Introducing Ontological CP-nets

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User profile

Sci-Fi movies
Action movies
Jogging
Listen to music
Talk about the weather

Quantitative Preferences

Sci-Fi movies [0.7]

Action movies [0.6]

Listen to music while jogging [0.8]

Talk about the weather while jogging [0.1]

Qualitative Preferences

Sci-Fi movies $\succ$ Action movies

while jogging | Listen to music $\succ$ Talk about the weather

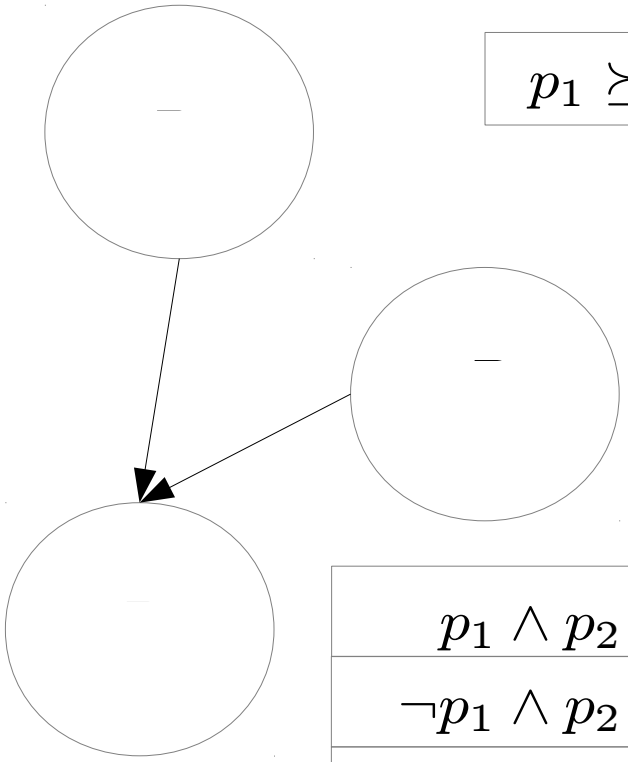
Conditionally Preferentially Independent (CPI)

- $A, B \in \mathcal{V}$ two variables
- $\mathcal{R} \subset \mathcal{V}$ s.t. A, B and $\mathcal{R}$ partition $\mathcal{V}$

Given $\rho \in \mathcal{R}$, A is CPI of B iff

- for all $\alpha_1, \alpha_2 \in A$ and $\beta_1, \beta_2 \in B$ we have: $\alpha_1\beta_1\rho \succ \alpha_2\beta_1\rho$ iff $\alpha_1\beta_2\rho \succ \alpha_2\beta_2\rho$.

CP-Nets



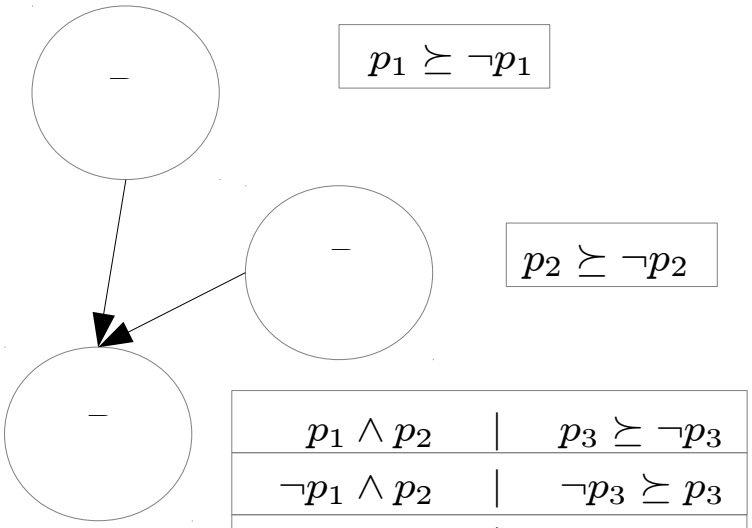
$$p_1 \succeq \neg p_1$$

$$p_2 \succeq \neg p_2$$

$p_1 \wedge p_2$	$p_3 \succeq \neg p_3$
$\neg p_1 \wedge p_2$	$\neg p_3 \succeq p_3$
$p_1 \wedge \neg p_2$	$\neg p_3 \succeq p_3$
$\neg p_1 \wedge \neg p_2$	$p_3 \succeq \neg p_3$

Semantics

- **Worsening flip**: a change in the value of a variable to a value which is less preferred by the conditional preference statement for that variable



$p_1 \wedge p_2$	$p_3 \succeq \neg p_3$
$\neg p_1 \wedge p_2$	$\neg p_3 \succeq p_3$
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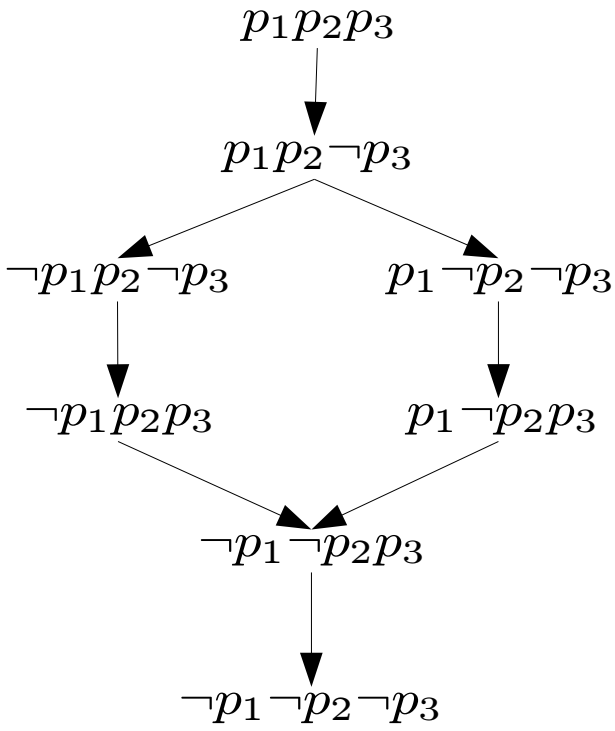


