Business Rules Contradiction in ORM

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This lecture is based on:

Mustafa Jarrar and Stijn Heymans: **Towards Pattern-Based Reasoning For Friendly Ontology Debugging**. Journal of Artificial Intelligence Tools. Volume 17. No.4. World Scientific Publishing. August 2008.   http://www.jarrar.info/publications/JH08.pdf

Keywords: frequency constraints, occurrence constraints, Cardinality, multiplicity, Rules, Business Rules, Business logic derivation rules, integrity constraints

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
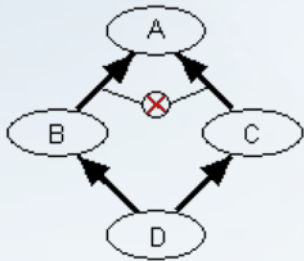
6. Add subtype relations and other constraints

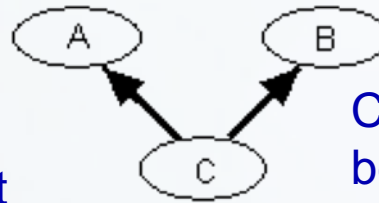7. Final checks, & schema engineering issues
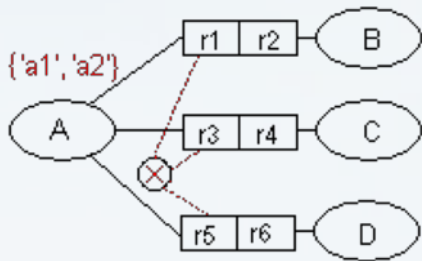
Constraint Contradictions (Examples)

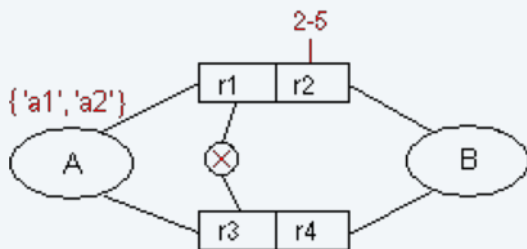**Some constraints may contradict each other (see cases below).**

D will never be populated, because of the exclusive constraint

C will never be populated, because A ad B ad disjoint by definition.

One of the roles (r1, r2, or r3) will never be populated, because we have only two values possible 'a1' and 'a2'

Due to the frequency constraint, there should be at least two different values to populate r1. In order to populate r3, we need, by the exclusion constraint, a value different from the two for role r1. In total, we thus need three different values in order to be able to populate both r1 and r2, but this contradicts with the value constraint on object-type A: we only have 2 values at our disposal.
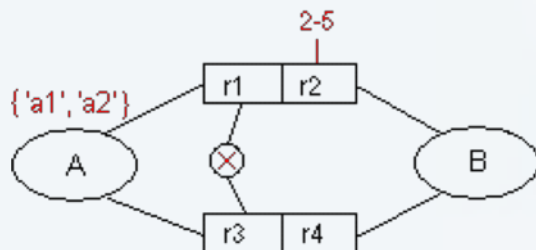
Constraint Contradictions (Examples)
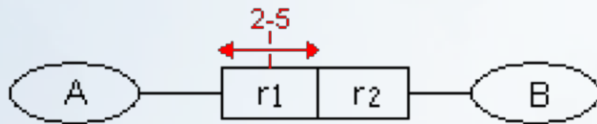
the uniqueness constraint indicates that the role r1 should be played by at most one element, while the frequency constraint demands that there are at least 2 and at most 5 participants in the role. It is thus impossible to populate r1.
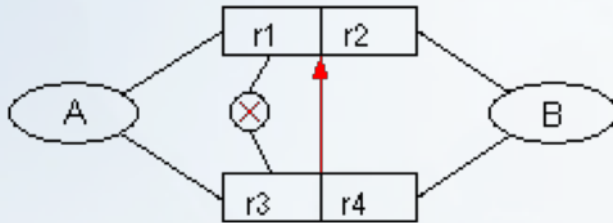

If the frequency constraint 3-5 on r1 is satisfied, each instance of A must play r1 at least three times, and thus three different instances of B are required. However, there are only two possible instances of B, which are declared by the value constraint {'x1', 'x2'}. Thus r1 cannot be populated.

