

NONMONOTONIC REASONING

NMR: Methods of drawing conclusions nondeductively, where these conclusions may be withdrawn in the face of new infoⁿ

E.g., As we add new flights to an airline flight schedule, we withdraw earlier conclusions that there were no such flights

E.g., Joe loaded gun, pointed it at Fred, pulled the trigger \vdash_{NM} Fred died

+ Joe unloaded gun before pointing it (& pulling the trigger) \vdash_{NM} Fred didn't die

+ Fred had a heart attack \vdash Fred died

+ Joe, a paramedic, applied first aid \vdash_{NM} Fred didn't die

E.g., John got bird, Tweety, for b. day \vdash_{NM} Tweety flies

+ Tweety is a hen \vdash_{NM} Tweety doesn't fly

+ Tweety is a game hen \vdash_{NM} Tweety flies

etc.

Approaches to nonmonotonic reasoning (NMR)

All methods are intended to be "elaboration-tolerant"

1. Assume completeness of the available knowledge in some relevant respect; hence draw conclusions about cases not explicitly covered (CWA, COMP, CIRC)
 e.g., airline database - unlisted flights don't exist
 e.g., university course guide - a course has no prerequisites except those specified
2. Provide default rules for drawing conclusions tentatively, in the absence of evidence to the contrary (default logic)
 e.g., (small) birds can fly
 e.g., Quakers are pacifists
3. Draw conclusions (more or less certainly) based on statistical or probabilistic knowledge
 e.g., next 2 coin flips will include one H (prob $\frac{3}{4}$)
 e.g., most of you know how to drive a car

Closed World Assumption (CWA)

"If certain basic facts (ground atoms) are true I know about it."

(So, any such facts I don't know about are false!)

CWA: Given a certain first-order lang. L and a knowledge base Δ in L , then for any ground atom P in L , if $\Delta \not\vdash P$ then assume $\neg P$

e.g., a knowledge base Δ of geographic relations: adjacent(US, Canada) adjacent(US, Mexico) etc.

$\Delta \vdash_{CWA} \neg \text{adjacent}(\text{Canada}, \text{Mexico})$

e.g., airline db.

e.g., a knowledge base Δ for UR course structure:

prereq(CSC172, CSC242)

prereq(CSC242, CSC244)

$\forall x. \text{CSC-course}(x) \wedge x \neq \text{CSC171} \Rightarrow \text{prereq}(\text{CSC171}, x)$

$\forall x, y, z. \text{prereq}(x, y) \wedge \text{prereq}(y, z) \Rightarrow \text{prereq}(x, z)$... etc.

$\Delta \vdash \text{prereq}(\text{CSC171}, \text{CSC244})$

$\Delta \vdash_{CWA} \neg \text{prereq}(\text{CSC200}, \text{CSC244})$

Some observations about CWA

1. CWA doesn't always yield a consistent theory, even if the original theory Δ is consistent.

e.g., $\Delta = \{P(A) \vee P(B)\}$

Let's define $\Delta_{asm} = \{\neg \alpha \mid \alpha \text{ ground atom of } L \text{ and } \Delta \not\vdash \alpha\}$

We see $\neg P(A) \in \Delta_{asm}$

$\neg P(B) \in \Delta_{asm}$

CWA(Δ) But $\{P(A) \vee P(B), \neg P(A), \neg P(B)\} \vdash \perp$ (inconsistent)

"CWA augmentation of Δ "

So $\Delta \cup \Delta_{asm} \vdash \perp$ (inconsistent)

2. In general derivation by CWA, i.e., $\Delta \vdash_{CWA} \dots$, is not effective, because " $\not\vdash$ " is not effective.

A more realistic version of CWA would be: if a certain algorithmic deduction procedure (one that always halts) can't derive α from Δ , then assume $\neg \alpha$.

3. If Δ is Horn and consistent, then $\Delta \cup \Delta_{asm}$ is consistent!

Proving this requires another theorem... (plus a lemma)

Theorem (consistency condition for CWA)

(Th. 6.1 in GBN)

For consistent Δ , $\Delta \cup \Delta_{asm}$ is consistent
iff for every +ve ground disjunction entailed
by Δ , Δ also entails one of the disjuncts.

