Paul Lintilhac

Artificial Intelligence

Problem Set 3

Problem 1:

1.A)

1.B)

1.C)

1.D)

1.E)

1.F)

1.G)

1.H)

1.I)

1.J)

Problem 2:

Using resolution proving, show that I is a consequence of A, D, F, and G.

We start with the set of clauses that includes , and work towards a contradiction. First, I rename the variables in each clause so that they are not confused with each other. This is to emphasize that the people and times in each clause may all be different variables (13 different variables in this case), until a substitution is made that makes them equivalent.

The general idea of the proof will be to start with the facts F and G that unborn time <alive time and alive time<dead time, and then plug the skolem constants associated with these times into the statement that a person must be alive, unborn, or dead. Finally I will use the transitive property to show that unborn time< dead time.:

First, we resolve D with F and G by letting :

Next, we resolve all of c, F, and G with A by letting :

--------------------------------

---------------------------------

-------------------------------------

I.e. the set of clauses are jointly false, and we have reached a contradiction. Thus I is a consequence of A, D, F, and G.

Problem 3:

Using Resolution theorem proving, show that J is a concequence of A, B,C, E, F, H, and I. We use the same method as before, combining the set of clauses, with J negated. Note that the negation of J gives

For this proof, I will start with a similar strategy of taking the main clauses with skolem constant (middle generations), and substituting it for as many other variables as possible without running into any conflicts. I expect the proof to ultimately show a contradiction: that the time at which the father was alive and the son unborn was earlier than the time at which the father was unborn and the grandfather alive

-----------------------------------------------------------------------------------------------------------------------------------------

I:

Where is a skolem function representing the time at which a grandson is unborn and grandfather is alive, and is a skolem function representing the time at which child is unborn and father is alive, and is a skolem function representing the person who is the child of grandfather and the father of grandson . First, let and reduce C.a and C.b. Note that is a unit, so we can set it to true, eliminating C.c.

I:

--------------------------------------------------

Now we can resolve C.a against H.a and H.b by letting , and then use C.b to again resolve with H.b by letting And Thus we create an extra clause under H, and eliminate C.

I:

--------------------------------------------------

Next we can resolve F and H.c by letting and then resolve F again with H.a by letting

I:

--------------------------------------------------

Now we can resolve B with F.a and F.b by letting and :

I:

--------------------------------------------------

Next we resolve H.a with I by letting

I:

--------------------------------------------------

Now we resolve B again with with I by letting

I:

--------------------------------------------------

Now we resolve E with I by letting This also allows us to resolve F with E, to get:

--------------------------------------------------

Finally, we let :

--------------------------------------------------

I.e. the set of clauses are jointly false, and we have reached a contradiction. Thus J must be a consequence of A,B,C, E,F, H, and I.