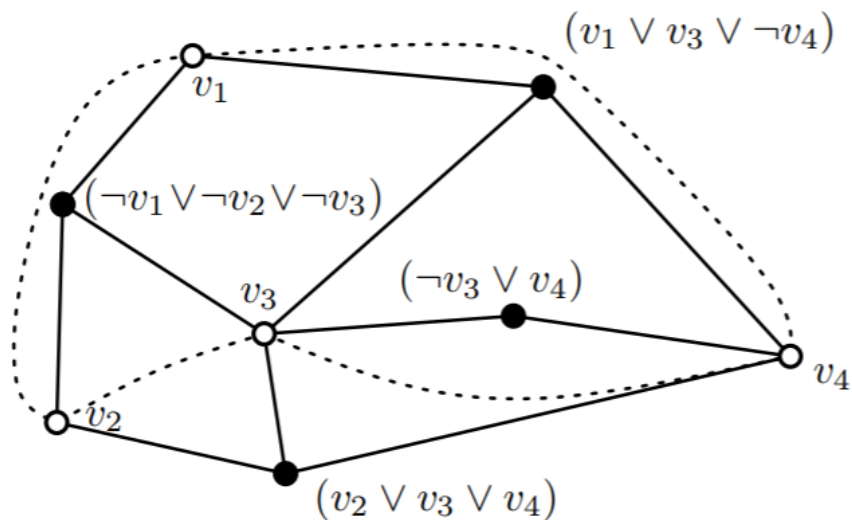


Linked Planar 3SAT

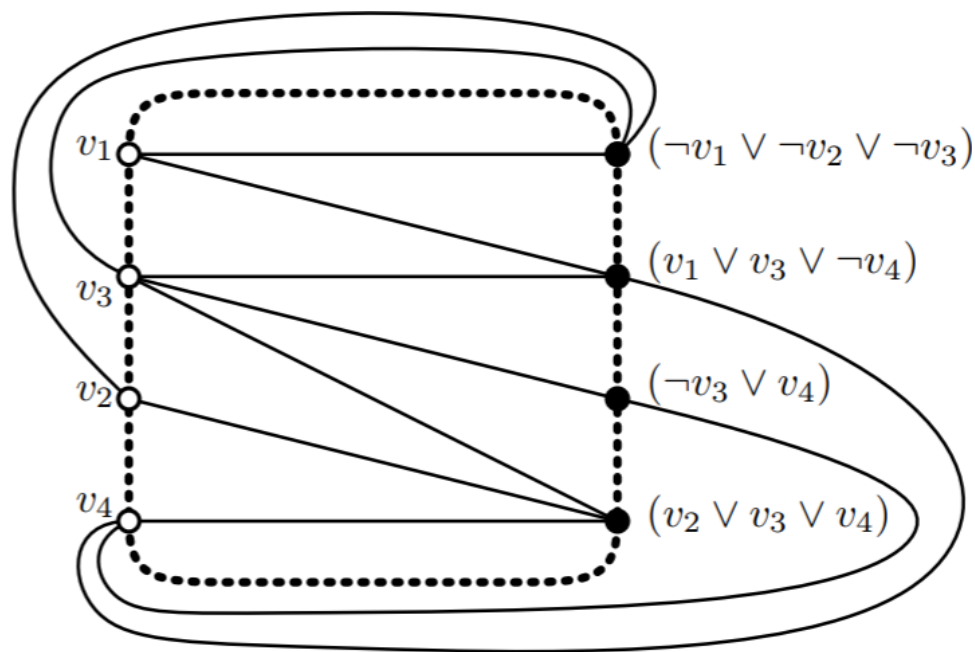
[Pilz 2018]

$$(v_1 \vee v_3 \vee \neg v_4) \wedge (\neg v_1 \vee \neg v_2 \vee \neg v_3) \\ \wedge (\neg v_3 \vee v_4) \wedge (v_2 \vee v_3 \vee v_4)$$



Planar 3SAT

$$(\neg v_1 \vee \neg v_2 \vee \neg v_3) \wedge (v_1 \vee v_3 \vee \neg v_4) \\ \wedge (\neg v_3 \vee v_4) \wedge (v_2 \vee v_3 \vee v_4)$$

