CS323 - Problem Set #3

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1 Nested Abnormalities

Problem 1.1 *Write the following in NAT (Nested Abnormality Theory).*

1. *Tweety is a bird. Birds normally fly. Penguins normally do not fly. Penguins are birds. In general things do not fly. Birds are 'things'. Mammals are things. Mammals normally do not fly. Bats are mammals. Bats normally fly.*

2. *A tool is normally usable. A boat is a tool. Boats usually have oars. Oars are tools. A broken oar is not usable. Boats are usable only in the presence of usable oars. A motorboat is usable even in the absence of oars. A motorboat requires gasoline for its actions.*

Problem 1.2 *Give an example of an Abnormality Theory not representable by Lifschitz's NAT. What is the problem? What can be done to amend it? (Hint: think of OOP[1]/Frames)*

2 PVS vs The Missionaries and Cannibals Problem (act III)

Problem 2.1

1. *Make your previous formalism take the location of the boat into account (for those who did not do that).*

2. *Take the Set-Theoretical formalisation from the web page (a pvs file) and prove all the lemmas in it. Notice that this formalism is not the final formalism of the MCP, and does not require that the Missionaries will not be outnumbered by the Cannibals.*

3 Circumscription

Problem 3.1 *Circumscribe the NAT formalisms you established in (1).*

[1] OOP is a shortening for *Object Oriented Programming*

Problem 3.2 *The following is a formalization of the* Nixon Diamond*:*

$$\varphi(Ab_1, Ab_2) = \left\{ \begin{array}{c} Quaker(x) \wedge \neg Ab_1(x) \implies Pacifist(x) \\ Republican(x) \wedge \neg Ab_2(x) \implies \neg Pacifist(x) \end{array} \right\}$$

Circumscribe Ab_1 *varying* $Pacifist$*, and then circumscribe* Ab_2 *in the result, varying* $Pacifist$ *again. Now Circumscribe it the other way around (*Ab_2 *and then* Ab_1*). Finally circumscribe* Ab_2 *varying* $Pacifist$ *and then* Ab_1 *varying* $Pacifist, Ab_2$*. Write down your observations (the last one is a form of* prioritized circumscription*).*