UML

UML Data Modeling
Data Modeling

How to represent data for application

- Relational model – with design principles
- XML
- Database design model
  - Not implemented by system
  - Translated into model of DBMS
Higher-Level Database Design Models

- **Entity-Relationship Model (E/R)**
- **Unified Modeling Language (UML)**
  
  Data modeling subset

- Both are graphical
- Both can be translated to relations automatically
  
  Or semi-automatically
UML Data Modeling: 5 concepts

(1) Classes
(2) Associations
(3) Association Classes
(4) Subclasses
(5) Composition & Aggregation
UML Data Modeling: **Classes**

**Name, attributes, methods**

*For data modeling: add “pk”, drop methods*
UML Data Modeling: 5 concepts

✓ (1) Classes
   (2) Associations
   (3) Association Classes
   (4) Subclasses
   (5) Composition & Aggregation
UML Data Modeling: **Associations**

Relationships between objects of two classes
Multiplicity of Associations

Relationships between objects of two classes

Each object of class $C_1$ is related to at least $m$ and at most $n$ objects of class $C_2$
Students must apply somewhere and may not apply to more than 5 colleges. No college takes more than 20,000 applications.
Multiplicity of Associations: Types of Relationships

- One-to-One
- Many-to-One
- Many-to-Many
- Complete
UML Data Modeling: 5 concepts

✓ (1) Classes
✓ (2) Associations
(3) Association Classes
(4) Subclasses
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UML Data Modeling: **Association Classes**

Relationships between objects of two classes, *with attributes on relationships*
Eliminating Association Classes

Unnecessary if 0..1 or 1..1 multiplicity
Self-Associations

Associations between a class and itself
Self-Associations

Associations between a class and itself

- Student
  - Sibling

- College
  - Branch
    - home: 1..1
    - satellite: 0..10
UML Data Modeling: 5 concepts

1. Classes
2. Associations
3. Association Classes
4. Subclasses
5. Composition & Aggregation
UML Data Modeling: **Subclasses**

- **Student**
  - S1D (PK)
  - SName
  - GPA

- **ForeignS**
  - country

- **DomesticS**
  - state
  - SSN

- **AP Students**

- **Took**
  - APCourse
    - courseNum (pk)
    - title
    - units

- **APInfo**
  - year
  - grade
Subclass Terminology & Properties

- **Superclass** = Generalization
- **Subclass** = Specialization
- Incomplete (Partial) vs. Complete
- **Disjoint** (Exclusive) vs. Overlapping

\( \text{every obj. in at least one subclass} \)

\( \text{at most...} \)
UML Data Modeling: 5 concepts

1. Classes
2. Associations
3. Association Classes
4. Subclasses
5. Composition & Aggregation
UML Data Modeling: Composition & Aggregation

Objects of one class belong to objects of another class
Higher-Level Database Design

- **Unified Modeling Language (UML)**
  Data modeling subset

- Graphical

- 5 concepts
  1. Classes
  2. Associations
  3. Association Classes
  4. Subclasses
  5. Composition & Aggregation

- Can be translated to relations automatically