University
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Deliverable #: Conceptual Design

Data Management Course

UM6P College of Computing

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Repository Link	`https://github.com/yasserJarboua/QueryMasters/`

1 Introduction

The Moroccan National Health Services (MNHS) requires a special database design in order to support their services, with the aim to manage patients, staff, hospitals, departments, appointments, prescriptions, medications, insurance, billing, and emergencies.The deliverable represents the conceptual design of the MNHS database using the ER diagram, showing the different relations and attributes that characterize each component of their environment.

2 Requirements

The deliverable should represent clearly the relations between each entity of the MNHS database, providing a full view of all the interactions, the participation constraints and the attributes of each entity and relation, all provided as an ER diagram.

2.1 Requirements Details

Our ER model addresses the following MNHS requirements:

- Patients with internal ID, optional CIN, Full name, DoB, sex, blood group, phone and multiple contact locations(each including street, city province, postal code and an optional phone).
- Staff categorized into practitioners, caregivers, and technical staff with role-specific attributes.
- Hospitals and departments, where each department belongs to exactly one hospital.
- Appointments linking one patient, one staff member, and one department, with the track of date, time, reason and status(Scheduled, Completed, Cancelled).
- Prescriptions issued by staff to patients, including multiple medications with dosage and duration.
- Medications include: DrugID, name, form, strength, manufacturer, therapeutic, class and active ingredient.
- Insurance coverage (CNOPS, CNSS, RAMED, private, or none), allowing multiple insurances per patient.
- Billing attached to clinical activities and linked to one insurance.
- Emergencies
- Pharmacy inventory tracked per hospital and medication (quantity, reorder level, unit price).

3 Methodology

In order to explain the design choices we will go through two sections: Entities Description and then the existing relations between them.

3.1 Entities Description:

- Patients: we've chosen to represent the patient as an entity, we chose the internal identifier as the primary key on our design because not everyone has a (CIN), a patient could be an adult as he could be a child, which motivated us to keep CIN as an optional attribute.Concerning the contact locations we decided to model it as a separate entity linked to Patients. We assigned it an AddressID as the primary key, with attributes such as street, city, province, postal code, and optional phone.
- Staff: we used the ISA Hierarchies to describe the subclasses of the staff entity (Practitioner, caregiving, technical) recording for each of them the necessary attributes mentioned on Lab description, and an id attached to the staff attribute.
- Hospitals And Departments: we chose to consider them both as entities, with a primary Key for each of them and with keeping track of their mandatory attributes (Hospitals: name, city, region / Departments:).
- Medications: the drugID is considered as our primary key to this entity, different attributes are linked to it to record the medications characteristics (class, name, from ...)
- Insurance: it has the attribute coverage type that holds different values (CNOPS, CNSS, RAMED, OR None)
- Bills: identified by the billID
- Emergencies: has the attributes admission timestamp, triage level(from 1(immediate) to 5(Non-Urgent)) and outcome;

3.2 Relations Between the entities

- Patient Related Relationships:
  1. Clinical Activities: it is a ternary relationship that links a patient, with at least a staff and bills, in the other hand a staff may have linked pair of patient and bills because not all the staff may do a clinical activity(like security guards etc...), and a bill has to have at least one patient and staffs we avoided using a bold arrow because many staff members may interact in one clinical activity.
  2. live-in : to match the patient with its appropriate contact location, each patient may have several contact locations which is described on the ER Diagram as a thin line between the patients and contact location.
  3. Covers: It's a relation that links between a patient and an insurance, as in the lab description a patient can have more than one insurance.

4. Appointments: We've chosen to represent it as a ternary relationship between Patient, Department and Staff.The usage of Bold arrows is justified by the constraint that the relation is between exactly one patient one staff and one department, and it records status, reason, time, date.
5. Prescription: it's a ternary relation between patient, staff and medication, it's not a total participation because a prescription may not contain a medication.In addition it holds three attributes: dosage, duration and a date.
6. Emergency:

- Staff Related Relationships:

  1. Appointment: Already discussed on the Patients relations.
  2. Prescriptions: Already discussed on the Patients relations.
  3. Clinical Activities: Already discussed on the Patients relations.
  4. Take over: it links between staff and emergency and it's a partial relation because it is mentioned that it is optional to have a staff who handled the triage/attending.
  5. WorK: it links between department and staff, a staff has to have at least one department to work on and a depart may have 0-many staffs,we did not add the relation 'Assigned to' because we considered it equivalent to the 'Work' relation.

- Department Related Relationships:

  1. Appointment: Already discussed on the Patients relations.
  2. Belong: a department belongs exactly to one hospital which is described as a bold arrow on the relationship.

- Hospital Related Relationships:

  1. belong: Already discussed on the Department relations.
  2. Pharmacy Inventory: links between medications and Hospital and keeps track for each hospital the on-hand quantity, reorder level, last restock timestamp, and unit price per medication.

- Medications Related Relationships:

  1. Prescription: Already discussed on Patients relations.
  2. Pharmacy Inventory: Already discussed on Hospital relations.

