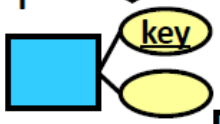
Tutorial 1
ER Modeling

CZ2007
Introduction to Databases

Tutorial 1

- Elements of ER Diagrams
  - Entities Sets 
  - Relationships 
  - Attributes 

  - Weak Entities Sets 
  - Subclasses 

Constraints

- Some conditions that entity sets and relationships should satisfy
- We will focus on three types of constraints
  - Key constraints ✓
  - Referential integrity constraints ✓
  - Degree constraints ✓

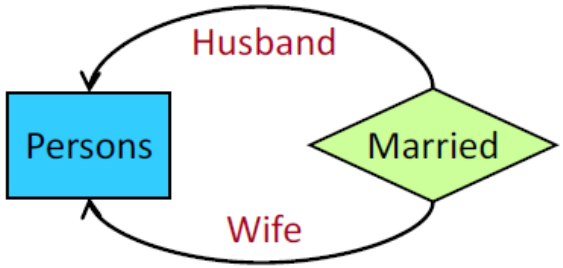
Referential Integrity

- One company may make multiple products
- i.e., every product must be involved in the Make relationship

Types of Relationships

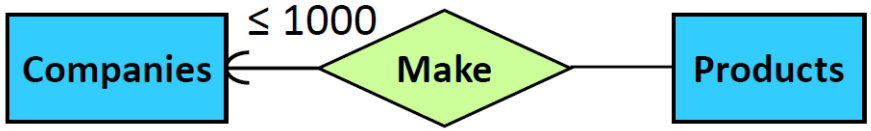
- Many-to-Many Relationships
- Many-to-One Relationships
- One-to-One Relationships

Roles



- Sometimes an entity set may appear more than once in a relationship

Degree Constraint



- Each (and every) company makes at most 1000 product

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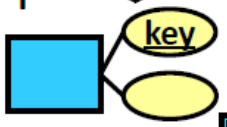
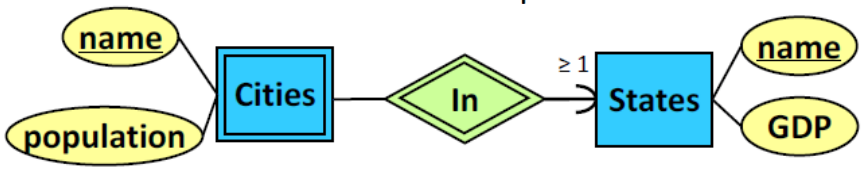
  - Attributes 

  - Weak Entities Sets 
  - Subclasses 

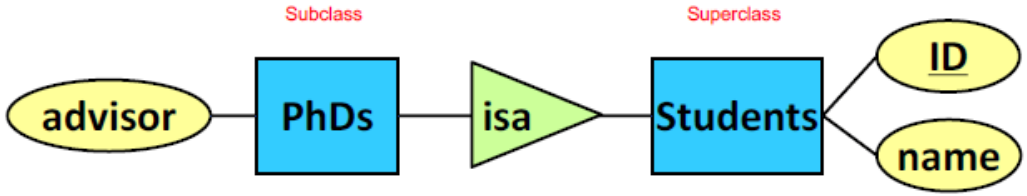
Weak Entity Sets

- Weak entity sets are a special type of entity sets that
  - cannot be uniquely identified by their own attributes
  - needs attributes from other entities to identify themselves
- Example: Cities in USA



- The relationship In is called the supporting relationship of Cities

Subclass



- PhDs are a special type of Students
- Subclass = Special type
- The connection between a subclass and its superclass is captured by the isa relationship, which is represented using a triangle

From Applications to ER Diagrams

- Identify the objects involved in your application
- Model each type of objects as an entity set
- Identify the attributes of each entity set
- Identify the relationships among the entity sets
- Refine your design
- Example: A database for NTU
  - Objects: Students, Faculties, Schools, Courses…
  - Entity sets: Students, Faculties, Schools, Courses…
  - Relationships: course-enrollment, course-lecturer…

Question 1

1. Construct an ER diagram for a hospital with the following user requirements:

   - The hospital has wards identified by a ward number. A ward is located in a particular block and on a particular floor.
   - Each ward consists of different rooms. All rooms have room numbers unique only to the ward but not unique between different wards. Each ward has at least one room.
   - Rooms may be of different sizes, with different number of beds and possibly with attached bathrooms. Rooms with the same number of beds need not be of the same size nor have similar bath facilities.
   - When a patient registers, information about his IC#, first name, surname, address, date of birth, registration date and gender are recorded. Upon discharge, the discharge date is also recorded.
   - If a patient is allocated to a room, no bed allocation details are recorded.
   - There are three categories of wards: cardiology, paediatrics and surgery. Each paediatric ward has a number of baby nurseries, while each surgical ward has a number of intensive care units (ICU).
   - During his/her hospitalisation, a patient may undergo surgical treatment, whereby multiple operations are possible. Complex procedures might require multiple surgeons.
   - An operation is characterised by the type of operation and the normal duration. The date / time of a particular operation has to be recorded.
   - Every surgeon has been involved in at least one operation but not every operation type has been carried out in this hospital.
   - Information about nurses includes staff#, first name, surname, and date of joining.
   - Every nurse is assigned to a ward. A ward is staffed by many nurses. However, a ward is managed by only one nurse. Not every nurse manages a ward.
   - Nurses are designated as student nurses or registered nurses. The particular year of study for student nurses and the year of graduation and rank for registered nurses are also stored.

