Translating Entity-Relationship to Relational Tables

M. Tamer Özsu

David R. Cheriton School of Computer Science
University of Waterloo

CS 348
Introduction to Database Management
Fall 2012

Notes
Main ideas:

- Each entity set maps to a new table
- Each attribute maps to a new table column
- Each relationship set maps to either new table columns or to a new table
Representing Strong Entity Sets

Entity set $E$ with attributes $a_1, \ldots, a_n$ translates to table $E$ with attributes $a_1, \ldots, a_n$.

Entity of type $E \leftrightarrow$ row in table $E$

Primary key of entity set $\rightarrow$ primary key of table

Example:

![Entity-Relation Diagram]

Student

<table>
<thead>
<tr>
<th>StudentNum</th>
<th>StudentName</th>
<th>Major</th>
</tr>
</thead>
</table>

Notes

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________
Representing Weak Entity Sets

Weak entity set $E$ translates to table $E$

Columns of table $E$ should include
- Attributes of the weak entity set
- Attributes of the identifying relationship set
- Primary key attributes of entity set for dominating entities

Primary key of weak entity set $\rightarrow$ primary key of table
Representing Weak Entity Sets (cont.)

Example:

Diagram:

```
Balance <-> Account <-> AccNum

Log

Transaction <-> TransNum

Date <-> Amount

Account

AccNum | Balance

Transaction

TransNum | AccNum | Date | Amount
```

Notes

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________
Representing Relationship Sets

- If the relationship set is an identifying relationship set for a weak entity set then no action needed

- If we can deduce the general cardinality constraint (1,1) for a component entity set $E$ then add following columns to table $E$
  - Attributes of the relationship set
  - Primary key attributes of remaining component entity sets

- Otherwise: relationship set $R \rightarrow \text{table } R$
• Columns of table $R$ should include
  • Attributes of the relationship set
  • Primary key attributes of each component entity set

• Primary key of table $R$ determined as follows
  • If we can deduce the general cardinality constraint (0,1) for a component entity set $E$, then take the primary key attributes for $E$
  • Otherwise, choose primary key attributes of each component entity
Representing Relationship Sets (cont.)

Example:

<table>
<thead>
<tr>
<th>Team</th>
<th>TeamName</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>Address</td>
</tr>
<tr>
<td>Location</td>
<td>LocName</td>
</tr>
</tbody>
</table>

Note that the role name of a component entity set should be prepended to its primary key attributes, if supplied.
Representing Aggregation

Tabular representation of aggregation of $R$

$= \text{tabular representation for relationship set } R$

To represent relationship set involving aggregation of $R$, treat the aggregation like an entity set whose primary key is the primary key of the table for $R$
Example:

```
Student
  StudentNum
EnrolledIn
  StudentNum  CourseNum
Course
  CourseNum
CourseAccount
  UserId   StudentNum  CourseNum  ExpirationDate
Account
  UserId
```
Create table for higher-level entity set, and treat specialized entity subsets like weak entity sets (without discriminators)

Example:

Representing Specialization
Representing Generalization (Approach #1)

Create a table for each lower-level entity set only

Columns of new tables should include
- Attributes of lower level entity set
- Attributes of the superset

The higher-level entity set can be defined as a view on the tables for the lower-level entity sets
Representing Generalization (Approach #1)

Example:

```
MakeAndModel
| LicenceNum |
| Vehicle    |
| Price      |
| COVERS     |

Truck
- LicenceNum
- MakeAndModel
- Price
- Tonnage
- AxleCount

Car
- LicenceNum
- MakeAndModel
- Price
- MaxSpeed
- PassengerCount
```

Notes

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Representing Generalization (Approach #2)

Treat generalization the same as specialization.

Example:

```
LicenceNum    MakeAndModel    Price
LicenceNum    Tonnage     AxelCount

Vehicle

Truck

Car

MakeAndModel

Price

Vehicle

Truck

Car

LicenceNum    MaxSpeed    PassengerCount

CS 348     ER to Relational     Fall 2012     14 / 16

Notes

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Example Translation: Relational Diagram

Course
- CourseNum
- CourseName

Student
- StudentNum
- StudentName
- GPA

Section
- CourseNum
- SectionNum
- Term
- ProfNum

EnrolledIn
- CourseNum
- SectionNum
- StudentNum
- Term
- Mark

Off-Site Section
- CourseNum
- SectionNum
- Term
- Location

Professor
- ProfNum
- ProfName