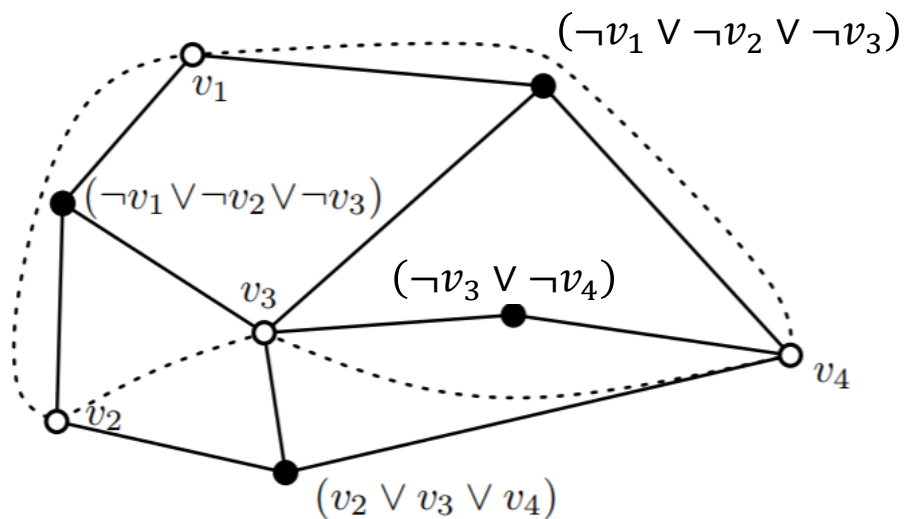


Linked Planar 3SAT

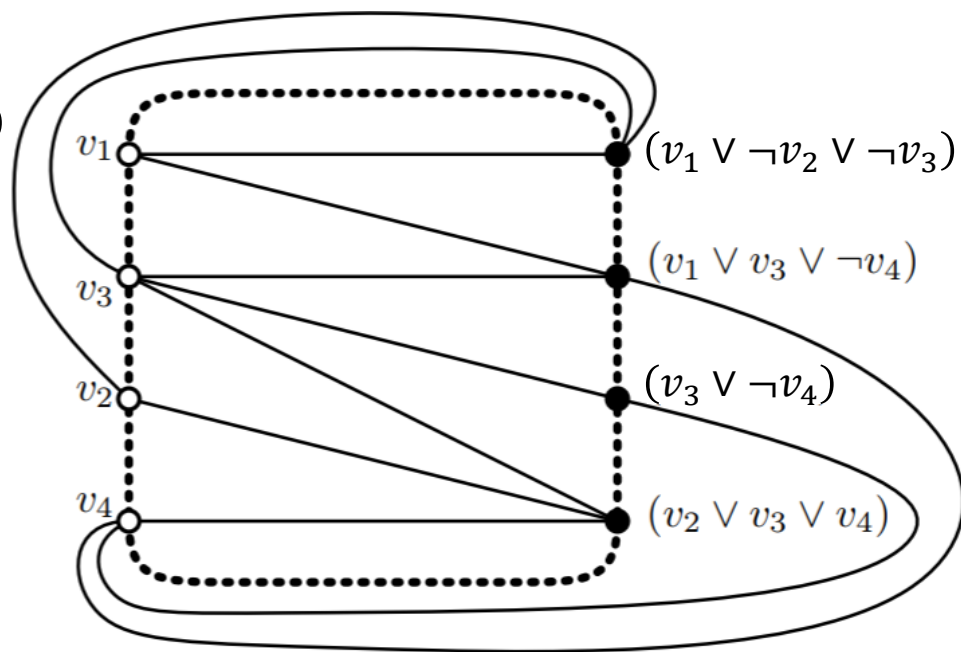
Linked Planar 3SAT

[Pilz 2018]

$$(\neg v_1 \vee \neg v_3 \vee \neg v_4) \wedge (\neg v_1 \vee \neg v_2 \vee \neg v_3) \\ \wedge (\neg v_3 \vee \neg v_4) \wedge (v_2 \vee v_3 \vee v_4)$$



$$(v_1 \vee \neg v_2 \vee \neg v_3) \wedge (v_1 \vee v_3 \vee \neg v_4) \\ \wedge (v_3 \vee \neg v_4) \wedge (v_2 \vee v_3 \vee v_4)$$