Question 1

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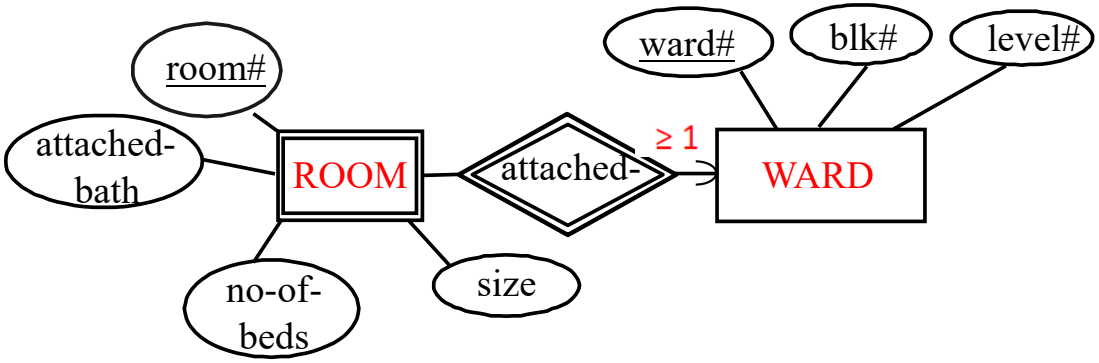

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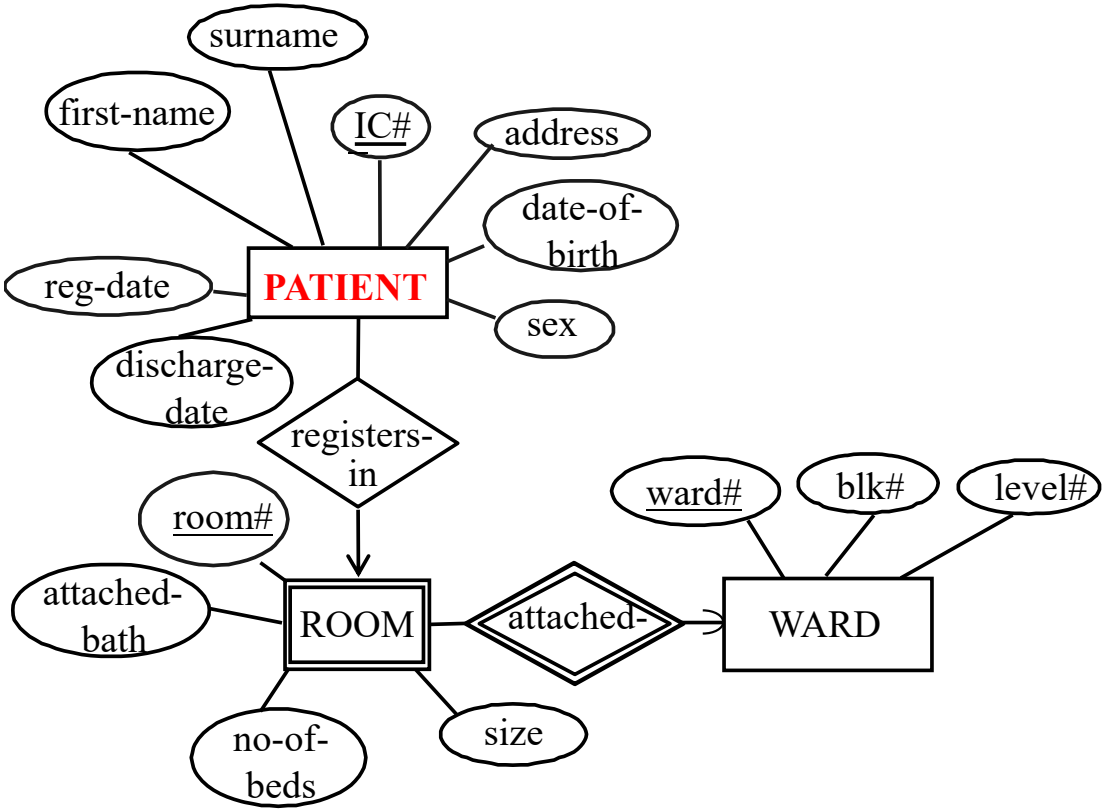

