CS323 - Winter 97 - Homework #2

Due date: February 4th.

January 23, 1997

1 The Hanks-McDermott shooting problem

Definition 1.1 *The* Hanks-McDermott shooting problem *(sometimes refered to as the "Yale shooting Problem") is the following story: A person can be either* ALIVE *or* DEAD. *A gun can be either* LOADED *or* UNLOADED. *At a known situation the person is alive, and a gun become loaded whenever a* LOAD *action occurs. Any time a person is shot (i.e., a* SHOOT *action) with a loaded gun, he becomes dead.*

Problem 1.2

1. *Formalize the problem in Situation Calculus. Emphasize which are your Frame Axioms.*
2. *Show the process of LOAD;SHOOT as a chain of situations, emphasising what sentences are true in each situation.*
3. *Add the action WAIT (with the apropriate axioms) to your Database. Show the process of LOAD;WAIT;SHOOT as a chain of situations, emphasising what sentences are true in each situation.*

2 The Missionaries and Cannibals Problem

In this Problem Set we will deal (again) with a *soft* version of the MCP we will call the Elementary-MCP.

Definition 2.1 *The* Elementary-K Missionaries and Cannibals Problem *is the following problem:*

K missionaries and K cannibals get to a river. There is a bridge over the river, and they want to cross over to the other bank. How shall they cross?

Problem 2.2 1. *Formalize the Elementary-2-MCP in Situation Calculus. Alter the formalism given for the Elementary-1-MCP in order to run it on the PVS. Prove that your formalism is solvable using the PVS. Point out the Frame Axioms you use.*

3 Circumscription

Problem 3.1 *Circumscribe the following formulas (these should become simple 1st order formulas describing the circumscribed predicate).*

1. $CIRC[isblock(A) \vee isblock(B); isblock]$
2. $CIRC[isblock(A) \vee isblock(B); isblock; A, B]$
3. $CIRC[\forall x \neg P(x); P]$
4. *Let x be a tuple of variables, $F(x)$ a formula with all parameters explicitly shown. Prove that if $F(x)$ does not contain P, then*

$$CIRC[\forall x(F(x) \implies P(x)); P] \equiv \forall x(F(x) \equiv P(x))$$

(i.e., in some cases Circumscription *is reducible to* predicate completion*).*

5. *Show that $Circ[Bird(Tweety) \wedge (\exists x)(Bird(x) \wedge \neg Fly(x)); \neg Fly; Bird, Fly]$ does not imply $Fly(Tweety)$.*

Bonus *Prove that for a predicate P there is no 1st order formula formulating the* transitive closure *of P.*