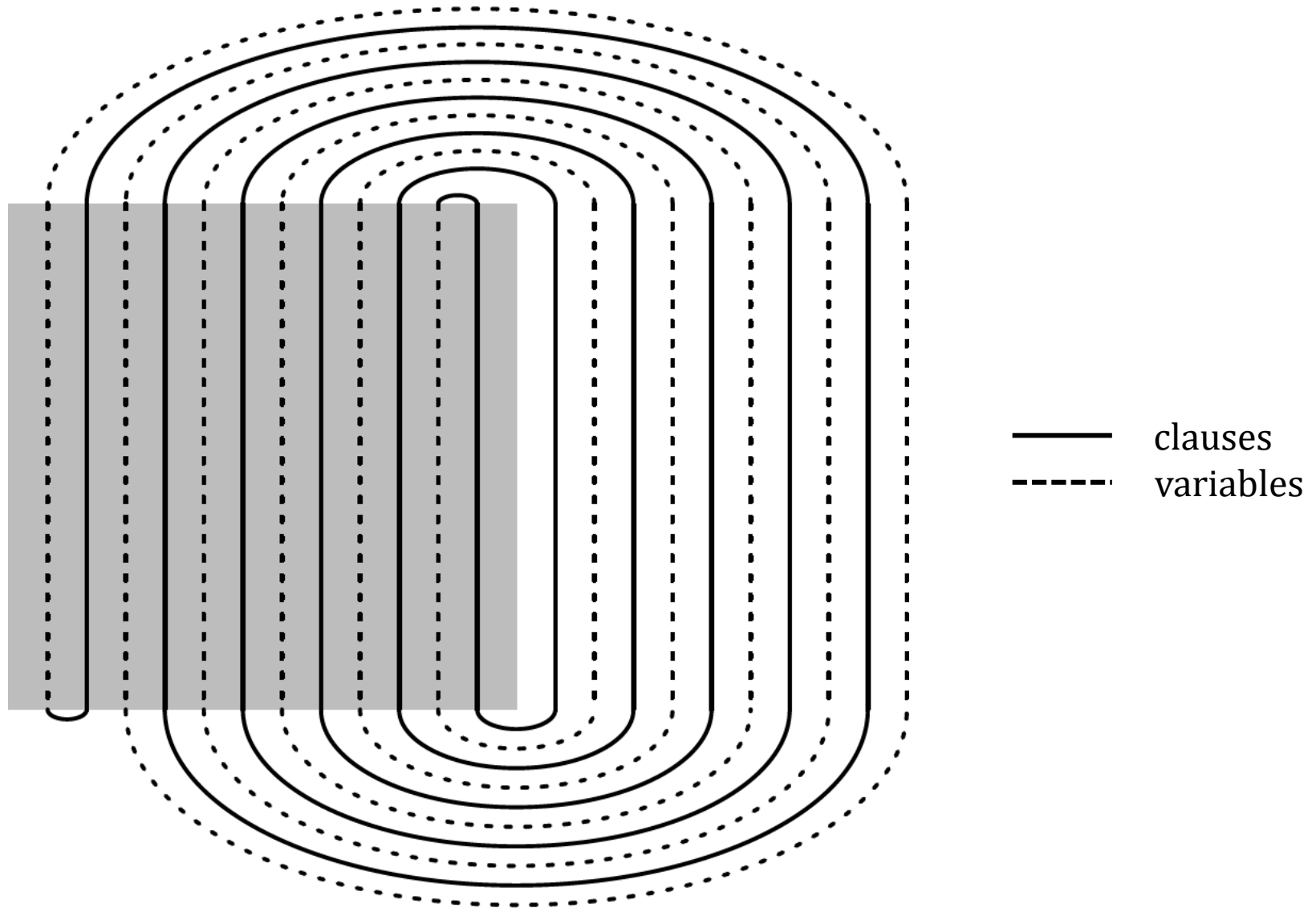


Planar Monotone 3SAT

Sided Linked Planar 3SAT



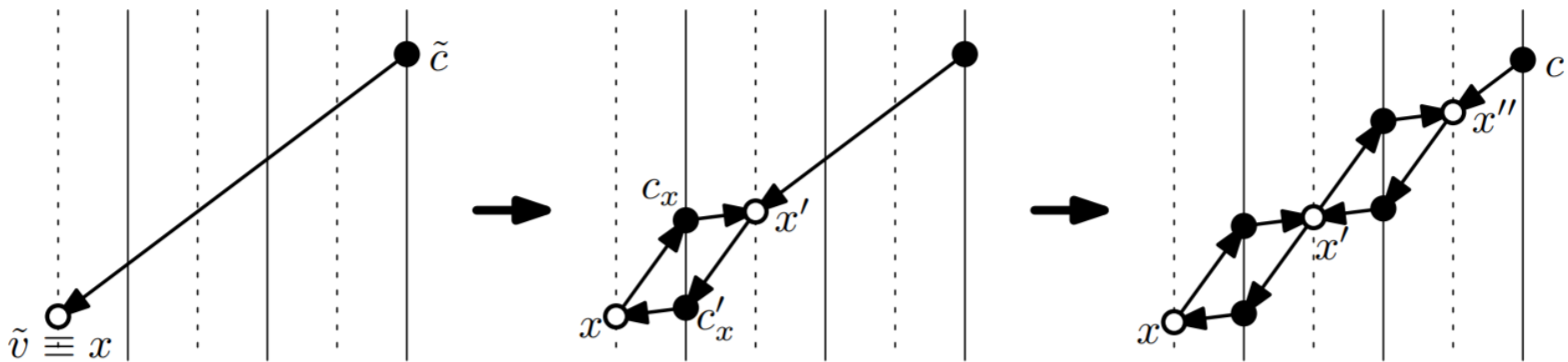
Linked Planar 3SAT is Hard [Pilz 2018]





Linked Planar 3SAT is Hard [Pilz 2018]

