ER Model- Part 4

EER Features

Extended E-R(EER) Features

- Some aspects of a database may be more aptly expressed by certain extensions to the basic E-R model.

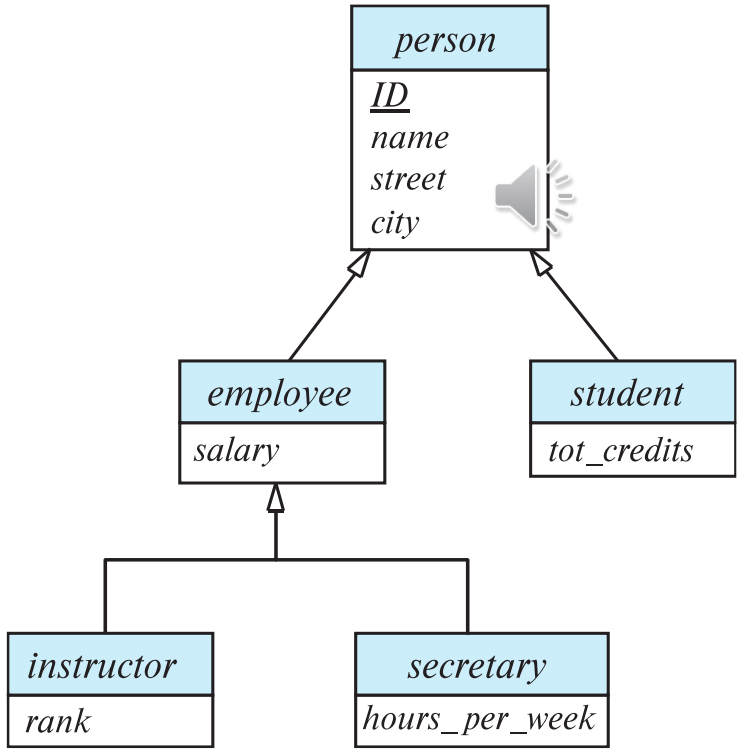
- Extended E-R features
  - specialization,
  - generalization,
  - higher- and lower-level entity sets,
  - attribute inheritance, and
  - aggregation.

Specialization

- Top-down design process; we designate sub-groupings within an entity set that are distinctive from other entities in the set.
- These sub-groupings become lower-level entity sets that have attributes or participate in relationships that do not apply to the higher-level entity set.
- For example, the entity set *person* may be further classified as one of the following:
  - *employee*.
  - *student*.
- The process of designating subgroupings within an entity set is called **specialization**.

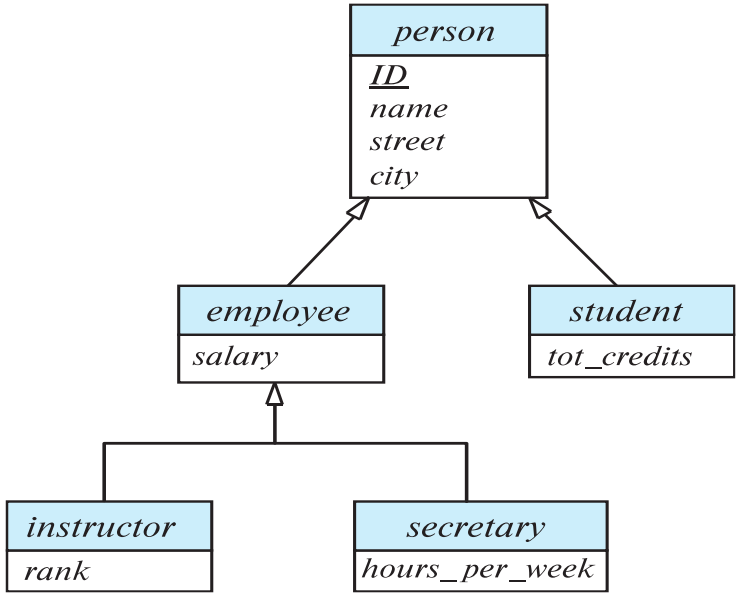
Specialization

- Higher- and lower-level entity sets also may be designated by the terms **superclass** and **subclass**, respectively