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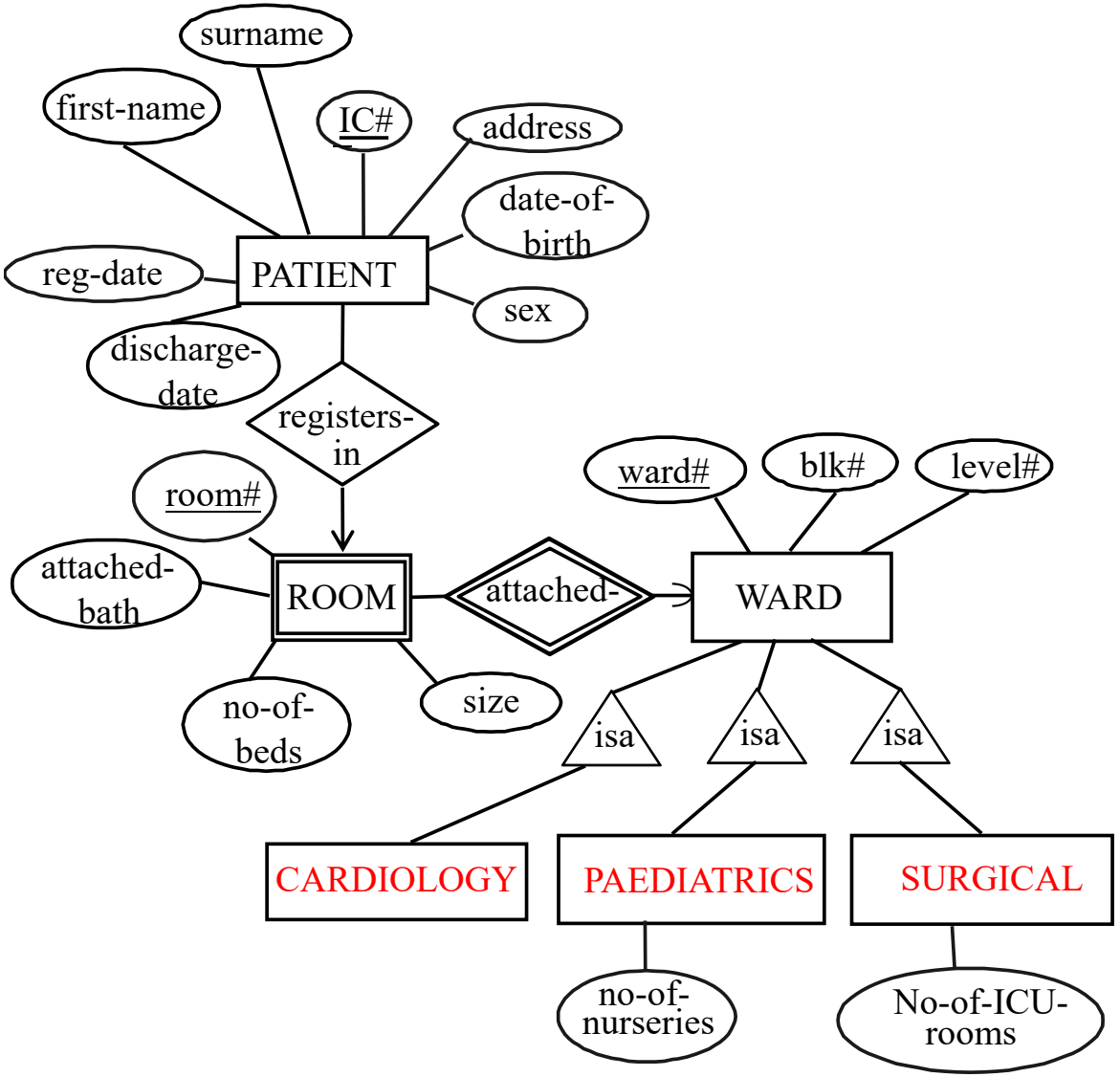
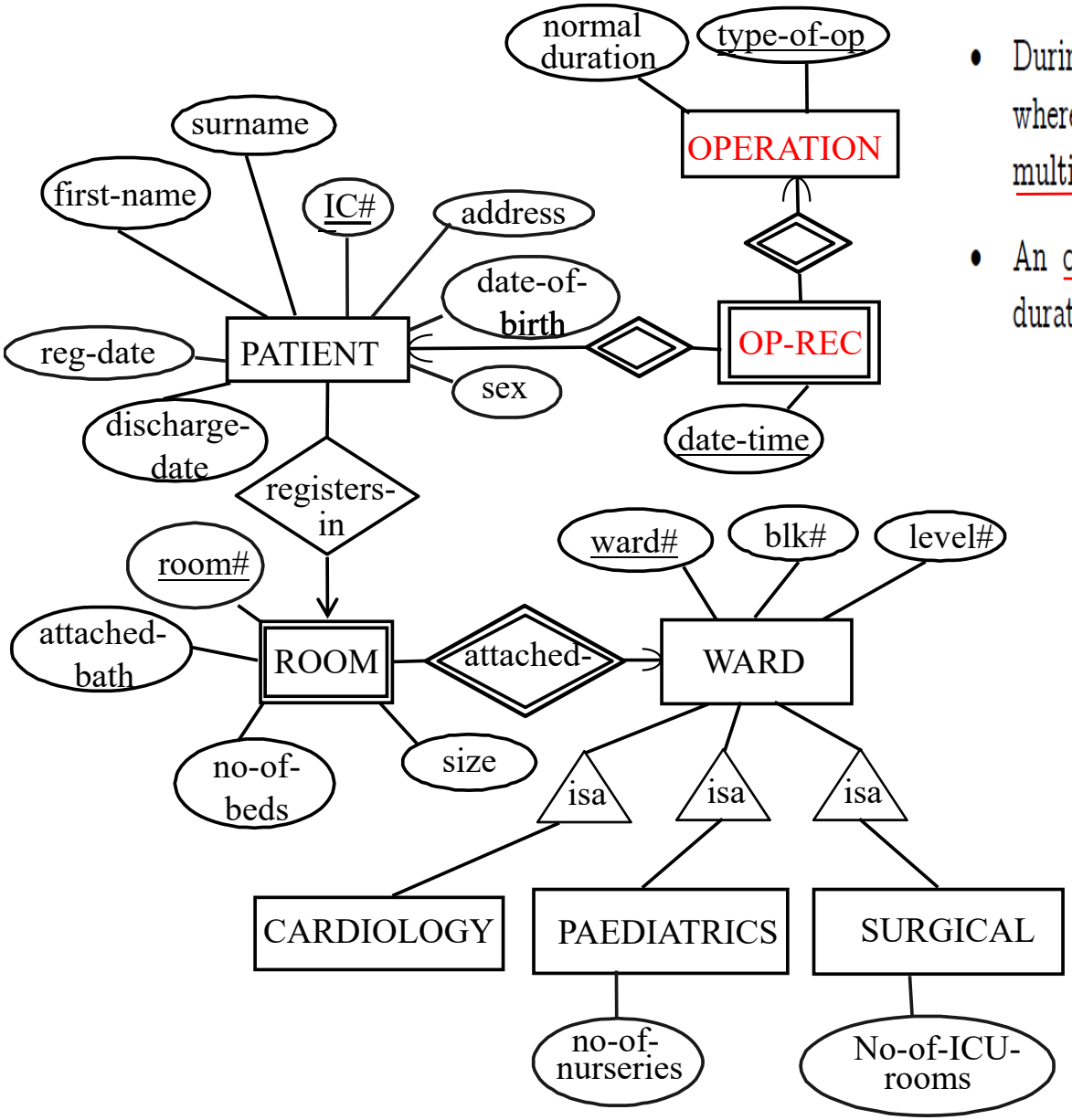