Who can tell where the contradictions?

Constraint Contradictions (Examples)

The exclusion constraint between the two roles r1 and r3 means that their populations should be distinct. However, in order to satisfy the subset constraint between the relations (r1; r2) and (r3; r4), the populations of r1 and r3 should not be distinct. In other words, the exclusion constraint between roles r1 and r3 implies an exclusion constraint between the relations (r1; r2) and (r3; r4), which contradicts any subset or equality constraint between both predicates.

➜ Many different examples are given in previous chapters

➜ Any Idea to detect such contradictions automatically?

Reasoning on ORM Schemes
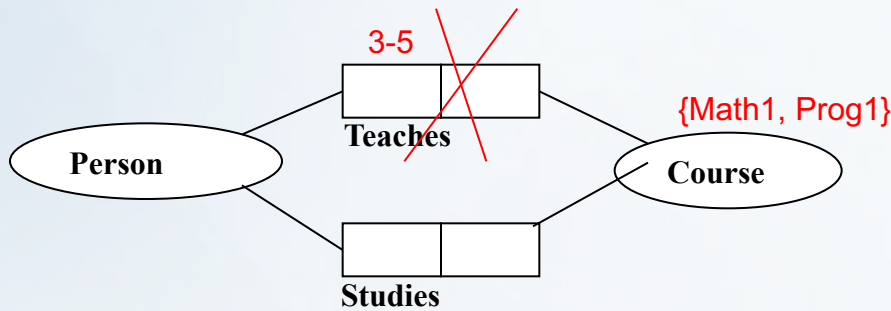
- **Schema satisfiability**: A schema is satisfiable if and only if there is at least one concept in the schema that can be populated. ➔ **Weak satisfiability**

- **Concept satisfiability**: A schema is satisfiable if and only if all concepts in the schema can be populated.

- **Role satisfiability:** A schema is satisfiable if and only if all roles in the schema can be populated. ➔ **Strong satisfiability**

  ➔ Concept satisfiability implies schema satisfiability .

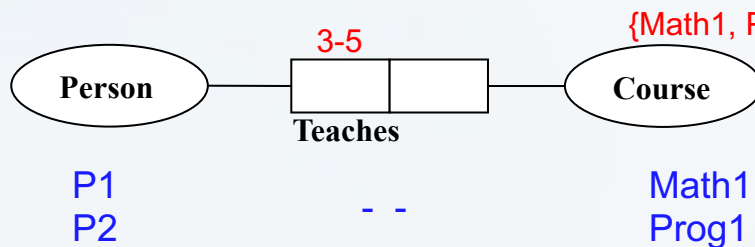 ➔ Role satisfiability implies concept satisfiability .
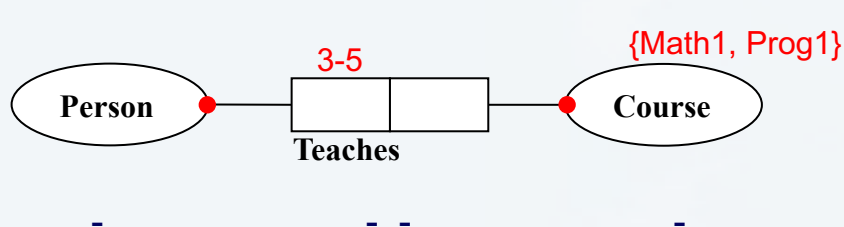
Schema Satisfiability

A schema is satisfiable if and only if there is at least one concept in the schema that can be populated.
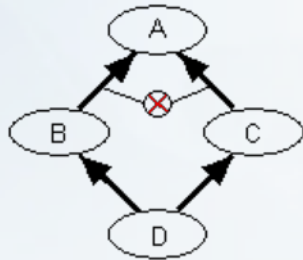
✓ **Schema-Satisfiable,**
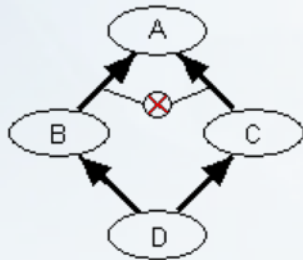   because A, B, and C can be populated

✓ **Schema-Satisfiable,**
As both concepts alone (Person & Courses) can be populated, although the roles cannot be populated.