 Δ un-ambiguous

Proof sketch. \Leftarrow : Assume Δ entails a disjunct of each ground disjunction it entails. Want to show $\Delta \cup \Delta_{asm}$ consistent. Assume it's not, i.e., $\Delta \cup \Delta_{asm} \vdash \square$; then $\Delta \cup F_{asm} \vdash \square$ for some finite $F_{asm} \subseteq \Delta_{asm}$. Then $\Delta \models \neg F_{asm}$. (by refutation theorem). But $\neg F_{asm}$ is a +ve ground disjunction, hence $\Delta \models f$ for some f s.t. $\neg f \in F_{asm}$, contradicting defⁿ of Δ_{asm} .

\Rightarrow : Assume $\Delta \cup \Delta_{asm}$ consistent. Want to show Δ entails a disjunct of every +ve ground disjunction it entails. Suppose it does not, i.e., $\Delta \models f_1 \vee \dots \vee f_k$ where the f_i are ground atoms, but $\Delta \not\models f_i$, $1 \leq i \leq k$. But then $\neg f_1, \dots, \neg f_k \in \Delta_{asm}$, Δ together with $f_1 \vee \dots \vee f_k$ this leads to inconsistency.

Lemma. If Δ is Horn, it is unambiguous

Preliminary observations about resolution proofs for Horn Δ :

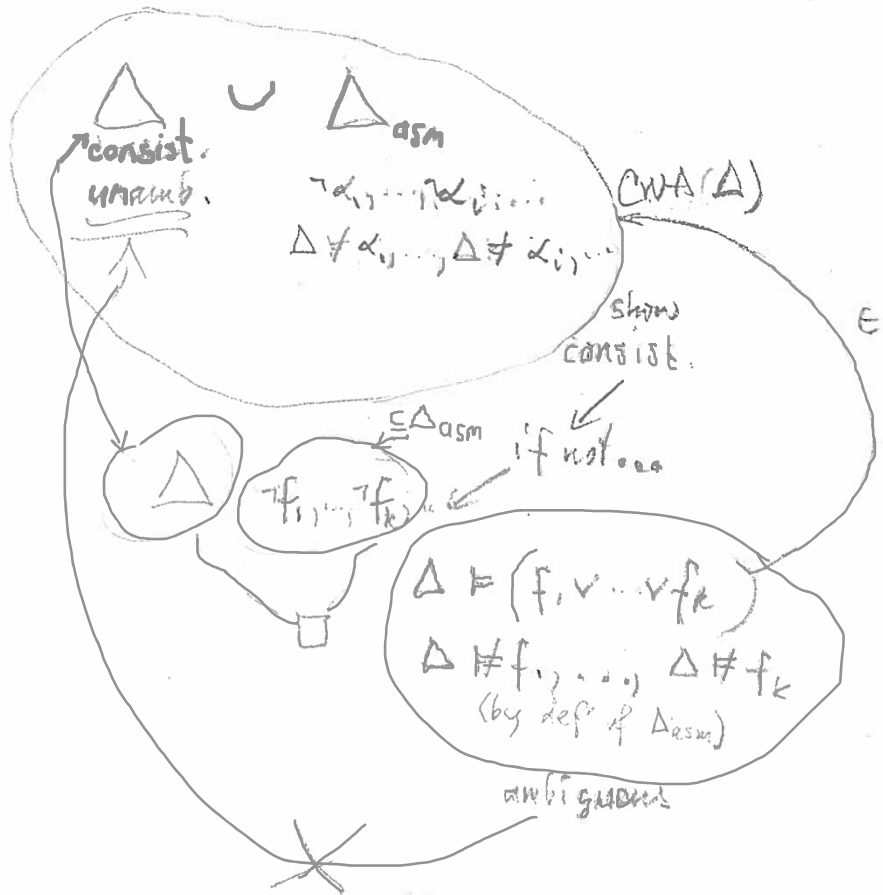
- the resolvent of any two Horn clauses is a Horn clause
- if one of the parents is completely negative, so is the resolvent
- factoring is not needed (roughly, because if two negative literals of a Horn clause can be resolved away after factoring, they can be resolved away anyway)

Proof of Lemma. First, $\not\exists \Delta$ is inconsistent, i.e., $\Delta \vdash \square$. Then every wff φ can be derived from Δ (because then $\Delta \cup \{\neg \varphi\} \vdash \square$). So every ground atom is derivable, and so Δ is unambiguous.

