Translation of EER model into relational model

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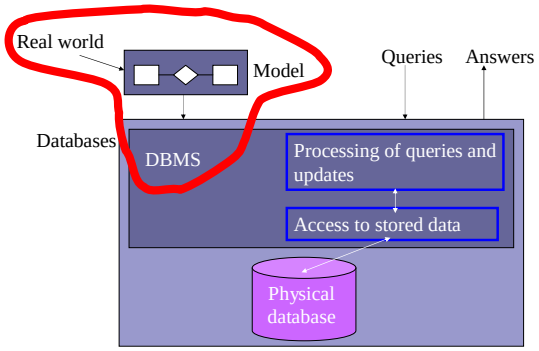
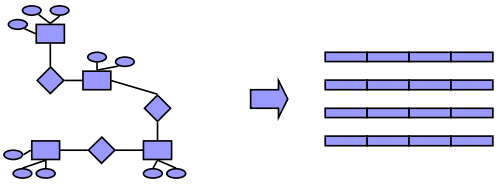
Overview



Translation ER/EER to Relational

- Migrate from mini world model to a model understandable to a DBMS



EER model for the COMPANY database

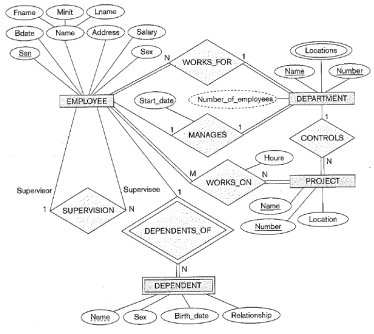


Figure 3.2
An ER schema diagram for the COMPANY database. The diagrammatic notation is introduced gradually throughout this chapter.

ER to Relations

Step 1: Mapping Regular Entity Types

For each strong entity type ***R***, create a relation ***E*** that has the same simple attributes as ***R***.

- **Derived attributes are not stored.**
- **Composite attributes are not stored, their component ones are stored.**
- **Multivalued attributes are treated later.**

PROJECT(Number, Name, Location)

EMPLOYEE(Ssn, Bdate, Fname, Minit, Lname, …)

Composite attributes are not stored, their component ones are stored.

DEPARTMENT (Number, Name)

"Number_of_employee": derived attribute are not stored.

"Location": multivalued attributes are treated later.

ER to Relations

Step 5: Mapping M:N Relationship Types

For each binary M:N relationship, identify the relations S and T that correspond to the connected entity types. Create a new relation R and use the primary keys from S and T as foreign keys and primary keys in R. If there are attributes on the relation these are also added to R.

On delete/update CASCADE ?!

DEPARTMENT(Number, Name)

EMPLOYEE(Ssn, Bdate, Fname, Minit, Lname, …)

PROJECT(Number, Name, Location)

WorksOn(Ssn, Number, Hours)

ER to Relations

Step 4: Mapping 1:N Relationship Types

1. For each binary 1:N relationship, identify the relation S that represents the entity type on the *N-side* of the relationship type, and relation T that represents the entity type on the *1-side* of the relationship type. Include as a foreign key in S the primary key of T. If there are attributes on the relation these are also added to S.

On delete/update CASCADE ?!

DEPARTMENT(Number, Name, Location)

EMPLOYEE(Ssn, Bdate, Fname, Minit, Lname, SupervisorSSN,...)

PROJECT (Number, Name)

WorksOn(Ssn, Number, Hours)

ER to Relations

Step 4: Mapping 1:N Relationship Types

1. For each binary 1:N relationship, identify the relation S that represents the entity type on the *N-side* of the relationship type, and relation T that represents the entity type on the *1-side* of the relationship type. Include as a foreign key in S the primary key of T. If there are attributes on the relation these are also added to S.
2. If many NULLs (i.e. few tuples in the relationship), then as M:N relationship type (**PK is PK(S)**).

On delete/update CASCADE ?!

DEPARTMENT(Number, Name, Location)

EMPLOYEE(Ssn, Bdate, Fname, Minit, Lname, SupervisorSSN,...)

PROJECT (Number, Name)

WorksOn(Ssn, Number, Hours)

Supervision(Ssn, SupervisorSSN)

ER to Relations

On delete/update CASCADE ?!

Step 3: Mapping 1:1 Relationship Types

For each binary 1:1 relationship ***B***, identify the relations ***S*** and ***T*** that correspond to the incoming entity types.

a) Choose one of the relations and add its primary key as a foreign key in the other relation. Prefer the entity type with **total participation** in B as the entity type to which the foreign key is added.

