SOLUTIONS: ARTIFICIAL INTELLIGENCE

1. Frame Representations

(a) Sedan

(b) Corporation

(c)

(Subclass CompanyVehicle Vehicle)
(ValueRestriction Corporation Owner CompanyVehicle)
(Subclass CompanyCar CompanyVehicle)
(MemberValue Sedan Style CompanyCar)
(Member Envig'sCar CompanyCar)
(OwnValue Envig Owner Envig'sCar)

(d)

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(forall (c s v x)
        (implies (and (MemberValue v s c) (Member x c)) (OwnValue v s x)))

(forall (c s v vr x)
        (implies
            (and (ValueRestriction vr s c) (OwnValue v s x) (Member x c))
            (Member v vr)))

(forall (c1 c2 x)
        (implies (and (Subclass c1 c2) (Member x c1)) (Member x c2)))
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2. Adversary Search

We cannot necessarily prune nodes in game trees which are graphs. Let n be a node whose first child node evaluates to k. If n has a sibling with value less than or equal to k, then n would be pruned. However, if all of the values of n's siblings are greater than k, then n would not be pruned. In a graph, n could have two sets of siblings such that it would be correct to prune n, with respect to one set, but incorrect to prune it with respect to the other.

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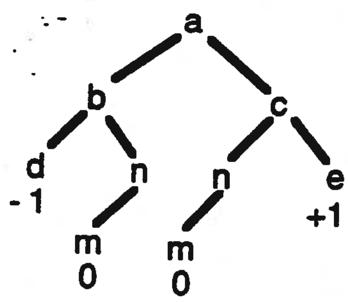

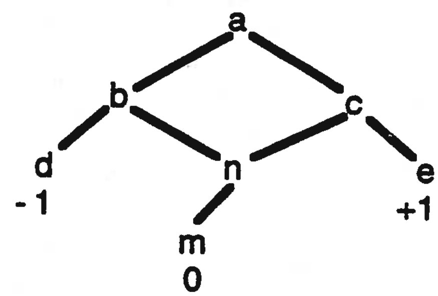

For example, consider the tree and graph above. First consider the example as a tree with n occurring twice. As a child of b, n is pruned, but as a child of c, it is not pruned. In this example, the value of b is -1 and c is 0, so a becomes 0.

Now consider the example as a graph. If we prune n from the graph during the evaluation of b, the value of c becomes 1 instead of 0, so the value of a also becomes 1. This change of value could easily affect the outcome of a game (e.g., if there were another possible move from a with value 0.99).

3. First-Order Logic

$$\neg\text{person(Sk-x1)} \lor \neg\text{time}(t_1) \lor \text{can-fool-at(SK-x1,}t_1)$$
$$\text{person(Sk-x3)}$$
$$\text{time(Sk-t3)}$$
$$\neg\text{can-fool-at(Sk-x3,Sk-t3)}$$

4. Nonmonotonic Reasoning

(a) The statement that Tweety is not acrophobic is a consequence of both extensions of this default theory. Therefore, ¬acrophobic(Tweety) is a cautious consequence of this theory.

(b) One extension of this theory has ¬acrophobic(Fred) as a consequence, but the other does not. Therefore, ¬acrophobic(Fred) is a brave consequence of this theory.

(c) acrophobic(Fred) is not a consequence of either extension of this theory. In fact, there is no way to derive acrophobic(x) for any x given the diagram we have.

(d) No. There is an argument for ¬acrophobic(Fred) in (b), but none against it. Brave consequences are those that are possibly, but not necessarily, true.

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5. Probability

Consider the cases where Pr(q –> p) holds:

$$Pr(q \rightarrow p) = Pr(q \wedge p) + Pr(p \wedge \neg q) + Pr(\neg p \wedge \neg q)$$

If we apply the definition of conditional probability, we get:

$$Pr(q \rightarrow p) = Pr(p \mid q)Pr(q) + Pr(p \mid \neg q)Pr(\neg q) + Pr(\neg p \mid \neg q)Pr(\neg q)$$

The latter two terms combine to produce:

$$Pr(q \rightarrow p) = Pr(p \mid q)Pr(q) + (Pr(p \mid \neg q) + Pr(\neg p \mid \neg q))Pr(\neg q)$$

and reduces to:

$$Pr(q \rightarrow p) = Pr(p \mid q)Pr(q) + Pr(\neg q)$$

Since $Pr(p \mid q) \leq 1$ and since $Pr(q) + Pr(\neg q) = 1$, we get $Pr(q \rightarrow p) \geq Pr(p \mid q)$.

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