Normalization of ER diagram

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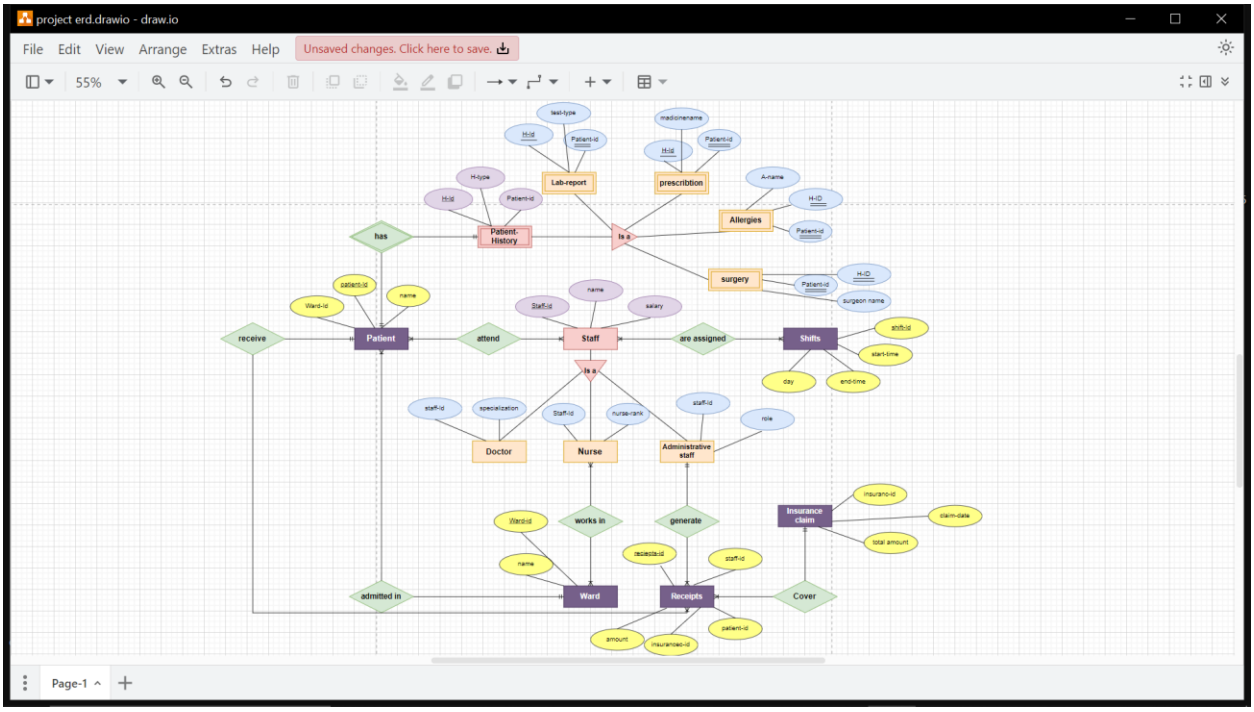
Hospital System with Shifts and Medical History Logs

Doctors, nurses, and administrative staff are assigned shifts based on availability and department load. Patient histories include lab reports, prescriptions, allergies, surgeries, and emergency visits. Each ward has capacity rules. The billing system integrates lab, pharmacy, and consultation charges and generates receipts. Insurance claims are digitally filed and tracked through the portal.

Entity Relationship Diagram:



Tables from ER Diagram

Staff (Staff-Id, name, salary)

Specialization:

- **Doctor** (Staff-Id, specialization)
- **Nurse** (Staff-Id, nurse-rank)
- **Administrative staff** (Staff-Id, role)

Shift (Shift-Id, start-time, end-time, day)

Staffshift (Staff-Id, shift-Id) (3rd table of staff and shift)

Patient (Patient-Id, Ward-id, name)

Patientstaff (patient-Id, Staff-id) (3rd table of staff and patient)

Ward (Ward-id, name)

wardNurse (Ward-Id, staff-id) (3rd table of Ward and nurse)

Receipts (Receipts-id, staff-id, patient-id, insurance-id, amount)

Insurance claim (insurance-id, total-amount, claim-date)

Patient history (H-id, patient-id, H-type)

Specialization:

- **Lab report** (patient-id, H-id, test-type)
- **Surgery** (patient-id, H-id, surgeon-name)
- **Prescription** (patient-id, H-id, medicine-name)

Normalization:

First Normal Form (1NF)

Definition:

- No multivalued attributes (each attribute holds atomic values).
- Each field contains only one value.
- Each record is unique.

As all entities have atomic attributes, no multivalued attributes. Each record in every table is unique with a clear primary key. Therefore, the database satisfies First Normal Form (1NF).

Second Normal Form (2NF)

Definition:

- Must be in 1NF.
- No partial dependency (non-prime attributes depend on the whole primary key, not part of it).
- If the table has a composite primary key, each non-key attribute must depend on the whole composite key, not just a part of it.

- **Tables with Primary Key and Attributes Dependent on It:** These tables have single primary keys and their attributes fully depend on the primary key, such as

Staff, Doctor, Nurse, Administrative staff, Shift, Ward (satisfy the 2NF)

In Doctor, Nurse, Administrative staff the staff-Id act as Primary key and foreign key at the same time

- **Tables with Composite Primary Key:** These tables use composite keys to handle many-to-many relationships such as **StaffShift, PatientStaff, WardNurse**
  (satisfy the 2NF)

- **Tables with Attributes Dependent on Primary Key, with Foreign Keys:** These tables have single primary keys, and their attributes depend on the primary key, but they also include foreign keys referencing other tables such as **Patient, Receipt, Patient history. (satisfy the 2NF)**

  - **Lab Report(Patient-Id, H-Id, Test-Type)**

Primary Key: (Patient-Id, H-Id) (composite key) (Foreign key) at the same time.
Test-Type depends on both Patient-Id and H-Id together, not on just one part. (satisfy the 2NF)

  - **Surgery(Patient-Id, H-Id, Surgeon-Name)**

Primary Key: (Patient-Id, H-Id) (composite key) (Foreign key) at the same time.
Surgeon-Name depends on both Patient-Id and H-Id together. (satisfy the 2NF)

  - **Prescription(Patient-Id, H-Id, Medicine-Name)**

Primary Key: (Patient-Id, H-Id) (composite key) (Foreign key) at the same time.
Medicine-Name depends on both Patient-Id and H-Id together. (satisfy the 2NF)

So all the tables are in 2NF as there is no partial dependency

Third Normal Form (3NF)

Definition:

- Must be in 2NF.
- No transitive dependency (non-prime attribute should not depend on another non-prime attribute).

Staff table: Name and Salary depend directly on Staff-Id.

Doctor/Nurse/Admin: specialization, nurse-rank, and role depend directly on Staff-Id.

Receipts: Amount depends directly on Receipts-id.

Insurance claim: total-amount, claim-date depend on Insurance-id.

PatientHistory specialization (Lab Report, Surgery, Prescription) are separated correctly.

No non-key attribute depends on another non-key attribute.

As there are no transitive dependencies, and non-prime attributes depend only on the primary key,

the database satisfies Third Normal Form (3NF).

So the tables are in normal form as it satisfy all the conditions of normalization