

Minimal Models for Modal Logics

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(Minimal) Model Generation

Useful for several tasks:

- hardware and software verification
- fault analysis
- commonsense reasoning
- ...

Minimality criteria for classical logics:

- domain minimality
- minimisation of a certain set of predicates
- minimal Herbrand models

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What are minimality criteria for modal logics?

Minimality Criteria for Modal Logics

From classical logics (e.g. through a translation-based approach)

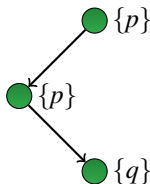
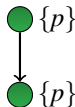
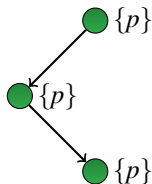
- domain minimality
- minimisation of a certain set of predicates
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A more “modal” minimality criterion

- minimal under bisimulation

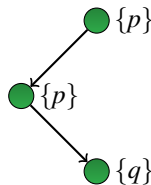
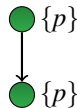
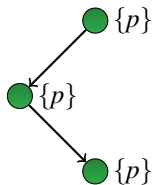
Minimality Criteria by Example

$$p \wedge (\diamond p \vee (\diamond p \wedge \square \diamond (p \vee q)))$$



Minimality Criteria by Example

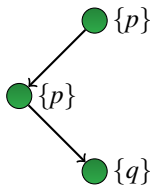
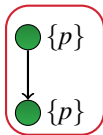
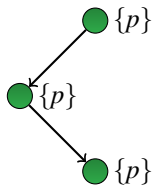
$$p \wedge (\diamond p \vee (\diamond p \wedge \square \diamond (p \vee q)))$$



Domain Minimal Models

Minimality Criteria by Example

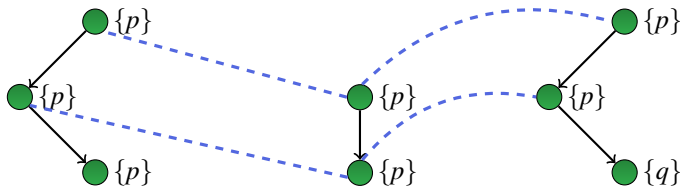
$$p \wedge (\diamond p \vee (\diamond p \wedge \square \diamond (p \vee q)))$$



Minimal Herbrand Model

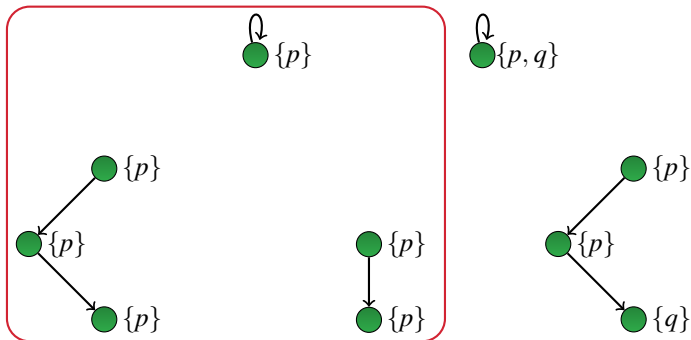
Minimality Criteria by Example

$$p \wedge (\diamond p \vee (\diamond p \wedge \square \diamond (p \vee q)))$$



Minimality Criteria by Example

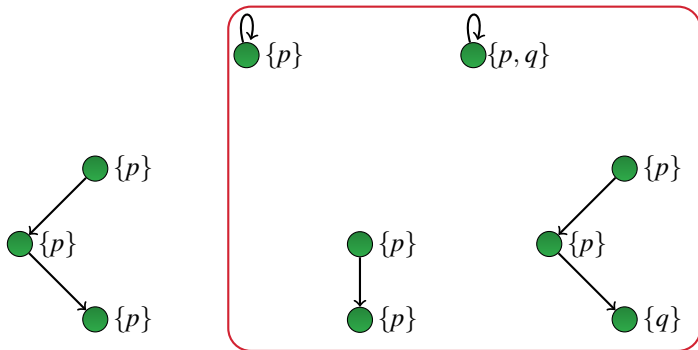
$$p \wedge (\diamond p \vee (\diamond p \wedge \square \diamond (p \vee q)))$$



Minimising q

Minimality Criteria by Example

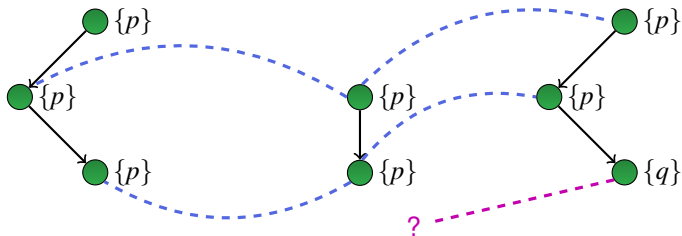
$$p \wedge (\diamond p \vee (\diamond p \wedge \square \diamond (p \vee q)))$$



Minimal under Bisimulation

Minimality Criteria by Example

$$p \wedge (\diamond p \vee (\diamond p \wedge \square \diamond (p \vee q)))$$



Thank You!