CS 235: Introduction to Databases
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Lecture Notes #2

The Big Picture
- Stages of building DB application: data tier
- Real-world domain.
  - understand client needs.
- Design data model:
  - using entity-relationship (E/R) model.
- Database data model:
  - using relational model.
- Create schema in DBMS, load data.
  - using SQL, loader.

Last Time
- Entity-Relationship Model

Outline
- More design issues
- Subclasses
- Keys

Subclasses
- Subclass:
  - special case
  - fewer entities
  - more properties.
- Example: Ales are a kind of beer.
  - In addition to the properties (= attributes and relationships) of beers, there is a color attribute for ales.

E/R Subclasses
- isa triangles indicate the subclass relation.

![Diagram of E/R Subclasses]
Different Subclass Viewpoints

- **E/R viewpoint**: An entity has a component in each entity set to which it logically belongs.
  - Its properties are the union of the properties of these E.S.
- **Object-oriented viewpoint**: An object (entity) belongs to exactly one class.
  - It inherits properties of its superclasses.

Subclasses Example

![Subclasses Diagram]

Multiple Inheritance

- Theoretically, an E.S. could be a subclass of several other entity sets.

![Multiple Inheritance Diagram]

Problems

- How should conflicts be resolved?
- Example: `manf` means grower for wines, bottler for beers. What does `manf` mean for “grape beers”?
- Need ad-hoc notation to resolve meanings.
- In practice, we shall assume a tree of entity sets connected by `isa`, with all “isas” pointing from child to parent.

Keys

- A key is a set of attributes whose values can belong to at most one entity.
  - The value of a key is unique.
- In E/R model, every E.S. must have a key.
  - It could have more than one key, but one set of attributes is the designated key.
- In E/R diagrams, you should underline all attributes of the designated key.

Example

- Suppose `name` is key for Beers.
- Beer `name` is also key for ales.
  - In general, key at root is key for all.
Example: A Multiattribute Key

- What is the key?

Surrogate Keys

- Synthetically generated unique identifiers, often by the database system
- Pros
  - Immutable, performance (integers)
- Cons
  - Disassociations, confusion
- Implementation
  - SEQUENCE (Oracle)
  - AUTO_INCREMENT (MySQL)