grounded fixpoints and active integrity constraints

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the problem

active integrity constraints

(flesca *et al.* 2004, caroprese *et al.* 2006 & 2011)

a nice formalism

a not-so-nice semantics

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a nice formalism
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main idea

integrity constraints for databases
in denial clausal form. . .

$$a, b, \neg c, \neg d \supset$$

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active integrity constraints

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integrity constraints for databases
in denial clausal form. . .
. . . together with repair "tips"

$$a, b, \neg c, \neg d \supset +c \mid -a$$

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main idea

integrity constraints for databases
in denial clausal form...
...together with repair "tips"

$$a, b, \neg c, \neg d \supset +c \mid -a$$

- "looks like" logic programming
- several semantics, all problematic

semantics of aics

$$a, b, \neg c, \neg d \supset +c \mid -a$$

(weak) repairs

sets of actions that make the bodies of all rules false
$\{-a\}$, $\{-b\}$, $\{+c\}$, $\{+d\}$
$\rightsquigarrow$ ignore the indications given by heads of rules

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founded repairs if you remove an action, there is a rule telling you to put it back
$\{-a\}$, $\{+c\}$
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no simple explanation (and no simple example)

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$\rightsquigarrow$ see previous sentences (also: way too restrictive)

grounded fixpoints

motivation

(boghaerts *et al.* 2015)
. . . fixpoints that can be built "from the ground up"

- no circularity?
- not too restrictive?

grounded fixpoints

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definition given an operator $\mathcal{O} : L \to L$, where L is a complete lattice, an element $x \in L$ is

- *grounded* if $\forall_{v \in L}$, if $\mathcal{O}(v \wedge x) \leq v$, then $x \leq v$
- *strictly grounded* if $\nexists_{y \in L}$ with $y < x$ and $\mathcal{O}(y) \wedge x \leq y$

(these are equivalent for powerset lattices)

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$\rightsquigarrow$ grounded fixpoints capture models of several interesting logic frameworks. . . how about aics?

the marriage

normalized aics

a *normalized* aic contains only one action in its head

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the operator

given a set of normalized aics η and a database DB

$$\mathcal{T}_\eta^{DB}(\mathcal{U}) = \mathcal{U} \uplus \{\mathrm{head}(r) \mid \mathcal{U}(DB) \models \mathrm{body}(r)\}$$

(apply the actions to $\mathcal{U}(DB)$ and compare the result with DB)

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grounded repairs

grounded fixpoints of $\mathcal{T}_\eta^{DB}$ are grounded repairs for DB and η

the nice generalization

theorem

- all grounded repairs are founded
- all justified repairs are grounded
- inclusions are strict, avoid problematic cases
- simple characterization: $\mathcal{U}$ is grounded if

$$\text{if } \mathcal{V} \subsetneq \mathcal{U} \text{ then } \mathcal{T}_\eta^{DB}(\mathcal{V}) \cap (\mathcal{U} \setminus \mathcal{V}) \neq \emptyset$$

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benefits

- generalizes to the non-normalized case (see paper)
- not driven by syntax
- suggests generalization to non-deterministic operators

thank you!