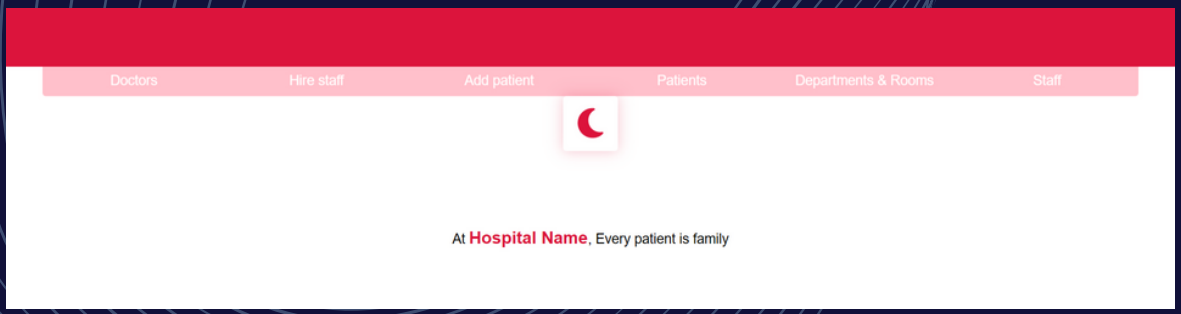


BUTTON2

BUTTON 1

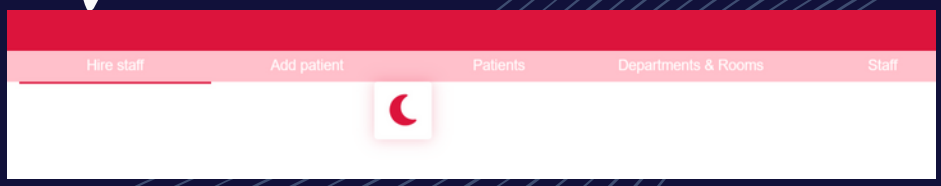
BUTTON2



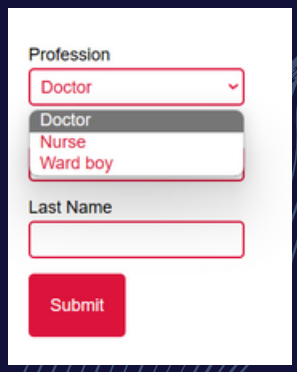


GUI

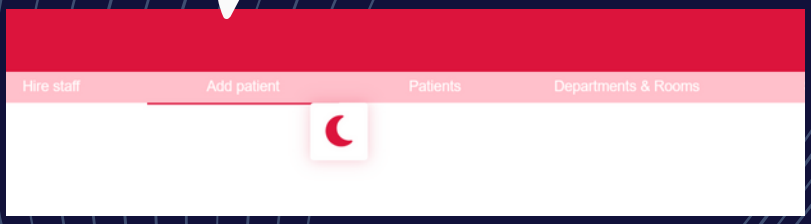
CLICK HIRE STAFF

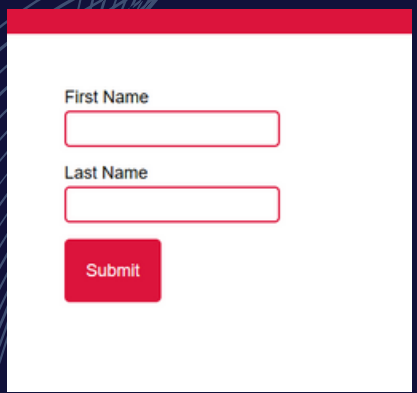


LIST



CLICK ADD PATIENT

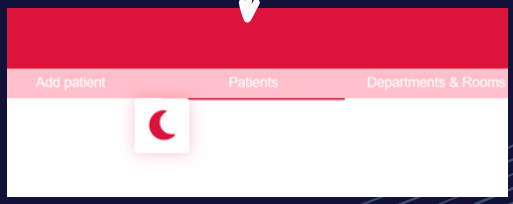


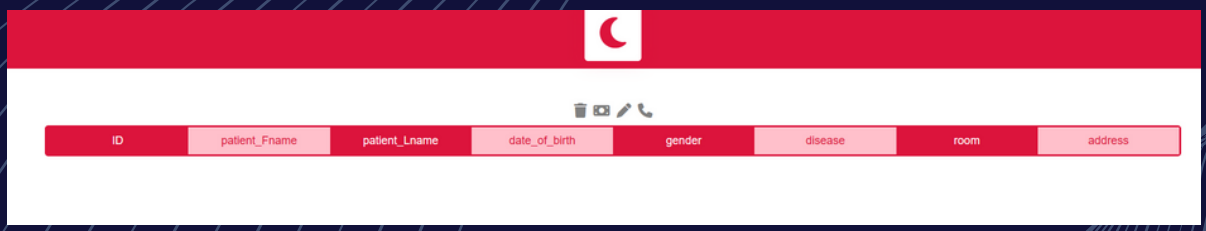


GUI

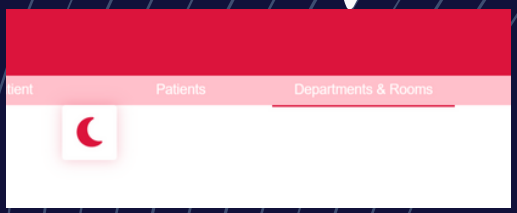
CLICK PATIENTS

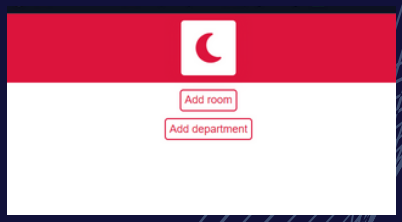
- VIEW THE DATABASE SAME AS DOCTOR , STAFF BUTTONS



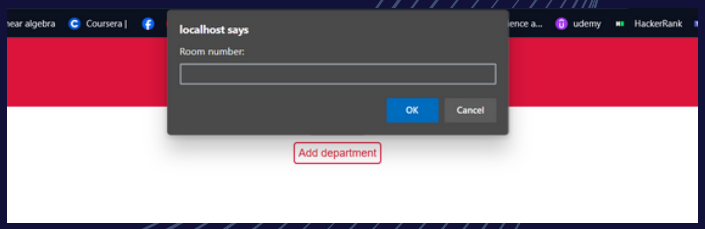


CLICK





CLICK ADD ROOM



Thank you!

حازم محمد احمد بكر
20221441990

ايسل محمود حسن
20221465749

شهد أحمد كرم
20221380283

احمد صلاح عبد القادر
20221445695