Question 1



- During his/her hospitalisation, a patient may undergo surgical treatment, whereby multiple operations are possible. Complex procedures might require multiple surgeons.
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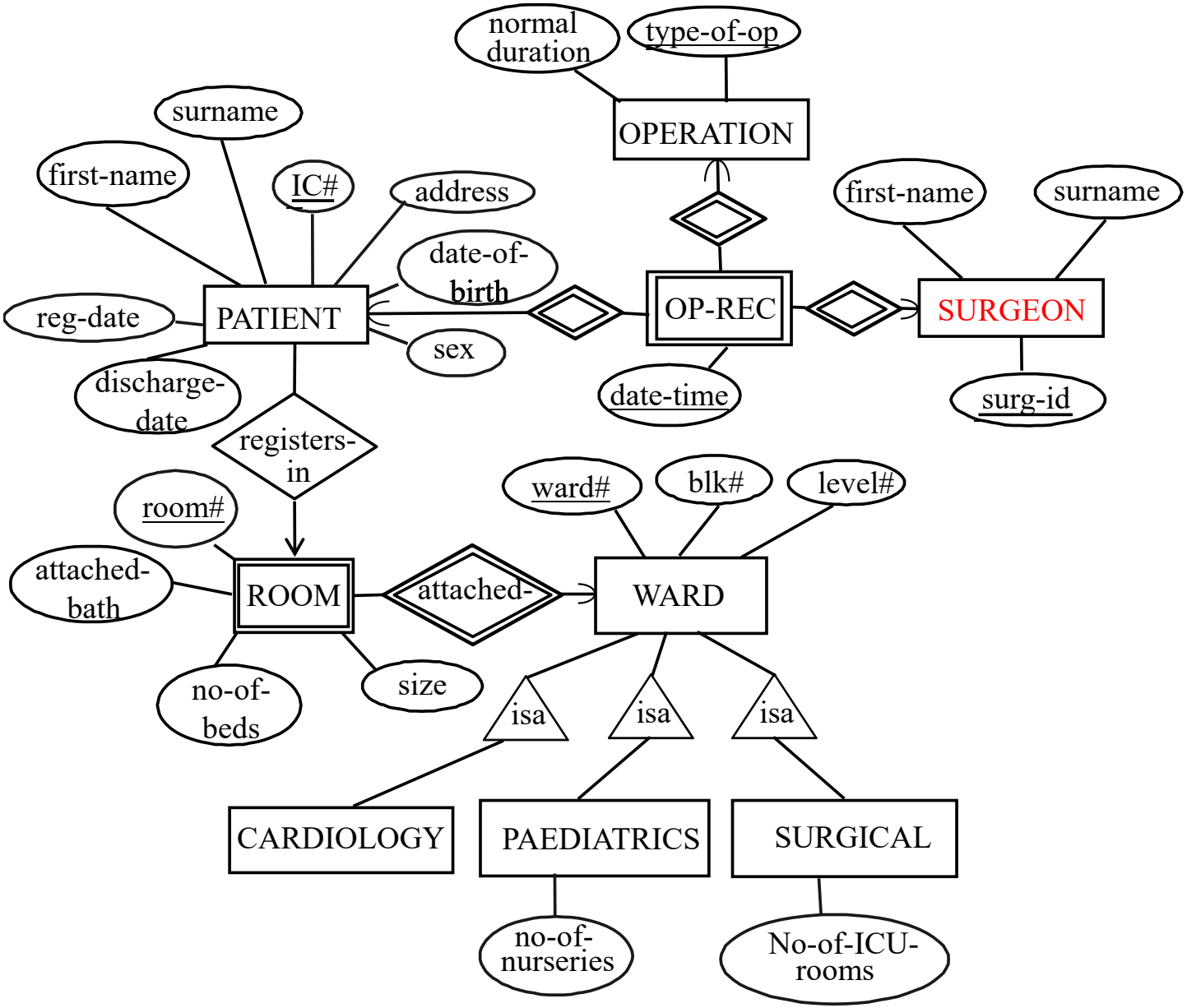
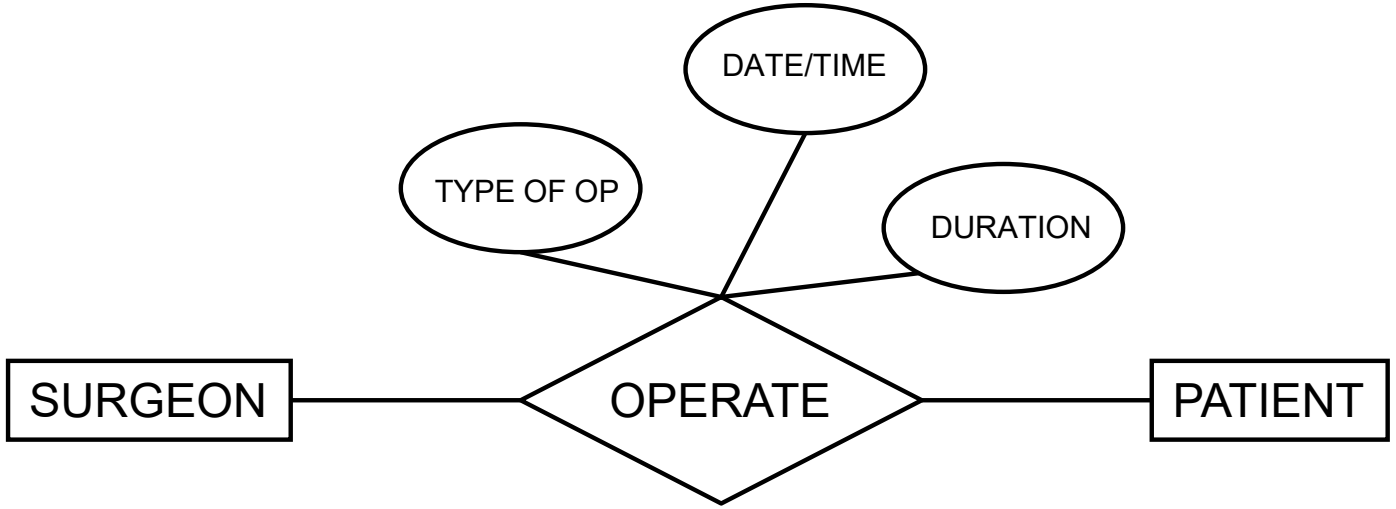
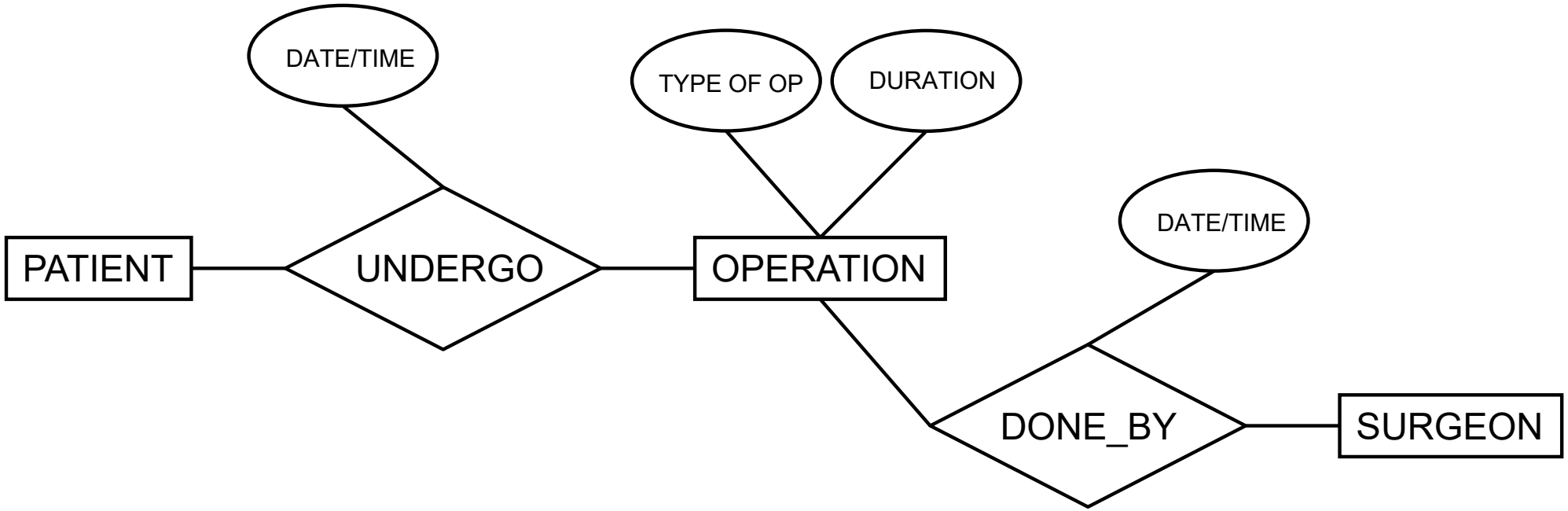
Question 1

