



Reasoning and Formal Modelling for Forensic Science
2010/2011; 2nd Semester
Prof. Dr. Benedikt Löwe

Homework Set # 4

Deadline: 18 March 2011

It is not acceptable to copy homework from other groups. While it is acceptable to discuss homework questions, you must find your own examples and arguments.

Homework can be handed in

- (1) in class at the beginning of the lecture (1pm) or
- (2) *via* e-mail to N.P.M.Car1@uva.nl until 1pm.

Late homework will not be accepted.

Exercise K (9 points).

Consider the following *partially controlled situation sequence*: We have individuals j (John), w (John's wife Jane), and n (their neighbour). Furthermore, we have properties SING and HAPPY and a relation KILL. We have three moments t_1 , t_2 , and t_3 and the semantics is given as follows:

In S_1 , we have

	SING	HAPPY	KILL	j	w	n
j	No	Yes	j	No	No	No
w	No	Yes	w	No	No	No
n	No	?	n	No	No	No

In S_2 , we have

	SING	HAPPY	KILL	j	w	n
j	No	?	j	No	No	No
w	No	?	w	No	No	No
n	Yes	Yes	n	No	No	No

In S_3 , we have

	SING	HAPPY	KILL	j	w	n
j	No	?	j	No	No	?
w	No	?	w	No	No	?
n	No	No	n	No	No	No

Furthermore, we have the rules

$$\begin{aligned} \rho_0 &= @_2 \neg \text{HAPPY}(w) \rightarrow @_3 \exists x \text{KILL}(j, x) \\ \rho_1 &= @_1 (\exists x \text{SING}(x) \rightarrow \neg \text{HAPPY}(w)) \wedge @_2 (\exists x \text{SING}(x) \rightarrow \neg \text{HAPPY}(w)) \end{aligned}$$

Check whether the following statements are consistent with the rules (give all details of the calculation; 3 points each). Note that some of the natural language statements first have to be made precise in terms of the language of the situations.

- (1) John's wife killed the neighbour (at time t_3).
- (2) The neighbour is still alive (at time t_3).
- (3) The neighbour is happy at some point during the story.

Exercise L (9 points).

In a rather unclear case, the police found a female frozen body in a park. There are various scenarios possible: she could have been killed, her body placed in the park to freeze; she could have been killed in the park; or she could have been hit in park, fell unconscious and froze to death. The victim has a large head wound, but it is uncertain whether this is the cause of death. The coroner states that the wound would not have killed her, but could have knocked her out. A background check shows that the woman was a successful businesswoman who had met a convicted criminal in a bar the night before her death. The police consider the criminal a suspect, and question him. He does not confess, but instead makes rather odd claims about the woman “taking a nap” in the park after she had hurt herself in the head.

The following model is created for this situation:

The modeller fixes two moments t_1 , the moment of the hit in the head, and t_2 , a later moment. He uses individuals w (for the woman), c (for the convicted criminal), and u (for an unknown person). He uses the properties DEAD, FROZEN, and the relation KILL. Finally, he gives the semantics for the two moments as follows:

In S_1 , we have

	DEAD	FROZEN	KILL	w	c	u
w	No	No	w	No	No	No
c	No	No	c	No	No	No
u	No	No	u	No	No	No

In S_2 , we have

	DEAD	FROZEN	KILL	w	c	u
w	Yes	Yes	w	No	No	No
c	No	No	c	?	No	No
u	No	No	u	?	No	No

A *modelling decision* is the decision to include or exclude a moment, an individual, a property, or a relation, or the decision to give the value “Yes”, “No”, or “?” in one particular case. For instance, the modeller made the modelling decision to “include the woman as an individual”, to “exclude the coroner as an individual” and to “set the value of $\text{KILL}(w, c)$ to ‘No’ at moment t_2 ”.

This is not a very good formal representation of the rather complex situation described. Argue against this representation by finding three *bad modelling decisions* (3 points each). For each such decision, identify the modelling decision precisely, find an *Argumentation Scheme* in order to reconstruct the decision of the modeller and attack this Argumentation Scheme by using the right critical questions.

[So that you know what is expected of you, here is an example unrelated to this exercise. “The modeller made the modelling decision of setting the value of $\text{HURT}(a, b)$ to ‘Yes’. This decision can be reconstructed as an *Argument from Position to Know*: The witness was in the position to know that a hurt b . The witness stated that a hurt b . Therefore, a hurt b . However, I do not believe that this is a good argument, since the witness is not trustworthy (CQ2).”]

Exercise M (7 points).

Our framework of *Partially Controlled Situation Sequences* is not very good at dealing with scenarios in which the order of events is unknown. Come up with a scenario in which this is the case, and use your example to discuss how you would try to approximate uncertainty about the order of events within the framework of *Partially Controlled Situation Sequences*. Be as precise as possible and use the formal notation. Also discuss possible problems of your approach.