
Exercise Sheet No 6

May 29, 2002

Deadline: June 6, 2002, before the lecture

1 bonus point

Exercise 6.1

(3 points)

Formalize the following as a set KB of propositional formulae:

If the unicorn is a mythological creature then it is immortal. But, if it is not a mythological creature then it is a mammal. If the unicorn is immortal or a mammal then it is horned. A unicorn is a magical creature if and only if it is horned.

Does it follow from KB that the unicorn is (a) a mythological creature, (b) a magical creature, or (c) a horned creature? Consider all questions (a, b, c) independent!

Exercise 6.2

Use the *Davis-Putnam* procedure to find a model of each of the following formulae, or prove that the particular formula has no model:

1. $(P \vee \neg Q) \wedge (\neg P \vee Q) \wedge (Q \vee \neg R) \wedge (\neg Q \vee \neg R)$ (3 points)

2. $(P \vee Q \vee \neg R) \wedge (P \vee \neg Q) \wedge \neg P \wedge \neg R \wedge \neg U$ (3 points)

Exercise 6.3

Represent the following sentences in first-order logic, using a consistent vocabulary (which you must define):

1. No mortal lives longer than 150 years. (1 point)

2. Some Pompeians like anchovies. (1 point)

3. There is a barber who shaves all men in town who do not shave themselves. (2 points)

4. Politicians can fool some of the people all the time, and they can fool all of the people some of the time, but they cannot fool all of the people all of the time. (2 points)

Exercise 6.4

Consider the blocks-world. Give the graphical pictures of three (substantially) different blocks-world interpretations that satisfy the following formulae, i.e. they are models of the formulas (2 points / model):

1. $(\forall x)[[(\exists y)\text{On}(y, x)] \Rightarrow \neg\text{Clear}(x)]$
2. $\text{On}(A, B) \Rightarrow \text{On}(D, C)$
3. $\text{Clear}(B) \vee \text{Clear}(A) \Rightarrow \text{On}(C, D)$
4. $(\forall x)[\text{Clear}(x) \Rightarrow \neg(\exists y)\text{On}(y, x)]$
5. $\neg\text{Clear}(C) \vee \text{Clear}(D) \Rightarrow \text{On}(C, B)$
6. $\text{Clear}(B) \vee \text{Clear}(C)$

Note, that we want interpretations that obey the usual physical constraints, e.g. the blocks are on top of other blocks or on the floor.