Knowledge Engineering (SCOM7348)

Conceptual Schema Design Steps

(Chapter 3)

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Conceptual Analyses

• 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 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 spited.
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.

From examples to fact types

- 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 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 of Birzeit.
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

- Mustafa ID4514
- Rami ID123
- SC242
- Knowledge Engineering
- SC242
- Birzeit University
Basic ORM Constructs and Syntax

- Object and Value Types
- Roles and relations
- Unary relations
- Ternary relations
- Nested Fact Types
- Ring Fact Types
Object and Values Types

<table>
<thead>
<tr>
<th>Person</th>
<th>Car</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams B</td>
<td>235PZN</td>
</tr>
<tr>
<td>Jones E</td>
<td>235PZN</td>
</tr>
<tr>
<td>Jones E</td>
<td>108AAQ</td>
</tr>
</tbody>
</table>

**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:
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.

```
<table>
<thead>
<tr>
<th>Student (nr)</th>
<th>enrolled in</th>
<th>Rating (nr)+</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>CS100</td>
<td></td>
</tr>
<tr>
<td>1002</td>
<td>CS100</td>
<td>(1001, CS100)</td>
</tr>
<tr>
<td>1002</td>
<td>CS114</td>
<td>(1002, CS114)</td>
</tr>
</tbody>
</table>
```

**Subject (code)**

```
“Enrollment”
```
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.
Project 1

Model the following 3 cases using ORM, in both Arabic and English. Each student is expected to deliver (through Ritaj) his/her model in PDF format, each case in a different file. Any ORM tool can be used. **Deadline: 18/2/2018 midnight.** Each student is expected to bring his laptop next lecture, so to present his/her models to all students.

**Case I:**
According the Israeli ID Card that each Palestinian must hold:
Each Person has a 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.

**Case II:**
According to the Ministry of Higher Education:
A University consists of a set of faculties, each faculty offer several Bachelor and Master programs. Each program consists of a set of courses. Same courses might be offered by different programs.

**Case III:**
Each person should be either a male or a female. A person may have a name, birth date, passport number, and born in country. A person may works for and manages a company, and may have a bank account.
References


