

Mapping an ER Model to the Relational Model

17 Jan 2001

11CT2 6 : ER to Relational mapping

1

Database Modelling

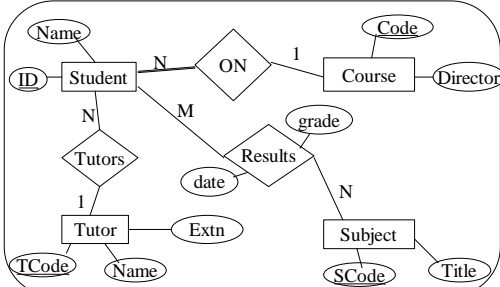
- ER model gives us a conceptual model of the world we want to represent in a database.
- But to implement the database we need to use the Relational Model.
- There is a simple way of mapping from the ER model to the Relational model.
 - This mapping gives well-designed relational tables.

17 Jan 2001

11CT2 6 : ER to Relational mapping

2

Example: Student ER Model

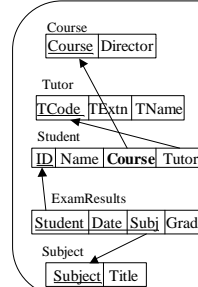


17 Jan 2001

11CT2 6 : ER to Relational mapping

3

Example: The Student DB



This collection of relations (tables) is how the model represented by the ER diagram (previous slide) can be represented in the relational model.

ER Relationships are represented by attributes in one table which refer to rows of another table. e.g. Student Course refers to the Course table and represents the ON relationship.

17 Jan 2001

11CT2 6 : ER to Relational mapping

4

Note referring attributes

Student				ExamResults			
ID	Name	Course	Tutor	Student	Date	Subj	Grade
98765	Smith, John	ICT	T1	98765	May98	11CT2	I
96874	Murphy, Ann	CS	T4	98765	May98	11CT5	II.2
97821	Jones, Lisa	ICT	T3	96874	Sept 98	1BA2	II.1
97345	O'Brien, Paul	ICT	T1	96874	May98	1BA1	III
96032	Kelly, Pat	CS	T3	97821	May98	11CT2	III
				97345	Sept 98	11CT2	II.1
				97345	May 98	11CT5	I
				96032	May 98	1BA2	II.2

An instance of the Student Database

Course	Course	Director
ICT	Algeo	Jones
CS		

Subject	Title
11CT2	Information Management
11CT5	Mathematics
1BA1	Logic
1BA2	Programming

17 Jan 2001

11CT2 6 : ER to Relational mapping

5

Example: Company Database

- Separate handout (from ElMasri book) shows
 - ER model for Company
 - Corresponding Relational DB Schema
 - An instance of that relational DB
- Note how various features of the ER model are represented in the relational model.

17 Jan 2001

11CT2 6 : ER to Relational mapping

6

Mapping Rules

- Mapping rules consist of 7 steps.
- The steps produce a well-designed (well-normalised) relational database from an ER model.
- Follow the steps carefully.
 - These slides give shorthand for the steps.
 - The full version is available separately (see subject handbook).

17 Jan 2001

1ICT2 6 : ER to Relational mapping

7

Terminology Reminders

- Relation = table
- Attribute = field/column
- PK = primary key
- FK = foreign key
 - I.e. an attribute which references the PK of another relation
 - Note that “adding an FK” means adding an attribute (not just a pointer) to a relation.
 - The new attribute refers to some other relation.

17 Jan 2001

1ICT2 6 : ER to Relational mapping

8

Step 1 : regular entity types

- Create a new relation that includes all the simple attributes.
 - For a composite attribute include only the simple component attributes.
 - Leave out multi-valued attributes (to step 6)
- Pick a PK.

17 Jan 2001

1ICT2 6 : ER to Relational mapping

9

Step 2 : weak entity types

- Create a new relation
- Include all simple attributes (or simple components of composite attributes)
- Include an FK to the owner entity's relation
 - e.g. add an SSN attribute to the dependent relation.
- PK is the combination of the FK and the partial key.

17 Jan 2001

1ICT2 6 : ER to Relational mapping

10

Step 3 : 1:1 relationships

- Add to one of the participating relations an FK to the other relation:
 - It is better to add to a relation that has total participation in the relationship.
 - E.g. add a MGRSSN attribute to the Department relation in which to record the department's manager.
- Include any relationship attributes.
 - E.g. add manager's start-date to Department.

17 Jan 2001

1ICT2 6 : ER to Relational mapping

11

Step 4 : 1:N relationships

- Add to the relation on the N-side an FK to the other relation.
 - E.g. add DNO to Employee to represent the department an employee works-for.
- Include any relationship attributes

17 Jan 2001

1ICT2 6 : ER to Relational mapping

12

Step 5 : M:N relationships

- Create a **new** relation containing
 - FKs to both participating relations
 - relationship attributes
- E.g. see Works-On
- PK is the combination of both FKs
 - Sometimes you also need to add one or more of the relationship attributes to form the PK.
 - E.g. PK in {Student, Subj, Year, Grade} if you want to store results of all repeats of exams.

17 Jan 2001

IICT2 6 : ER to Relational mapping

13

Step 6 : multi-valued attributes

- create a new relation containing
 - FK to the relation of the entity
 - the attribute or attributes (if composite)
- PK is the FK *plus*
 - the attribute if it was a simple one
 - one or more of the attributes for composite ones.
 - E.g. {Course, Year} is a primary key for the Num-modules(Course, Year Number) table of the University example

17 Jan 2001

IICT2 6 : ER to Relational mapping

14

Step 7 : ternary relationships

- New relation containing a foreign key referencing each of the (3) entities involved.
- Include any relationship attributes.
- PK is usually the combination of all three FKs, but
 - may also require some relationship attributes
 - may not need all three FKs if some entity can only participate once with each combination of the others.

17 Jan 2001

IICT2 6 : ER to Relational mapping

15

Notes

- You need to use your discretion in choosing primary keys.
- The relational model you get by following these rules may show up flaws in your ER model!
 - If the set of relations doesn't seem right to you, try to fix the ER model to account for the problem.

17 Jan 2001

IICT2 6 : ER to Relational mapping

16

How many relations ?

- You should end up with one relation for each
 - entity (both regular and weak)
 - M:N relationship
 - multi-valued attribute
 - Ternary relationship

17 Jan 2001

IICT2 6 : ER to Relational mapping

17

Other checks to make

- Every FK pointer should point **to** a relation which represents an entity type.
 - i.e. one resulting from steps 1 or 2
- The attributes at each end of an FK pointer must be of the same type (domain).
 - If in doubt about this check the meaning of Foreign Key.

17 Jan 2001

IICT2 6 : ER to Relational mapping

18