The names of all countries that are members of the NATO which are not located in Europe

country(N, C, Cap, CapProv, A, Pop)

ismember(C, O, T)

encompasses(C, Cont, Perc)

$F(N) :- \exists C, Cp, CpProv, A, Pop, T :$
$($ country(N, C, Cp, CpProv, A, Pop)
$\wedge$ ismember(C, 'NATO', T)
$\wedge \neg\exists$ Perc : encompasses(C, "Europe", Perc)$)$

$F(N) :- \exists \vec{x}\ (F_1 \wedge F_2 \wedge \neg\exists Perc: F_3)$ — F_4, F_5, F_6

free$(F_3) = \{C, Perc\}$ rr$(F_3) = \{C, Perc\}$

free$(F_4) = \{C\}$ rr$(F_4) = \{C\}$

→ free$(F_5) = \{C\}$ rr$(F_5) = \emptyset$

free$(F_6) = \{C, Cp, CpProv, A, Pop, T, N\}$

rr$(F_6) = $ rr$(F_1) \cup$ rr$(F_2) \cup$ rr$(F_5) =$ free(F_6)

free$(F) = \{N\}$ rr$(F) = \{N\}$ F is safe range

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$F(N) :- \exists C, Cp, CpProv, A, Pop, T :$
$($ country(N, C, Cp, CpProv, A, Pop)
$\wedge$ ismember(C, 'NATO', T)
$\wedge \neg\exists$ Perc : encompasses(C, "Europe", Perc)$)$

consider bottom-up evaluation

.... $\wedge \neg\exists$ Perc: Enc(C, "Europe", Perc) — F_5

recall: free$(F_5) = \{C\}$ not in RANF
rr$(F_5) = \emptyset$

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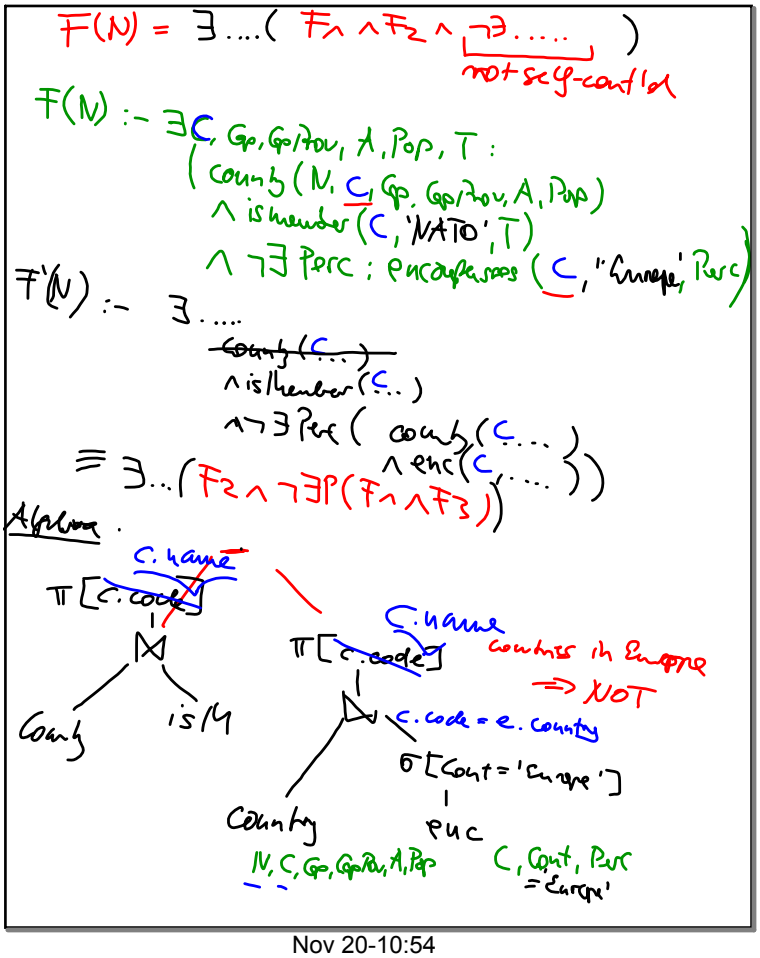

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$$\exists v\,(r(v,x) \wedge \neg s(x,y,v)) \wedge \exists w\,(r(w,y) \wedge \neg s(y,x,w))$$

first step: push x, v, and w, y into not

$$\exists v: \neg\,(r(v,x) \wedge s(x,y,v))$$

$$\wedge\, \exists w: \neg\,(r(w,y) \wedge s(y,x,w))$$

$$\wedge\, r(w,y) \wedge r(v,x)$$

push into $\exists$

$$\neg(r(w,y) \wedge r(v,x)) \wedge \exists v:(r(v,x) \wedge r(w,y) \wedge s(x,y,v)) \wedge \exists w:(r(w,y) \wedge r(v,x) \wedge s(y,x,w))$$

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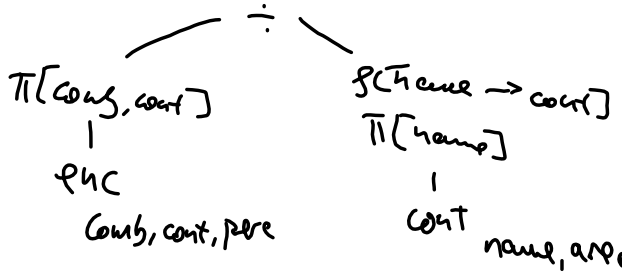
$F(X) :- \forall y : (\text{combled}(y) \rightarrow \text{enc}(X, y))$

$\forall y \, (\neg \text{cont}(y) \vee \text{enc}(X, y))$

$F(C) :- \text{comb}(X) \wedge \forall y (\text{cont}(y) \vee \text{enc}(X, y))$

$\text{comb}(X) \wedge \neg \exists y \, (\text{cont}(y) \wedge \neg \text{enc}(X, y))$

$\rightsquigarrow$ enc $\div$ cont



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