

**Hospital Database**

Prepared by

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# Business Requirements

## Patient

* We have a set of patients each patient has unique id, first name, last name, gender, date of birth, diagnosis of a doctor, address, unique email.
* Each patient is can be examined by multiple doctors and we store examine date and the diagnosis.
* Each patient can perform any number of operations.
* each patient can stay in a room and we store entry and leaving date.

## Doctor

* Each doctor has unique id, first name, last name, degree which is one of the following (Bachelor – Master - Doctoral), years of experience and specialization that he works in hospital.
* He can work only in one specialization.
* Doctor may manage specialization.
* Doctor may supervise many nurses
* Doctor can perform any number of operations
* Doctor also has a set of appointments marked with day (Sunday- Monday.. etc) and shift number from 1 to 6 and the clinic he will work at this shift.
* Doctor can examine any number of patients

## Specialization

* There are set of specialization in our hospital and it has unique name and the date that we launch this specialization in our hospital.
* Each specialization have at least one clinic associated with it, but each clinic must belongs to one specialization.
* Specialization must be managed by one doctor.
* Specialization may have many number of doctors work in it.

## Clinic

* We have clinic unique id, name and floor number (0 to 10).

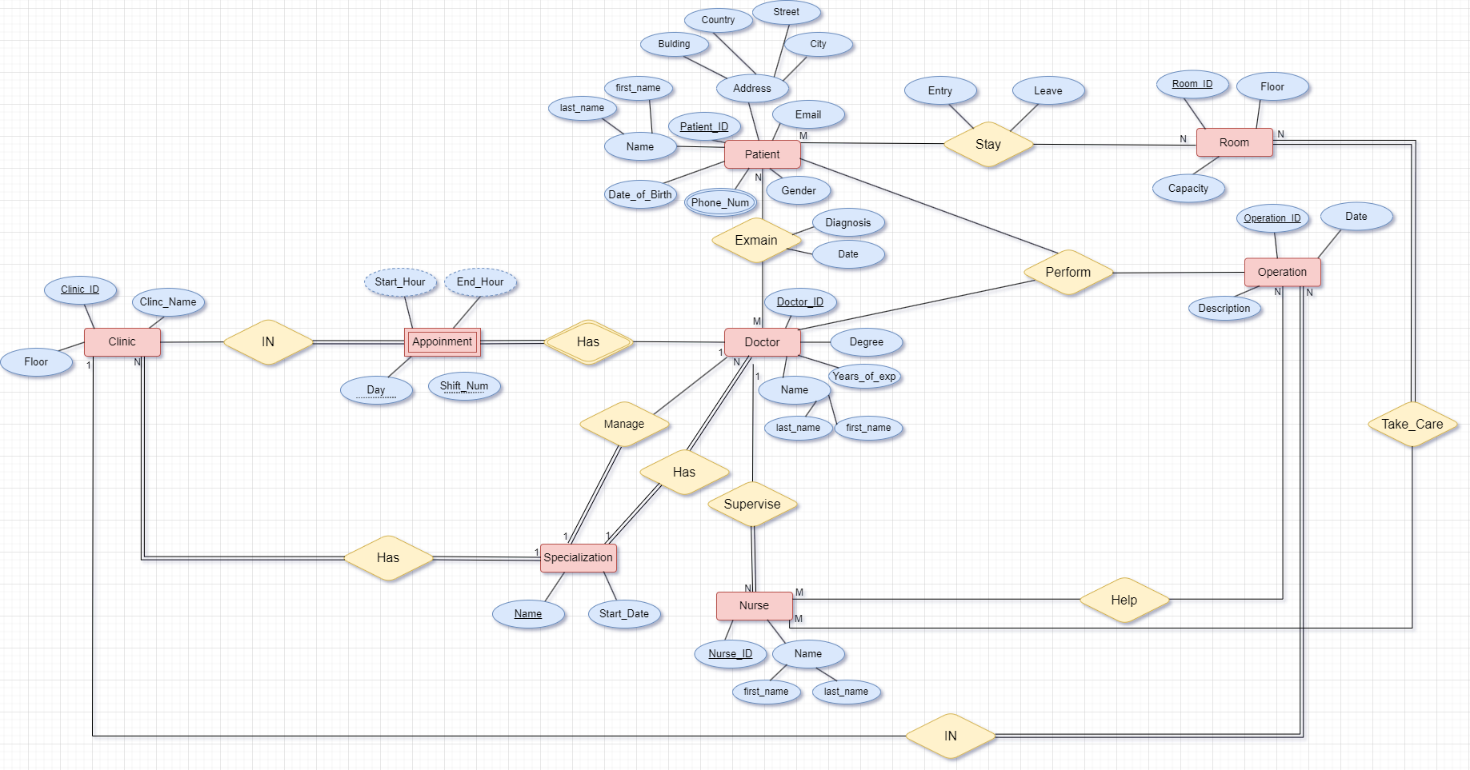
## Nurse

* We have set of nurses that has first name, last name, unique id.
* Each nurse may participate in operations many times.
* Each nurse may take care of many rooms.

