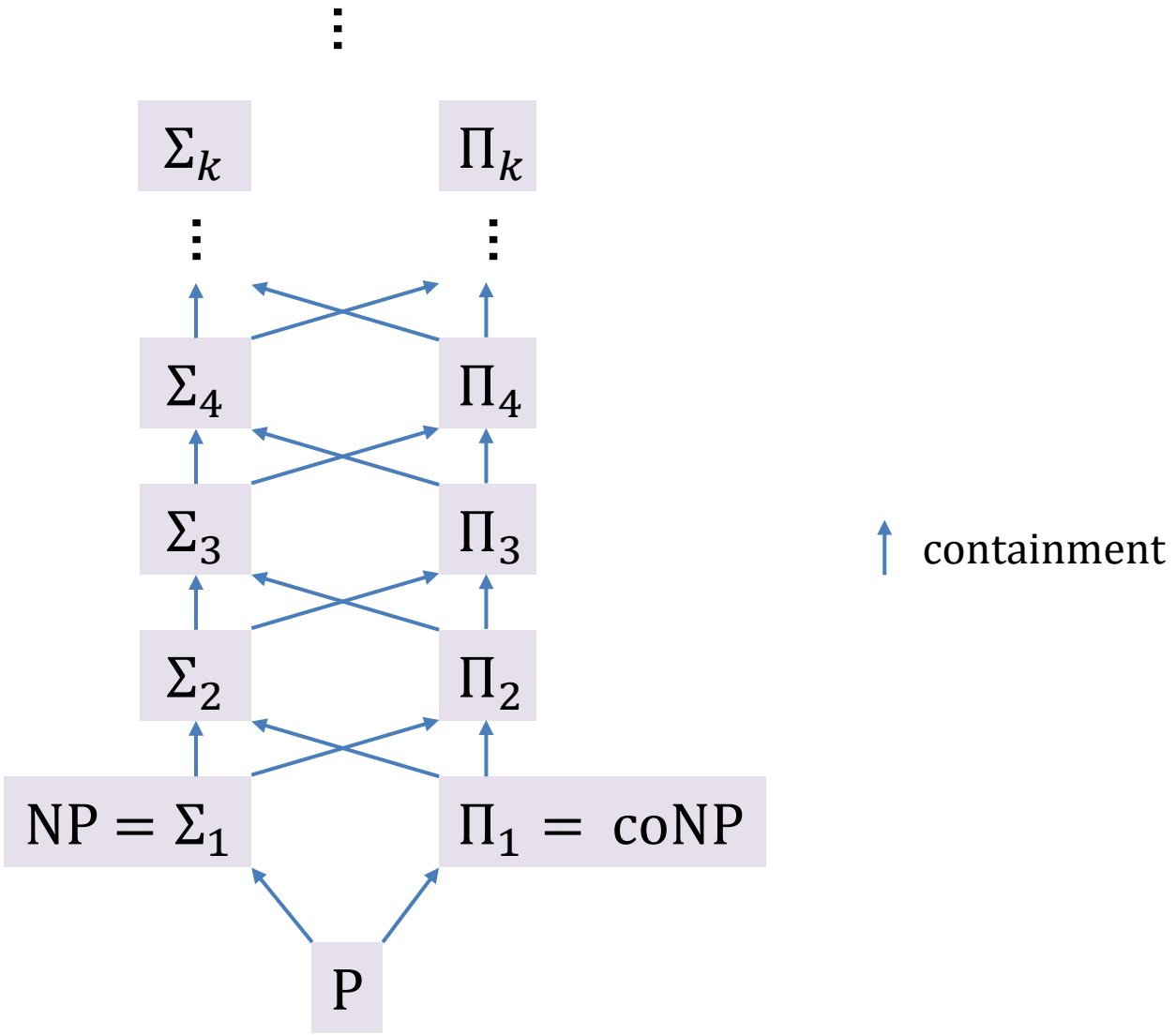
PSPACE

Polynomial Hierarchy



http://ovid.cs.depaul.edu/documents/phcom.pdf

Completeness in the Polynomial-Time Hierarchy
A Compendium*

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Abstract

We present a Garey/Johnson-style list of problems known to be complete for the second and higher levels of the polynomial-time Hierarchy (polynomial hierarchy, or **PH** for short). We also include the best-known hardness of approximation results. The list will be updated as necessary.

