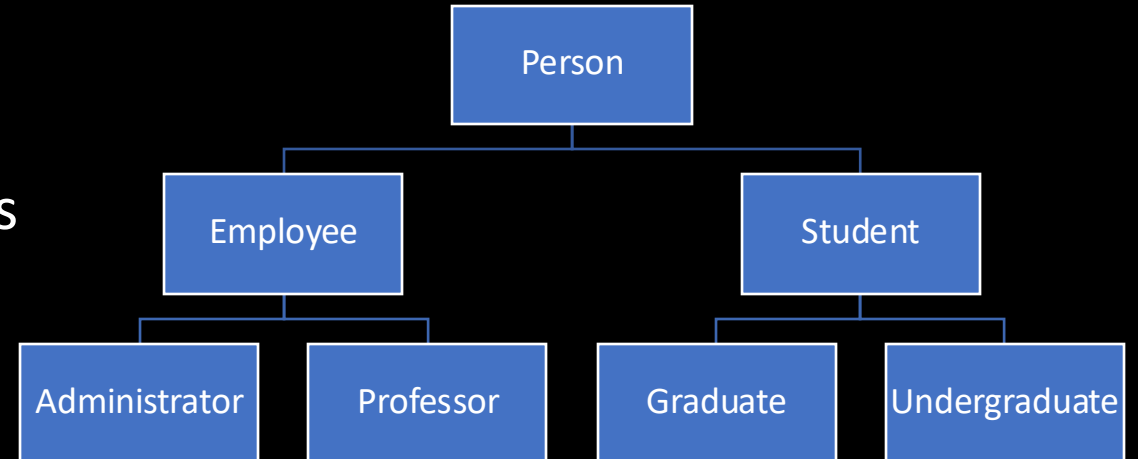# Advanced Data Modeling

Specialization Hierarchy

- Hierarchical relationships - Parent-child relationship
  - One parent has many children, one child has one parent
  - Supertype and subtype entities
  - Implements inheritance concept
  - Requires special types of constraints
    - Disjoint vs. overlapping
    - Completeness
  - Usage depends on requirements
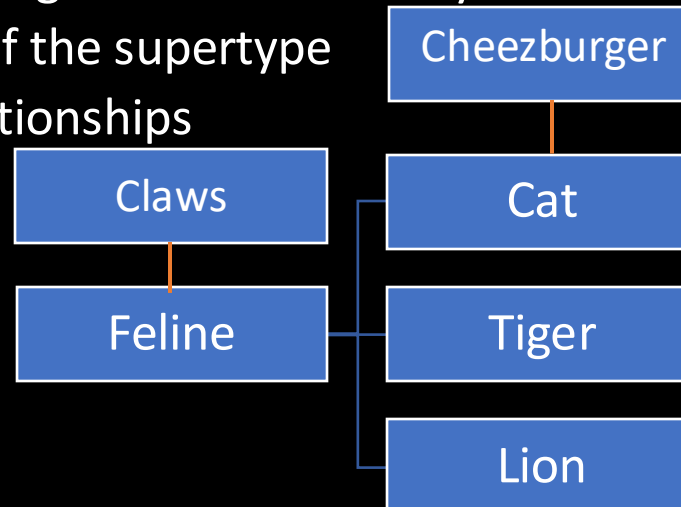 - Should be natural to the data represented

Specialization Hierarchy

- Supertype
  - Parent entity – has one or more children
  - Generalized entity type related to one or more entity subtypes
  - Contains the common attributes of all the subtypes
- Subtype
  - Child entity – has one parent
  - Specialized entity related to its parent, and may have further subtypes
  - Contains unique attributes of the subtype

