Chapter 4: The Enhanced E-R Model and Business Rules

Modern Database Management
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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
- **Inheritance**:
  - Subtype entities inherit values of all attributes of the supertype
  - An instance of a subtype is also an instance of the supertype

Figure 4-1 -- Basic notation for supertype/subtype relationships

Figure 4-2 -- Employee supertype with three subtypes

Figure 4-3 -- Supertype/subtype relationships in a hospital

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
Generalization and Specialization

- **Ways to develop super/subtype relationships:**
  - **Generalization:** The process of defining a more general entity type from a set of more specialized entity types. BOTTOM-UP
  - **Specialization:** The process of defining one or more subtypes of the supertype, and forming supertype/subtype relationships. TOP-DOWN

**Figure 4-4 – Example of generalization**

(a) Three entity types: CAR, TRUCK, and MOTORCYCLE

All these types of vehicles have common attributes

**Figure 4-4(b) – Generalization to VEHICLE supertype**

So we put the shared attributes in a supertype

Note: no subtype for motorcycle, since it has no unique attributes

**Figure 4-5 – Example of specialization**

(a) Entity type PART

Applies only to manufactured parts

Only applies to purchased parts

**Figure 4-5(b) – Specialization to MANUFACTURED PART and PURCHASED PART**

Created 2 subtypes

Note: multivalued attribute was replaced by a relationship to another entity

**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)
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

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

**Employee, Type:**
- Hourly Employee
- Salaried Employee
- Consultant

**Employee, Name**
- Address
- Social_Security
- Date_Hired
- **Employee, Type**

**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

**Part:**
- **Manufactured Part**
- **Purchased Part**
- **Supplier**

**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 4-13(a) – Possible entity clusters for Pine Valley Furniture**

Related groups of entities could become clusters

**Figure 4-13(b) – EER diagram of PVF entity clusters**

More readable, isn’t it?