FUN with Complexity: Walking through Doors is Hard, even without Staircases

Manuel Frohn

RWTH Aachen

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Content

PSPACE-Complexity

A given problem requires a polynomial amount of memory in relation to the input, to be solved ⇔ The problem is in PSPACE

SAT
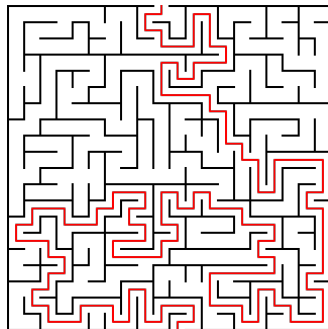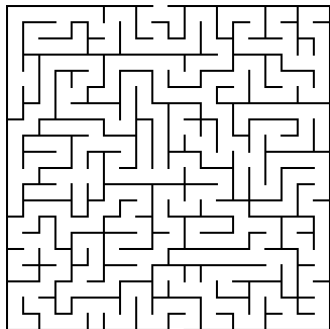
$x_1 \wedge x_2 \vee \neg x_3$

Quantified SAT

$\forall x_1 \exists x_2 : x_1 \wedge x_2 \vee \neg x_3$
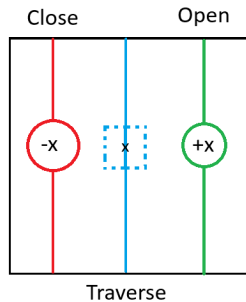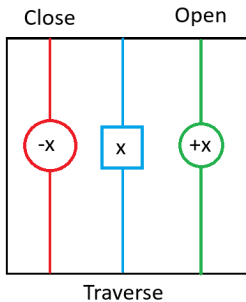
1-PlayerMotionPlaning

Given: Enviroment, Agent, Goal
Question: Is the goal achivable

Basic Door Device

PSPACE-hardness of doors

Theorem

*If a game features **door devices** which each are controled by an* *open* *and a* *close* ***preasure plate*** *and the agent has to navigate from entrance to exit, then the game is **PSPACE-hard***
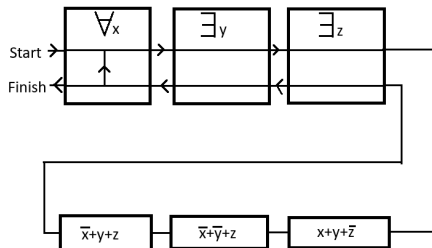
PSPACE-hardness of doors - Proof

True Quantified SAT

$\forall x \exists y \exists z : (\overline{x} \lor y \lor z) \land$

$(\overline{x} \lor \overline{y} \lor z) \land (\lor x \lor y \lor \overline{z})$

1-Player   Motion   Planning

Clause
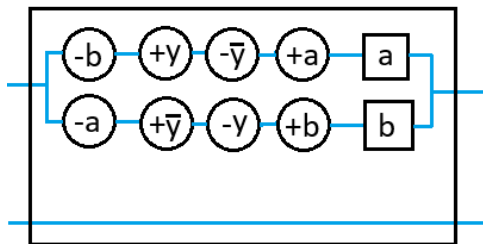
$(\overline{x} \lor y \lor z)$
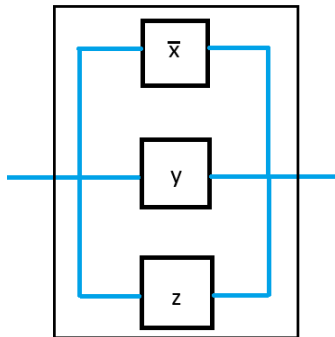
Gadget

PSPACE-hardness of doors - Proof

Exists-Quantor
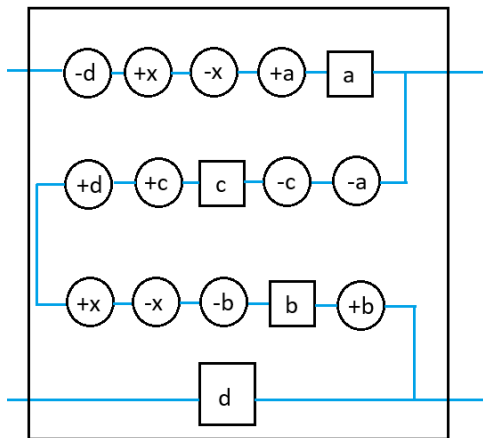
$$\exists y$$

Gadget

PSPACE-hardness of doors - Proof
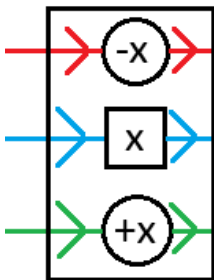
All-Quantor

$$\forall x$$
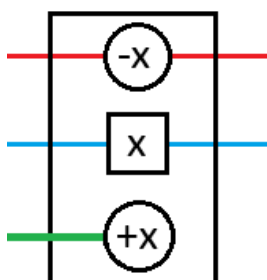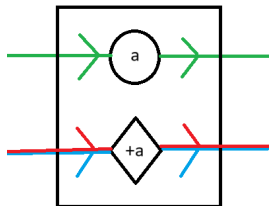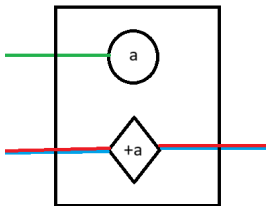
Gadget

Door Device - Variants

Self closing doors

Self closing doors - Variants
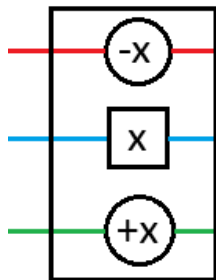
Directed   **Open-Optional**s   **Symetric**