A General Theory of Motion Planning Complexity: Characterizing Which Gadgets Make Games Hard

Erik D. Demaine* Dylan H. Hendrickson* Jayson Lynch*

https://arXiv.org/abs/1812.03592

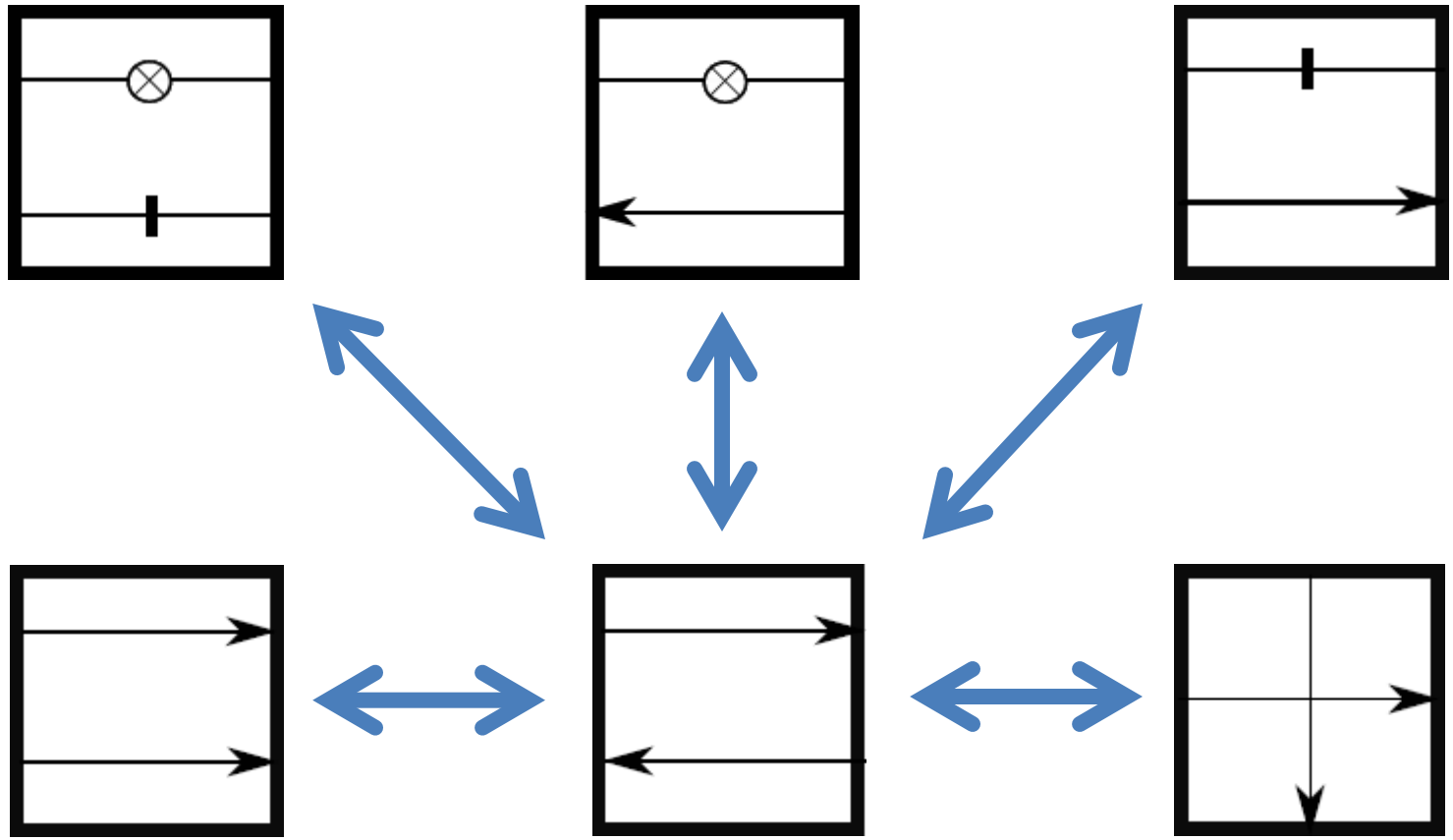
Abstract

We build a general theory for characterizing the computational complexity of motion planning of robot(s) through a graph of "gadgets", where each gadget has its own state defining a set of allowed traversals which in turn modify the gadget's state. We study two families of such

