UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA

Course Name : Database Management System

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Module 2: Reduction to Relation Schemas

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Reduction to Relation Schemas

- Entity sets and relationship sets can be expressed uniformly as *relation schemas* that represent the contents of the database.
- **A database which conforms to an E-R diagram can be represented by a collection of schemas**.
- For each entity set and relationship set there is a **unique schema** that is assigned the name of the corresponding entity set or relationship set.
- Each schema has a number of columns (generally corresponding to attributes), which have unique names.

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Representing Entity Sets

- A strong entity set reduces to a schema with the same attributes

  student(ID, name, tot_cred)

- A weak entity set becomes a table that includes a column for the primary key of the identifying strong entity set

  section (course_id, sec_id, sem, year)

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Representing Relationship Sets

- A many-to-many relationship set is **represented as a schema with attributes for the primary keys of the two participating entity sets, and any descriptive attributes of the relationship set.**
- Example: schema for relationship set *advisor*

advisor = (*s_id, i_id*)

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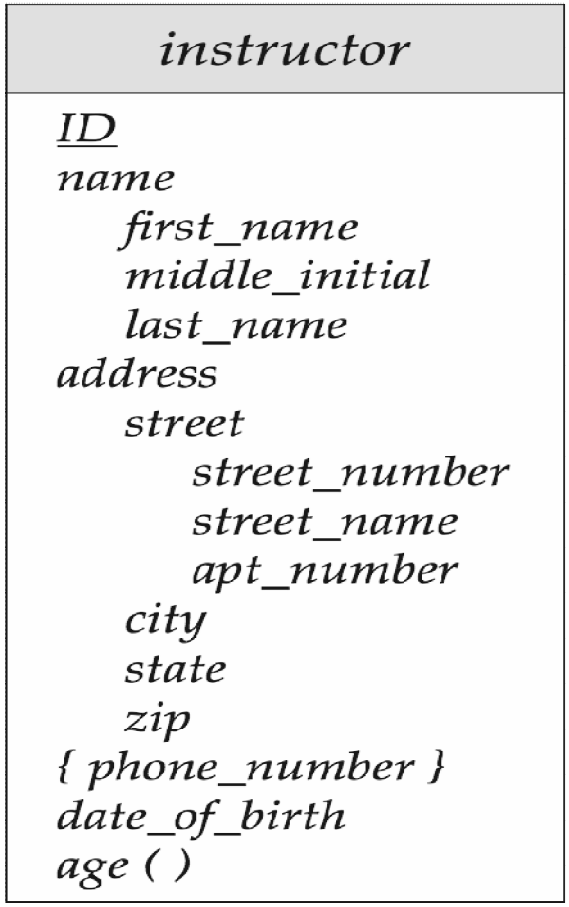
Representation of Entity Sets with Composite Attributes



- **Composite attributes are flattened out by creating a separate attribute for each component attribute**
  - Example: given entity set *instructor* with composite attribute *name* with component attributes *first_name* and *last_name* the schema corresponding to the entity set has two attributes *name_first_name* and *name_last_name*
    - Prefix omitted if there is no ambiguity (*name_first_name* could be *first_name)*
- **Ignoring multivalued attributes**, extended instructor schema is
  - *instructor(ID,*
    first_name, middle_initial, last_name,
    street_number, street_name,
    apt_number, city, state, zip_code,
    date_of_birth)

Representation of Entity Sets with Multivalued Attributes

- **A multivalued attribute *M* of an entity *E* is represented by a separate schema** *EM*
- Schema *EM* has attributes corresponding to the primary key of *E* and an attribute corresponding to multivalued attribute *M*
- Example: Multivalued attribute *phone_number* of *instructor* is represented by a schema:
  ***inst_phone*= (*ID*, *phone_number*)**
- Each value of the multivalued attribute maps to a separate tuple of the relation on schema *EM*
  - **For example, an *instructor* entity with primary key 22222 and phone numbers 456-7890 and 123-4567 maps to two tuples:**
    (22222, 456-7890) and (22222, 123-4567)

