The Entity-Relationship Model (Part III)

Subclasses

Subclass = special case = fewer entities = more properties

Example: Ales are a kind of beer. Not every beer is an ale but some are. Let us suppose that in addition to all the properties of beers, they have the attribute color.

How to define the beer and ales entity set?

Hierarchy of Entity Set

One entity type might be a subtype of another.

- Ales is a subtype of beer
- Freshman is a subtype of Student

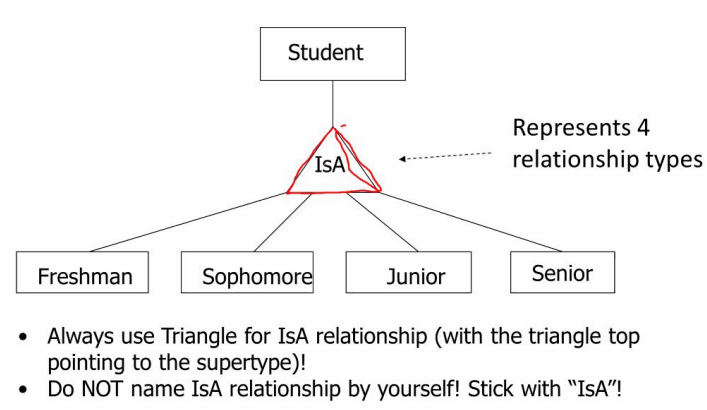
The "IsA" (Is A) relationship exists between the supertype entity and its subtype entity.

"Ales IsA beer"

"Freshman IsA Student"

IsA relationship is drawn as a triangle.

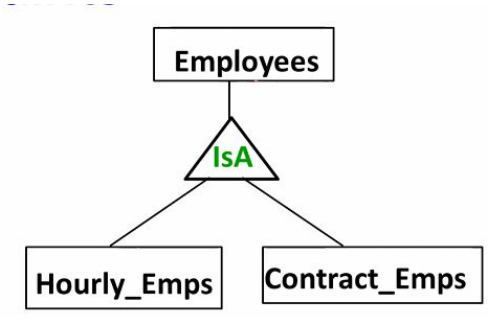
Superclass is on top and subclass is on the bottom.



Properties of IsA Relationship

- **Inheritance**: subtype inherits all attributes of supertype. The key of the supertype is the key of the subtype. Subtypes can have new attributes.
  - **For example**, GraduationDate attribute adds to Senior.
- **Transitivity:** Ales is a subtype of Beer; Beer is a subtype of Alcoholic drink; So Ales is also a subtype of Alcoholic drink. The **key** of Ales is the name (since the transitivity property works here and the key to alcoholic drink is name).
  - Use the same key as the supertype

IsA Constraints



- **Overlap constraints:** Can some employees be an Hourly_Emps and a contract_emp at the same time? Allowed: overlap constraint; Disallowed: no overlap constraint
  - If there is some employee that can be an hourly employee and a contract employee at the same time, then there is an overlap constraint.
- **Covering constraints:** Does every employee have to be either an Hourly_emp or a Contract_emps entity? Yes: covering constraint; No: no covering constraint (*for example, there are full-time employees too*)
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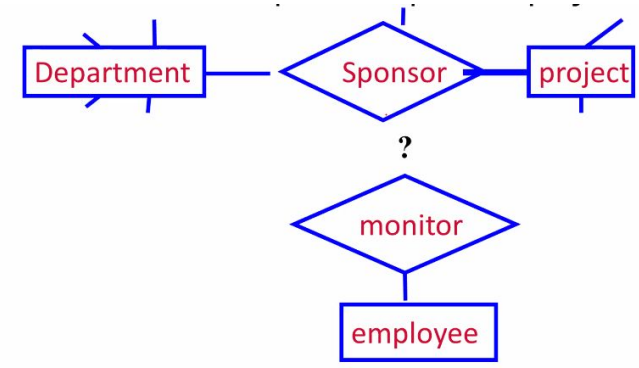
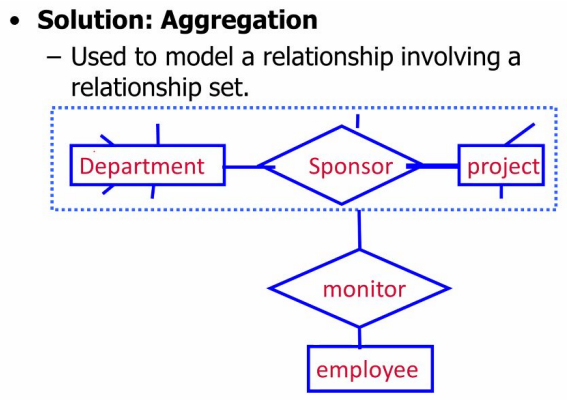
Aggregation: Motivation Example



- **How to model relationships between relationships?**
- **For example,** for each project, it is assigned an officer to monitor the sponsorship of the project.
  - You cannot simply draw a line between two diamonds. This is a **BIG NO**.
  - No connection between relationship and 1 entity set once. We cannot have a diamond connected with a rectangle using only ONE single line. You must have a recursive relationship (two lines).
- The solution is to use aggregation. This is a simplified version and we can see that we do not have any attributes.

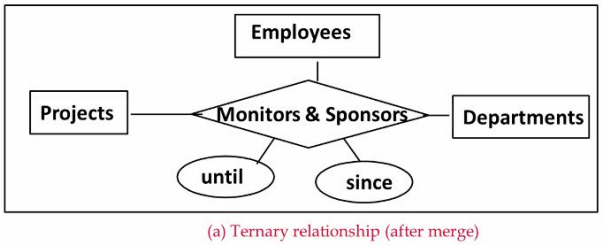


Aggregation

- Describes relationship among relationships and treats a relationship set as an entity set.

Aggregation vs. Ternary Relationship?

- Can we merge monitors and sponsors relationships? If you do, then it becomes a **Ternary Relationship**.
- In this particular example, we cannot merge these two relationships. Monitors is a distinct relationship with a descriptive attribute until. So you must use aggregation.



(a) Ternary relationship (after merge)

Conceptual Design Using the ER Model

- ER modeling can get tricky. **Design choices:**
  - Should a concept be modeled as an entity set or an attribute?
  - Should a concept be modeled as an entity set or a relationship?
  - Identifying relationships: Binary or ternary?
- **A concept should be defined as an entity set if one of the following conditions happens:**
  - **Rule 1:** it is more than the name of something and it has at least one non-key attribute
  - **Rule 2:** It is associated with “many” instances in a 1 to many or many to many relationship