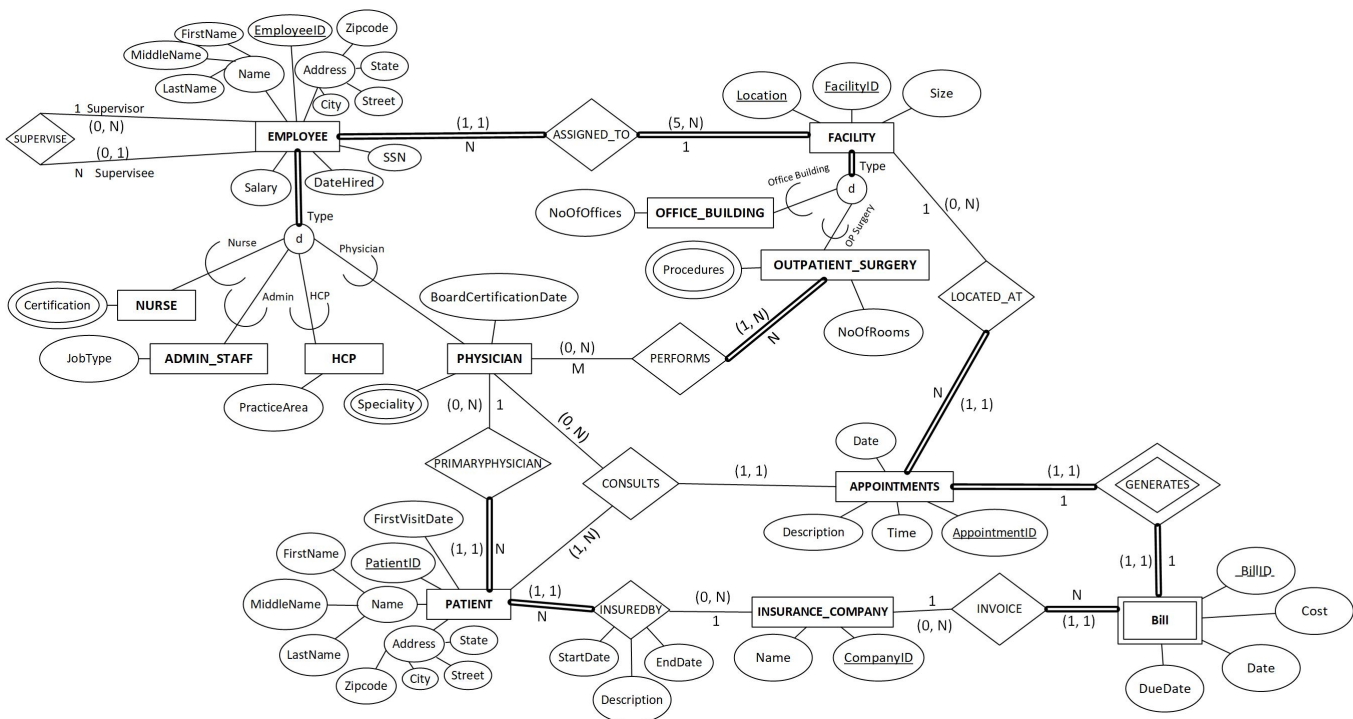


Question 1: Outline the goals of this phase of the project.

Solution

1. Given the requirements, both data and functional ones, we intend to create a conceptual schema for the database, using a high-level conceptual data model called Enhanced Entity-Relationship Model along with its corresponding diagram.
2. Identity the entities and relationships of our mini-world, Morris Health Services, with their corresponding attributes (including key and partial key attributes). Define the constraints on the relationships using the traditional and (min, max) notations.
3. Identify superclasses and subclasses within these entities with appropriate specialization types and constraints.
4. Introduce entities, attributes and relationships according to our experience and assumptions. Assumptions need to be documented as well. Mention all assumptions for structural constraints.
5. Highlight the difficulties that we faced while making this diagram.
6. Identify the constraints that can be applied over the ER diagram.

Question 2: Make an EER diagram



Github Link for better visual.

Question 3: Mention any assumptions you made in doing the above that go beyond what is given in the project description. In particular, mention all assumptions that led you in determining structural constraints.