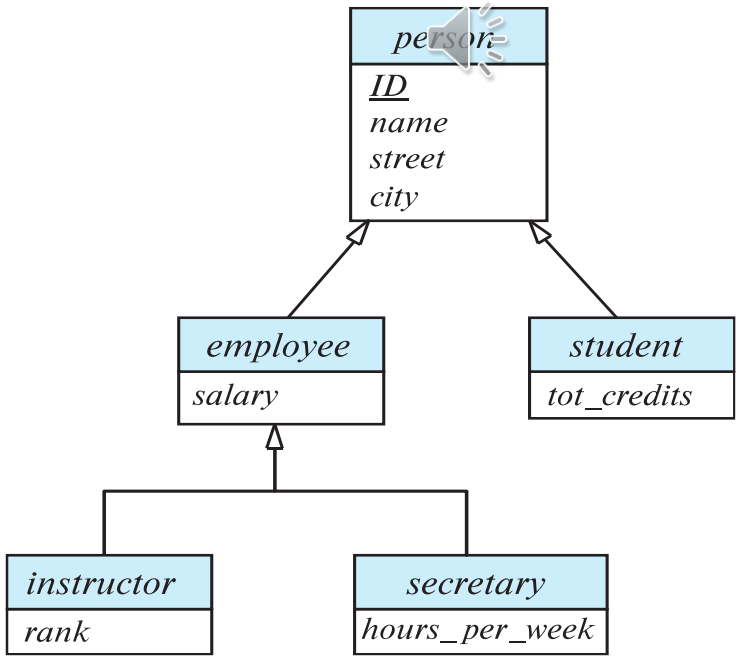
Generalization

- **A bottom-up design process** – combine a number of entity sets that share the same features into a higher-level entity set.
- Specialization and generalization are simple inversions of each other; they are represented in an E-R diagram in the same way.
- The terms specialization and generalization are used interchangeably.



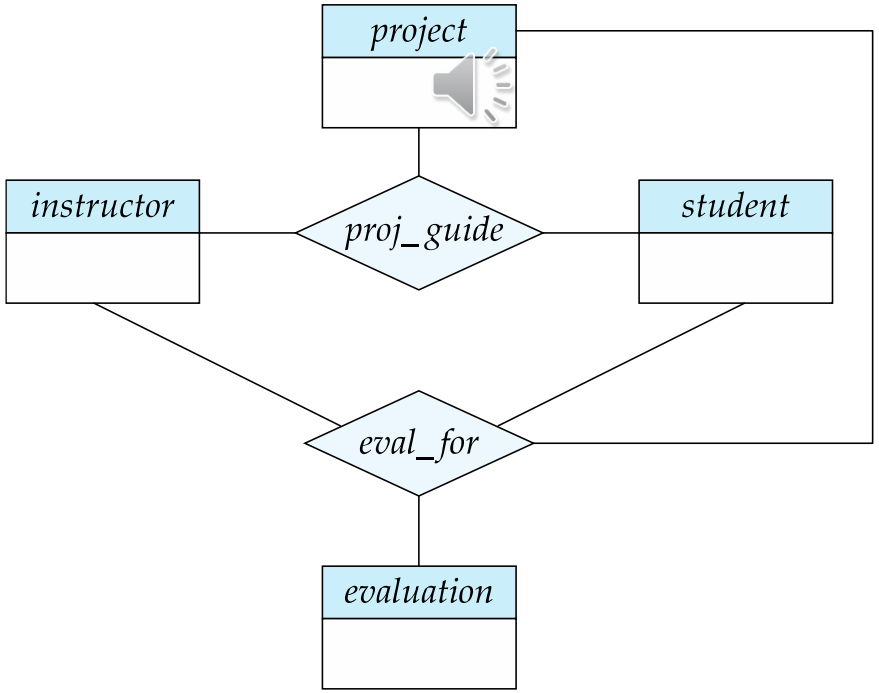
Attribute Inheritance & participation inheritance

- A crucial property of the higher- and lower-level entities created by specialization and generalization is **attribute inheritance**.
- The attributes of the higher-level entity sets are said to be **inherited** by the lower-level entity sets.
- A lower-level entity set (or subclass) also inherits participation in the relationship**(participation inheritance)** sets in which its higher-level entity (or superclass) participates.



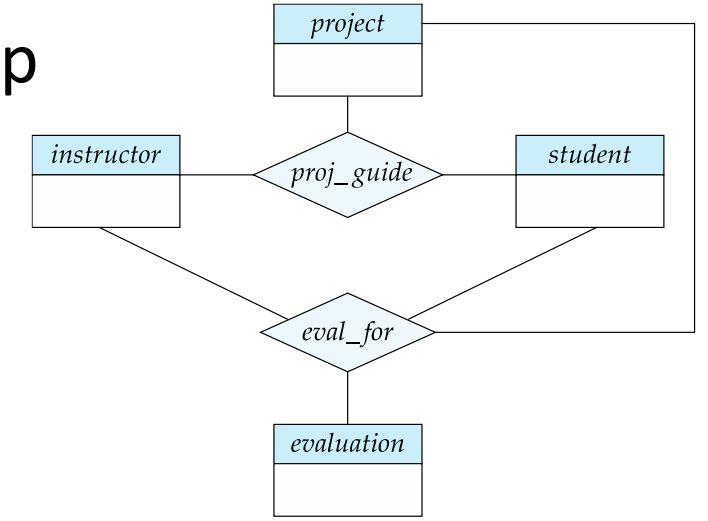
Aggregation

- Consider the ternary relationship *proj_guide*, which we saw earlier
- Suppose we want to record evaluations of a student by a guide on a project