4 Implementation & Results

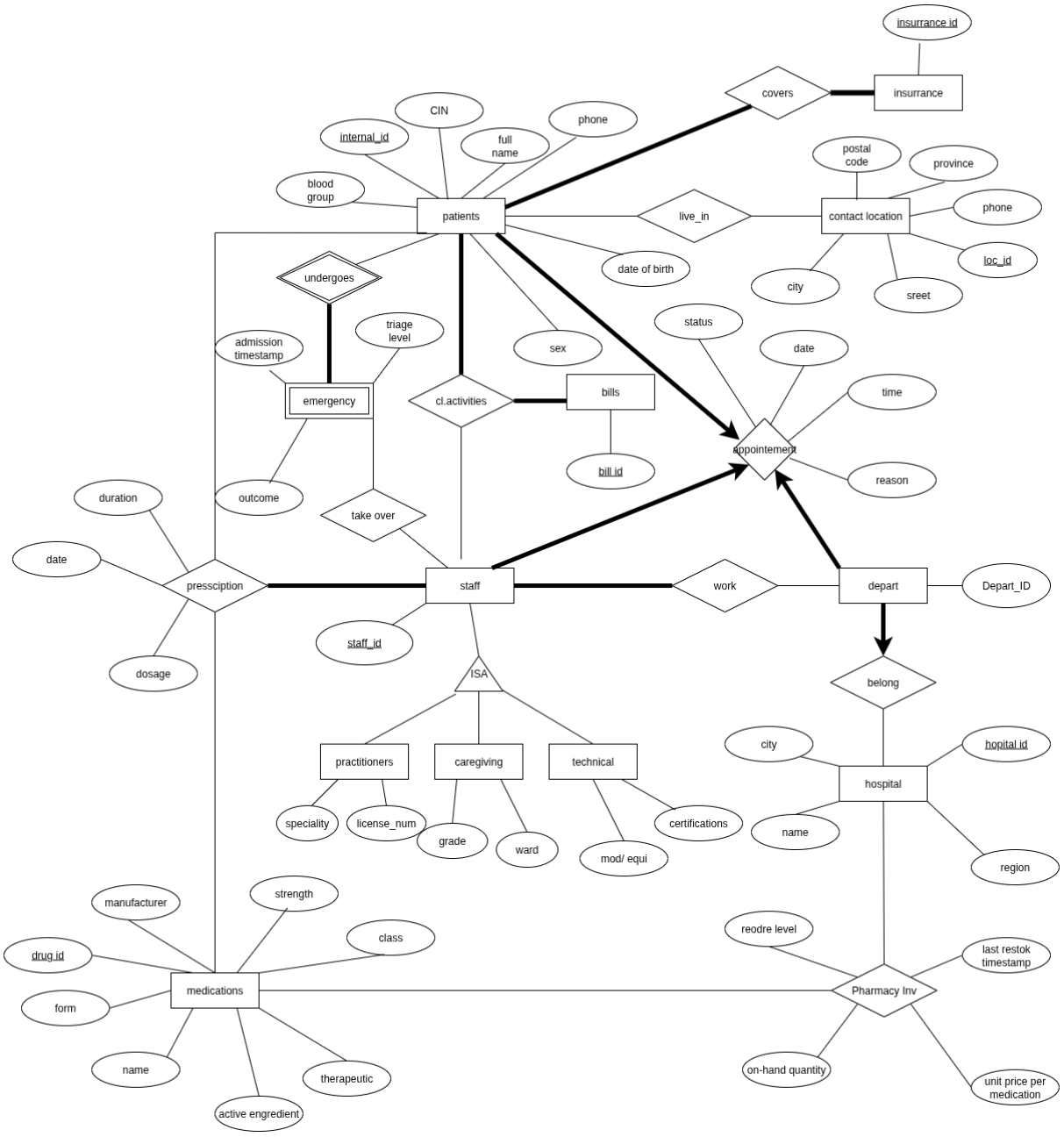

Figure 1: Entity–Relationship Diagram for MNHS Database

5 Discussion

5.1 Challenges Faced During the Project:

1. Different Interpretations of Relationships: Each team member understood the relationships mentioned in the script differently, which caused confusion and inconsistencies in our work.

2. Confusion Around Ternary Relationships: We struggled to fully grasp the concept of ternary relationships and when it is appropriate to replace them with aggregation.

3. Optimization of the ER Model: Towards the end, we were unsure whether we could add additional relationships or details to improve clarity and meaning, or if we had to strictly adhere to the original script without modifications. On one hand, refining the model could improve clarity and better convey our understanding. On the other hand, keeping it unchanged would preserve the authenticity of our initial interpretation and work. This dilemma made it challenging to decide how much to revise the model without losing the essence of our original efforts.

5.2 Lessons Learned:

1. We discovered how challenging it can be to precisely capture customer requirements when creating the ER model.

2. We learned many new concepts about ER diagrams, especially when dealing with complex cases that required deep reflection and discussion.

3. We began developing the intuition needed to choose the best modeling approach—whether to use ternary relationships, binary relationships, or aggregation.

4. We improved our logical thinking skills by connecting real-world situations with the project content.

5. As our diagram evolved, our understanding of the next steps in the design process also improved, leading us to consider the efficiency and scalability of our model.

6 Conclusion

As we finish this first big step of our project, we can see how important the early planning (conceptual design) really was. Its main job was to help us understand what the customer wanted and turn those wants into a clear plan for our project. This step was more challenging than we expected. The biggest problem was understanding the customer's requirements. We sometimes disagreed on the best way to do things or which customer need was most important. These moments were demanding and required a lot of patience. However, working through these problems taught us a lot. We learned how to talk through our disagreements and find a solution that everyone could agree on. We learned to always go back to the customer's main goals when we felt stuck. By the end, we had a much stronger plan because we had carefully thought through every part of it. n short, this phase was about more than just drawing a design. It was a big learning experience. We learned how to work together better, how to understand complex requirements, and why having a solid plan is the key to good project management. Even though it was hard, the skills we gained will help us greatly in the next steps of the project.