LECTURE 3 - RELATIONAL DATA MODEL

Relational DB:
A set of relations

Relation:
A two-dimensional table in which data is arranged

Relationship Schema:
Ri={A1,…,Am}
Relation name + a set of attribute names + attribute types

Relation instance:
The set of "current" tuples

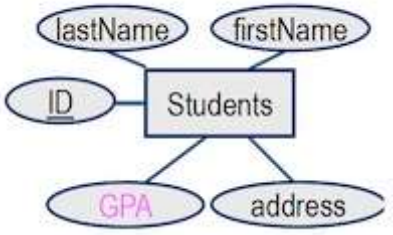
Database schema:
D={R1,…,Rn}
A set of relation schemas

Database instance:
A collection of relation instances

Logical Database Design

Input = E/R diagram
Output = A relational database schema (a collection of relations)

Converting Entity Sets to Tables:

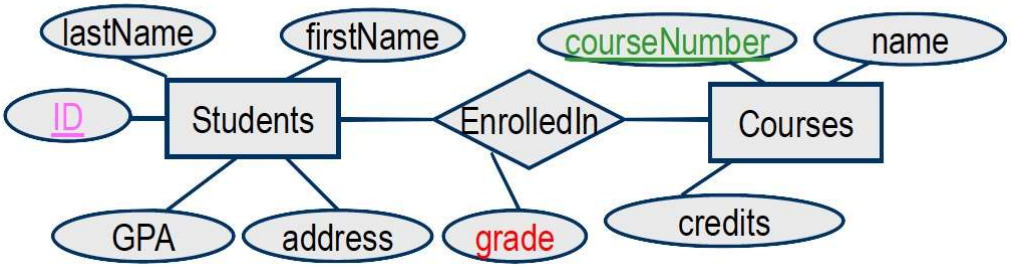


Schema: Students(*ID*, firstName, lastName, GPA, address)

Converting Relationships to Tables:

For each relationship set R create a relationship (table) with the same name R.
The set of attributes of this relation includes:

- **Key attribute(s)** of each entity set involved in the relationship.
- The **"explicit" attributes** which R may have.

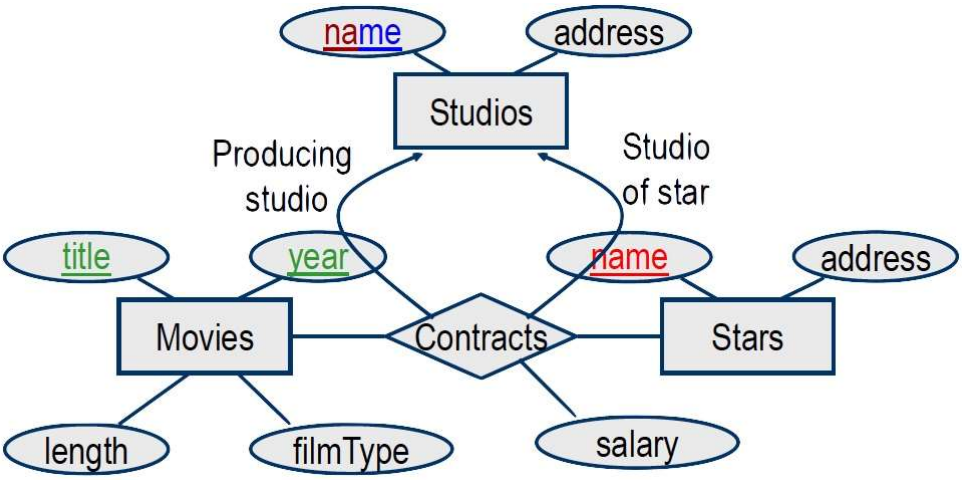


Schema: = Students(*ID*, *courseNumber*, grade)

Identifying The *Key* of Relationship R

If **R** is a binary relationship between entity sets **E1** and **E2**, then the multiplicity of this relationship determines the *key* of R:

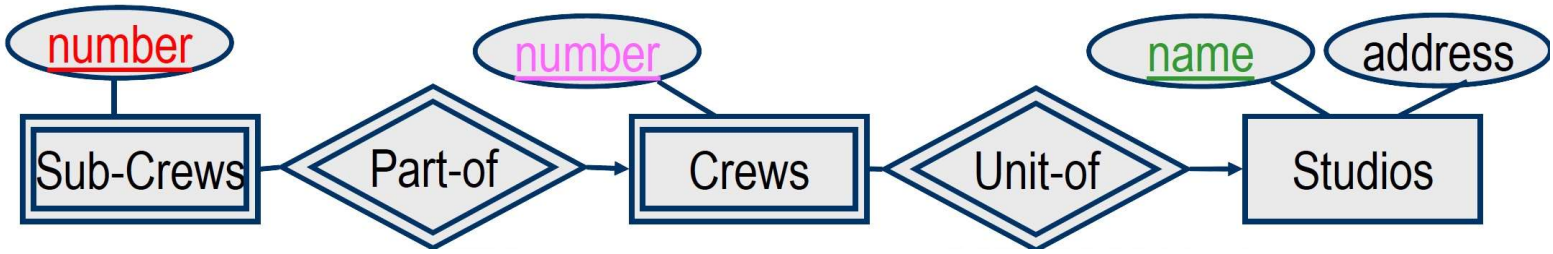
- If R is **M-M**, then the keys of E1 and E2 together are "part of" the key of R
- If R is **M-1** from E1 to E2, then the key of E1 is part of the key of R
- If R is **1-1**, then either E1 or E2 (but not both) is part of the key of R



The primary key of contracts is = (*title*, *year*, *stars-name*, *studios-name*)

Converting Weak Entity Sets to Tables

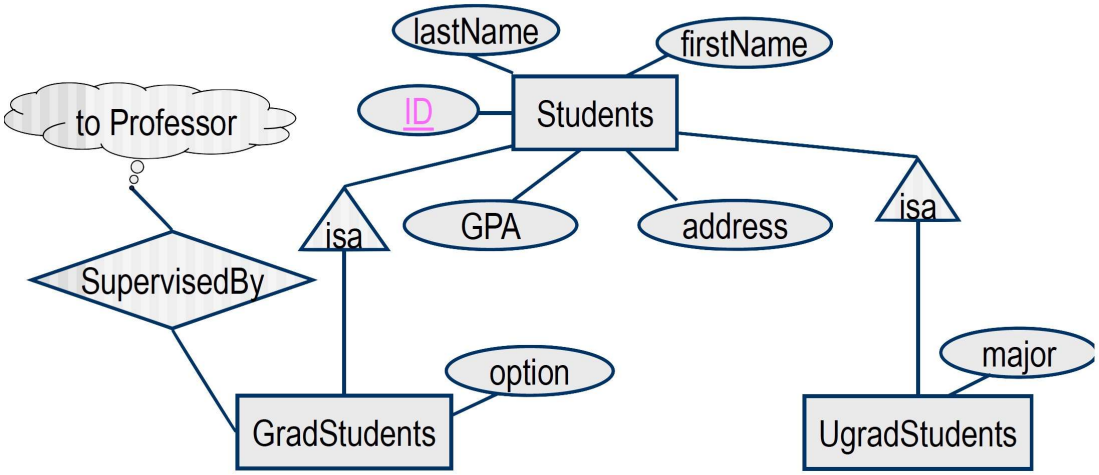
- The relation/table W for the weak entity set **W**, must include all the attributes of **W** as well as the key attributes of the strong entity sets to which **W** is associated.
- Any relationship **R** to which the weak entity set **W** contributes, must include all the key attributes of **W**
  - i.e., the key attributes of every entity set that contributes to W"s key
- The weak relationships **R**, from the weak entity set **W** to other entity sets that provide the key for **W**, need not be converted into a separate table
  - i.e., double diamonds connecting a weak entity set need not become a separate table.



Schema:
Sub-Crews (*number*, *crewNumber*, *name*)
Studios (*name*, address)

Converting isa-Hierarchies to Tables

1. **Straight-E/R** style method
    - For each entity set E, create a relation (table) e, and give it attribute(s) A, whenever:
        - A belongs to E
        - A is the key attribute of the parent(s) relation
2. The **object-oriented** method
3. The **nulls** method
    - If we are allowed to use NULL as a value in tuples, we can handle a hierarchy of entity sets (classes) with a single relation
        - This relation has all the attributes belonging to any entity set (class) of the hierarchy.
        - An entity/object is represented by a single tuple that has NULL in each attribute that is not defined for that entity/object.
    - ==Supports efficient query processing but is inefficient in space utilization.==
        - **Queries**: allows us to find in a single relation R, every tuple/object from any set involved in the hierarchy
        - **Queries**: Allows us to find all the information about an entity/object in a single tuple in R
        - **Space Utilization**: which is too costly for having repeated and redundant information
        - **Note**: Nulls are not allowed in the relational model theory, but practically, it is supported by commercial DBMS



Straight-E/R Schema:

Students (*ID*, lastName, firstName, GPA, address)

GradStudents (*ID*, option)

UgradStudents (*ID*, major)

SupervisedBy (*StudentID*, professorID)

NULL Schema:

SupervisedBy (*ID*, *professorID*)

Student (*ID*, lastName, firstName, GPA, address, option, major)