Next, $\exists \Delta$ is consistent, and let $(f_1 \vee \dots \vee f_k)$, $k \geq 2$, be any disjunction of ground atoms s.t. $\Delta \models (f_1 \vee \dots \vee f_k)$. Then $\Delta \cup \{\neg (f_1 \vee \dots \vee f_k)\} \vdash \square$, i.e., $\Delta \cup \{\neg f_1, \dots, \neg f_k\} \vdash \square$, where we can take \vdash to mean derivation by (narrow) resolution, because (narrow) resolution is complete for Horn sets (not allowing for equality).

Consider such a resolution refutation. There must be a first step at which one parent clause is from $\{\neg f_1, \dots, \neg f_k\}$, because Δ alone does not derive \square (by the consistency assumption). Let this parent be $\neg f_i$. Now $\not\exists$ (for contradiction) that $\Delta \cup \{\neg f_i\} \vdash \square$. Then the resolvent $\neg g_1 \vee \dots \vee \neg g_m$ of the above step must have $m \geq 1$ (else we would have derived \square , thus proving f_i). But then the refutation cannot be completed, because the literals in $\neg g_1 \vee \dots \vee \neg g_m$ (and in its descendants, which must all be completely negative) can only be "resolved away" using clauses from Δ (rather than any of $\{\neg f_1, \dots, \neg f_k\}$), and if this were possible, then we would be able to derive \square using only $\Delta \cup \{\neg f_i\}$, again contrary to our assumption. QED.

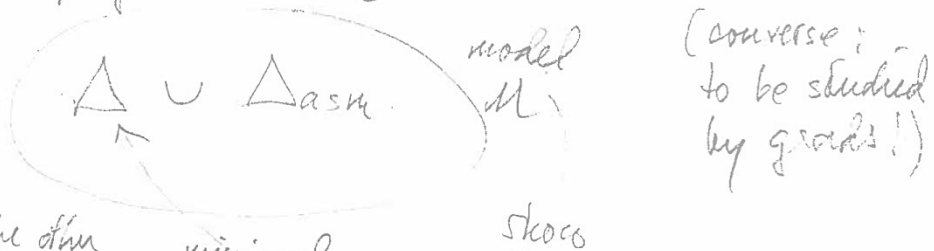
Δ consist, unamb.
 \Rightarrow CWA(Δ)
 consist.



Semantic counterpart to CWA?

We're being "as conservative as possible" in judging ground atoms to be true. ("Guilty of falsehood unless proven true" - Napoleonic code!) \Rightarrow Minimal models.

For propositional logic:



For the Δ in Δ_{asm} , we need $\Delta \not\models p$.

minimal model of Δ

\exists o.w.

M not minimal for Δ

Let M' be "smaller": $M' = M \upharpoonright p: \text{False}$

$\models_{M'} p, \not\models_{M'} \neg p$

$M'(p) = \text{True}$

$\therefore \Delta \not\models p$

$\therefore \exists p \in \Delta_{asm}$

contradicting $M(p) = \text{True}$



Cor. (from theorem & lemma) For Δ consistent & Horn, $\Delta \cup \Delta_{asm}$ is consistent. (as claimed earlier)

→ So it's reasonable to use CWA in Prolog:
 "negation as failure" (i.e. we assume the negation of an atom if we fail to prove it).

Minimal-model semantics

Can we provide a modified entailment relation that "matches" derivability using CWA, i.e. \models_{CWA} ?

Intuitively, CWA assumes "complete knowledge of +ve instances of all predicates". All instances that aren't provably true are assumed to be false. So we seem to be minimizing the extensions of all predicates, subject to the known constraints. This turns out to be the case, under certain assumptions.

Roughly, then, the semantic counterpart of \models_{CWA} , say $\Delta \models_{CWA} \varphi$, turns out to be that φ is true in all minimal models of Δ (where we are "minimizing truth"). Some details follow.

Defⁿ. A propositional model (or interpretation) assigns T or F to every propositional variable (& is a model of Δ if it renders every $\varphi \in \Delta$ true)

Defⁿ. For prop. models M_1, M_2 , $M_1 \leq M_2$ iff M_1 assigns F wherever M_2 does.

Lemma. Let Δ be a propositional Horn set.