✗ **Schema-Unsatisfiable,**
As both concepts alone (Person &Courses) can be populated, although the roles cannot be populated.

Concept Satisfiability

A schema is satisfiable if and only if all concepts in the schema can be populated.

✕ **Concept-Unsatisfiable,**
because there is one concept (i.e. D) that cannot be populated.
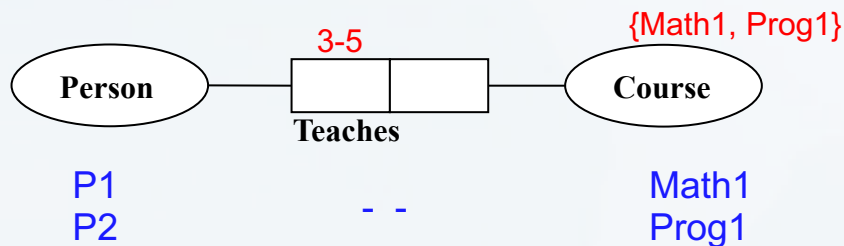
✔ **Concept-Satisfiable,**
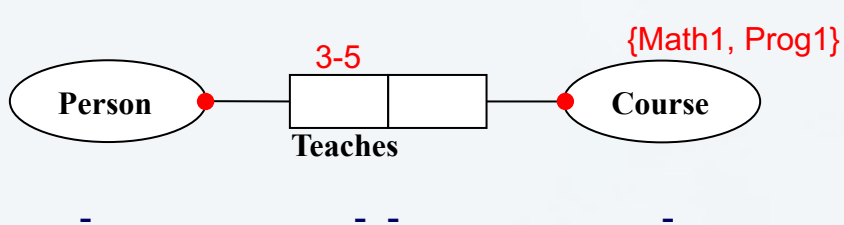As all concepts can be populated, although the roles cannot be populated.

✕ **Concept-Unsatisfiable,**
As no concepts can be populated, because of the mandatory constraints.

Role Satisfiability

A schema is satisfiable if and only if all roles in the schema can be populated.

Person —— Teaches [3-5] —— Course {Math1, Prog1}
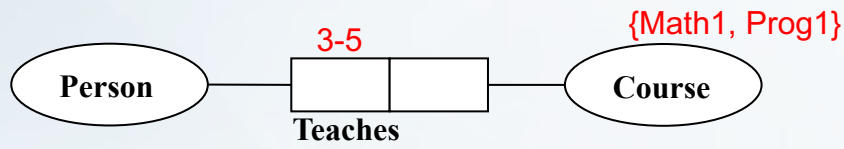
✗ **Role-Unsatisfiable,** As no roles can be populated.

Person ●—— Teaches [3-5] ——● Course {Math1, Prog1}
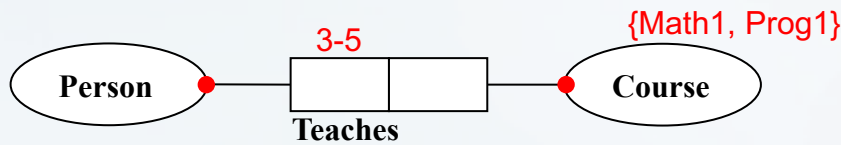
✗ **role-Unsatisfiable,** As all roles cannot be populated.