	1-Player Game	2-Player Game	Team Game
Polynomially Bounded (DAG)	**NL** vs. **NP-complete**: full characterization [§5]	**P** vs. **PSPACE-complete**: full characterization [§6]	**P** vs. **NEXPTIME**: full characterization [§7]
Polynomially Unbounded (reversible, deterministic gadgets)	**NL** vs. **PSPACE-complete**: full characterization [§2] **Planar**: equivalent [§2.3]	**P** vs. **EXPTIME-complete**: partial characterization [§3]	**P** vs. **RE-complete** (⇒ **Undecidable**): partial characterization [§4]

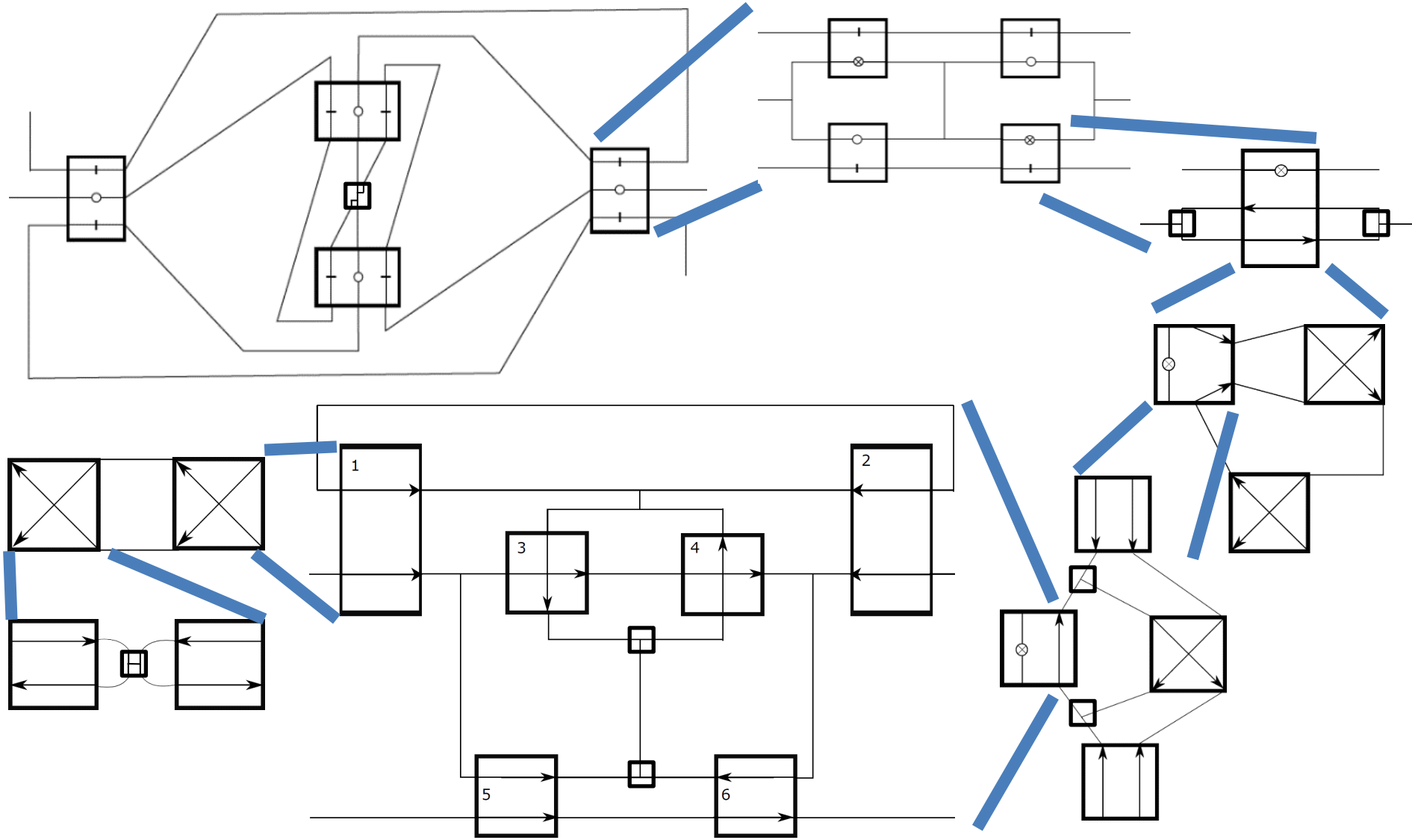
Everything Simulates Everything

[Demaine, Grosof, Lynch, Rudoy 2018]