Then if $p \vee \neg q_1, \dots, \vee \neg q_n \in \Delta$, and there is a minimal model \mathcal{M} of Δ s.t. $\models_{\mathcal{M}} \{q_1, \dots, q_n\}$, then $\Delta \models p$ (i.e., p is true in all models of Δ).

Proof sketch: Since \mathcal{M} is minimal, then $\mathcal{M}_{q_i:F}$ is not a model of Δ (i.e., we can't "switch" any of the $\{q_1, \dots, q_n\}$ from T to F). Hence some clause of Δ is false in $\mathcal{M}_{q_i:F}$. That can only be if q_i is the positive literal of that clause, & all the negative literals of the clause are F in \mathcal{M} . In other words, each q_i must occur as the +ve literal of some clause $q_i \vee \neg q'_1 \vee \dots \vee \neg q'_r \in \Delta$, where we again have $\models_{\mathcal{M}} q_i$ and $\models_{\mathcal{M}} \{q'_1, \dots, q'_r\}$.

By "iteration" of this argument (more precisely, by an inductive argument), we see that Δ must contain a subset $\Delta' \subseteq \Delta$, where each propositional variable q occurring in Δ' (1) occurs both as literal q & literal $\neg q$ in Δ' ; (2) does not occur ^{+vely} in $\Delta - \Delta'$; and (3) is true in \mathcal{M} , i.e., $\models_{\mathcal{M}} q$. But clearly \mathcal{M} is a minimal model of Δ' (because of point (2)), not only of Δ . So every minimal model of Δ' is a maximal model of it! But then every model of Δ' has all variables of Δ' true in it & in particular $\models_{\mathcal{M}} p$.

Theorem (p.4 Allen handout) For propositional, Horn Δ , the models of $CWA(\Delta)$ are precisely the minimal models of Δ .

Proof. \Rightarrow : Assume $\models_M CWA(\Delta)$, but M is not a minimal model of Δ . Then there is a "more false" model M' with $p^{M'} = F$ while $p^M = T$ (for some p). Thus $\Delta \not\models p$, hence $\neg p \in CWA(\Delta)$, hence $p^M = F$ (from $\models_M CWA(\Delta)$). \times

\Leftarrow : Here the Horn assumption is crucial. Let M be a min. model of Δ . Suppose $\not\models_M CWA(\Delta)$. Then $\not\models_M \neg p$, i.e., $p^M = T$, for some $\neg p \in CWA(\Delta)$. Let M' differ from M only in that $p^{M'} = F$. Suppose M' fails to be a model of Δ . Then the change from $p^M = T$ to $p^{M'} = F$ falsifies some (Horn) clause $p \vee q_1 \vee \dots \vee q_n \in \Delta$. But then $\models_M \{q_1, \dots, q_n\}$. But then $\Delta \models p$ (by the lemma about minimal models of Horn sets !!), which contradicts $\neg p \in CWA(\Delta)$. Hence M' is a model of Δ , where $M' < M$, a contradiction.

Defⁿ For models M_1, M_2 of a first-order language L , $M_1 \leq M_2$ iff they have the same domain and $p^{M_1} \subseteq p^{M_2}$ for every predicate symbol P in L .

Theorem (p.4 Allen handout) For Horn Δ , with a unique names assumption and domain closure assumption, the models of $CWA(\Delta)$ are precisely the minimal models of Δ . DCA:

The only objects are those named by the ground terms of L

UNA: Distinct constants denote distinct entities, unless we can assume them identical

Restricted CWA (applied to certain predicates only)

Defⁿ $CWA_{P_1, \dots, P_n}(\Delta) = \Delta \cup \{ \neg P_i(\tau_1, \dots, \tau_k) \mid 1 \leq i \leq n, \tau_1, \dots, \tau_k \text{ are ground, and } \Delta \not\models P_i(\tau_1, \dots, \tau_k) \}$

Defⁿ For models M_1, M_2 of a 1st-order lang. L , $M_1 \leq_{P_1, \dots, P_n} M_2$ iff they have the same domain and $P_i^{M_1} \subseteq P_i^{M_2}$ for $1 \leq i \leq n$. (Note: other pred. interpretations can differ arbitrarily.)