Specialization Hierarchy

- Inheritance – subtypes gain attributes and relation[ships] supertypes
  - "has a" – (entity) "has a" (entity)
  - "is a" – subtype "is a" (supertype entity)
    - Relationship directly resulting from the hierarchy
    - Only exists in the context of the supertype
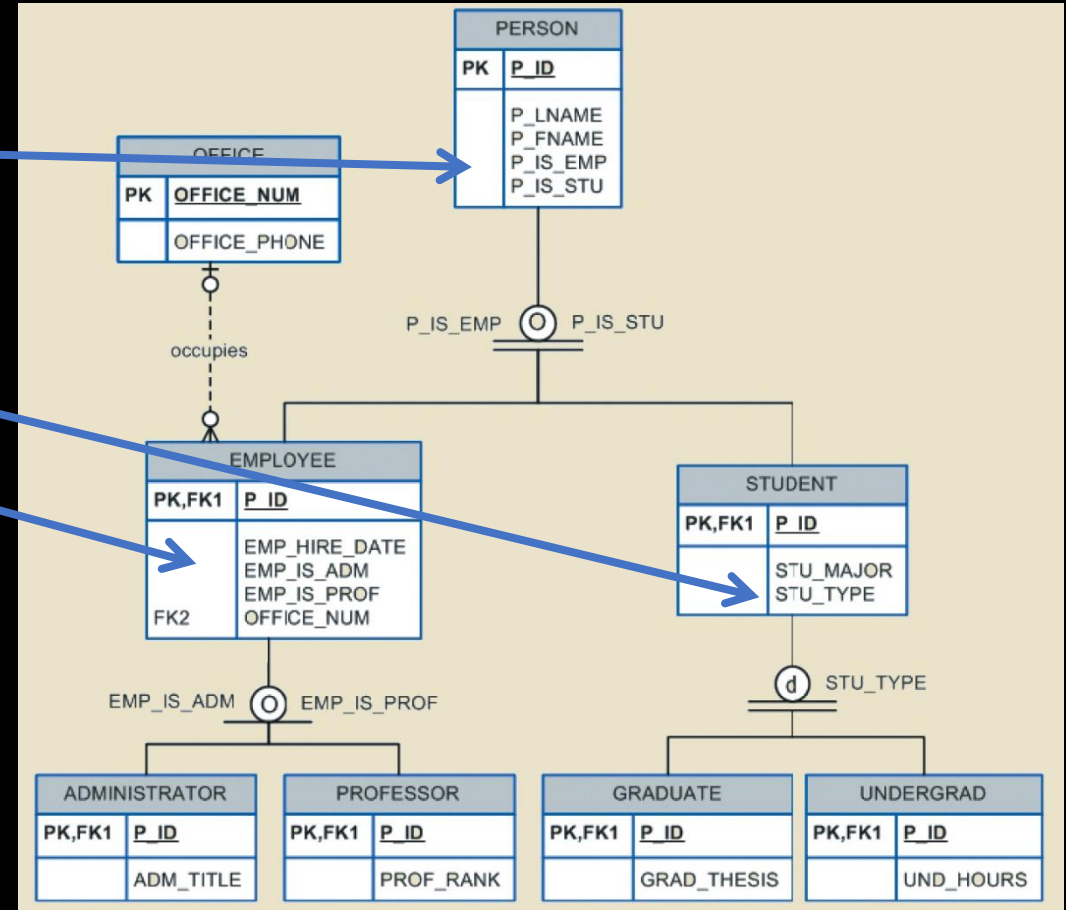   - Inherits attributes and relationships

Specialization Hierarchy

- Implementation
  - All entity subtypes inherit their primary key attribute from their supertype
    - The primary key of the parent is the primary key and foreign in the child
  - Supertype and its subtype(s) maintain a 1:1 relationship
  - Supertype requires a special attribute – subtype discriminator
    - Determines to which entity subtype the supertype occurrence is related
    - Equality is common – e.g., subtype discriminator value = some value, it is subtype A
    - Can use inequalities – e.g.,
      - subtype discriminator value is < some value, it is subtype A
      - subtype discriminator value is > some value, it is subtype B