Crossover Gadget

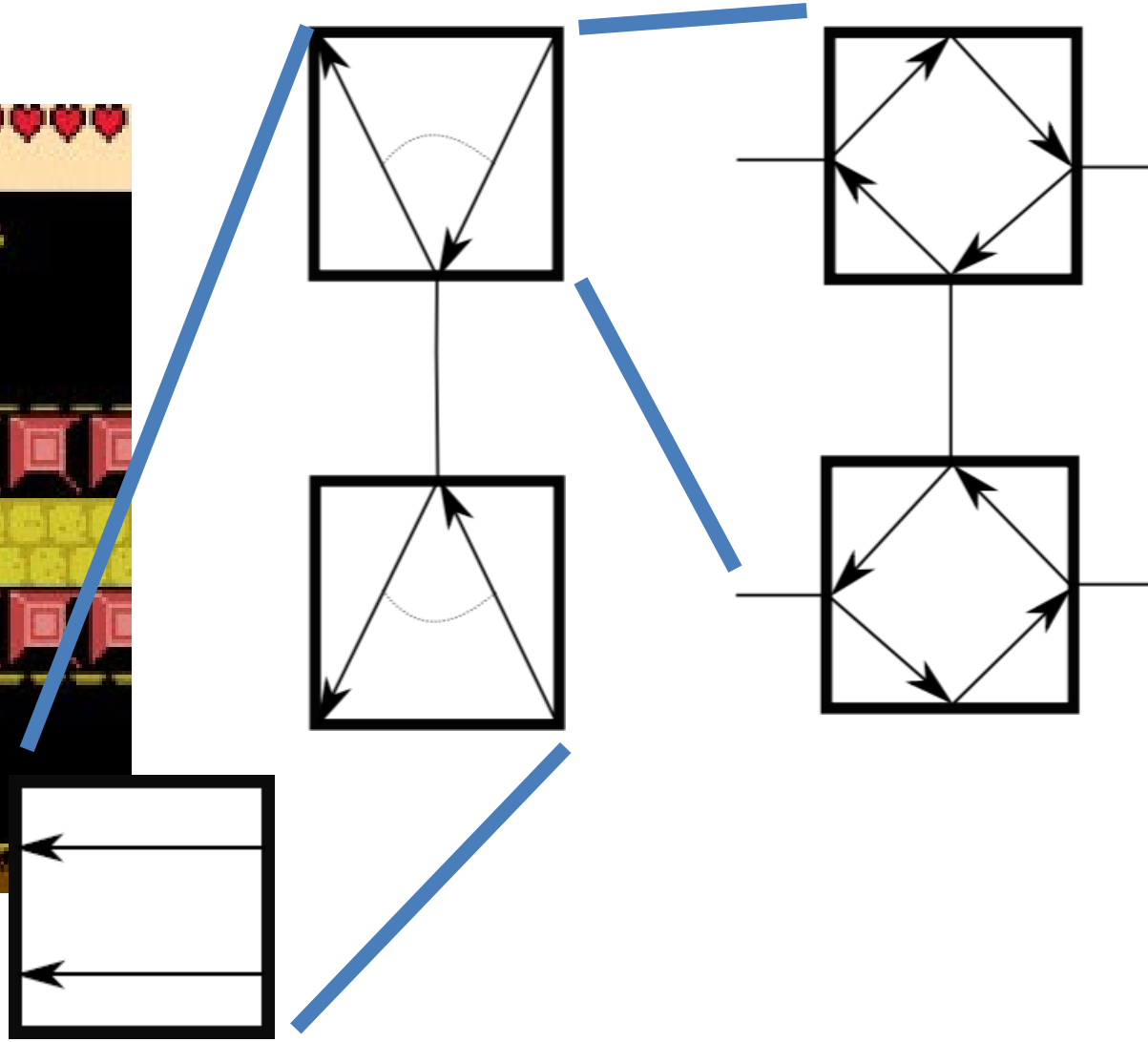
[Demaine, Grosof, Lynch, Rudoy 2018]