Theorems ... ones analogous to previous two hold for the relativized case (consistency Th³, p4, & min. mod. Th², p6)

Theorem: Prolog with negation as failure, and with UNA & DCA, derives only those negative ground literals which are true in all minimal models of the premises.

Note: We can't weaken the Horn requirement to "Horn in P_1, \dots, P_n " (i.e., at most one +ve occurrence of any of P_1, \dots, P_n in a single clause).

e.g., $\{P(A) \vee Q, P(B) \vee \neg Q\}$ is Horn in P , but its CWA_P -extension is inconsistent

We looked at CWA:

"I know all atomic truths (like $P(A, B)$) deductively. Hence if I can't deduce an atomic truth, its negation holds."

- reasonable in cases where little deduction is possible (e.g., airline db)
- consistent for "unambiguous" KB's, e.g., Horn KB's
- corresponds to minimal models (assuming UNA, DCA)
HORN

Next: Predicate Completion (COMP)

"I know all general conditions for the truth of P explicitly. Hence, no other such general conditions are true."

E.g., $\Delta = \{P(A)\}$ "all we know" (about P)

As general condⁿ for truth of P :

$$\forall x. x = A \Rightarrow P(x)$$

Assuming this is the only general condⁿ:

$$\forall x. P(x) \Rightarrow x = A, \text{ i.e., } \boxed{\forall x. P(x) \Leftrightarrow x = A}$$

$$\text{COMP}[\Delta; P] \{ \}$$

Note: From $\forall x. P(x) \Leftrightarrow x = A$

we have $\neg P(B), \neg P(C), \dots$ if $A \neq B, A \neq C, \dots$

E.g., $\Delta = \{P(A), P(B)\}$

As general condition for truth of P :

$$\forall x. (x = A \vee x = B) \Rightarrow P(x)$$

If this is the only condition:

$$\forall x. P(x) \Rightarrow (x = A \vee x = B)$$

$$\text{So } \boxed{\text{COMP}[\Delta; P] = \{\forall x. P(x) \Leftrightarrow (x = A \vee x = B)\}}$$

E.g., $\Delta = \{\forall x. \text{Penguin}(x) \Rightarrow \text{Bird}(x)\}$

This is already in the form of a general condition for truth of Bird . So:

$$\boxed{\text{COMP}[\Delta; \text{Bird}] = \{\forall x. \text{Penguin}(x) \Leftrightarrow \text{Bird}(x)\}}$$

so the only kinds of birds are penguins

May seem silly - but that's because we've presupposed so little knowledge. Being a penguin surely isn't the only condition for being a bird!

E.g., $\Delta = \{ \text{Bird}(\text{Opus}), \text{Bird}(\text{Tweety}), \forall x. \text{Penguin}(x) \Rightarrow \text{Bird}(x), \forall x. \text{Canary}(x) \Rightarrow \text{Bird}(x) \}$

General condition for Bird:

$\forall x. (x = \text{Opus} \vee x = \text{Tweety} \vee \text{Penguin}(x) \vee \text{Canary}(x)) \Rightarrow \text{Bird}(x)$

Adding the converse:

$\text{COMP}[\Delta; \text{Bird}] = \{ \forall x. (x = \text{Opus} \vee x = \text{Tweety} \vee \text{Penguin}(x) \vee \text{Canary}(x)) \Leftrightarrow \text{Bird}(x) \}$

So "there are no birds other than Opus, Tweety, Penguins, & canaries"

cf. CWA:

$\Delta \xrightarrow{\text{CWA}} \neg \text{Bird}(\text{Penny})$ *strong conclusion*

$\Delta \xrightarrow{\text{COMP}[\Delta; \text{Bird}]} \neg \text{Bird}(\text{Penny}) \vee \text{Penny} = \text{Opus} \vee \text{Penny} = \text{Tweety} \vee \text{Penguin}(\text{Penny}) \vee \text{Canary}(\text{Penny})$

$\Delta \xrightarrow{\text{COMP}[\Delta; \text{Bird}], \text{UNA}} \neg \text{Bird}(\text{Penny}) \vee \text{Penguin}(\text{Penny}) \vee \text{Canary}(\text{Penny})$

What about something like

$\Delta = \{ \text{Bird}(A) \vee \text{Bird}(B) \}$?

There's still a way to define $\text{COMP}[\Delta; \text{Bird}]$

What about $\Delta = \{ \neg \text{Bird}(A) \}$?