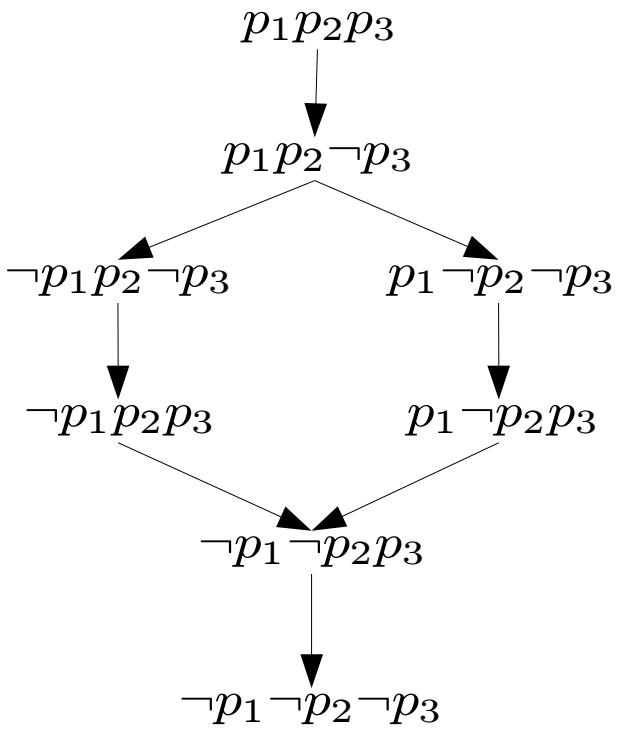
Inference

- Dominance query:
  given two outcomes o_1 and o_2, decide wether
  $o_1 \succ o_2$

- Outcome Oprimization:
  find the optimal outcome (if any)

Constrained CP-nets

- A CP-net whose variables are constrained via a set of constraints $\mathcal{C}$



Constrained CP-nets

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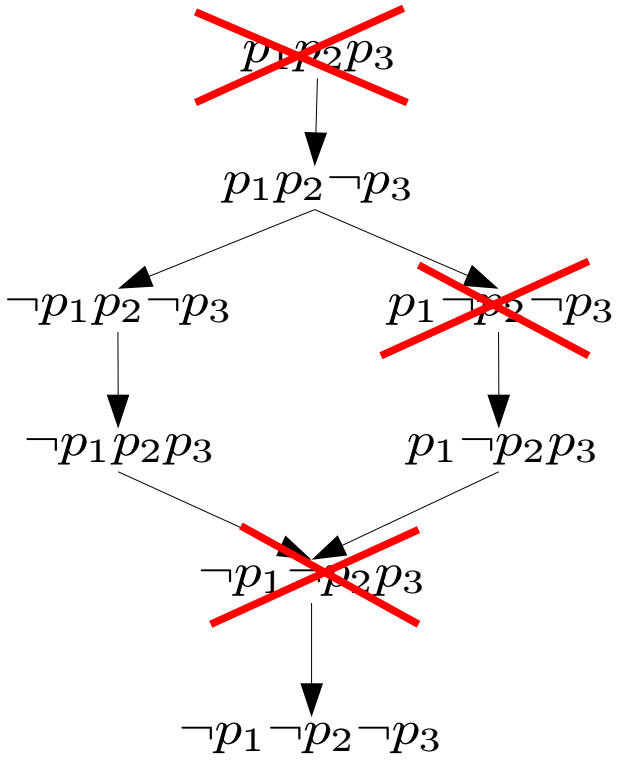

$$\mathcal{C} = \begin{cases} \neg(P_1 \wedge P_2 \wedge P_3) \\ \neg(P_1 \wedge \neg P_2 \wedge \neg P_3) \\ \neg(\neg P_1 \wedge \neg P_2 \wedge P_3) \end{cases}$$

Constrained CP-nets

- Satisfiability of a CP-net
- Feasible outcomes
- Eligibility of a set of CP-statements

$$(\alpha \succ \beta \mid \gamma) \quad \longmapsto \quad \alpha \Rightarrow \gamma$$

Ontological CP-Nets

- Variable values are DL formulas
- Formulas are satisfiable w.r.t an ontology
- Formulas are constrained via an ontology
- No equivalent cp statements

Ontological CP-nets

- Implicitly constrained variables
- (Un)Satisfiable preferences

  $(\alpha \succ \beta \mid \gamma) \quad \longmapsto \quad (\alpha \Rightarrow \gamma) \sqcap (\alpha \Rightarrow \neg\beta)$
- Outcome definition
  - Clause encoding
- Dominance and eligibilty testing
- Complexity of reasoning

Thank you