

Formal Methods

UML outline to logic translator

DIPARTIMENTO DI INFORMATICA
E SISTEMISTICA ANTONIO RUBERTI



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A.A. 2012/2013



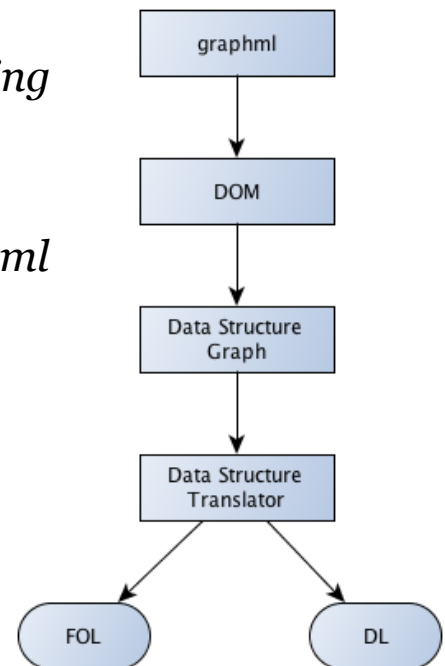
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In our project we have designed an application that provide the first order logic and description logic representation of UML Class Diagram.

In order to achieve this task, we have developed a Java application that takes as input a graphml file (generated by a graph editor named yEd) and provide the corresponding FOL/DL translation.

The approach to the problem previews a stratified solution, that we can reassume as following:

- 1) The user design classes' UML diagram using the yEd editor*
- 2) We generate a DOM tree from the input xml code to populate a data structure*
- 3) From the data structure graph we can derive a data structure translator, and using a logic knowledge we obtain respective FOL and DL*





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The graph editor (yEd), is an editor to design a graph, in particular it natively support the creation of classes, attributes and operations.

Instead, associations, generalizations and key constraints cannot be represented by simple edges, but we need to introduce new nodes.



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Graphml

Cost: polynomial

DOM

Requires one visit from the DOM tree to get the nodes, and another visit to get the edges, than put them into an hash map

Data Structure Graph

Data Structure Translator

The worst case the cost is quadratic, but in average case the degree of each node is very low, so we can consider it linear

Cost: linear

FOL

DL

In the worst case total cost is QUADRATIC



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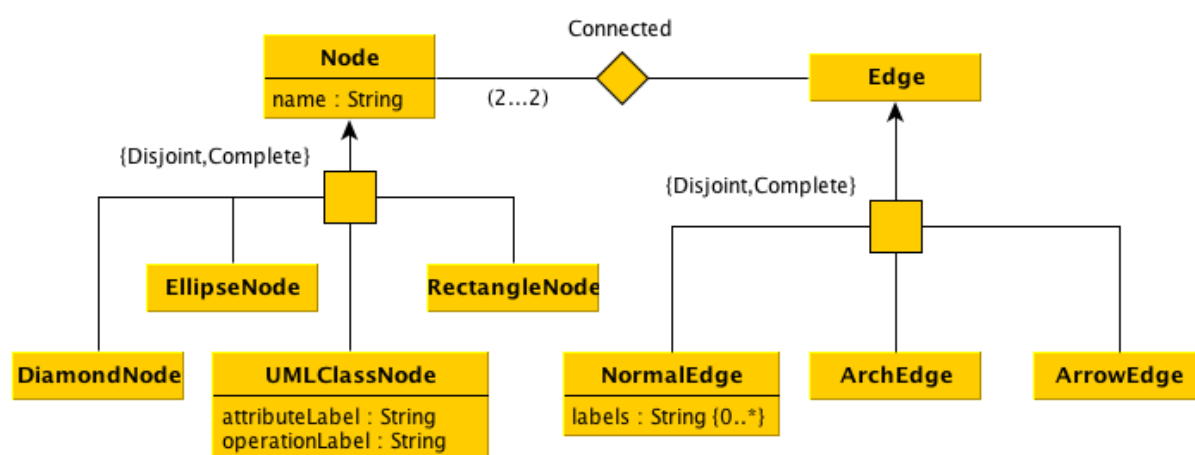
FOL