- Every surgeon has been involved in at least one operation but not every operation type has been carried out in this hospital.





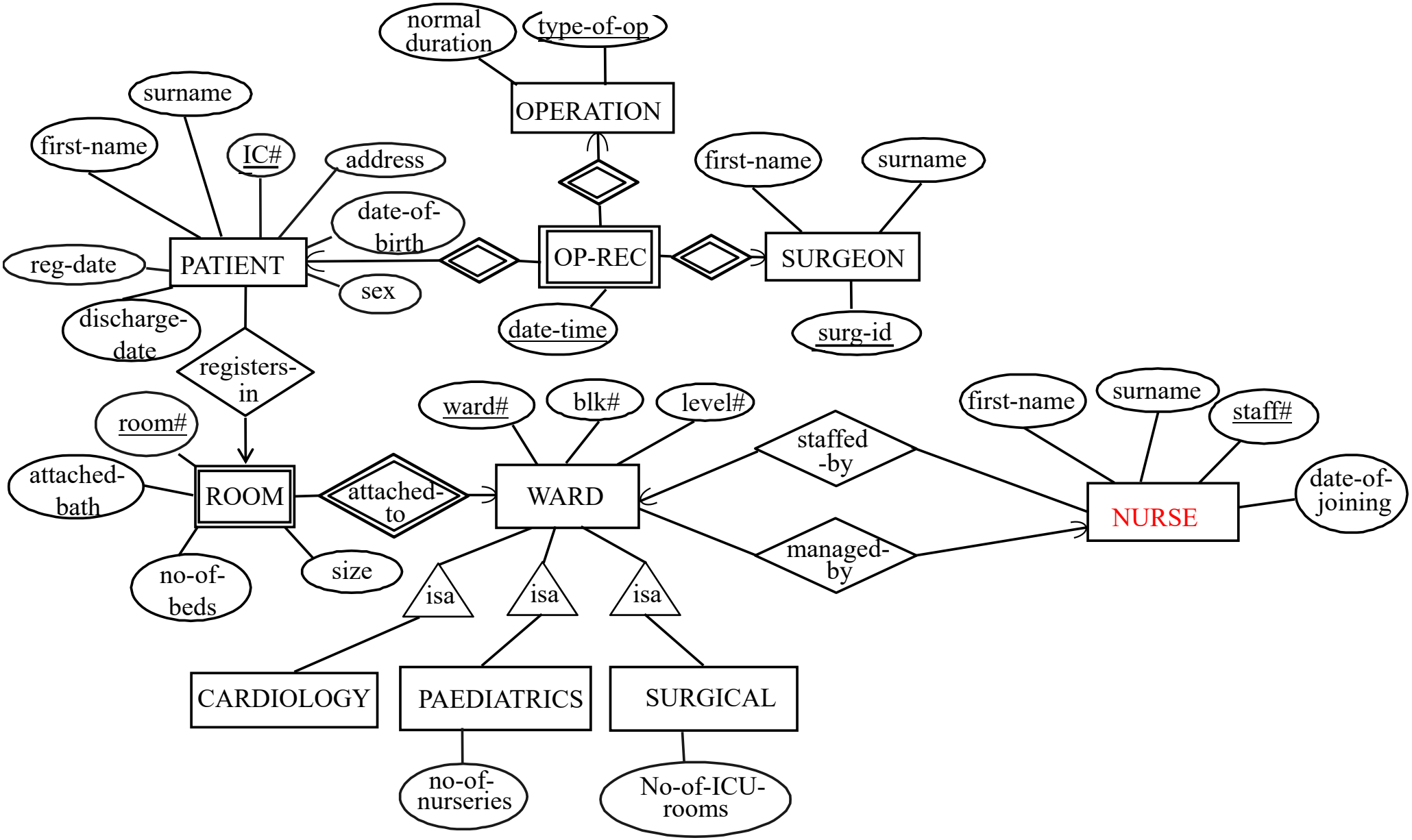
- Problems with this approach:
- Can’t capture operations that are not performed (as given in text); create OPERATION as entity will solve this; also allows some OPERATION to be involved in a relationship, and some don’t
- If “heart surgery” is performed many times, “type” and “duration” will have the same values and repeated many times



