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Feb 17th 2006

Tutorial Exercises
for seventh week

1. The *closed world assumption* (CWA) says that given a theory (set of formulas) T we may form an enlarged theory CWA(T) by adding to T the negation of all basic formulas without free variables that cannot be proved from T. So

$$\text{CWA}(T) = T \cup \{ \ \neg P(t_1, \ldots, t_n) \ : \ \text{not} \ (T \vdash P(t_1, \ldots, t_n)), t_i \ \text{ground} \ \}.$$

   Show that deduction using CWA is non-monotonic, *ie* give a theory T and formulas F, G, for which you can show that such that CWA(T) ⊢ G and not(CWA(T ∪ {F})) ⊢ G.

2. Show that applying CWA twice has the same effect as applying it once, *ie*

$$\text{CWA}(T) = \text{CWA}(\text{CWA}(T))$$

3. The CWA above adds in negation of basic ground formulae only. Suppose it is used for any formulae at all, and consider an initial KB with just one formula

$$\text{happy}(jim)$$

   . What happens if we look at using the CWA for $\forall x \ \text{happy}(x)$ and for $\exists y \ \neg \text{happy}(y)$?

4. The *Unique Names Assumption* is often used in conjunction with the CWA. It deals with equality reasoning, and says that for any two syntactically different ground terms t_1, t_2 (i.e. terms without variables), we have that $\neg(t_1 = t_2)$.

   Give a situation where this is an appropriate assumption, and another situation where it is wrong, under the normal reading of the terms in question.

5. Here are some queries to Prolog (with no program clauses) that relate to the UNA. Are they justified by the UNA, and what you know about equality reasoning?

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SICStus 3.10.1
| ?- a = b.
no
| ?- f(a) = f(f(a)).
no
| ?- f(X) = f(f(Y)).
X = f(Y) ?
yes
| ?- f(X) = f(f(X)).
X = f(f(f(f(f(f(f(f(f(f(...)))))))))) ?
yes
| ?-
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