Translating Entity-Relationship to Relational Tables

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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:

```
Student
```

```
StudentNum    StudentName      Major
```

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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:

```
Balance    Account    AccNum

Log

Transaction    TransNum

Date    Amount

Account

<table>
<thead>
<tr>
<th>AccNum</th>
<th>Balance</th>
</tr>
</thead>
</table>

Transaction

<table>
<thead>
<tr>
<th>TransNum</th>
<th>AccNum</th>
<th>Date</th>
<th>Amount</th>
</tr>
</thead>
</table>
```
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 $R \rightarrow$ 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
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 $R$
Representing Aggregation (cont.)

Example:
Representing Specialization

Create table for higher-level entity set, and treat specialized entity subsets like weak entity sets (without discriminators)

Example:

```
Student
  StudentNumber
  StudentName

Graduate
  StudentNumber
  ProfessorName

Degrees

Professor
  ProfessorName

SupervisedBy (1, 1)

Student
  StudentNumber
  StudentName

Graduate
  StudentNumber
  ProfessorName

Degree
  StudentNumber
  Degree

Professor
  ProfessorName
```
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:

```
<table>
<thead>
<tr>
<th>LicenceNum</th>
<th>MakeAndModel</th>
<th>Price</th>
<th>Tonnage</th>
<th>AxelCount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

```
<table>
<thead>
<tr>
<th>LicenceNum</th>
<th>MakeAndModel</th>
<th>Price</th>
<th>MaxSpeed</th>
<th>PassengerCount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
Representing Generalization (Approach #2)

Treat generalization the same as specialization.

Example:

MakeAndModel

Vehicle

LicenceNum

Price

CoverS

Tonnage

Truck

AxelCount

Car

MaxSpeed

PassengerCount

Vehicle

<table>
<thead>
<tr>
<th>LicenceNum</th>
<th>MakeAndModel</th>
<th>Price</th>
</tr>
</thead>
</table>

Truck

<table>
<thead>
<tr>
<th>LicenceNum</th>
<th>Tonnage</th>
<th>AxelCount</th>
</tr>
</thead>
</table>

Car

<table>
<thead>
<tr>
<th>LicenceNum</th>
<th>MaxSpeed</th>
<th>PassengerCount</th>
</tr>
</thead>
</table>
Example Translation: ER Diagram

CourseNum → Course → CourseName
(0, N)

SectionOf

Term → (1, 1)

CourseNum → Section → SectionNum
(1, 1)

(1, 1)

Professor → TaughtBy

Off-Site Section → EnrolledIn

Mark

GPA

Student

StudentName

StudentNum

Location

ProfName

ProfNum

(6, 50)

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Example Translation: Relational Diagram

Course
- CourseNum
- CourseName

Section
- CourseNum
- SectionNum
- Term
- ProfNum

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

EnrolledIn
- CourseNum
- SectionNum
- StudentNum
- Term
- Mark

Professor
- ProfNum
- ProfName

Student
- StudentNum
- StudentName
- GPA