

CS3743 Introduction to Database Systems ER-R Schema Translation

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Outline

- 1 ER-R Schema Translation
 - General Rules
 - Rules for Special Cases
 - Putting Things Together

Overview

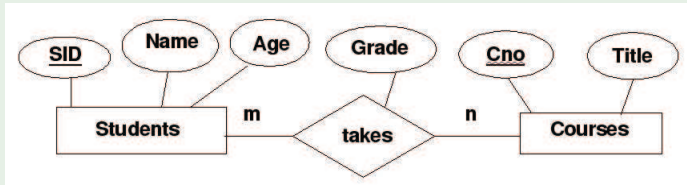
- Despite that major DBMSs only support relational model, a good database design should start from an ER schema, and then translate the ER schema into a relational schema
- There is a set of simple rules which can be followed to translate an ER schema into a relational schema
- While software that performs ER-R translation does exist, we do it manually for small database projects

General Rules of Translation

- Translate each strong entity type into a relation
- Translate each relationship type into a relation whose primary key contains a key for each entity type that participates the relationship type
- Translate each ER attribute into a relational attribute
- Translate each key in ER schema into a key in relational schema

General Rules of Translation

Example

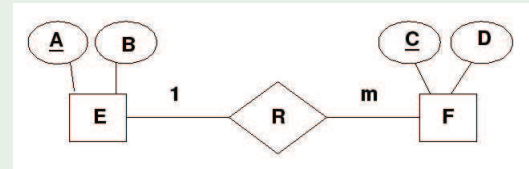


is translated into three relations:

Students	Takes	Courses
<u>SID</u> Name Age	<u>SID</u> <u>CNO</u> Grade	<u>CNO</u> Title

Translate One-to-Many Relationships Using Foreign Keys

Example



is translated into two relations E and F, where F.A references E.A

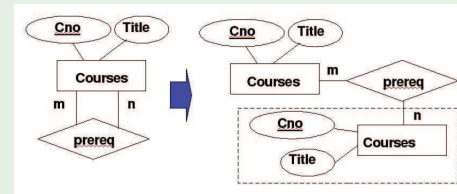
E	F
<u>A</u> B	<u>C</u> D A

Translate Unary Relationships

- Transform the unary relationship into a binary relationship by creating a shadow of the entity type.
- Translate this binary relationship into relation(s) according to the rules.
- After the translation, remove the redundant relation, or if there is no redundant relation, remove the relation with fewer attributes.

Translate Unary Many-to-Many Relationships

Example

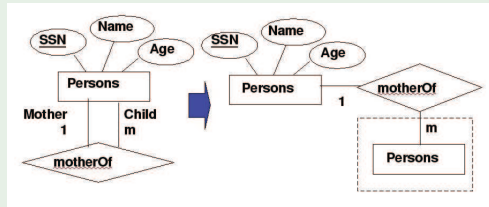


is translated into two tables, where both Prereq.CNO and Prereq.PCNO reference Courses.CNO

Courses	Prereq
<u>CNO</u> Title	<u>CNO</u> <u>PCNO</u>

Translate Unary One-to-many Relationships

Example

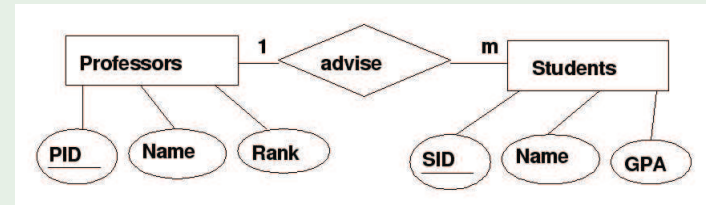


is translated into one table, where MotherSSN references Persons.SSN

Persons			
<u>SSN</u>	Name	age	MotherSSN

Translate One-to-Many Relationships

Example



can be translated using either the general rule or the special rule

Translate One-to-Many Relationships

Example (Cont.)

Option 1:

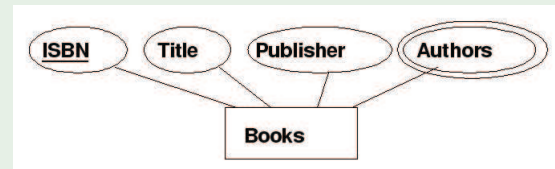
Professors			Advises	
<u>PID</u>	Name	Dept	<u>PID</u>	<u>SID</u>
Students				
<u>SID</u>	Name	GPA		

Option 2:

Professors			Students			
<u>PID</u>	Name	Dept	<u>SID</u>	Name	GPA	Advisor

Translate Multi-Value Attribute

Example

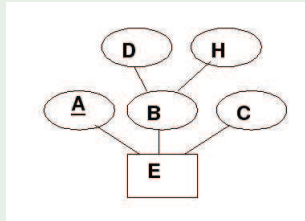


is translated into two tables

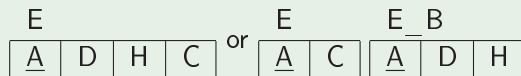
Books			Book_Authors	
<u>ISBN</u>	Title	Publisher	<u>ISBN</u>	Author