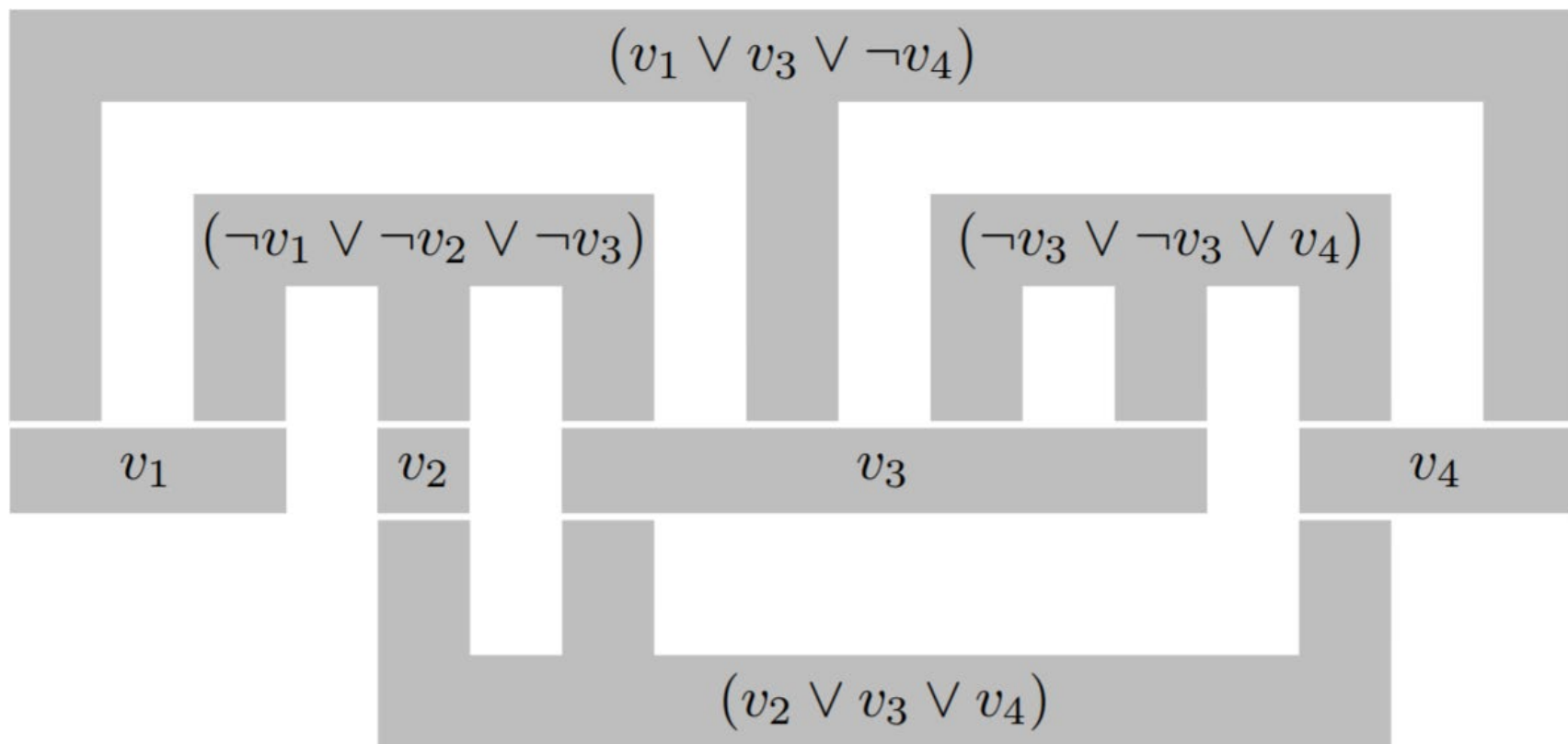
parsimonious



— clauses
- - - variables

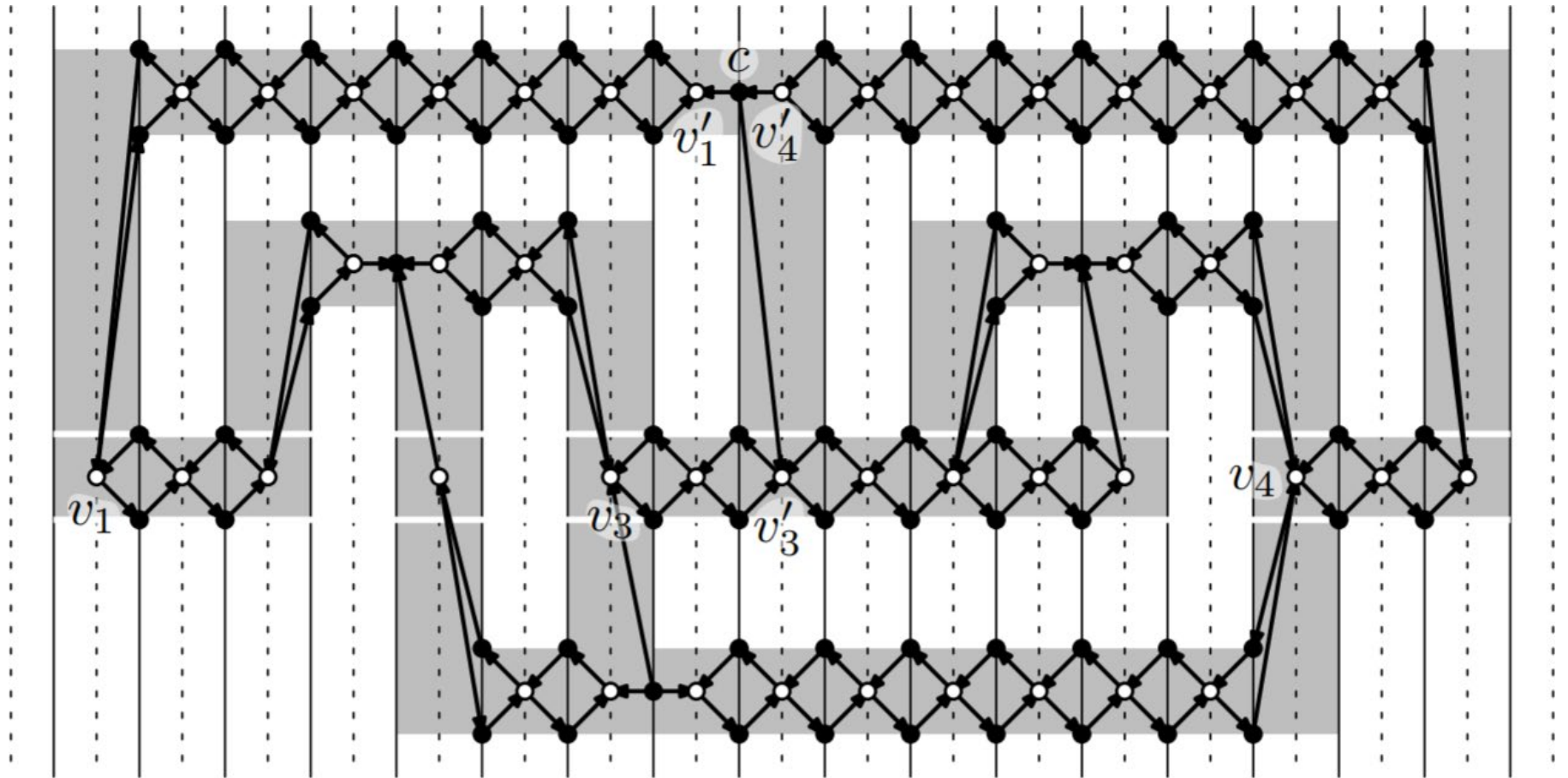


Linked Planar 3SAT is Hard [Pilz 2018]