Solution

1. SUPERVISES recursive relationship: Each specialization of EMPLOYEES has a supervisor, who supervises multiple employee types. Hence, this is a 1:N mapping as a group of employees can only have one supervisor. The corresponding (min, max) notation is Supervisee (0, 1) and Supervisor (0,N).
2. N:1 for EMPLOYEES (1,N) with total participation to FACILITIES (5,N) with total participation. We assume that a minimum of employees of each specialization are assigned to their corresponding facility.
3. An APPOINTMENT is LOCATED_AT one FACILITY only, however a FACILITY can host many APPOINTMENTS (N:1 from APPOINTMENT to FACILITY). An appointment can be located at only one facility (hence (1,1) where a facility may or may not have an appointment (0,N).
4. M:N for PHYSICIAN (0,N) to OUTPATIENT_SURGERY (1,N). Minimum participation is 0 for PHYSICIAN because the description says that an entity type of physician may perform an outpatient surgery. On the OUTPATIENT_SURGERY's side, we assume total participation for the sake of practicality.
5. N:1 for PATIENT (1,1) TO PHYSICIAN (0,N) over PRIMARYPHYSICIAN. This is because each patient has only one primary physician and each physician may not be a primary physician because they could only be specialists.
6. PHYSICIAN To CONSULTS - (0,N)
PATIENT To CONSULTS (1,N)
APPOINTMENTS To CONSULTS (1,1)
A particular physician may consult a patient at a given time and we assume that a physician consults many patients. A patient has to consult a physician through an appointment. An appointment exists because a patient consults a doctor at a particular time and there shouldn't be more than one record of that consultation.
7. Each APPOINTMENT has a cost associated with it and thereby, generates a BILL. This is a 1:1 relationship along with total participation from both the entities with (1,1) cardinality too.
8. As per our database requirements, each BILL is covered by an INSURANCE_COMPANY (hence (1,1)). Whereas, at a given time, an insurance company may not have a bill associated with it and at any other time, it could have many bills to cover.
9. Each PATIENT is insured by one INSURANCE_COMPANY. A patient can have only one insurance and many patients have an insurance plan with one insurance company. (N:1 from patients to insurance company with (1,1) for PATIENT and (0,N) for INSURANCE_COMPANY).

10. We've assumed that a nurse can have multiple certifications, a physician can specialise in multiple fields and outpatient_surgery can conduct multiple procedures.
11. The INSURED_BY relationship has the following attributes given the subscription model being omnipresent today - StartDate, EndDate and Description which tells us about the insurance.
12. Added a few more attributes for the weak entity BILL like Cost, Date and DueDate.

Question 4: Make a list of constraints that apply over and above what you can show in the diagram. In particular, make a list of additional keys for entity types (if there are any).

Solution

1. Every employee has a unique EmployeeID and has SSN as an additional key.
2. Every insurance company has a unique name and id.
3. Every facility has a unique location and id.
4. An invoice for the previous day is sent out to insurance company on one day. This cannot be represented here.
5. We need to use check constraints to verify the values of attributes like Certification for NURSE, PracticeArea for HCP, JobType for ADMIN_STAFF, Procedures for OUTPATIENT_SURGERY and Speciality of Physician.
6. Business constraints like each and every room in a building is occupied and utilized productively (sum of all rooms occupied by different employees equates the total number of rooms), time for an appointment once confirmed cannot be changed.
7. Most importantly, we need adhere to HIPAA regulations when we deal with patient's data.
8. We need to track the state of an appointment (active or complemented or cancelled or ongoing).
9. We need to ensure that the foreign keys refer to the right primary key in the subsequent phases.
10. Constraints on data types of each attribute cannot be covered here.
11. Let's say we delete a patient's record. We need to delete the associated data of that patient with other entities like physicians and appointments in a proper way. In other words, we need to ensure concurrency control.
12. We need to implement access levels and roles.
13. To check if physicians are in the network of the insurance company or not.

Question 5: Besides the above, comment on the difficulties you faced in doing this conceptual design task.

Solution

1. FACILITIES can be specialized into many subclasses, like INPATIENT_SURGERY, EMERGENCY_ROOM and URGENT_CARE based on its attribute, TYPE. Additionally, it can also be specialized into UNIVERSITY_STUDENT for university students. For example: St Michael's Medical Care has separate offices for university students, which has its own administration staff, HCPs and physicians. These can be represented using a common subclasses in our EER diagram. However, the entire section gets cramped into one place as different lines intersect eachother, compromising the readability of our diagram. Hence, we dropped it at this stage but we shall consider them in the subsequent phases.
2. There was some friction in creating the PERFORMS relationship between PHYSICIAN and OUTPATIENT_SURGERY as this went beyond our dicussion in class. It enhanced our understanding about the possibilities of relationships between different superclasses and different subclasses. Additionally, we learned that there cannot be any relationship between a superclass and its subclass.