Knowledge Representation and Reasoning
Course Project
Problem 12 : Inheritance Hierarchies

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Approach

1 Making Credulous Extensions

- Given a hierarchy of statements, and source. First the taxonomy is made a-connected with respect to the source.
- The node which is ambiguous i.e whose predecessors are having both postive and negative edges to that node is identified. The node is resolved to give two extensions. One extension will have predecessors which have positive edge to that node and another one will have predecessors which have negative edge to that node. The two extensions are once again resolved for ambiguous nodes using the same procedure. This will result in the maximal, un-ambiguous, a-connected extensions of the given hierarchy
- These credulous extensions do not incorporate any notion of admissibility or preemption

2 Getting admissibility of edges in Original Hierarchy

The admissibility of each edge is found according to the following definition:

- An edge $v \cdot (\neg)x$ is admissible in Γ with respect to a if there is a positive path $a \cdot s_1 \cdot ...s_n \cdot v (n \geq 0)$ in E and
  1. each edge in $a \cdot s_1 \cdot ...s_n \cdot v$ is admissible in Γ with respect to a (recursively)
  2. no edge in $a \cdot s_1 \cdot ...s_n \cdot v$ is redundant in Γ with respect to a
  3. no intermediate node $a, s_1, ..., s_n$is a preemptor of $v \cdot (\neg)x$ with respect to a.
- A node y along path $a \cdot ... \cdot y \cdot ... \cdot v$ is a preemptor of $v \cdot x (v \cdot \neg x)$ with respect to a if $y \cdot \neg x \in E (y \cdot x \in E)$.
- A positive edge $b \cdot w$ is a redundant in Γ with respect to node a if there is some positive path $b \cdot t1 \cdot ... \cdot tm \cdot w \in E (m \geq 1)$ for which
  1. each edge in $b \cdot t1 \cdot ... \cdot tm$ is admissible in Γ with respect to a (i.e., none of the edges are themselves preempted);
  2. there are no c and$i$ such that $c \cdot \neg t_i$ is admissible in Γ with respect to a
  3. there is no c such that $c \cdot \neg w$ is admissible in Γ with respect to a.

- A Negative edge $b \cdot \neg w$ is a redundant in with respect to node a if there is some negative path $b \cdot t1 \cdot ... \cdot tm \cdot \neg w \in E(m \geq 1)$ for which

  1. each edge in $b \cdot t1 \cdot ... \cdot tm$ is admissible in Γ with respect to a (i.e., none of the edges are themselves preempted);
  2. there are no c and$i$ such that $c \cdot \neg t_i$ is admissible Γ in with respect to a
  3. there is no c such that $c \cdot w$ is admissible in Γ with respect to a.

3 Making Preferred Extensions

- Let X and Y be credulous extensions of$\mathit{\Gamma}$ with respect to a node a. First the topological order of the nodes is taken from Γ. X and Y agree to a node if the predecessors of that node are the same in X and Y, and both X,Y agree on all those predecessors recursively. In other words, all the paths from source node to the node in consideration should be the same in X and Y.
- Get all the nodes which both X and Y agree namely "common nodes". Get the nodes namely "checking nodes" whose sources are in common nodes. Take edges of X and Y separately whose target is in checking nodes and remove any intersection among them. For remaining edges in X and Y, the count of inadmissibilty edges in each is taken. The one with less inadmissibility count is preferred over the other.
- A credulous extension is a preferred extension if there is no other credulous extension that is preferred to it.

4 Reasoning

- Skeptical Reasoning: Believe all those conclusions x that are supported by $a \cdot s_1 \cdot ... s_k \cdot x$ in all the preferred extensions.
- Ideally Skeptical Reasoning: Believe all those conclusions $a \rightarrow x$ that are supported by some path in each preferred extension.