Chapter 4:
The Enhanced ER Model and Business Rules

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Supertypes and Subtypes

- **Subtype**: A subgrouping of the entities in an entity type which has attributes that are distinct from those in other subgroupings.

- **Supertype**: An generic entity type that has a relationship with one or more subtypes.

- **Attribute Inheritance**:
  - Subtype entities inherit values of all attributes of the supertype.
  - An instance of a subtype is also an instance of the supertype.
Figure 4-1a Basic notation for supertype/subtype relationships - Traditional EER notation

- Attributes shared by all entities
- Relationships in which all instances participate
- General entity type
- Relationships in which only specialized versions participate
- and so forth
- Specialized versions of supertype

SUPERTYPE

- Attributes unique to subtype 1
- Attributes unique to subtype 2
Figure 4-2 – Employee supertype with three subtypes

All employee subtypes will have emp_nbr, name, address, and date-hired

Each employee subtype will also have its own attributes.
Relationships and Subtypes

- Relationships at the **supertype** level indicate that all subtypes will participate in the relationship.

- The instances of a **subtype** may participate in a relationship unique to that subtype. In this situation, the relationship is shown at the subtype level.
Both outpatients and resident patients are cared for by a responsible physician.

Only resident patients are assigned to a bed.
Constraints in Supertype/Completeness Constraint

- **Completeness Constraints**: Whether an instance of a supertype **must** also be a member of at least one subtype
  - Total Specialization Rule: Yes (double line)
  - Partial Specialization Rule: No (single line)
A patient must be either an outpatient or a resident patient.
A vehicle could be a car, a truck, or neither.
Constraints in Supertype/Disjointness constraint

- **Disjointness Constraints**: Whether an instance of a supertype may *simultaneously* be a member of two (or more) subtypes
  - Disjoint Rule: An instance of the supertype can be only ONE of the subtypes
  - Overlap Rule: An instance of the supertype could be more than one of the subtypes
Figure 4-7a – Examples of disjointness constraints

Disjoint rule

A patient can either be outpatient or resident, but not both.
A part may be both purchased and manufactured.
Constraints in Supertype/Subtype Discriminators

- **Subtype Discriminator**: An attribute of the supertype whose values determine the target subtype(s)
  - **Disjoint** – a *simple* attribute with alternative values to indicate the possible subtypes
  - **Overlapping** – a *composite* attribute whose subparts pertain to different subtypes. Each subpart contains a boolean value to indicate whether or not the instance belongs to the associated subtype
Figure 4-8 – Introducing a subtype discriminator (disjoint rule)

A simple attribute with different possible values indicating the subtype
Figure 4-9 – Subtype discriminator (*overlap* rule)

A composite attribute with sub-attributes indicating “yes” or “no” to determine whether it is of each subtype.
Figure 4-10 Example of supertype/subtype hierarchy
Entity Clusters

- EER diagrams are difficult to read when there are too many entities and relationships.
- Solution: group entities and relationships into *entity clusters*.
- **Entity cluster**: set of one or more entity types and associated relationships grouped into a single abstract entity type.
Figure 4-13a – Possible entity clusters for Pine Valley Furniture

Related groups of entities could become clusters
More readable, isn’t it?

1 A relationship diamond and name (e.g., Ordered_on) could be inserted here, although none is on Figure 4-13a.