Introduction to AI
-Tutorial NAF for NMR-

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SLDNF

Apply SLDNF to compute all possible answers for p(X) given S:

p(X) ← q(X), not r(X), not s(X)
q(1) ←
q(2) ←
q(3) ←
r(2) ←
r(X) ← not t(X)
s(X) ← u(X)
t(1) ←
t(3) ← t(3)

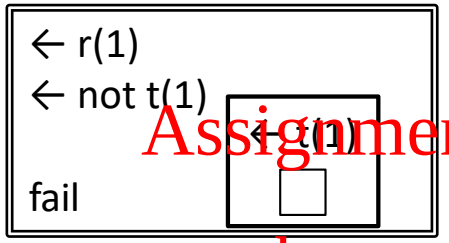
SLDNF – sample solutions

← p(X)

← q(X), not r(X), not s(X)

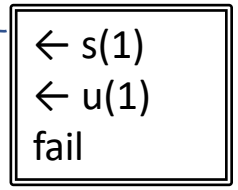
{X/1}

← not r(1), not s(1)



← not s(1)

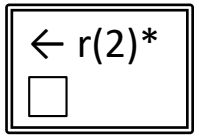
□ {X/1}



Backtrack: {X/2}

← not r(2), not s(2)

fail

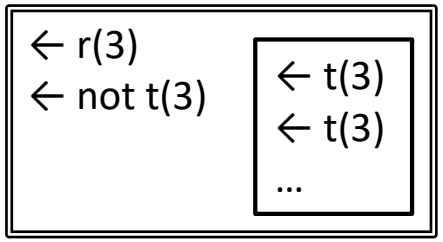


*no need to try the other clause

Retry {X/3}

← not r(3), not s(3)

Loop!



Computed answers: {X/1}

SLDNF and safe selection of sub-goals

Given S={p(X) ← q(X,Y), not r(Y), q(2,3) ←, r(4) ←} and P=p(X)

1. Apply SLDNF with a safe selection of sub-goals to compute an answer for P, giving the answer explicitly
2. Explain why a non-safe selection of sub-goals might give an incorrect answer to P

SLDNF and safe selection of sub-goals – possible solutions

Given S={p(X) ← q(X,Y), not r(Y), q(2,3) ←, r(4) ←} and P=p(X)

1. ← p(X)

   ← q(X,Y), not r(Y)

{X/2,Y/3}

   ← not r(3)

   □ {X/2}

   ← r(3)

   fail

2. A non-safe selection of sub-goals may select not r(Y) at step 2 in the derivation above and fail (by succeeding in proving r(4) in a sub-computation)

NAF semantics

S={ p(X) ← q(X), not r(X), not s(X), q(1) ←, q(2) ←, q(3) ←, r(2) ←, r(X) ← not t(X), s(X) ← u(X), t(1), t(3) ← t(3)}

1) What is the completion of S?

2) Determine whether

   Comp(S) ╞ p(1) , Comp(S) ╞ ¬ p(1)

   Comp(S) ╞ p(2) , Comp(S) ╞ ¬ p(2)

   Comp(S) ╞ p(3) , Comp(S) ╞ ¬ p(3)

3) Determine all stable models of S

NAF semantics – sample solutions

S={ p(X) ← q(X), not r(X), not s(X), q(1) ←, q(2) ←, q(3) ←, r(2) ←, r(X) ← not t(X), s(X) ← u(X), t(1), t(3) ← t(3)}

1) CET+ $p(X) \leftrightarrow q(X) \wedge \neg r(X) \wedge \neg$ not s(X)

$q(X) \leftrightarrow X=1 \vee X=2 \vee X=3$

$r(X) \leftrightarrow X=2 \vee \neg$ not t(X)

$s(X) \leftrightarrow u(X)$

$t(X) \leftrightarrow X=1 \vee (X=3 \wedge t(X))$

$u(X) \leftrightarrow$ false

2) Comp(S) $\models$ p(1)

Comp(S) $\models \neg$ p(2)

NAF semantics – sample solutions

S={ p(X) ← q(X), not r(X), not s(X), q(1) ←, q(2) ←, q(3) ←, r(2) ←, r(X) ← not t(X), s(X) ← u(X), t(1) ←, t(3) ← t(3)}

3) X={q(1), q(2), q(3), r(2), r(3), t(1), p(1)}

Indeed

- S^X ={p(1) ← q(1), q(1) ←, q(2) ←, q(3) ←, r(2) ←, r(3) ←, s(1) ← u(1), s(2) ← u(2), s(3) ← u(3), t(1) ←, t(3) ← t(3)}
- LHM(S^X) ={q(1), q(2), q(3), r(2), r(3), t(1), p(1)}=X