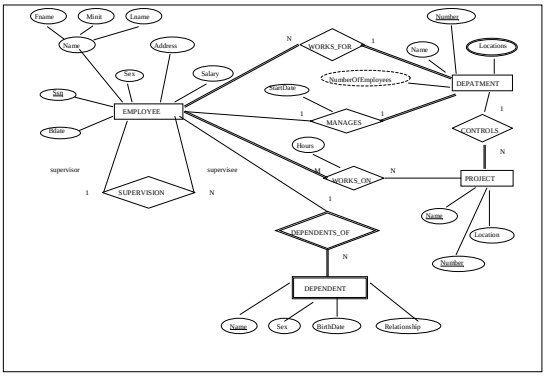
ER- and-EER-to-Relational Mapping



Step 1: Regular Entity types

- For each regular entity type E in the ER schema,
  - create a relation R that includes all the simple attributes of E
  - include only simple component attributes of composite attribute
  - choose one of the key attributes of E as primary key for R
- Ex. Employee, Department, Project relations
  - primary key :
    - Employee(SSN), Department(DNUMBER), Project(PNUMBER)

Step 2: Weak Entity Types

- For each weak entity type W with owner entity type E:
  - create a relation R that includes all the simple attributes of W
  - *include as foreign key attributes of R the primary key attributes of E*
  - primary key of R = primary key of E + partial key of W
- E.g.
  - DEPENDENT relation
  - primary key : {*ESSN*, DEPENTDENT_NAME}
  -

Step 3: Binary Relationships

- For each binary 1:1 relationship type R in the ER schema:
  - identify the relations S and T that correspond to the entity types participating in R
  - choose the relation S corresponding to entity type with total participation in R
  - include as foreign key in S the primary key of T
  - include all the simple attributes of the R as attributes of S
- E.x. MANAGES
  - DEPARTMENT => total participation, the role of S
  - We include primary key SSN of EMPLOYEE as foreign key MGRSSN in the DEPT.
  - We also include StartDate of the MANAGES in the DEPT. and rename it MGRSTARTDATE

Step 3: Alternative

- Notice that alternative mapping of a 1:1 relationship type =>
  - merge the two entity types and the relationship into a single relation
- This is particlularly appropriate when both participations are total and when the entity types do not participate in any other relationship type.

Step 4: Binary (1:N)

- For each regular binary 1:N relationship type R,
  - identify the relation S corresponding to the participating entity type at the N-side of the relationship type
  - include as foreign key in S the primary key of the relation T
  - include any simple attributes of R as attributes of S
- Ex. WORKS_FOR, CONTROLS,SUPERVISION
- For WORKS_FOR:
  - primary key of the DEPARTMENT as foreign key of EMPLOYEE: DNO
- For SUPERVISON? CONTROL?

Answers

- FOR SUPERVISION
  - primary key of the EMPLOYEE as foreign key of EMPLOYEE itself
  - : SUPERSSN
- For CONTROL,
  - primary key of the DEPARTMENT as foreign key of PROJECT
  - : DNUM

Step 5: Binary (M:N)

- For each binary M:N relationship type R with participating entity types X and Y,
  - create a new relation S to represent R
  - include as foreign key attributes in S the primary keys of the X and Y
  - primary key of S : combination of the primary keys of the X and Y
  - include any attributes of the relationship type.
- E.g. WORKS_ON relationship type
  - participating entity types : PROJECT and EMPLOYEE
  - WORKS_ON(ESSN, PNO, Hours)

Step 6: Multi-valued attributes

- For each multivalued attribute A,
  - create a new relation R
  - include attribute corresponding to A + primary key attribute K of the relation that represents entity type that has A as an attribute.
  - primary key of R : combination of A and K
- Ex. DEPT_LOCATION
  - {DNUMBER, DLOCATION}