Specialization Hierarchy

- Subtype discriminator
  - Person
  - Student
  - Employee

- Remember
  - It is an attribute
  - Use good naming
  - Keep it simple
  - Example: P_Type may be better than P_IS_EMP and P_IS_STU in this ERD
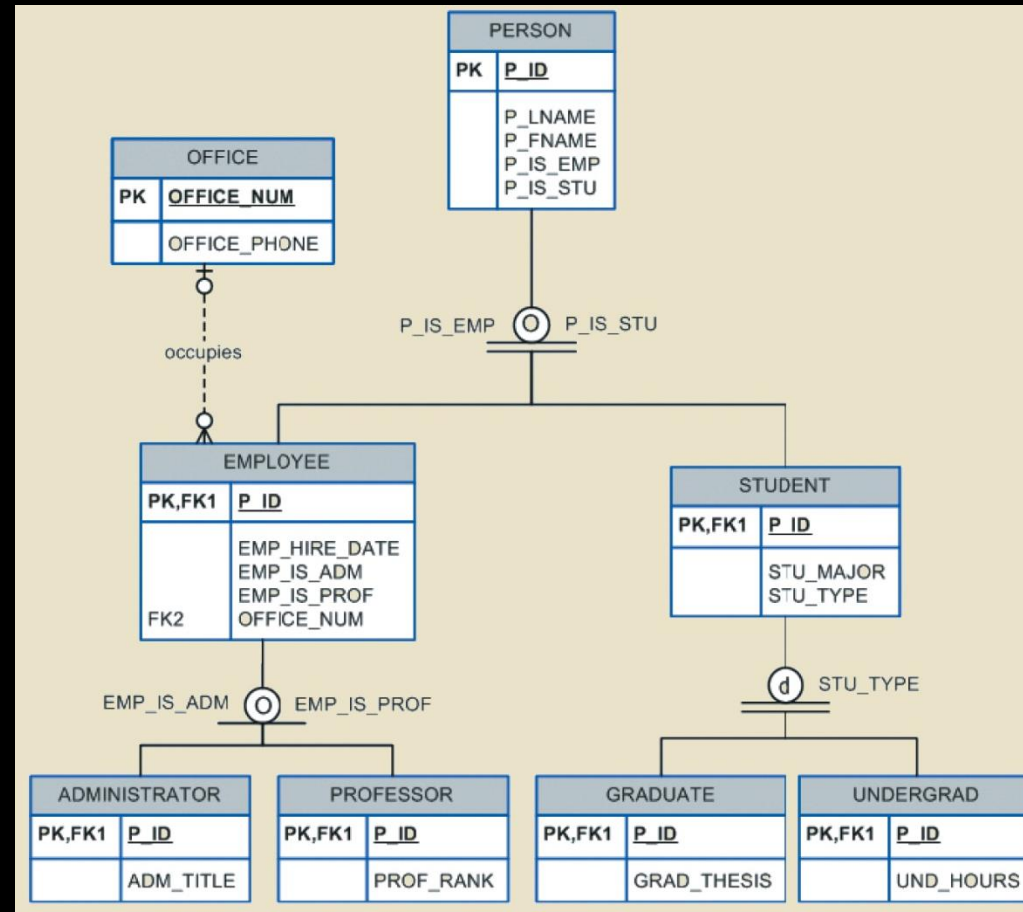
Specialization Hierarchy