Person —— Teaches [3-5] / Reviews —— Course {Math1, Prog1}

- -

Reviews
P1   Math1
P1   Prog1
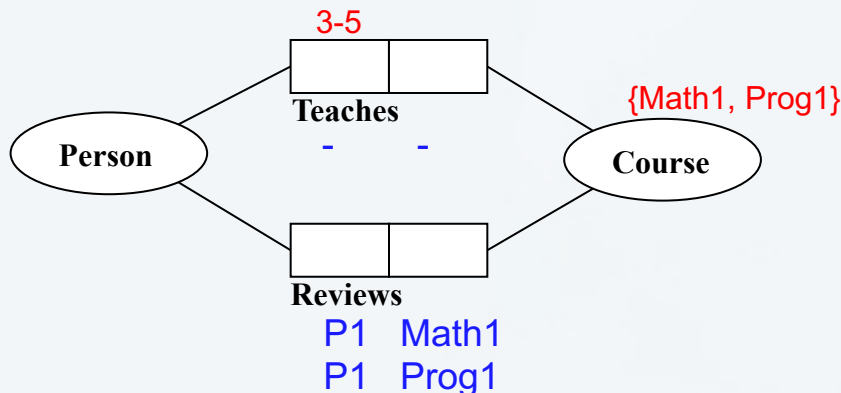
✗ **role-Unsatisfiable,** As not all roles can be populated.

Role Satisfiability

A schema is satisfiable if and only if all roles in the schema can be populated.

3-5   {Math1, Prog1}   ✗ **Role-Unsatisfiable,**

Person   ...ed.

Person   ...lated.

Although it is a strong requirement, but we recommend that your conceptual model is <u>Role Satisfiable</u>.

Teaches   {Math1, Prog1}   As not all roles can be populated.