Linked Planar 3SAT is Hard [Pilz 2018]

parsimonious



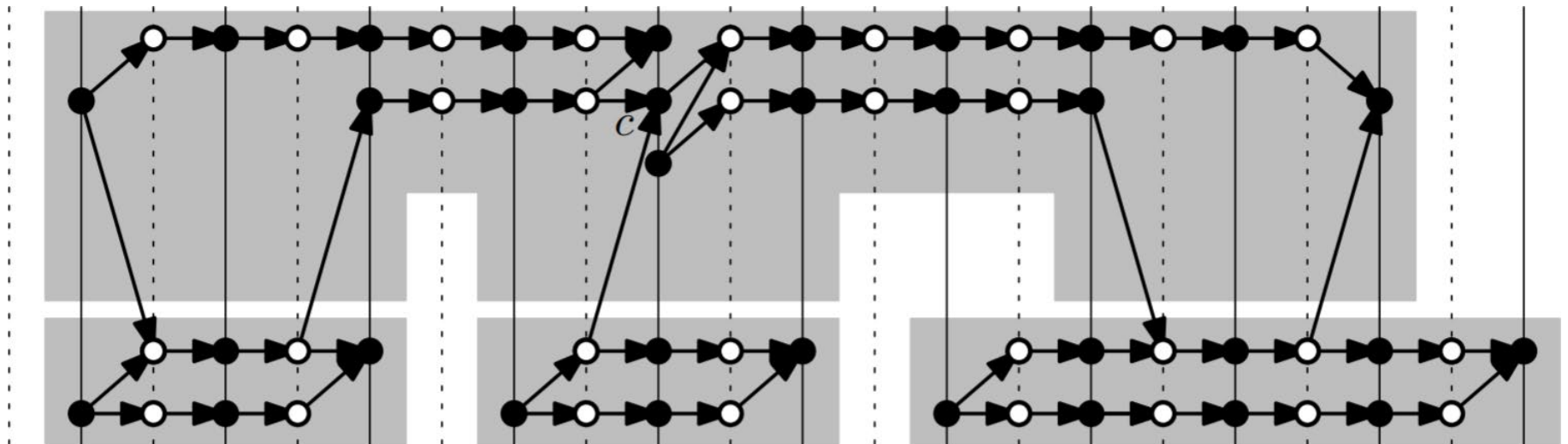
— clauses
- - - variables



Sided Linked Planar 3SAT-3 is Hard

[Pilz 2018]

