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## Forward Reasoning Algorithm

function FOLFC-ASK( $KB, \alpha$ ) returns a substitution or false

inputs:  $KB$ , the knowledge base, a set of first-order definite clauses  $\alpha$ , the query, an atomic sentence

local variables:  $new$ , the new sentences inferred on each iteration

repeat until  $new$  is empty

$new \leftarrow \{ \}$

for each rule in  $KB$  do

$(p_1 \wedge \dots \wedge p_n \Rightarrow q) \leftarrow \text{STANDARDIZE-VARIABLES}(rule)$

for each  $\theta$  such that  $\text{SUBST}(\theta, p_1 \wedge \dots \wedge p_n) = \text{SUBST}(\theta, p'_1 \wedge \dots \wedge p'_n)$

for some  $p'_1 \wedge \dots \wedge p'_n$  in  $KB$

$q' \leftarrow \text{SUBST}(\theta, q)$

if  $q'$  does not unify with some sentence already in  $KB$  or  $new$  then  
add  $q'$  to  $new$

$\phi \leftarrow \text{UNIFY}(q', \alpha)$

if  $\phi$  is not fail then return  $\phi$

add  $new$  to  $KB$

return false

Output:

Criminal (Robert) is proven!

Inferred Facts:

American (Robert)

Own (A, TI)

Minile (TI)

Criminal (Robert)

Hostile (A)

Enemy (A, America)

Weapon (TI)

Cells (Robert, TI, A)

Conclusion

Q

1. Occupation (Emily, Surgeon)  $\vee$  Occupation (Emily, Lawyer)

2. Occupation (Joe, Actor)  $\wedge \exists o$  (Occupation (Joe, o)  $\wedge o \neq$  Actor)

3.  $\forall p$  (Occupation (p, Surgeon)  $\rightarrow$  Occupation (p, Doctor))

4.  $\forall p$  (Customer (Joe, p)  $\rightarrow$  Occupation (p, Lawyer))

5.  $\exists p$  (Boss (p, Emily)  $\wedge$  Occupation (p, Lawyer))

6.  $\exists p$  (Occupation (p, Lawyer)  $\wedge \forall q$  (Customer (q, p)  $\rightarrow$  Occupation (q, Doctor)))

7.  $\forall p$  (Occupation (p, Surgeon)  $\rightarrow \exists q$  (Occupation (q, Lawyer)))