- Problems with this approach:
- DATE/TIME repeated
- How to ensure that operations undergone by PATIENTS are those performed by SURGEONS

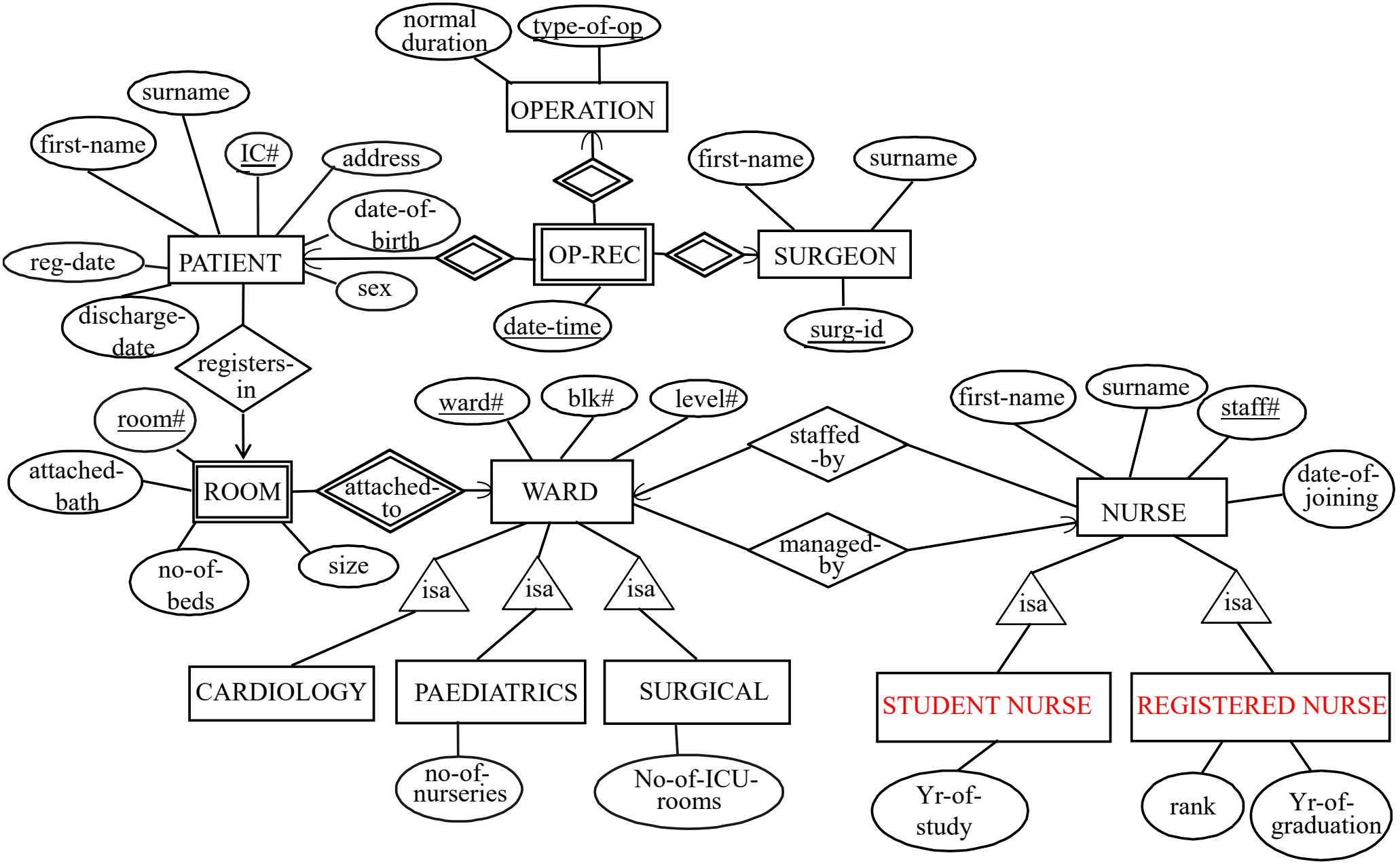
Question 1

- Information about nurses includes staff#, first name, surname, and date of joining.
- Every nurse is assigned to a ward. A ward is staffed by many nurses. However, a ward is