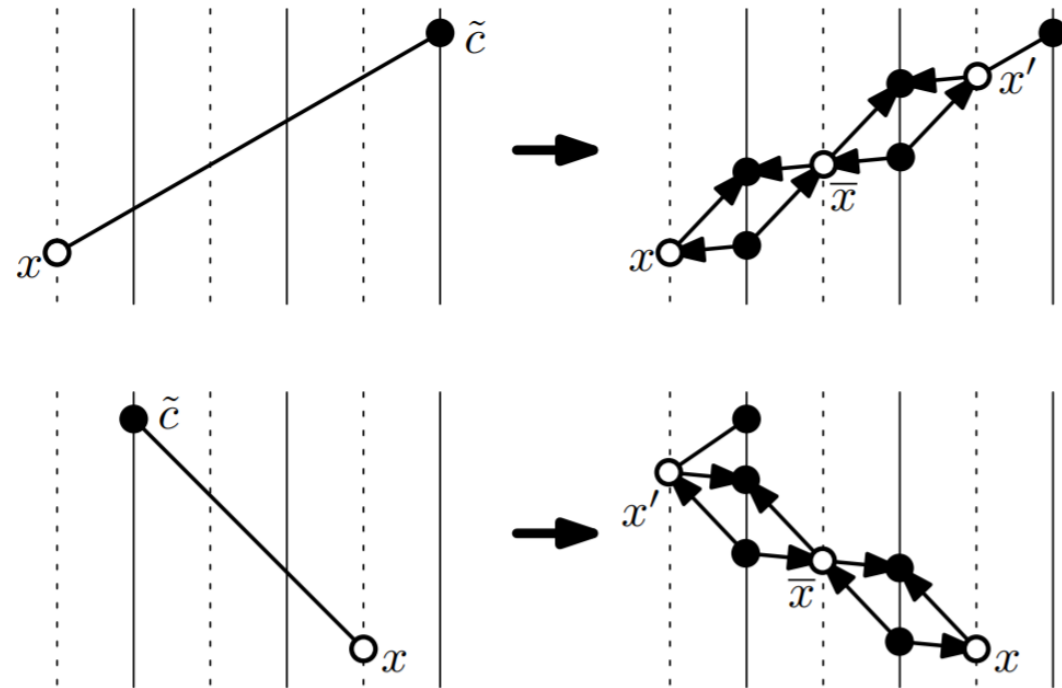
parsimonious



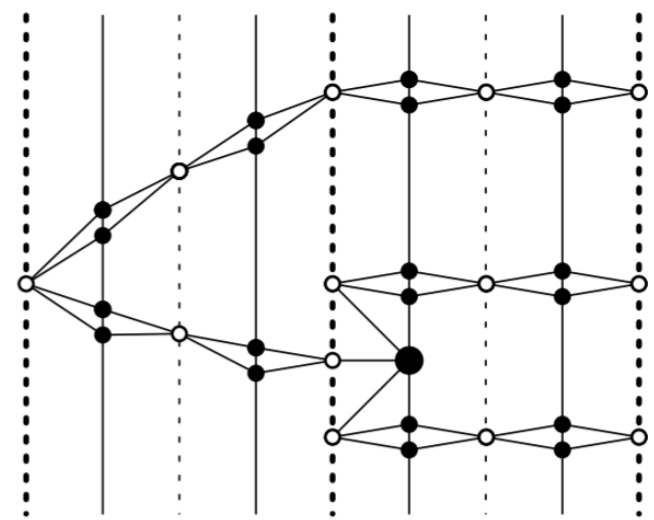
— clauses
- - - variables



Linked Planar Monotone 3SAT is Hard [Pilz 2018]