Person   -   -   **Course**

Reviews
P1   Math1
P1   Prog1

DogmaModeler

http://www.jarrar.info/Dogmamodeler/
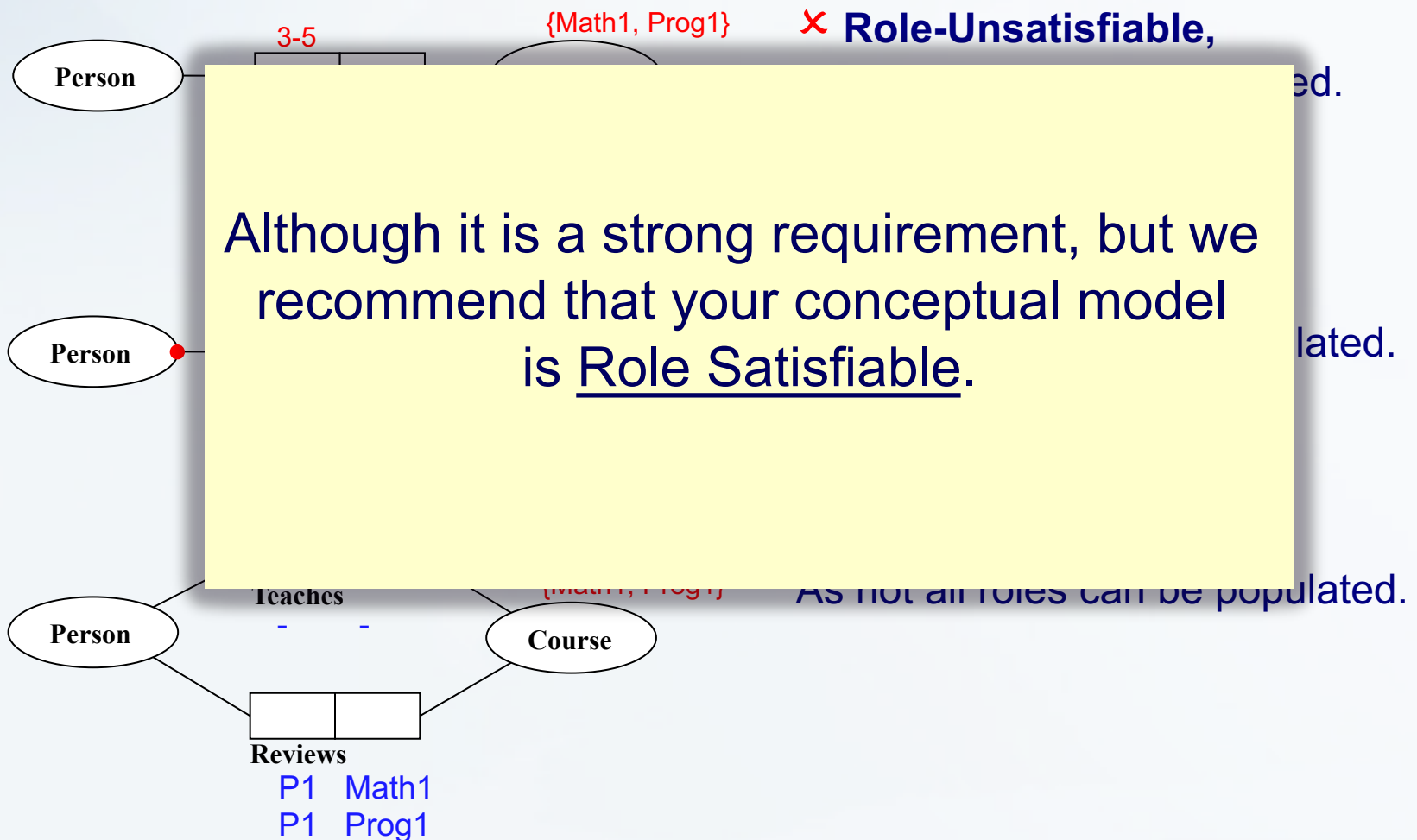