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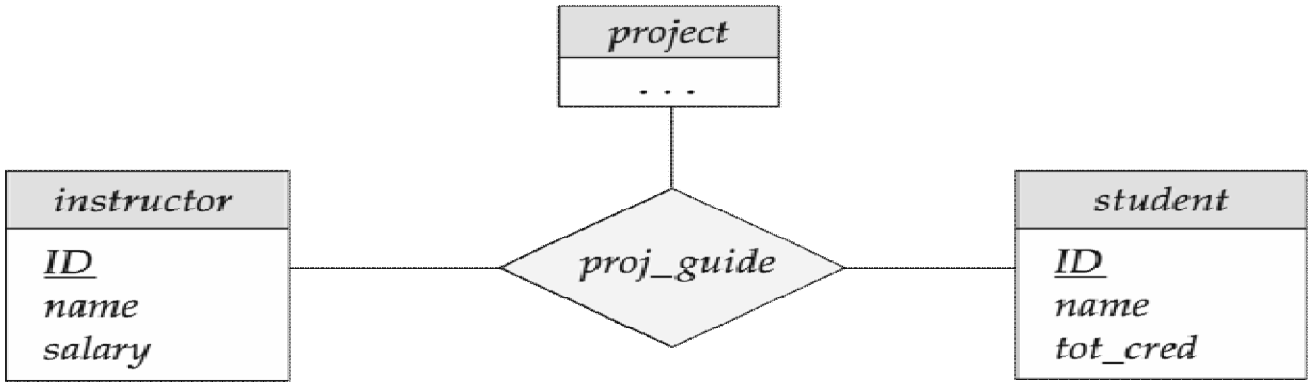
Non-binary Relationship Sets

- Most relationship sets are binary
- There are occasions when it is more convenient to represent relationships as non-binary.
- E-R Diagram with a Ternary Relationship



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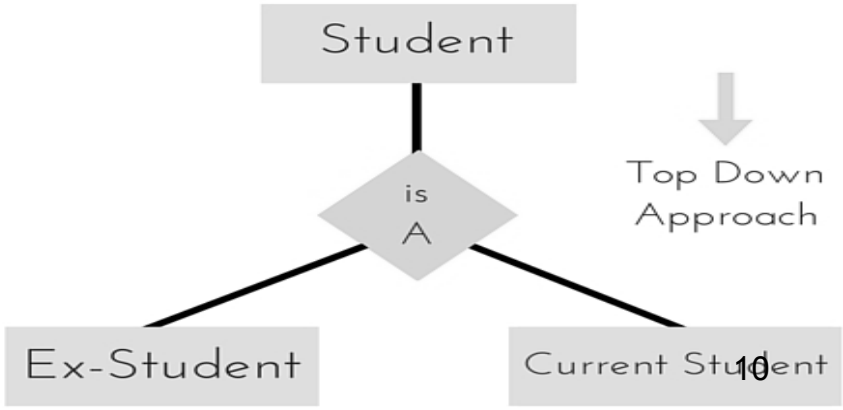
Cardinality Constraints on Ternary Relationship

- We allow at most one arrow out of a ternary (or greater degree) relationship to indicate a cardinality constraint
- For example, an arrow from *proj_guide* to *instructor* indicates each student has at most one guide for a project
- If there is more than one arrow, there are two ways of defining the meaning.
  - For example, a ternary relationship *R* between *A*, *B* and *C* with arrows to *B* and *C* could mean
    1. Each *A* entity is associated with a unique entity from *B* and *C* or
    2. Each pair of entities from (*A, B*) is associated with a unique *C* entity, and each pair (*A, C*) is associated with a unique *B*
  - Each alternative has been used in different formalisms
  - To avoid confusion we outlaw more than one arrow