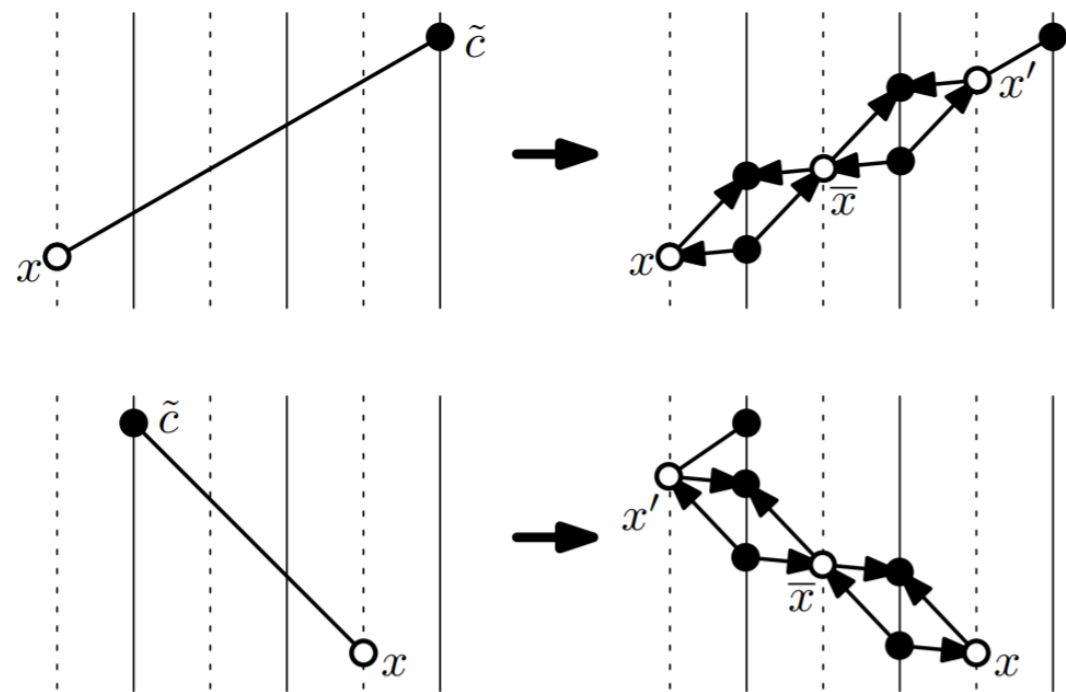
parsimonious



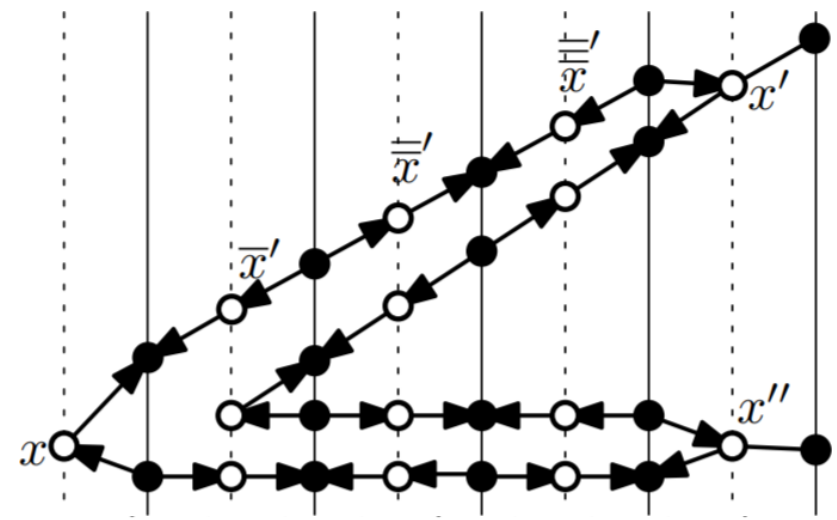
- clauses
- - - variables
- . - . (2 parities)



Linked Planar Monotone 3SAT-3 is Hard [Pilz 2018]