Is the only tool that can detect constraint contradiction for ORM
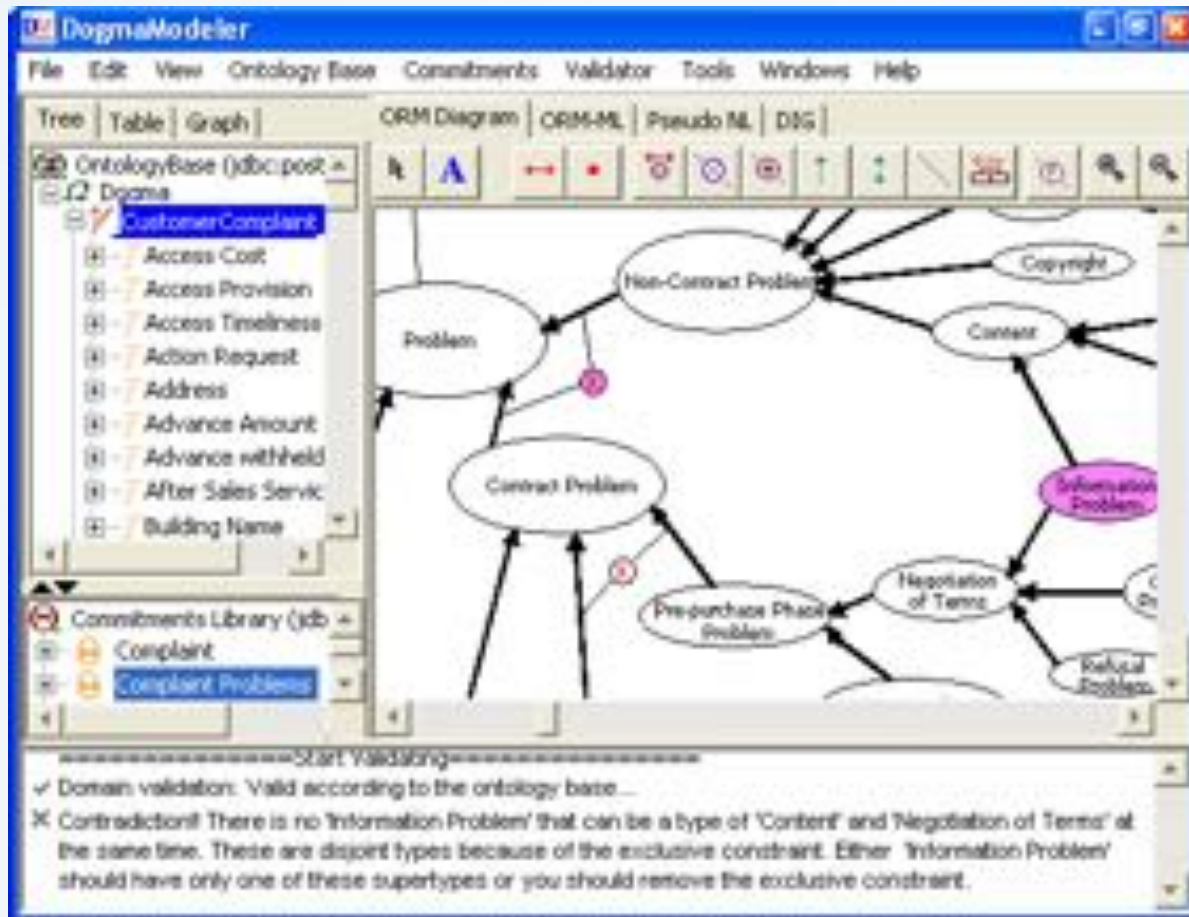
DogmaModeler

