

Computational Logic

Assignment 5

Due: 29/03/2006

1. Show that the axioms of symmetry and transitivity can be derived from the axioms of reflexivity and f-substitutivity
2. Show that each resolution step using either the axiom of symmetry, transitivity, or substitutivity can be simulated by resolution and paramodulation. In the simulation, resolution cannot be used with the mentioned equational axioms.
3. Consider the set of clauses

$$\mathcal{F} = \{\{p(f(a)), q(y), r(b)\}, \{\neg p(f(b))\}, \{\neg q(a)\}, \{\neg r(a)\}\}$$

and the equational system $\mathcal{E} = \{f(X) \approx X, a \approx b\}$. Show by resolution and paramodulation that $\mathcal{F} \cup \mathcal{E}$ is unsatisfiable.

4. Model the following problems, and show their solutions, using CHR and SWI Prolog, or Ciao Prolog.
 - (a) Aaron, Bob and Carla are three suspects for a murder. Anyone who is involved with the murder will always lie, and those not involved will tell the truth. The statements from the suspects are: Aaron - "I am innocent and Bob and Carla were both involved.", Bob - "Carla is innocent.", Carla - "I am guilty or Aaron is.". Can you determine who is involved in the murder? Explain.
 - (b) Determine the satisfiability of the following constraints;
 - i. $X = 3 + T \wedge T + X = 3 \wedge Y + 2X = Z \wedge Y + X + 3 = Z$
 - ii. $2X + 4Y + 6Z = 1 \wedge X + 2Y + 2Z = 0 \wedge Z = 1$.
 - (c) Write a predicate $\text{minmax}(X, Y, Min, Max)$ which holds if Min is the minimum of X and Y and Max is the maximum. Note that the goal $\text{minmax}(X, Y, 3, 4)$ should succeed with two answers and $\text{minmax}(X, Y, 4, 3)$ should fail.