* Do not forget the attributes of the relationship type.

PROJECT(Number, Name, Location)

EMPLOYEE(Ssn, Bdate, Fname, Minit, Lname, …)

DEPARTMENT (Number, Name, Manager)

ER to Relations

On delete/update CASCADE ?!

Step 3: Mapping 1:1 Relationship Types

For each binary 1:1 relationship ***B***, identify the relations ***S*** and ***T*** that correspond to the incoming entity types.

a) Choose one of the relations and add its primary key as a foreign key in the other relation. Prefer the entity type with **total participation** in B as the entity type to which the foreign key is added.

b) Merge S and T into a single relation R. Set the primary key of S or T as the primary key of R. Indicated when S and/or T with total participation.

c) Implement as M:N relationship (unlike M:N relationship, **PK is either PK(S) or PK(T)**). Convenient if few tuples in the relationship.

* Do not forget the attributes of the relationship type.

ER to Relations

Step 2: Mapping Weak Entity Types

For each weak entity type ***W*** with owner entity type ***E***, create a relation ***R*** that has the same simple attributes as ***W***, also add (as a foreign key) the primary key attributes from the relation that corresponds to ***E***.

Primary key attributes in R are composed of the primary key attributes from E and the partial key from W.

On delete/update CASCADE ?!

DEPARTMENT(Number, Name)

EMPLOYEE(Ssn, Bdate, Fname, Minit, Lname, SupervisorSSN,...)

PROJECT (Number, Name)

WorksOn(Ssn, Number, Hours)

DEPENDENT(Ssn, Name, Sex, Birth_date, …)

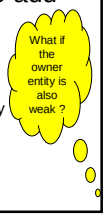
ER to Relations

Step 2: Mapping Weak Entity Types

For each weak entity type ***W*** with owner entity type ***E***, create a relation ***R*** that has the same simple attributes as ***W***, also add (as a foreign key) the primary key attributes from the relation that corresponds to ***E***.

Primary key attributes in R are composed of the primary key attributes from E and the partial key from W.

On delete/update CASCADE ?!



ER to Relations

Step 7: Mapping N-ary Relationship Types

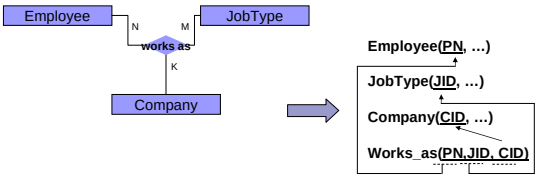
For each N-ary relationship with N>2, create a new relation S that contains the primary keys from the incoming relations as foreign keys. Primary key of S are those keys that come from cardinality constraints $\neq 1$.

* Do not forget the attributes of the relationship type.

On delete/update CASCADE ?!

N-ary relationships

- Example. A person works as an engineer at one company and as a gym instructor at another company.

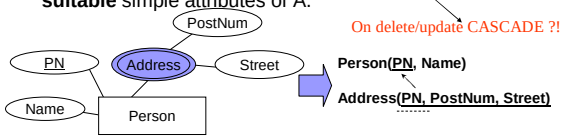


ER to Relations

Step 6: Mapping multivalued attributes

For each multivalued attribute A in R, create a new relation P that contains one attribute for each attribute in A and the primary key K of R as a foreign key. The primary key of P is the combination of K and **some suitable** simple attributes of A.

On delete/update CASCADE ?!



ER to Relations

- Materializing the relationship:
  - M:N implies two joins
  - 1:N implies one or two joins
  - 1:1 implies zero, one or two joins
  - N-ary implies N joins.

DEPARTMENT(Number, Name)

EMPLOYEE(Ssn, Bdate, Fname, Minit, Lname, …)

PROJECT(Number, Name, Location)

WorksOn(Ssn, Number, Hours)

SELECT *E.Fname, P.Name, W.Hours*
FROM *EMPLOYEE E, PROJECT P, WorksOn W*
WHERE *W.SSN = E.SSN* **AND** *W.Number = P.Number*

ER to Relations

- Materializing the relationship:
  - M:N implies two joins
  - 1:N implies one or two joins
  - 1:1 implies zero, one or two joins
  - N-ary implies N joins.