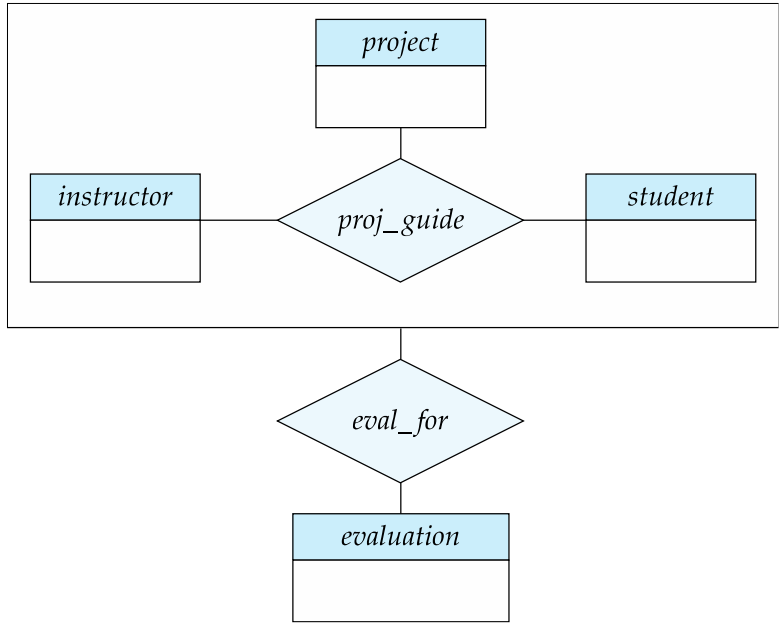
Aggregation

- Relationship sets *eval_for* and *proj_guide* represent overlapping information
  - Every *eval_for* relationship corresponds to a *proj_guide* relationship
  - However, some *proj_guide* relationships may not correspond to any *eval_for* relationships
    - So we can't discard the *proj_guide* relationship
- Eliminate this redundancy via *aggregation*
  - Treat relationship as an abstract entity
  - Allows relationships between relationships
  - Abstraction of relationship into new entity



Aggregation

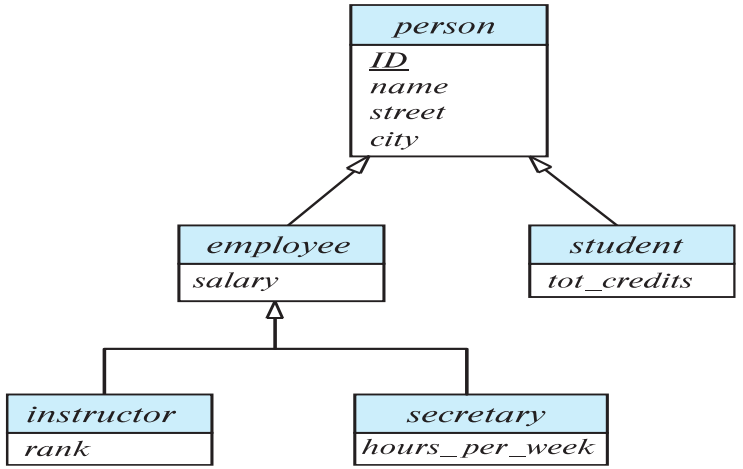
- Eliminate this redundancy via *aggregation* without introducing redundancy, the following diagram represents:
  - A student is guided by a particular instructor on a particular project
  - A student, instructor, project combination may have an associated evaluation



Reduction of EER features to Relational Schema

- **Representation of Generalization/Specialization**
- **Method** 1:
  - Form a schema for the higher-level entity
  - Form a schema for each lower-level entity set, include primary key of higher-level entity set and local attributes

schema	attributes
person	ID, name, street, city
student	ID, tot_cred
employee	ID, salary



  - Drawback: getting information about, an *employee* requires accessing two relations, the one corresponding to the low-level schema and the one corresponding to the high-level schema

Representation of Generalization/Specialization

- **Method** 2: (for disjoint)
  - Form a schema for each entity set with all local and inherited attributes

    employee(id, name, street, city, salary)
    student(id, name, street, city, tot_credit)

  - Drawback: *name, street* and *city* may be stored redundantly for people who are both students and employees

Aggregation

- To represent aggregation, create a schema containing
  - Primary key of the aggregated relationship,
  - The primary key of the associated entity set
  - Any descriptive attributes
- In our example:
  - The schema *eval_for* is:
  - *eval_for* (*s_ID, project_id, i_ID, evaluation_id*)
  - The schema *proj_guide* is redundant.