Preference-based Argumentation

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Outline

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- The core of an argument: Reasons + a claim
  - Reason: Because Tweety is a bird and birds fly
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- Argumentation can be used for:
  - Internal agent's reasoning
  - Modelling interactions between agents

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- **premise/reason**:

  John has political responsibilities

  and

  $\mathcal{I}$ is in the national interest

  and

  if a person has pol. resp. and info about that person is in the national interest then that info should be published

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- A3 (John does have pol. resp. because he is now middle east envoy, and if a person...)

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Abstract argumentation theories (Dung 1995)

- An argumentation theory is a pair $\langle \mathcal{A}, \mathcal{R} \rangle$ where:
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  - The sets $\{a, b\}$, $\{b, c\}$ and $\{a, b, c\}$ are **not** conflict-free

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- Introduced by Von Neumann and Morgenstern in 1944

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- Reasoning with stable/admissible extensions is hard
  - Deciding the existence of stable extensions is NP-hard
  - Deciding the existence of an non-empty admissible extension is NP-hard

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- This work: Study the properties of a specific Preference-based Argumentation Framework

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- A Preference-based Argumentation Theory (**PBAT**) is a pair $\langle \mathcal{A}, \mathcal{R} \rangle$:
  - $\mathcal{A}$ = a set of arguments
  - $(a, b) \in \mathcal{R}$ iff $(a, b) \in \mathcal{C}$ and $b \not\succ a$

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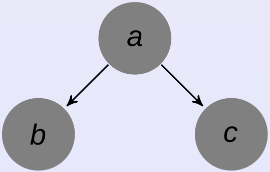

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- All results are based on transitivity

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- stable extensions = most preferred sets wrt $\rhd$ **permitted** by $\mathcal{C}$

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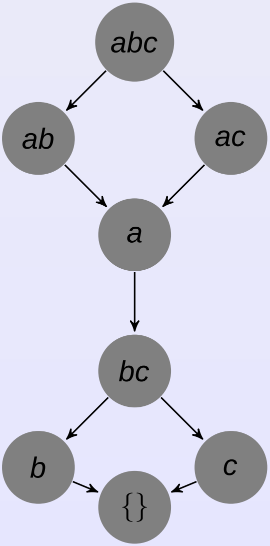

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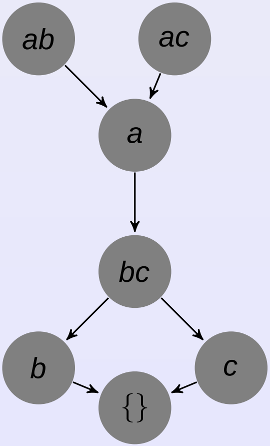

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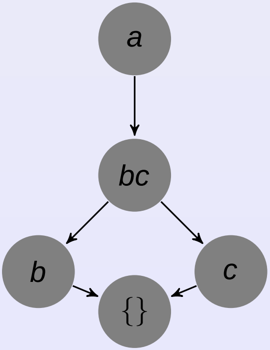

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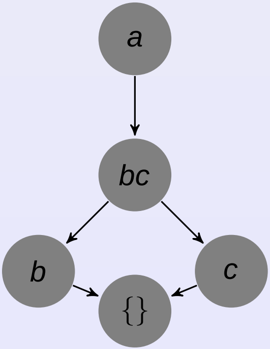

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- Key property: There **always exists** a ”self-defending” argument

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- Deciding whether *a* is included in every stable extension is co-NP-hard

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- The stable extensions can be computed with Polynomial Delay

Theories without incomparability

- Reasoning becomes a bit easier if there is no incomparability

  i.e. there are no $a, b \in \mathcal{A}$ s.t. $a \not\succeq b$ and $b \not\succeq a$

- Key Properties
  - Correspondence between the stable extensions of T and Maximal Independent Sets of $\mathcal{G}_T$
  - Maximal Independent Sets can be computed with Polynomial Delay

- The stable extensions can be computed with Polynomial Delay

- Exponential worst case behavior

  A theory with n arguments can have $n^{n/3}$ stable extensions

Negotiation

- Negotiation: search for a mutually acceptable **agreement** between two (or several agents) on one or more issues

- Offers ranked by their utility

  Reservation value

- Alternate Offers Protocol

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  - Can I accept an offer that I have previously rejected?
  - Issue by issue?

PBA and Negotiation

- Offers supported by arguments

  Argument preference determines offer preference

  Best offer is supported by the most preferred argument

- Performatives: *Propose*, *Argue*, *Reject*, *Agree*, *Nothing*, *Withdraw*....