Step 7: N-ary Relationship Types

- For each n-ary relationship type
  - Include as foreign key attributes all primary keys of participating entity types
  - Any attributes of the given relationship type
  - Primary key is combination of all foreign keys
    - Exception if cardinality constraint is 1.
      - E.g. one supplier for a particular part/project combination
      - Primary Key = {PRNO,PNO} not {PRNO,PNO,SNO}

ER-to-Relational Mapping (Summary)

Table 9.1 Correspondence between ER and Relational Models

ER Model	Relational Model
Entity type	"Entity" relation
1:1 or 1:N relationship type	Foreign key (or "relationship" relation)
M:N relationship type	"Relationship" relation and two foreign keys
n-ary relationship type	"Relationship" relation and n foreign keys
Simple attribute	Attribute
Composite attribute	Set of simple component attributes
Multivalued attribute	Relation and foreign key
Value set	Domain
Key attribute	Primary (or secondary) key

Class Question

Step 8: EER Specialization/Generalization

- For Superclass/Subclass Relationships in Specialization(or Generalization)
  - convert each specialization with m subclass {S1,S2,..,Sm} and subclass C, where the attributes of C are {k, a1,…,an} and k is the key, into relation schemas using one of the four following options

Options A and B

- Option 8A: Create a relation L for C with attributes Attrs(L)={k,a1,…,an} and PK(L)=k. Create a relation Li for each subclass Si, 1 <= i <= m, with the attributes Attrs(Li) = {k}U{attributes of Si} and PK(Li)=k.
- Option 8B: Create a relation Li for each subclass Si, 1 <= i <= m, with the attributes Attrs(Li) = {k ,a1,…,an} U {attributes of Si} and PK(Li)=k.

Options C and D

- Option 8C: Create a single relation L with attributes Attrs(L) = {k ,a1,…,an} U {attributes of Si} U … U {attributes of Sm} U {T} and PK(L)=k.
  - **T is a type that distinguishes amongst the different subclasses**
  - **This is for disjoint subclasses.**
- Option 8D: Create a single relation schema L with attributes Attrs(L) = {k ,a1,…,an} U {attributes of Si} U … U {attributes of Sm} U {T1,…,Tm} and PK(L)=k.
  - **T1,…,Tm are types**
  - **This is for overlapping subclasses**

Examples from the Textbook

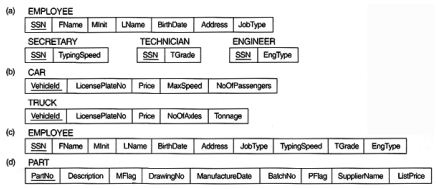


Figure 9.2 Options for mapping specializations(or generalizations) to relations.
(a) Mapping the EER schema of Figure 4.4 to relations by using Option A.
(b) Mapping the EER schema of Figure 4.3(b) into relations by using option B.
(c) Mapping the EER schema of Figure 4.4 by using Option C, with Job Type playing the role of type attribute.
(d) Mapping the EER schema of Figure 4.5 by using Option D, with two Boolean type fields Mflag and Pflag

Another Example

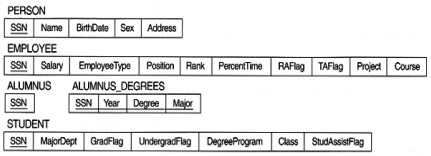


Figure 9.3 Mapping the EER specialization lattice in Figure 4.7 using multiple options.

Step 9: Categories

- A category is a subclass of the union of two or more superclasses that can have different keys.
- When there are separate keys
  - Create a surrogate key
  - Add this surrogate key as a foreign key to each superclass
- When the keys are the same, revert to step 8!
- Shared subclasses (keys are the same)=> step 8!

Yet Another Example

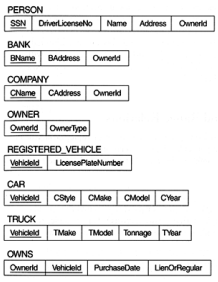


Figure 9.4 Mapping the categories of Figure 4.8 to relations