4-Spinners are PSPACE-hard

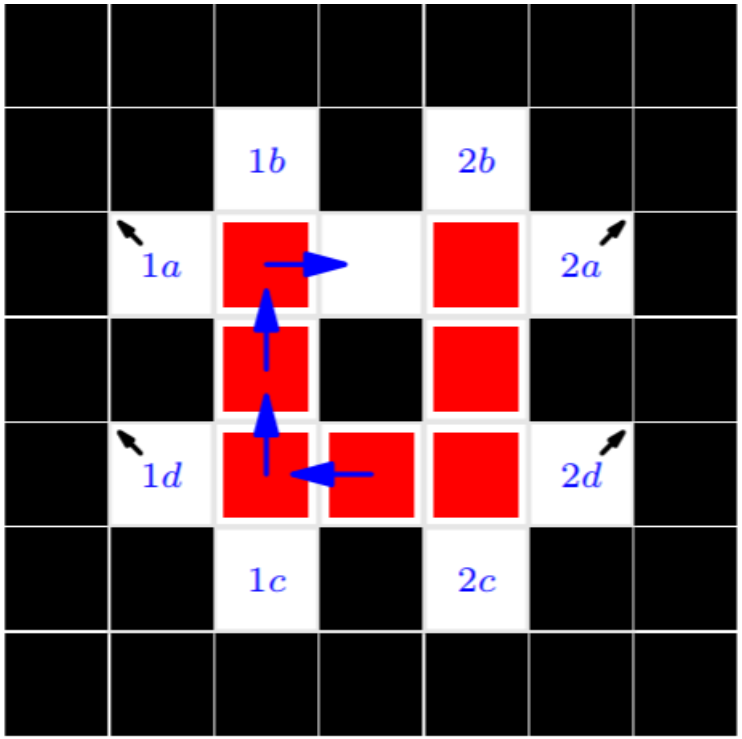
[Demaine, Grosof, Lynch, Rudoy 2018]

The Legend of Zelda:
Oracle of Seasons

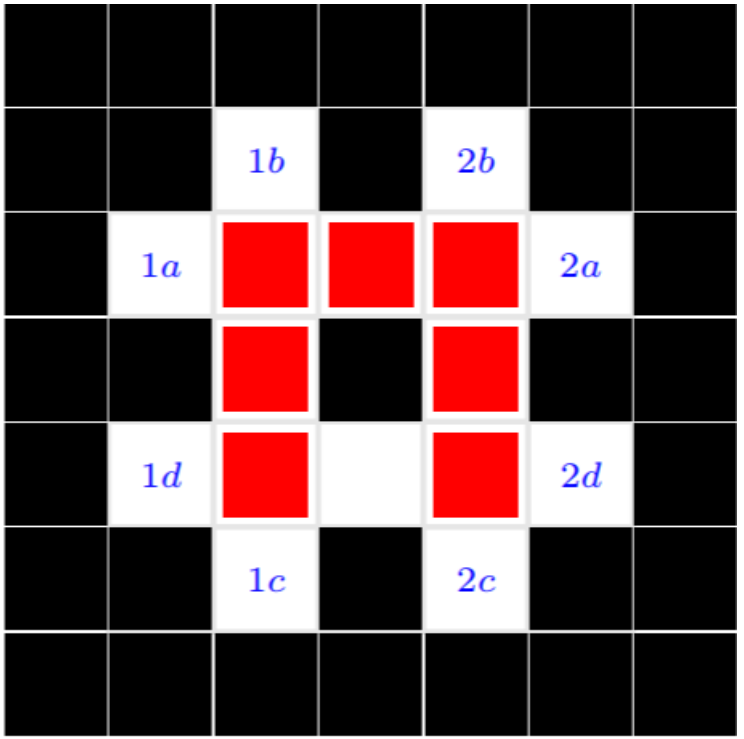


3D PushPull-1F is PSPACE-hard

[Demaine, Grosof, Lynch 2017]



