From E-R Models to Relational Databases

Examples

Converting Relationship Sets

Many-to-Many Relationship Sets

Relational Schema:

\[ E(A_1, A_2, A_3, A_4) \]
\[ F(B_1, B_2, B_3, B_4, B_5, B_6) \]
\[ R(EA_1, FB_1, FB_2, C_1, C_2) \]

Notes:

- C1 and C2 can participate in the primary key of F (either jointly, or separately).
- R.EA1 is a foreign key referencing E.
- R.FB1,R.FB2 is a foreign key referencing F.
Many-to-One Relationship Sets

Relational Schema:
E(A1, A2, A3, A4, FB1, FB2, C1, C2)
F(B1, B2, B3, B4, B5, B6)

Notes:
• E.FB1, E.FB2 is a foreign key referencing F.

One-to-One Relationship Sets

Relational Schema 1:
E(A1, A2, A3, A4, FB1, FB2, C1, C2)
F(B1, B2, B3, B4, B5, B6)

Notes:
• E.FB1, E.FB2 is a foreign key referencing F.

Relational Schema 2:
E(A1, A2, A3, A4)
F(B1, B2, B3, B4, B5, B6, C1, C1, EA1)

Notes:
• F.EA1 is a foreign key referencing E.
Weak Entity Sets

Relational Schema:
E(A1, A2, A3, A4, FB1, FB2, C1, C2)
F(B1, B2, B3, B4, B5, B6)

Notes:
• E.FB1, E.FB2 is a foreign key referencing F.

Aggregation

Relational Schema:
E(A1, A2, A3, A4)
F(B1, B2, B3, B4, B5, B6)
R(EA1, FB1, FB2, C1, C2)
G(D1, D2)
S(GD1, D3, REA1, RFB1, RFB2)

Notes:
• C1 and C2 can participate in the primary key of F (either jointly, or separately). If this is the case, they must be included in the attribute list for S.
• R.EA1 is a foreign key referencing E.
• R.FB1, R.FB2 is a foreign key referencing F.
• S.GD1 is a foreign key referencing G.
• S.REA1, S.RFB1, S.RFB2 is a foreign key referencing R. S.REA1 is a foreign key referencing E. S.RFB1, S.RFB2 is a foreign key referencing F.
Class Hierarchies

In this example, E is the class "container", which has four attributes common to all subclasses in the hierarchy, including the primary key, A1. E has three disjoint subclasses, F, G, and H. Entities in F must belong to at least one, but possibly, both subclasses, K and L. G has a subset of its entities belonging to subclass M.

(note, black dots identify entity sets that contain actual physical entities in this hierarchy.)

E-R approach

Relational Schema:

E(A1, A2, A3, A4)
F(EA1, B1, B2)
G(EA1, C1, C2)
H(EA1, I1)
K(EA1, BB1, BB2, BB3)
L(EA1)
M(EA1, CC1, CC2)

Notes:

• F.EA1, G.EA1, H.EA1, K.EA1, L.EA1 and M.EA1 are all foreign keys referencing E.

Object-Oriented Approach

Relational Schema:

EFK(A1, A2, A3, A4, B1, B2, BB1, BB2, BB3)
EFL(A1, A2, A3, A4, B1, B2)
EG(A1, A2, A3, A4, C1, C2)
EGM(A1, A2, A3, A4, C1, C2, CC1, CC2)
EH(A1, A2, A3, A4, I1)

Notes:

• Tables are created only for those entity sets that contain physical entities (i.e., for all terminal paths in the hierarchy).
Universal Table

Relational Schema:

\[ E(A_1, A_2, A_3, A_4, B_1, B_2, BB_1, BB_2, BB_3, C_1, C_2, CC_1, CC_2, I_1) \]

Variants

- **Universal table with type**: Add an attribute specifying which terminal class an object belongs to:

  \[ E(A_1, \text{Type}, A_2, A_3, A_4, B_1, B_2, BB_1, BB_2, BB_3, C_1, C_2, CC_1, CC_2, I_1) \]

- **E-R approach with type**: modify \( E \) and \( F \) to specify subtype of each tuple:

  \[ E(A_1, \text{Type}, A_2, A_3, A_4) \]
  \[ F(EA_1, \text{Type}, B_1, B_2) \]