PROJECT(Number, Name, Location)

EMPLOYEE(Ssn, Bdate, Fname, Minit, Lname, …)

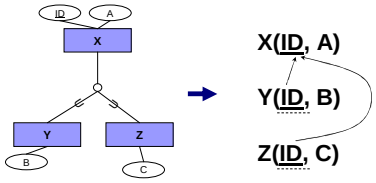
DEPARTMENT (Number, Name, Manager)

SELECT *E.Fname, D.Name*
FROM *EMPLOYEE E, DEPARTMENT D*
WHERE *D.Manager = E.Ssn*;

EER to Relations

Step 8: Mapping Specialization

a) create relations for each class (super+sub)

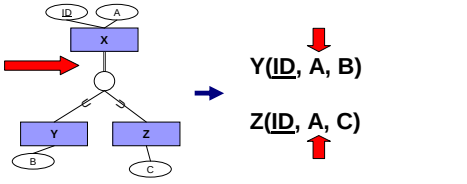


* Always works.

EER to Relations

Step 8: Mapping Specialization

b) subclass relations only

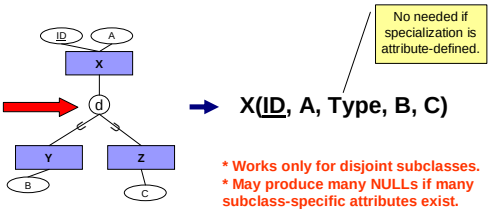


* Works only for total participation.
* Overlapping implies duplication.

EER to Relations

Step 8: Mapping Specialization

c) single relation with one type attribute and all subclass attributes

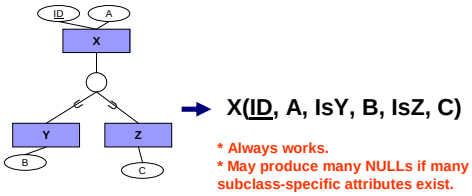


* Works only for disjoint subclasses.
* May produce many NULLs if many subclass-specific attributes exist.

EER to Relations

Step 8: Mapping Specialization

d) single relation with multiple type attributes and all subclass attributes



* Always works.
* May produce many NULLs if many subclass-specific attributes exist.

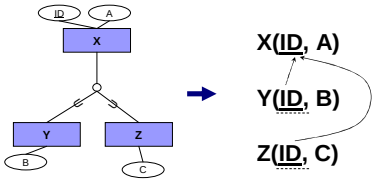
EER to Relations

- Materializing the superclass/subclasses
  - Option a, inner/outer join.
  - Option b, outer join (against theory…).
  - Option c, done.
  - Option d, done.

May be more space inefficient but more time efficient.

EER to Relations

a) create relations for each class (super+sub)



X(ID, A)

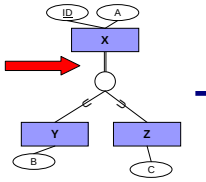
Y(ID, B)

Z(ID, C)

SELECT *X.ID, X.A, Y.B*
FROM *X* **LEFT JOIN** *Y* **ON** *X.ID = Y.ID*;

EER to Relations

b) subclass relations only



Y(ID, A, B)

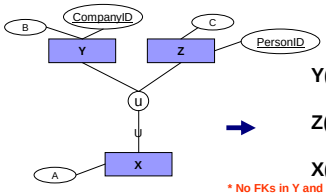
Z(ID, A, C)

SELECT *Y.ID, Z.ID, Y.A, Z.A,Y.B, Z.C*
FROM *Y* **FULL OUTER JOIN** *Z* **ON** *Y.ID = Z.ID*;

EER to Relations

Step 9: Mapping of Union Types

a) If the defining superclasses have different primary keys, introduce a surrogate key in the union relation and use it as a foreign key in the superclasses.



Y(CompanyID, B, XID)

Z(PersonID, C, XID)

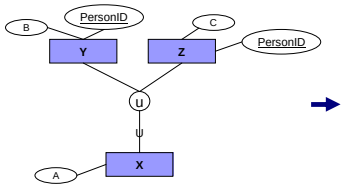
X(XID, A)

* No FKs in Y and Z, unless total participation (correct figure 7.7 in the book)

EER to Relations

Step 9: Mapping of Union Types

b) If the defining superclasses use the same primary key, no need for surrogate key.



Y(PersonID, B)

Z(PersonID, C)

X(PersonID, A)

* No FKs in Y and Z, unless total participation (correct figure 7.7 in the book)

Example: LARM days