

## Representação do Conhecimento e Raciocínio (RCR) Knowledge Representation and Reasoning (KRR)

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Final Recourse Exam, February 20th, 2006

(2,5 hours + 0.5 tolerance; document and computer consultation allowed – no networking!)

I – Consider the following logic program:

```
god_exists ← not ¬ god_exists
¬ god_exists ← not god_exists
¬ go_to_church ← not god_exists
go_to_church ←
```

The first two rules express two defaults with incompatible conclusions. The first one reads “I conclude God exists if I assume to be false that there is a proof for His non-existence”. The second reads “I conclude God does not exist if I assume to be false that there is a proof for His existence”. The third rule states “I don’t go to church if I do not believe God exists”. The fourth rule affirms “I go to church”.

- 1) What is the Well-Founded Model (with explicit negation) of the program?
- 2) What are its Answer-Sets?
- 3) Compare and comment the results obtained by each semantics in the two previous questions. Which results appear to you preferable and why?

II – Consider the following taxonomic description:

- In general, carnivore are big and dangerous.
- Feline are carnivore animals.
- Both cat and lion are feline.
- Lion are big.
- Tamed circus animals are not, normally, dangerous.
- Generally, untamed circus animals are chained.
- King, Shaka, and Arthur are lions, the two latter ones being circus animals.
- Shaka is not tame.
- Tom is a cat.

- 1) Using a logic program specification, represent this taxonomy.
- 2) Provide the program’s semantics.
- 3) Explain, succinctly, why the specification produces the correct results.

III - Consider a company with a president, a board of directors and (at least) two departments: the quality management and the financial ones.

To improve the quality of the products produced by the company, the quality management department has decided not to buy any product whose reliability is less than guaranteed. See the figure below for all rules, where rules with variables stand for the set of all their ground instances.

On the other hand, to save money, the financial department has decided to buy products of a type in need if they are cheap.

The board of directors, in order to keep production going, has decided that whenever there is still a need for a type of product, exactly one product of that type must be bought.

This can be coded by the following logic programming rules, stating that if X is a product of a needed type, and if the need for that type of product has not been already satisfied by buying some other product of that type, then X must be bought; if the need is satisfied by buying some other product of that type, then X should not be bought.

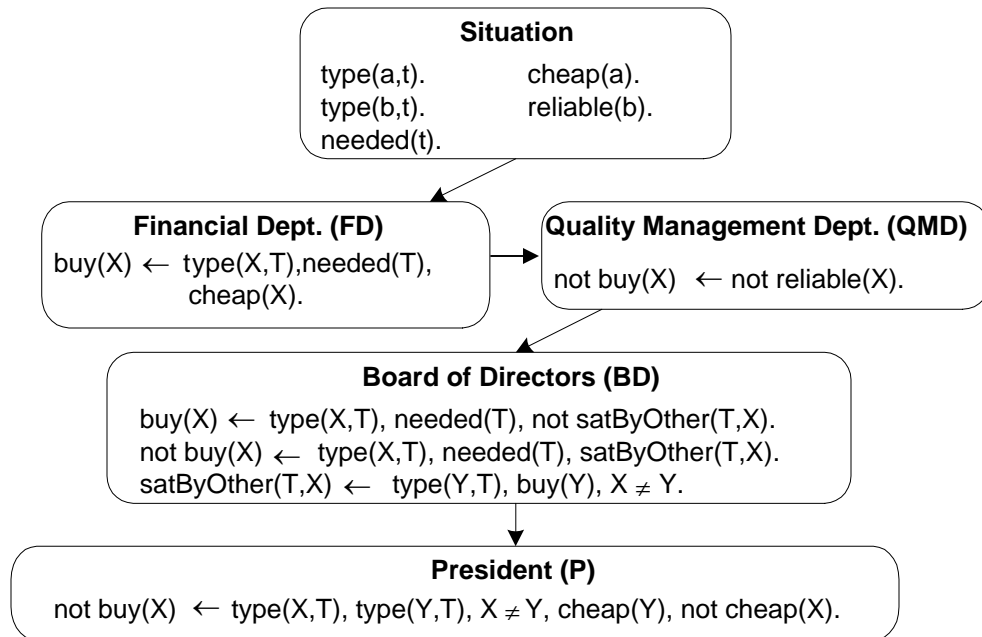
Finally, the president decided for the company never to buy products that have a cheap alternative. I.e. if two products are of the same type, and only one of them is cheap, the company should not buy the other.

Suppose further that there are two products, 'a' and 'b', the first being cheap and the latter reliable, both of type 't' and both of needed type 't'.

According to the company's organizational chart, the rules of the president can overrule those of all other sectors, and those established by the board can overrule those decided by the departments. The quality department has precedence over the financial one.

This situation can easily be modeled by the DLP in the Figure below.

## Company Knowledge Graph



1) We wish to know what would be the decision of each of the four sectors about which products to buy, not taking under consideration the deliberation of any other sectors. Explain your answer formally.

*Limit your answer to one page.*

2) More interestingly, we wish to know what is the decision of the company as a whole, when taking into account the rules of all sectors and their hierarchical organization. Explain your answer formally.

*Limit your answer to one page.*