managed by only one nurse. Not every nurse manages a ward.

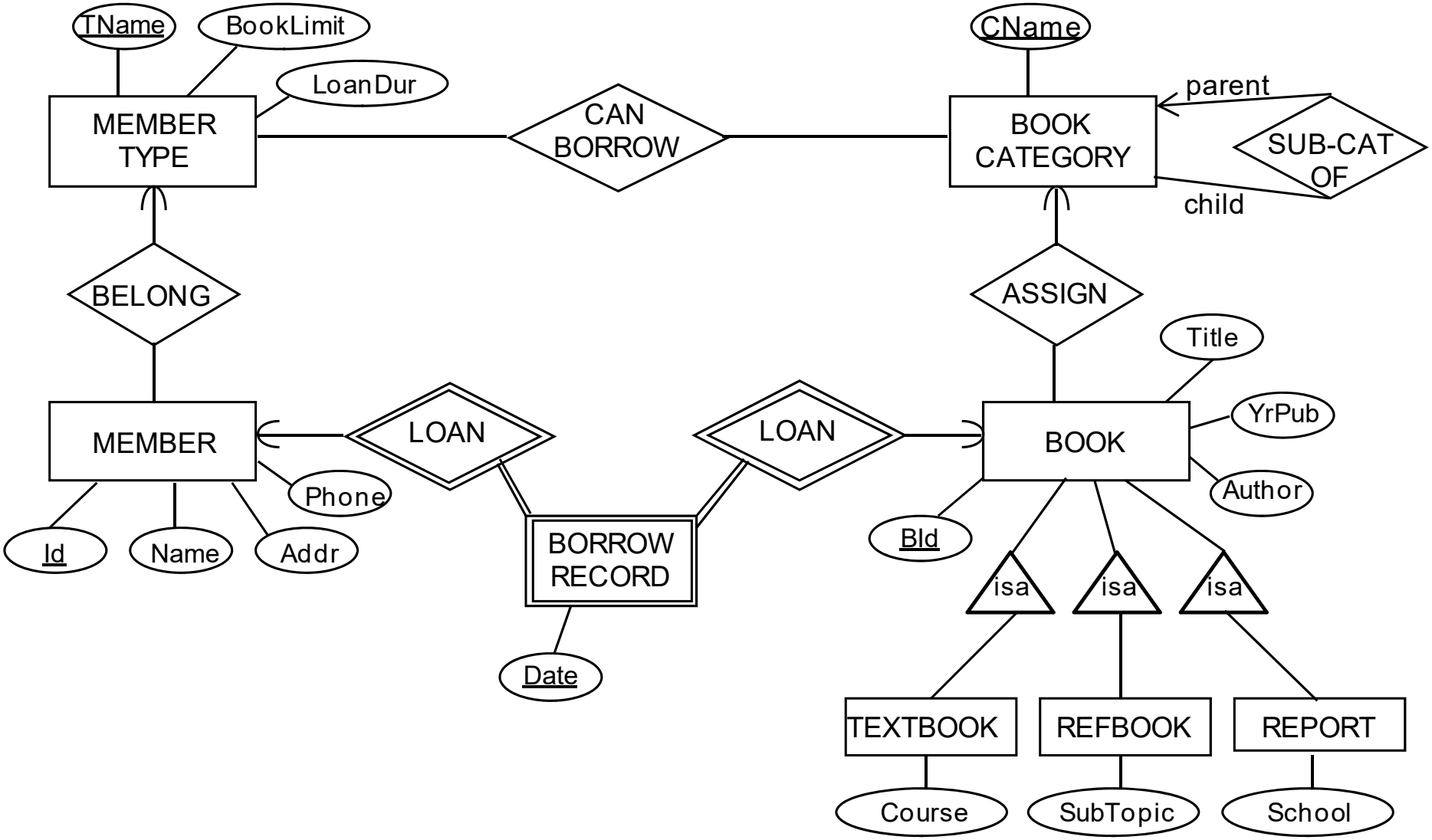


Question 1

- Nurses are designated as student nurses or registered nurses. The particular year of study for student nurses and the year of graduation and rank for registered nurses are also stored.



Question 2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