No positive occurrences of Bird, so we have

$\forall x. \text{False} \Rightarrow \text{Bird}(x)$ (i.e., $\forall x. \text{True} \vee \text{Bird}(x)$)

$\therefore \text{COMP}[\Delta; \text{Bird}] = \Delta \cup \{ \forall x. \text{Bird}(x) \Rightarrow \text{False} \}$

$= \Delta \cup \{ \forall x. \neg \text{Bird}(x) \}$

$= \{ \neg \text{Bird}(A), \forall x. \neg \text{Bird}(x) \}$

equivalently, $\{ \forall x. \neg \text{Bird}(x) \}$

Defⁿ. A kb Δ is solitary in P iff, after conversion to clause form, every clause of Δ that contains a positive occurrence of P contains no other occurrences of P

Note: Δ solitary in P \Rightarrow Δ is Horn in P

(but not necessarily Horn in general)

e.g., $\{Q(A) \vee P(B)\}$ $\{\neg P(A) \vee P(B)\}$
 solitary in P, not Horn Horn, not solitary

General defⁿ of COMP[Δ ; P], with Δ solitary in P

Assume P is 1-place predicate. (generalization obvious!)

Let $\psi_1, \dots, \psi_n \in \Delta$ be the formulas containing a positive occurrence of P (if written as clauses).

Rewrite each ψ_i in the form $\forall x. E_i \Rightarrow P(x)$

If there are no such ψ_i ($n=0$) then

$$\text{COMP}[\Delta; P] = \Delta \cup \{\forall x. \neg P(x)\},$$

else

$$\text{COMP}[\Delta; P] = \Delta \cup \{\forall x. P(x) \Rightarrow (E_1 \vee \dots \vee E_n)\}$$

Theorem (6.2, p126 G&N) If Δ is consistent and solitary in P, then $\text{COMP}[\Delta; P]$ is consistent

The conditions of the theorem are sufficient for consistency, but not necessary - e.g., consider adding a tautology $\forall x. P(x) \vee \neg P(x)$

Parallel Predicate Completion COMP[Δ ; P_1, \dots, P_n]

Suppose: Δ is solitary in each of P_1, \dots, P_n and no distinct P_i, P_j occur positively in the same formula (if written as a clause).

Then we can write the formulas of Δ containing positive occurrences of P_1, \dots, P_n as

$$\forall x. E_i \Rightarrow P_i(x) \text{ where } E_i \text{ contains no negative occurrences of } P_1, \dots, P_n$$

(each E_i may have been collected from several formulas of Δ !)

Then by definition

$$\begin{aligned} \text{COMP}[\Delta; P_1, \dots, P_n] \\ = \Delta \cup \{\forall x. P_1(x) \Rightarrow E_1, \dots, \forall x. P_n(x) \Rightarrow E_n\} \end{aligned}$$

E.g., $\Delta = \{\text{Canary}(\text{Tweety}), \forall x. \text{Canary}(x) \Rightarrow \text{Bird}(x)\}$

$$\text{COMP}[\Delta; \text{Canary}, \text{Bird}] =$$

$$\Delta \cup \{\forall x. \text{Canary}(x) \Rightarrow x = \text{Tweety}, \forall x. \text{Bird}(x) \Rightarrow \text{Canary}(x)\}$$

$$= \{\forall x. \text{Canary}(x) \Leftrightarrow x = \text{Tweety}, \forall x. \text{Bird}(x) \Leftrightarrow \text{Canary}(x)\}$$

So "being a bird", "being a canary", & "being Tweety" all become equivalent.

Defⁿ Δ is ordered in P_1, \dots, P_n if we can order the above formulae $\forall x. E_i \Rightarrow P_i(x)$ in such a way that E_i contains no occurrences of the P_1, \dots, P_n except possibly positive occurrences of P_1, \dots, P_{i-1} (i.e., "earlier" predicates)

E.g., $\Delta = \{ \text{Canary}(\text{Tweety}), \forall x. \text{Canary}(x) \Rightarrow \text{Bird}(x) \}$ is ordered in Canary, Bird.

Theorem. If Δ is consistent and ordered in P_1, \dots, P_n then $\text{COMP}[\Delta; P_1, \dots, P_n]$ is consistent.