Specialization

- **Top-down design process**; we designate sub-groupings within an entity set that are distinctive from other entities in the set.
- These sub-groupings become **lower-level entity sets that have attributes or participate in relationships that do not apply to the higher-level entity set**.
- Depicted by a *triangle* component labeled **ISA (e.g., *Ex-student* "is a" *student*).**
- **Attribute inheritance** – a lower-level entity set inherits all the attributes and relationship participation of the higher-level entity set to which it is l



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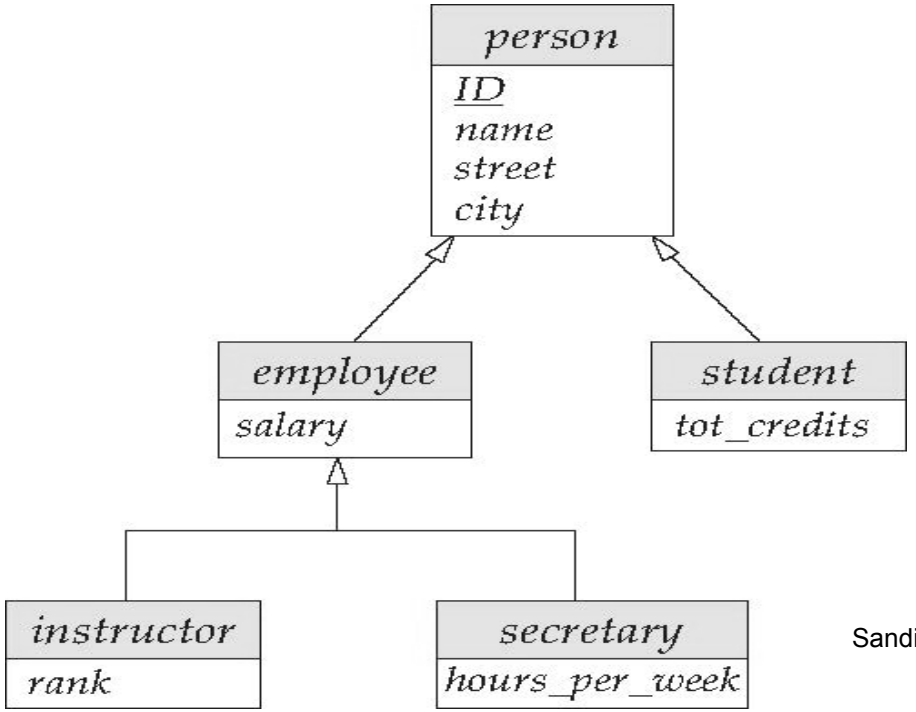
Specialization Example

- **Overlapping** – *employee* and *student*
- **Disjoint** – *instructor* or *secretary*
- **Total and partial**



E.g.
Let's say you have a super class 'account' with sub classes 'Savings Account' and 'Current Account'. This is a disjoint constraint situation because a bank account can either be Savings or Current. It cant be both at the same time. For an overlapping constraint situation, let's say we have a super class 'Person' and subclasses 'Customer' and 'Employee'. In this case, a person can be Customer and Employee both. Therefore, overlapping.

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Representing Specialization via Schemas

- Method 1:
  - **Form a schema for the higher-level entity**
  - Form a schema for each lower-level entity set, **include primary key of higher-level entity set and local attributes**

schema	attributes
person	ID, name, street, city
student	ID, tot_cred
employee	ID, salary

  - Drawback: **getting information about, an *employee* requires accessing two relations**, the one corresponding to the low-level schema and the one corresponding to the high-level schema

Representing Specialization as Schemas (Cont.)

- Method 2:
  - **Form a schema for each entity set with all local and inherited attributes**

schema	attributes
person	ID, name, street, city
student	ID, name, street, city, tot_cred
employee	ID, name, street, city, salary

  - Drawback: ***name, street*** **and** ***city*** **may be stored redundantly for people who are both students and employees**

Thank You

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