## Operations

* Operation can be performed by more than one doctor one and one patient only.
* We need to store operation description and date of the operation and clinic that the operation was done in.

# ERD



# Mapping ERD to Logical Schema



Constraints:

## Primary Key Constraints

* **Doctor**: id is the primary key.
* **Patient**: id is the primary key.
* **Examine**: Composite primary key on doctor\_id, patient\_id, date.
* **Patient\_Phone**: Composite primary key on patient\_id, phone.
* **Specialization**: name is the primary key.
* **Appointment**: Composite primary key on doctor\_id, day, shift\_number.
* **Clinic**: id is the primary key.
* **Operation\_details**: id is the primary key.
* **Perform\_operation**: Composite primary key on doctor\_id, operation\_id, patient\_id.
* **Nurse**: id is the primary key.
* **Operation\_help**: Composite primary key on nurse\_id, operation\_id.
* **Room**: id is the primary key.
* **Patient\_stay**: Composite primary key on patient\_id, room\_id, entry.
* **Take\_care**: Composite primary key on nurse\_id, room\_id.

## Foreign Key Constraints

* **Doctor**:
  + specialization references Specialization(name).
* **Examine**:
  + doctor\_id references Doctor(id).
  + patient\_id references Patient(id).
* **Patient\_Phone**:
  + patient\_id references Patient(id).
* **Specialization**:
  + manager\_id references Doctor(id).
* **Appointment**:
  + doctor\_id references Doctor(id) with ON DELETE CASCADE.
  + clinic\_id references Clinic(id).
* **Clinic**:
  + specialization references Specialization(name) with ON UPDATE CASCADE and ON DELETE CASCADE.
* **Operation\_details**:
  + clinic\_id references Clinic(id).
* **Perform\_operation**:
  + doctor\_id references Doctor(id).
  + operation\_id references Operation\_details(id).
  + patient\_id references Patient(id).
* **Nurse**:
  + supervizor\_id references Doctor(id).
* **Operation\_help**:
  + nurse\_id references Nurse(id).
  + operation\_id references Operation\_details(id).
* **Patient\_stay**:
  + patient\_id references Patient(id).
  + room\_id references Room(id).
* **Take\_care**:
  + nurse\_id references Nurse(id) with ON DELETE CASCADE.
  + room\_id references Room(id) with ON DELETE CASCADE.

## Check Constraints

1. **Doctor:**

degree which is one of the following (Bachelor – Master - Doctoral)

* **Patient**:
  + gender must be either 'Male' or 'Female'.
* **Appointment**:
  + shift\_number must be between 1 and 6.
  + day must be one of 'Sunday', 'Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', or 'Saturday'.
* **Clinic**:
  + floor must be between 0 and 10.
* **Room**:
  + floor must be between 0 and 10.

## Unique Constraints

* **Patient**:
  + email is unique.

## Triggers

* **trg\_EnsureDoctorClinicSpecialization**:
  + Ensures that a doctor is assigned to a clinic that matches their specialization. This is an AFTER INSERT, UPDATE trigger on the Appointment table.
* **trg\_CheckRoomCapacity**:
  + Ensures that no patient is assigned to a room that has reached its maximum capacity. This is an AFTER INSERT, UPDATE trigger on the Patient\_stay table.

## Identity Columns

* **Clinic**:
  + id is an identity column (auto-incremented).
* **Operation\_details**:
  + id is an identity column (auto-incremented).
* **Room**:
  + id is an identity column (auto-incremented).

# Normalization

We normalized the database to third normal form that which is the most common for out case.

We checked all tables after mapping to logical schema and It achieved all 3 first normal from:

1 NF : no multivalued attributes (phone of patients in a single table) or nested relations (no tables such as Doctor\_specializaton or Doctor\_nurse) (each table represents a single object) and all tables contains a primary key.

2 NF: 1 NF is achieved and no partial dependencies (each non-prime attribute in all tables depends on the all attributes of the primary key together and not part of it)

This may happen in tables that contains composite primary key only and we checked it.

Tables with composite keys (like Examine, Appointment, Perform\_operation, etc.) ensure that all non-key attributes depend on the full composite primary key.

3 NF:

* 2 NF is achieved.
* There are no transitive dependencies (i.e., non-prime attributes depend only on the primary key).

All non-prime attributes in tables like Doctor, Patient, Clinic, Room, and others depend directly on their respective primary keys.

The Doctor table's specialization is a foreign key, but it depends on the Specialization table's name, which is itself a primary key. This does not violate 3NF.