Translate Composite Attribute

Example

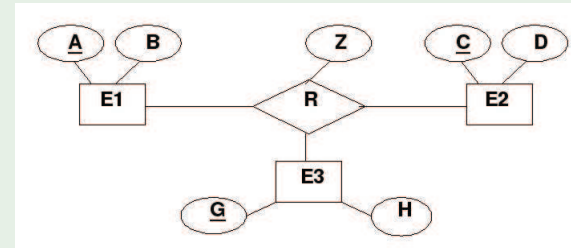


is translated into either one table or two tables

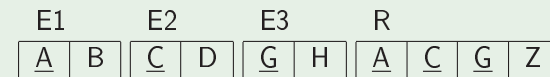


Translate Ternary Relationships

Example

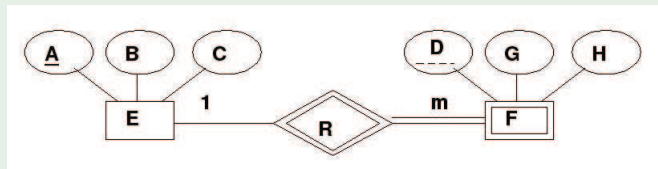


is translated into four tables



Translate Weak Entity Type

Example



is translated into two tables E and F, where F.A references E.A

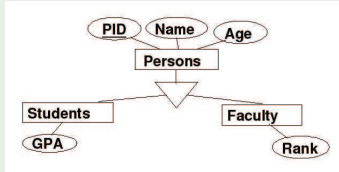


Translate IS-A Relationships

- Method 1: Allows parts of an entity to be stored in different relations
 - Translate each subclass into a relation, which contains the primary key of the root superclass and attributes that appear in the subclass
- Method 2: Each entity must be completely stored in one relation.
 - Translate each subclass into a relation, which contains All inherited attributes as well as attributes that appear in the subclass (Each entity is stored in the relation of the most specific subclass)
 - Remove relations that will be empty all the time

IS-A Translation: Method One

Example

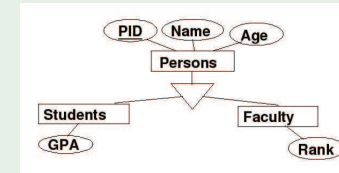


is translated into three tables

Persons			Students		Faculty	
PID	Name	Age	PID	GPA	PID	Rank
101	John	27	101	3.5	102	Prof
102	Bill	29				
103	Mary	22				

IS-A Translation: Method Two

Example

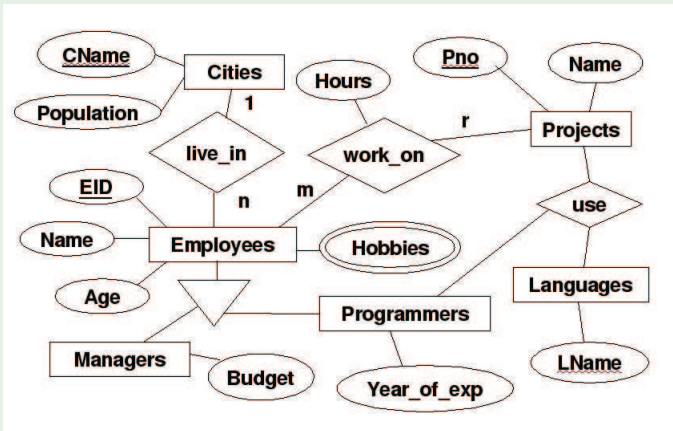


is translated into three tables

Persons			Students				Faculty			
PID	Name	Age	PID	Name	Age	GPA	PID	Name	Age	Rank
103	Mary	22	101	John	27	3.5	102	Bill	29	Prof

Translate a Complete ER Diagram

Example



Translate a Complete ER Diagram

Result of Method One

- ① Employees(EID Name, Age, CName)
- ② Employee-Hobby(EID, Hobby)
- ③ Managers(EID, Budget)
- ④ Programmers(EID, Years_of_exp)
- ⑤ Cities(CName, Population)
- ⑥ Projects(Pno, Name)
- ⑦ Languages(LName)
- ⑧ Work_on(EID, Pno, Hours)
- ⑨ Use(EID, Pno, LName)

Translate a Complete ER Diagram

Result of Method Two

- 1 **Employees**(EID, Name, Age, CName)
- 2 **Employee-Hobby**(EID, Hobby)
- 3 **Managers**(Manager-EID, Name, Age, Budget, CName)
- 4 **Manager-Hobby**(Manager-EID, Hobby)
- 5 **Programmers**(Programmer-EID, Name, Age, Years_of_experience, CName)
- 6 **Programmer-Hobby**(Programmer-EID, Hobby)
- 7 **Cities**(CName, Population)
- 8 **Projects**(Pno, Name)
- 9 **Languages**(LName)
- 10 **Work_on**(EID, Pno, Hours)
- 11 **Manager-Work_on**(Manager-EID, Pno, Hours)
- 12 **Programmer-Work_on**(Programmer-EID, Pno, Hours)
- 13 **Use**(Programmer-EID, Pno, LName)