- Special types of constraints
  - Disjoint subtypes
    - Contains a unique subset of the supertype entity set
    - Supertype entity occurrence can be only one of the subtypes
  - Overlapping subtypes
    - Contain nonunique subsets of the supertype entity set
    - Supertype entity occurrence can be one or more of the subtypes
  - Completeness: specifies if supertype occurrence must also be a subtype
    - Partial completeness
      - Not every supertype occurrence is a member of a subtype
    - Total completeness
      - Every supertype occurrence must be a member of a subtype
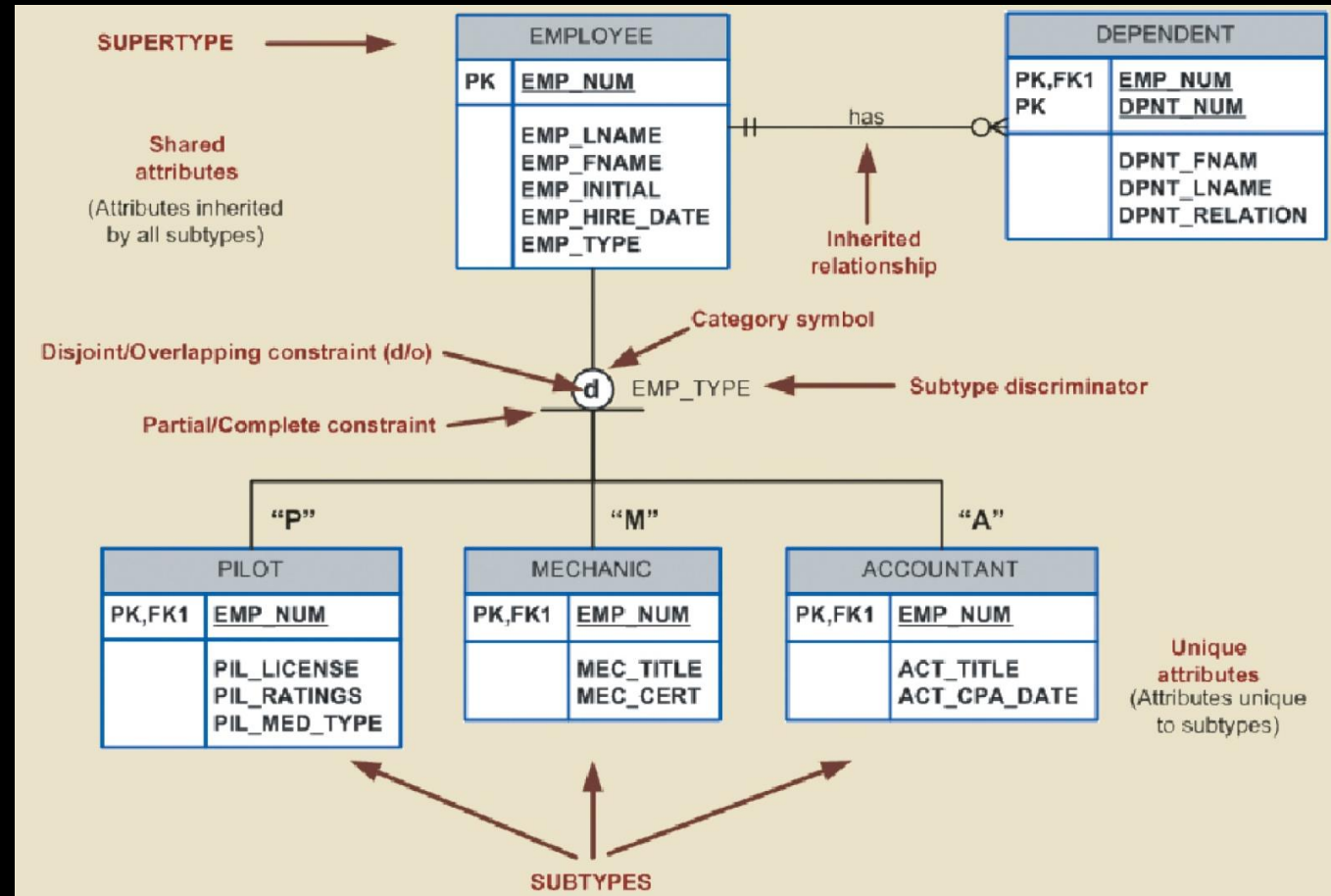
Specialization Hierarchy

SPECIALIZATION HIERARCHY CONSTRAINT SCENARIOS		
TYPE	**DISJOINT CONSTRAINT**	**OVERLAPPING CONSTRAINT**
Partial	Supertype has optional subtypes. Subtype discriminator can be null. Subtype sets are unique.	Supertype has optional subtypes. Subtype discriminators can be null. Subtype sets are not unique.
Total	Every supertype occurrence is a member of only one subtype. Subtype discriminator cannot be null. Subtype sets are unique.	Every supertype occurrence is a member of atleast one subtype. Subtype discriminators cannot be null. Subtype sets are not unique.