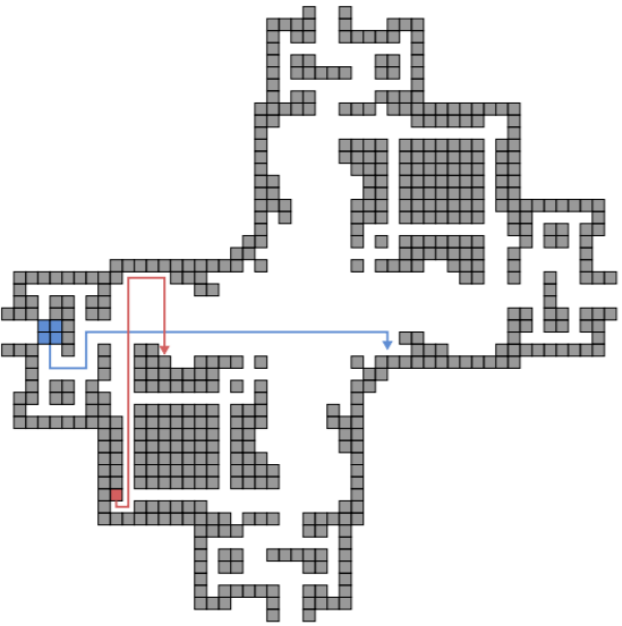
(a) 2-Toggle in state A. The arrows indicate the transition to state B.



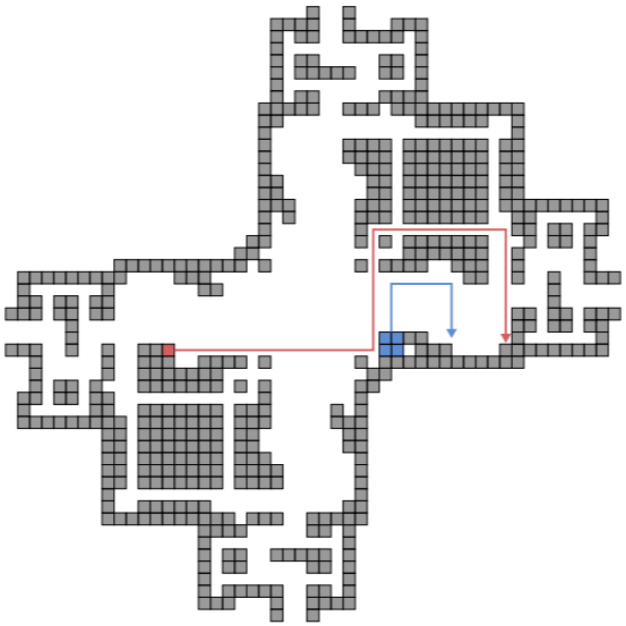
(b) 2-Toggle in state B.

Tilt Assembly is PSPACE-hard

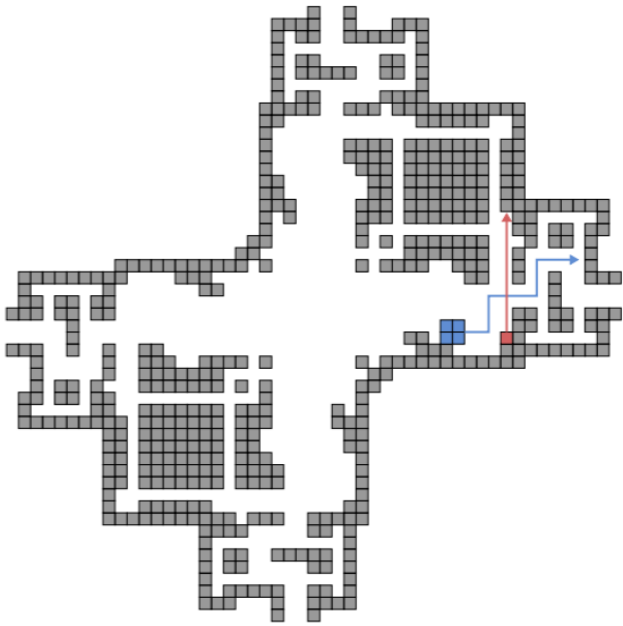
[Balanza-Martinez, Caballero, Cantu, Garcia, Luchsinger, Reyes, Schweller, Wylie 2019]



(a) $\langle S, E, N, E, S \rangle$



(b) $\langle E, N, E, S \rangle$



(c) $\langle E, N, E, N, E \rangle$

Crossing 2-toggle