Conceptual Analyses
Conceptual Schema Design Steps

(Chapter 3)

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Watch this lecture and download the slides from

http://jarrar-courses.blogspot.com/2015/01/dataandbusinessprocessmodelling.html

Some diagrams in this lecture are based on [1]
Conceptual Analyses

Conceptual Schema Design Steps

Part 1: Conceptual Analyses Steps

- Part 2: Basic ORM Constructs and Syntax
- Part 3: Use case (ID Card)
- Part 4: Use case (University Programs)
Given an application domain, e.g. hospital, and three information modelers, what steps do you suggest them to start with, to build the hospital’s conceptual model?

There is no strict or perfect modeling process or procedure!

You may start with any step you think suitable, taking into account the complexity of the domain, available resources, modelers’ prior knowledge about the domain, etc.

It is recommended that you modularize the domain into sub-domains, build a conceptual schema for each sub-domain, then integrate all sub-schemes into one conceptual schema.

The following procedure (7 steps) is to help you model a sub-domain, but you don’t have to strictly follow these steps.
Conceptual Schema Design Steps

1. From examples to elementary facts
2. Draw fact types and apply population check
3. Combine entity types
4. Add uniqueness constraints
5. Add mandatory constraints
6. Add set, subtype, & frequency constraints
7. Final checks, & schema engineering issues
Elementary Facts and Fact Types

What is a fact?

- Rami smokes.
- Rami drives car.
- Rabab was born in Ramallah.
- Rami smokes and drives car.
- If Rabab was born in Ramallah and Ramallah is part of Palestine, then Rabab was born in Palestine.

⇒ A fact must be either true or false

What is a fact type?

- Person smokes.
- Person drives car.
- Person was born in a city.
- Person smokes and drives car.
- If a Person was born in a city and this City is part of a country, then this person was born in that country.
Elementary Facts and Fact Types

What is an elementary fact type?

- Person smokes.
- Person drives car.
- Person was born in a city.
- Person smokes and drives car. **✗**
- If a Person was born in a city and this City is part of a country, then this person was born in that country. **✗**

→ An elementary fact type cannot be split.
Conceptual Schema Design Steps

1. From examples to elementary facts
1. Make elementary facts from examples

Mustafa teaches Knowledge Engineering.
Rami is enrolled in Knowledge Engineering.
Knowledge Engineering is offered by the University of Birzeit.

The Person that has the name **Mustafa** teaches the course that has the title **Knowledge Engineering**.
The Person **Rami** is enrolled in the course that has the title **Knowledge Engineering**.
The course that has the title **Knowledge Engineering** is offered by the university that has the name **University of Birzeit**.

More precise

The Person (ID4514) that has the name **Mustafa** teaches the course (SC242) that has the title **Knowledge Engineering**.
The Person (ID123) **Rami** is enrolled in the course (CS242) that has the title **Knowledge Engineering**.
The course (CS242) that has the title **Knowledge Engineering** is offered by the university that has the name **University of Birzeit**.

From examples to fact types
Conceptual Schema Design Steps

1. From examples to elementary facts
2. Draw fact types and apply population check
2. Draw fact types and apply population check

- The Person (ID4514) that has the name Mustafa teaches the course (SC242) that has the title Knowledge Engineering.
- The Person (ID123) Rami is enrolled in the course (CS242) that has the title Knowledge Engineering.
- The course (CS242) that has the title Knowledge Engineering is offered by the university that has the name University of Birzeit.
2. Draw fact types and apply population check

- The Person (ID4514) that has the name Mustafa teaches the course (SC242) that has the title Knowledge Engineering.
- The Person (ID123) Rami is enrolled in the course (CS242) that has the title Knowledge Engineering.
- The course (CS242) that has the title Knowledge Engineering is offered by the university that has the name University of Birzeit.

Test with population

<table>
<thead>
<tr>
<th>Person (nr)</th>
<th>Course (Code)</th>
<th>University (Name)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID4154</td>
<td>SC242</td>
<td>Birzeit University</td>
</tr>
<tr>
<td>ID123</td>
<td>SC242</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>ID</th>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustafa</td>
<td>ID4154</td>
<td>SC242</td>
<td>Knowledge Engineering</td>
</tr>
<tr>
<td>Rami</td>
<td>ID123</td>
<td>SC242</td>
<td>Knowledge Engineering</td>
</tr>
</tbody>
</table>
Conceptual Analyses

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- Part 2: Basic ORM Constructs and Syntax
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Basic ORM Constructs and Syntax

- Object and Value Types
- Roles and relations
- Unary relations
- Ternary relations
- Nested Fact Types
- Ring Fact Types
**Object Type** (non lexical)
You cannot lexicalize, or refer to a person without using a value of its properties.

**Value Type** (lexical)
It is always a value of an Object Type.
Roles and Relations

Called **Binary Relation**
It consists of two roles ("drives" and "is driven by")

Called **Role**
which is part of a relation
Unary Relations

Pat smokes
Lee smokes
Shir does not smoke

Called **Unary Relation**
as it has one role ("smokes")

You can transform unary fact types into binary:

<table>
<thead>
<tr>
<th>Smokers</th>
<th>Nonsmokers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pat</td>
<td>Norma</td>
</tr>
<tr>
<td>Lee</td>
<td>Shir</td>
</tr>
<tr>
<td></td>
<td>Terry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Person (firstname)</th>
<th>SmokingStatus (code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pat</td>
<td>S</td>
</tr>
<tr>
<td>Lee</td>
<td>N</td>
</tr>
<tr>
<td>Norma</td>
<td>S</td>
</tr>
<tr>
<td>Pat</td>
<td>S</td>
</tr>
<tr>
<td>Shir</td>
<td>N</td>
</tr>
<tr>
<td>Terry</td>
<td>N</td>
</tr>
</tbody>
</table>
Called **Ternary Relation**
as it has three roles ("smokes")
Nested Fact Types

Called **Nested Fact Type**
The fact type “Student enrolled in Subject” is objectified, i.e., the whole Fact type is seen as an Object Type.
Ring Fact Types

Same object type is connected to two roles in the same relation
An object type can be only connected with roles. Each role can be connected with only one object type.
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Model the Information found in your ID Card, using ORM, for example:

Each Person has an ID Number, First Name, Father Name, Grandfather Name, BirthDate, Birth Place, Religion, Gender, and Address. A Person maybe a father/mother of one or more persons, and wife/husband of another person. etc.

- Each student is expected to deliver (PDF and Hard copies) of his/her ORM model before (Deadline: 17/2/2015).
- Any ORM tool can be used.
- Each student is expected to bring his laptop next lecture, so to present his/her models to all students.
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Use Case (University Programs)

Model Information about University Programs, using ORM, for example:

According to the Ministry of Higher Education:
A University consists of a set of faculties, each faculty consists of departments, each department offers several Bachelor and Master programs. Each program consists of a set of courses. Same courses might not be offered by different programs. A course has number, title, description, etc.

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• Any ORM tool can be used.
• Each student is expected to bring his laptop next lecture, so to present his/her models to all students.
References