- d in the circle means disjoint
- o in the circle means overlapping

Specialization Hierarchy

Specialization Hierarchy

Specialization Hierarchy

PERSON(**p_id**, p_lname, p_fname, p_is_emp, p_is_stu)

EMPLOYEE(*p_id*, emp_hire_date, emp_is_adm, emp_is_prof, *office_num*)
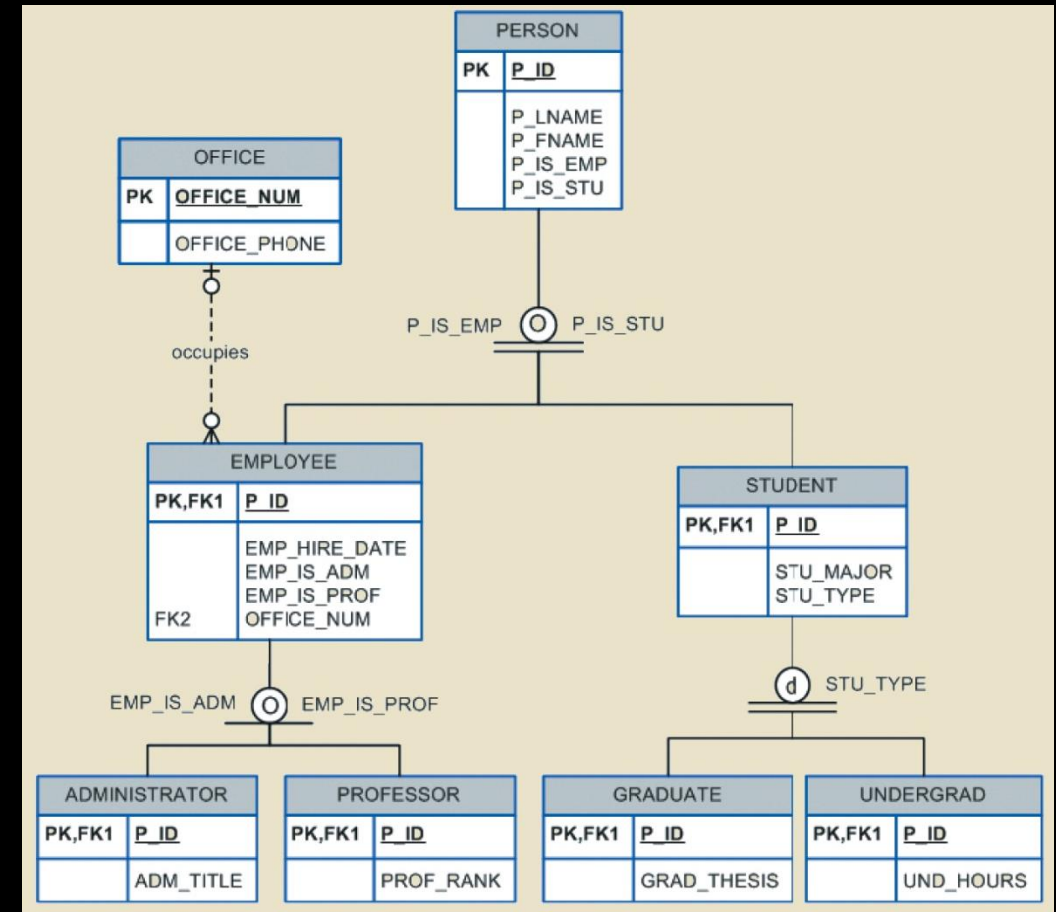
STUDENT(*p_id*, stu_major, stu_type)

ADMINISTRATOR(*p_id*, adm_title)

PROFESSOR(*p_id*, prof_rank)

GRADUATE(*p_id*, grad_thesis)

UNDERGRAD(*p_id*, und_hours)

OFFICE(**office_num**, office_phone)

Specialization Hierarchy

- Granite Sales Company keeps information on employees and their work departments.
- The department name, internal mailbox number, and office phone extension are kept for each department.
- A department can have many assigned employees, each assigned to only one department.
- Employees can be salaried employees, hourly employees, or contract employees.
- All employees are assigned an employee number, which is kept along with the employee's name and address.
- For hourly employees, hourly wage and target weekly work hours are stored (e.g., the company may target 40 hours/week for some, 32 hours/week for others, and 20 hours/week for others).
- Some salaried employees are salespeople who can earn a commission in addition to their base salary.
- The yearly salary amount is recorded in the system for all salaried employees.
- For salespeople, their commission percentage on sales and commission percentage on profit are stored in the system. For example, John is a salesperson with a base salary of $50,000 per year plus a 2-percent commission on the sales price for all sales he makes plus another 5 percent of the profit on each.
- For contract employees, the beginning date and end dates of their contract are stored along with the billing rate for their hours.

Specialization Hierarchy