Is the only tool that can detect constraint contradiction for ORM

DogmaModeler

Is the only tool that can detect constraint contradiction for ORM

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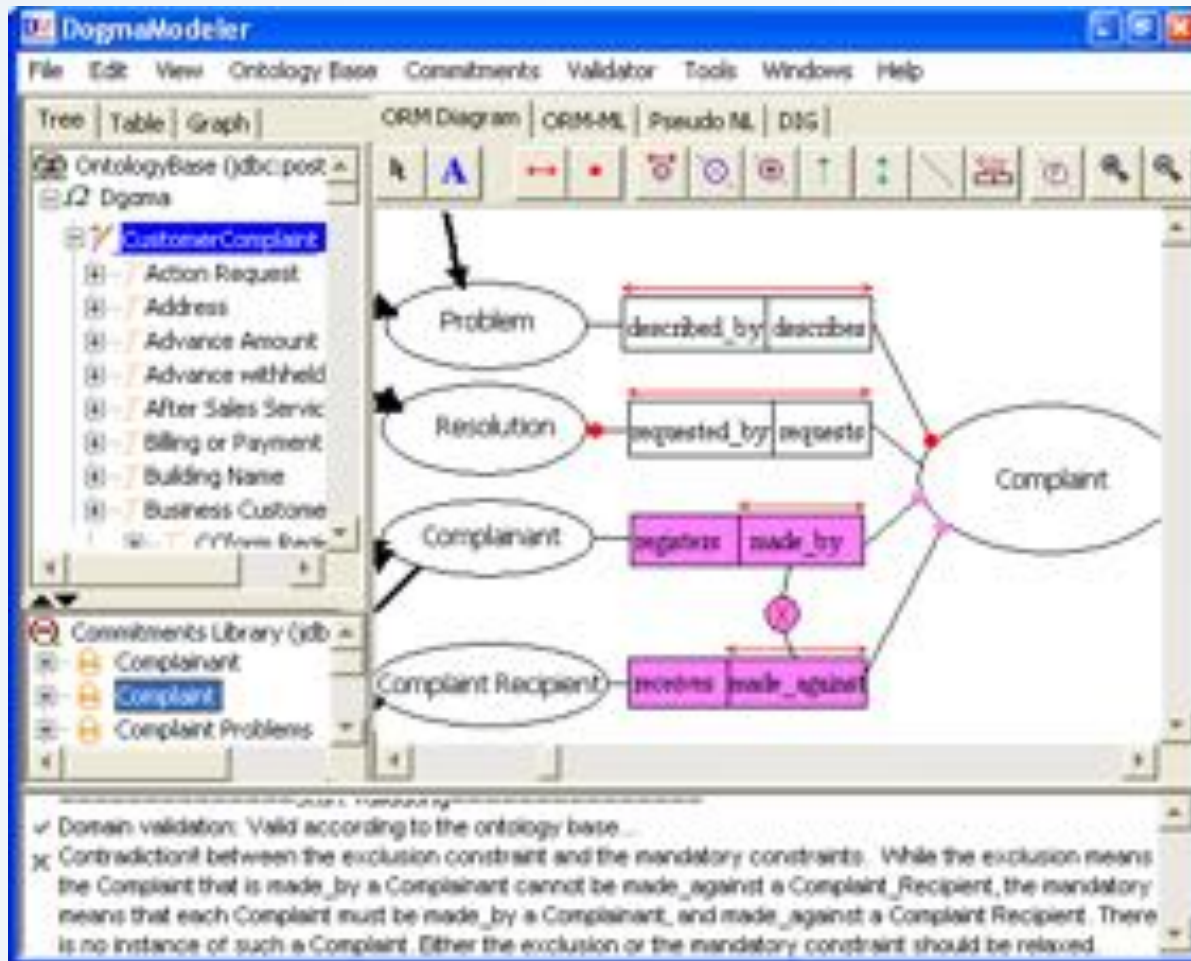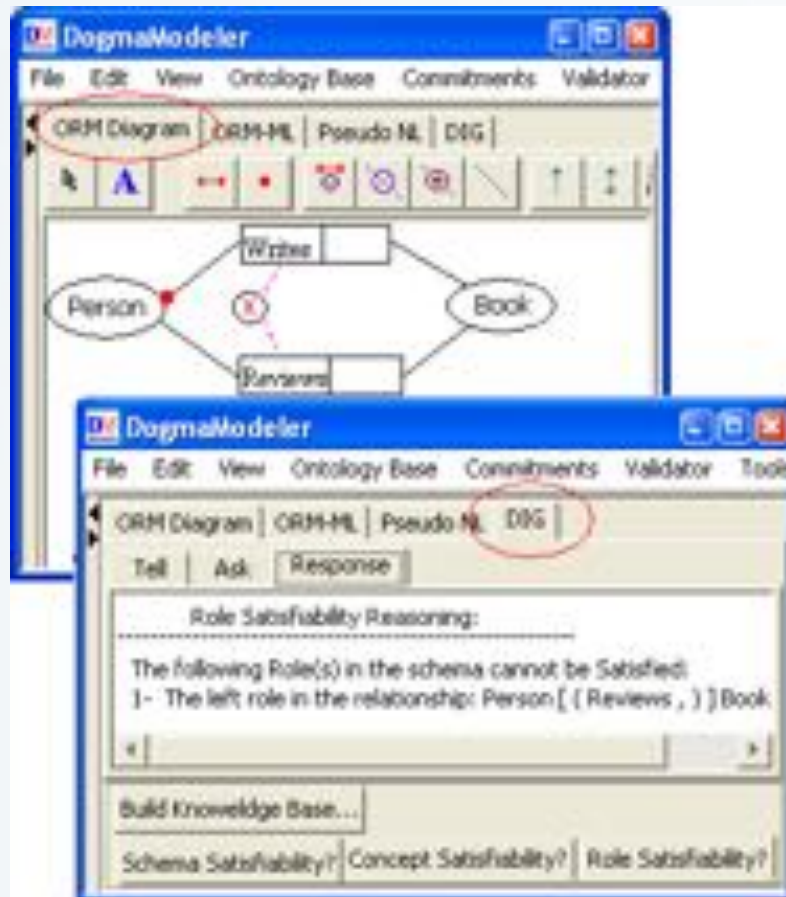[2] Mustafa Jarrar and Robert Meersman: Ontology Engineering -The DOGMA Approach. Book Chapter in "Advances in Web Semantics I". Chapter 3. Pages 7-34. LNCS 4891, Springer.ISBN:978-3540897835. (2008).

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