DL

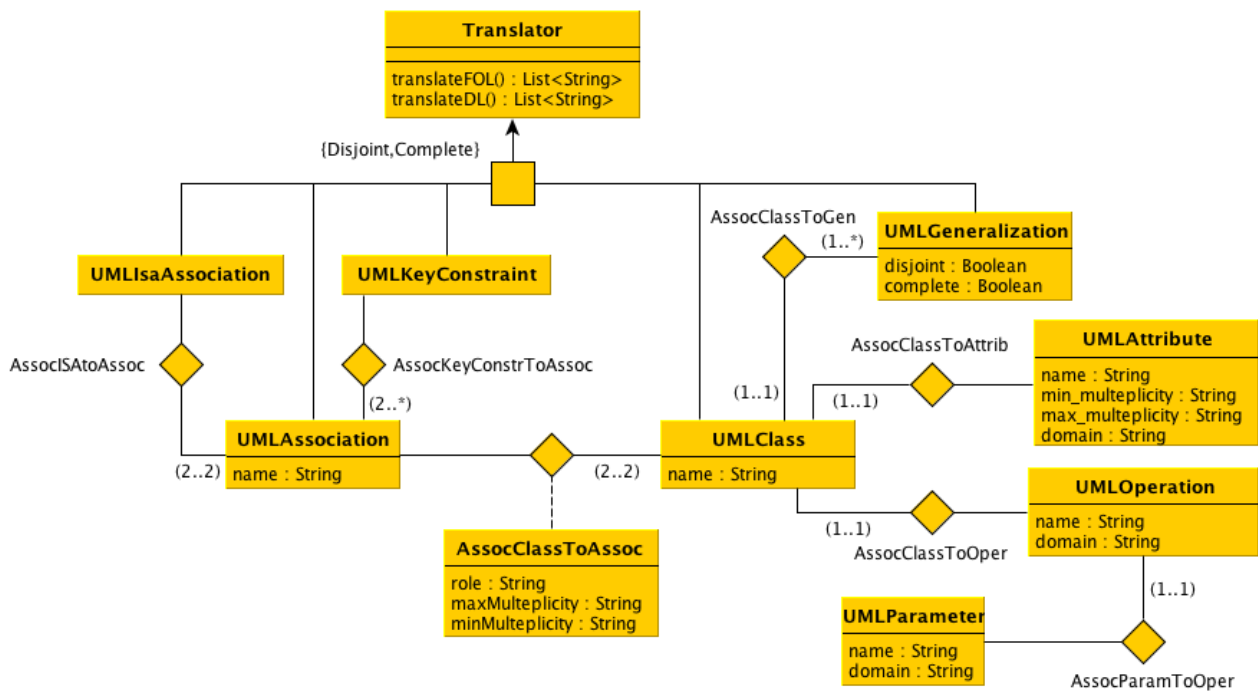
In average case total cost is LINEAR



In this outline we reassume the UML class diagram of the graph data structure

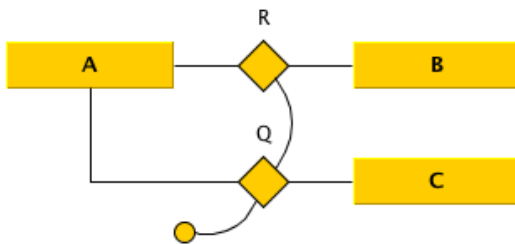


In this outline we reassume the UML class diagram of the translator



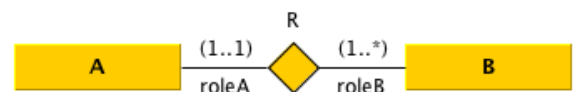
A class in UML models is a set of objects that share certain common properties as attributes and operations

ClassA
name : String
telephon : int {0...1}
operation(par1 : String) : int



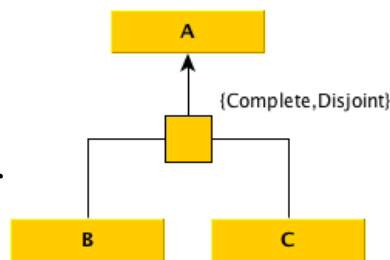
Introducing a node with a circular form and connected it to the association's nodes using a bent arch we can express a key constraint

An association in UML is a relation between the instance of two or more classes moreover an association between two classes is a property of both classes

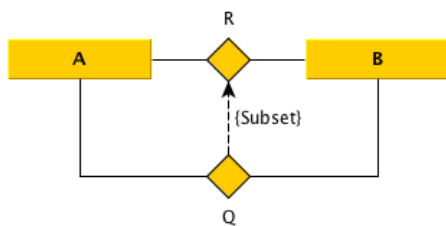


The generalization link is used between two classes to show that a class incorporates all of the attributes and operations of another

Completeness asserts that every instances of the superclass is also an instance of at least one of the subclasses



Disjointness asserts that different subclasses cannot have common instances



We propose to express constraints and dependencies in a textual and formal manner by using a subset




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How to start the program:

from the common line:

> java -jar utl.jar diagram.graphml [output.txt]

*It's the file exported
from yEd and
represents the UML
Class Diagram*



*It's the file where the
FOL/DL formulae will
be saved, if omitted
they will be printed on
screen*