Theorem (semantics for completion of 1 predicate)
For Δ solitary in P , the models of $\text{COMP}[\Delta; P]$ are precisely the s_P -minimal models of Δ .

Note: no UNA, DCA needed (unlike for CWA)

Expressing "defeasible generalizations" using COMP ("minimizing abnormality")

"P are generally Q"

$$\forall x. P(x) \wedge \neg Ab_{P,Q}(x) \Rightarrow Q(x)$$

or use some arbitrary numeric index here - G&N

i.e., "All P that are not abnormal (w.r.t. P, Q) are Q"

E.g., "Animals generally don't fly"

$$\forall x. A(x) \wedge \neg Ab_{A, \text{Fly}}(x) \Rightarrow \neg \text{Fly}(x)$$

"Birds are abnormal (w.r.t. Animals, Fly)"

$$\forall x. B(x) \Rightarrow Ab_{A, \text{Fly}}(x)$$

E.g., "Birds generally fly"

$$\forall x. B(x) \wedge \neg Ab_{B, \text{Fly}}(x) \Rightarrow \text{Fly}(x)$$

"Chickens are abnormal (w.r.t. birds, flying)"

$$\forall x. C(x) \Rightarrow Ab_{B, \text{Fly}}(x)$$

A bigger example

A: animals, B: birds, C: chickens, D: ducks, E: elephants. "∀x" understood for each formula.

1. $A(x) \wedge \neg Ab_{A, Fly}(x) \Rightarrow \neg Fly(x)$

2. $B(x) \wedge \neg Ab_{B, Fly}(x) \Rightarrow \neg Fly(x)$

3. $C(x) \wedge \neg Ab_{C, Fly}(x) \Rightarrow \neg Fly(x)$

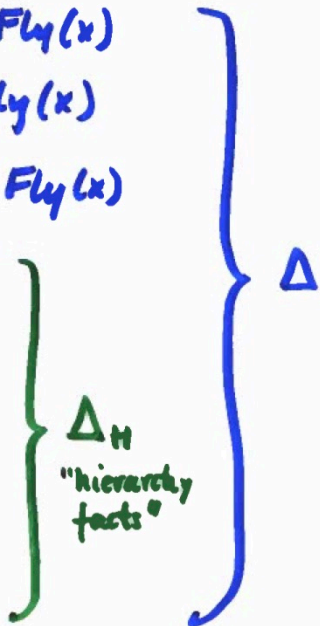
2 { 4. $B(x) \Rightarrow A(x)$
5. $E(x) \Rightarrow A(x)$

1 { 6. $C(x) \Rightarrow B(x)$
7. $D(x) \Rightarrow B(x)$

3 8. $B(x) \Rightarrow Ab_{A, Fly}(x)$

4 9. $C(x) \Rightarrow Ab_{B, Fly}(x)$

5 10. $False \Rightarrow Ab_{C, Fly}(x)$



We generally do the completion of Δ_H (not Δ) for +vely occurring pred's in $\Delta_H \rightarrow$ stronger result than doing this for all of Δ !

$COMP[\Delta_H; B, A, Ab_{A, Fly}, Ab_{B, Fly}, Ab_{C, Fly}] =$

$\{A(x) \Leftrightarrow B(x) \vee E(x), B(x) \Leftrightarrow C(x) \vee D(x),$

$B(x) \Leftrightarrow Ab_{A, Fly}(x), C(x) \Leftrightarrow Ab_{B, Fly}(x), \neg Ab_{C, Fly}(x)\}$

∴ Chickens don't fly. To prove ducks fly, we need $\neg C(x) \vee D(x)$.
To prove elephants don't fly, we need $\neg B(x) \vee \neg E(x)$.

Roughly, we're making the assumptions

• For familiar type predicates P, Q, if P is a subtype of Q, I know it (∴ Q has no (familiar) subtypes other than those I know about)

• For important properties (incl. flying abnormalities) of familiar types, I know them (∴ a familiar type P has no important abnormalities w.r.t. its super-types other than those I know about)

I know the distinctions abnormalities of each type and its super-types

But, I think it would still be simpler, & just as elaboration low-cost, to say: "If I don't know that a (type of) bird doesn't fly, then it flies." // "If I don't know that a certain familiar type of chicken doesn't fly, then it doesn't."