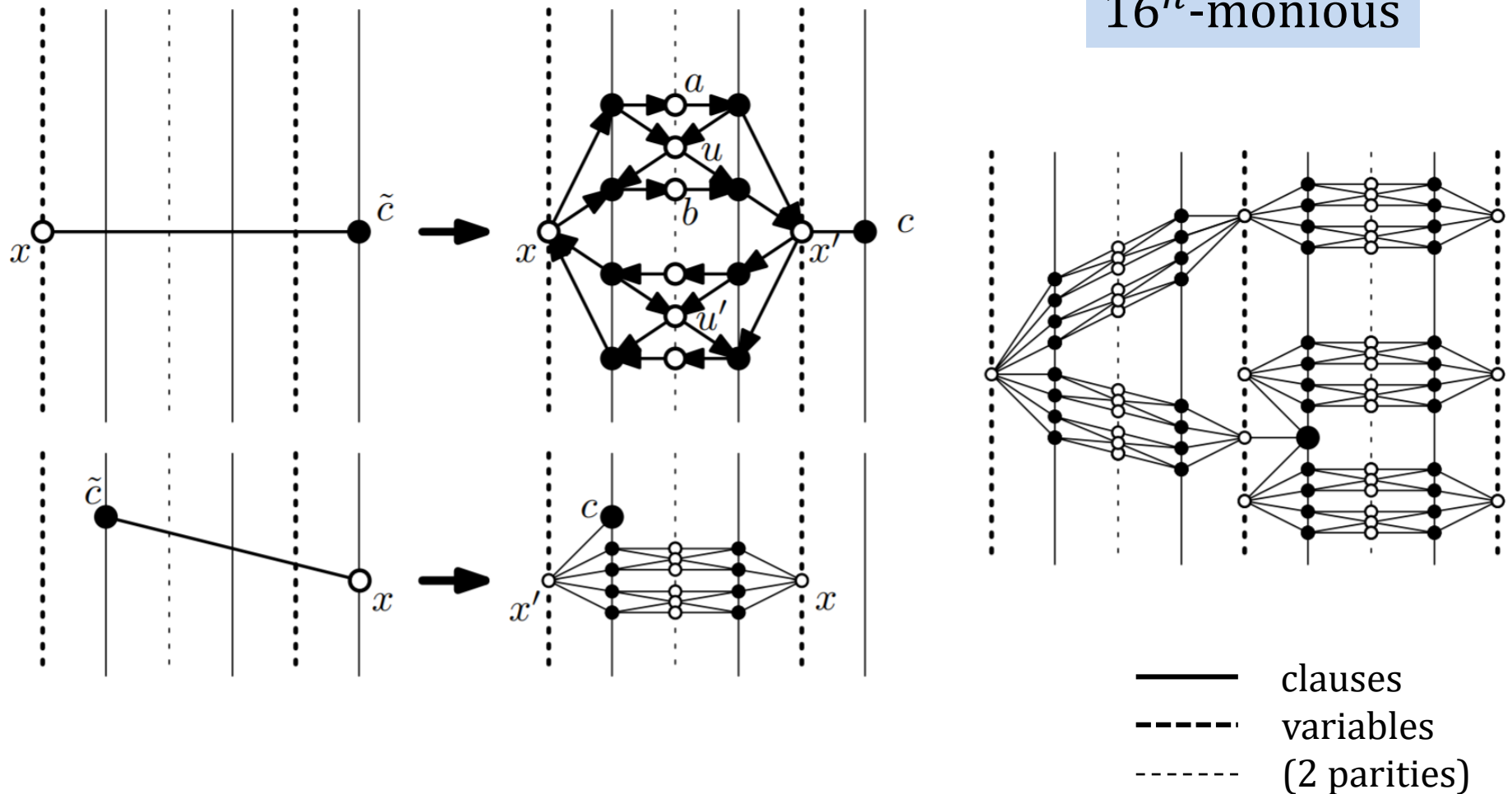
parsimonious



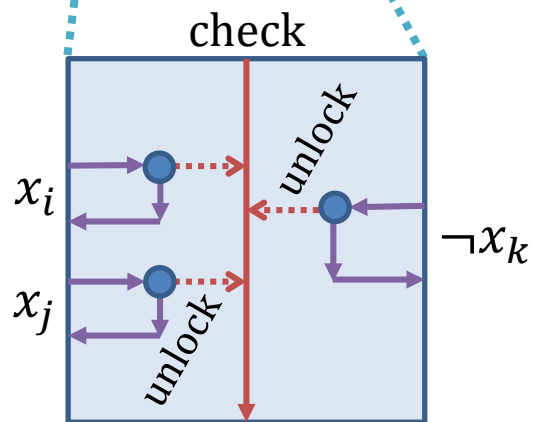
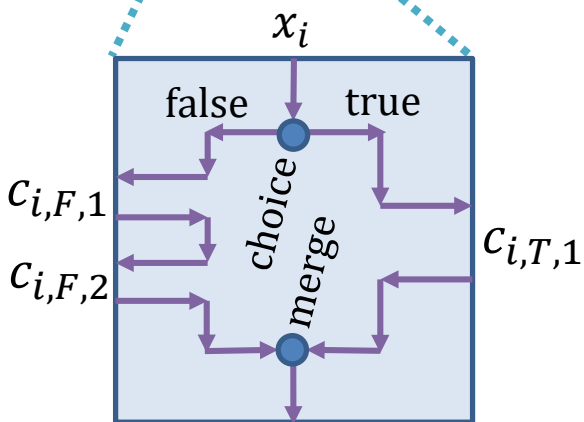
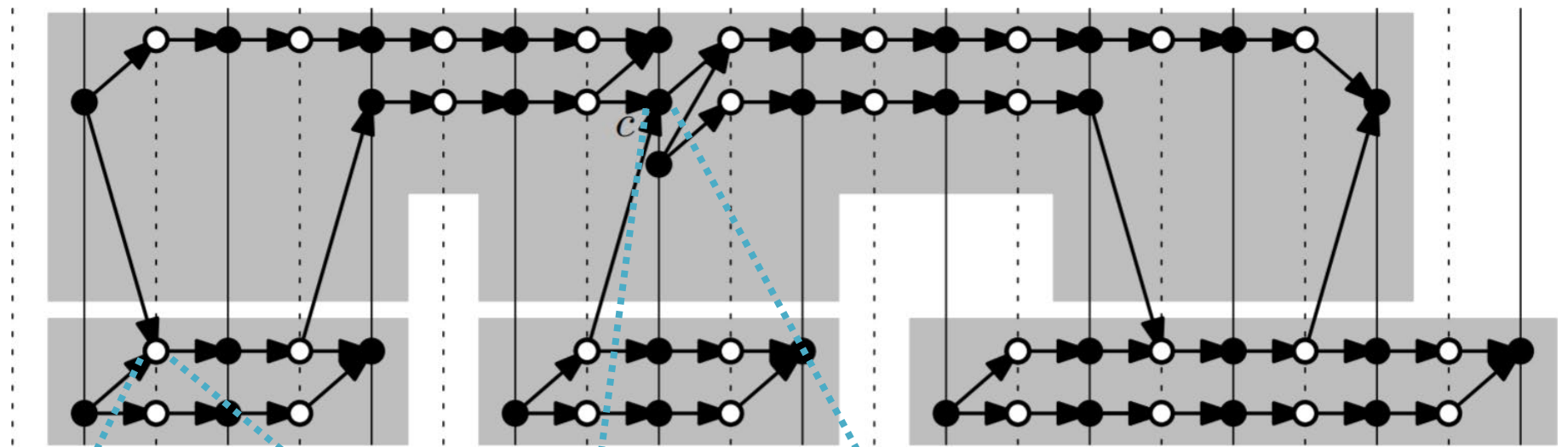
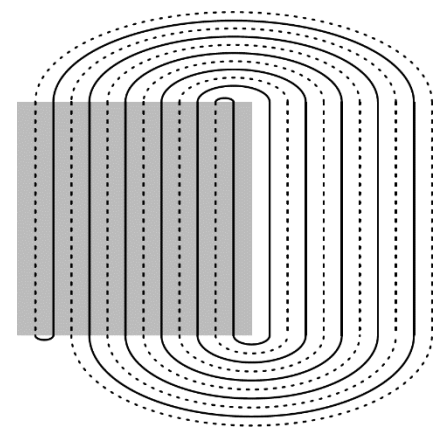
- clauses
- - - variables
- - - (2 parities)

Linked Planar E3SAT is Hard

[Pilz 2018]



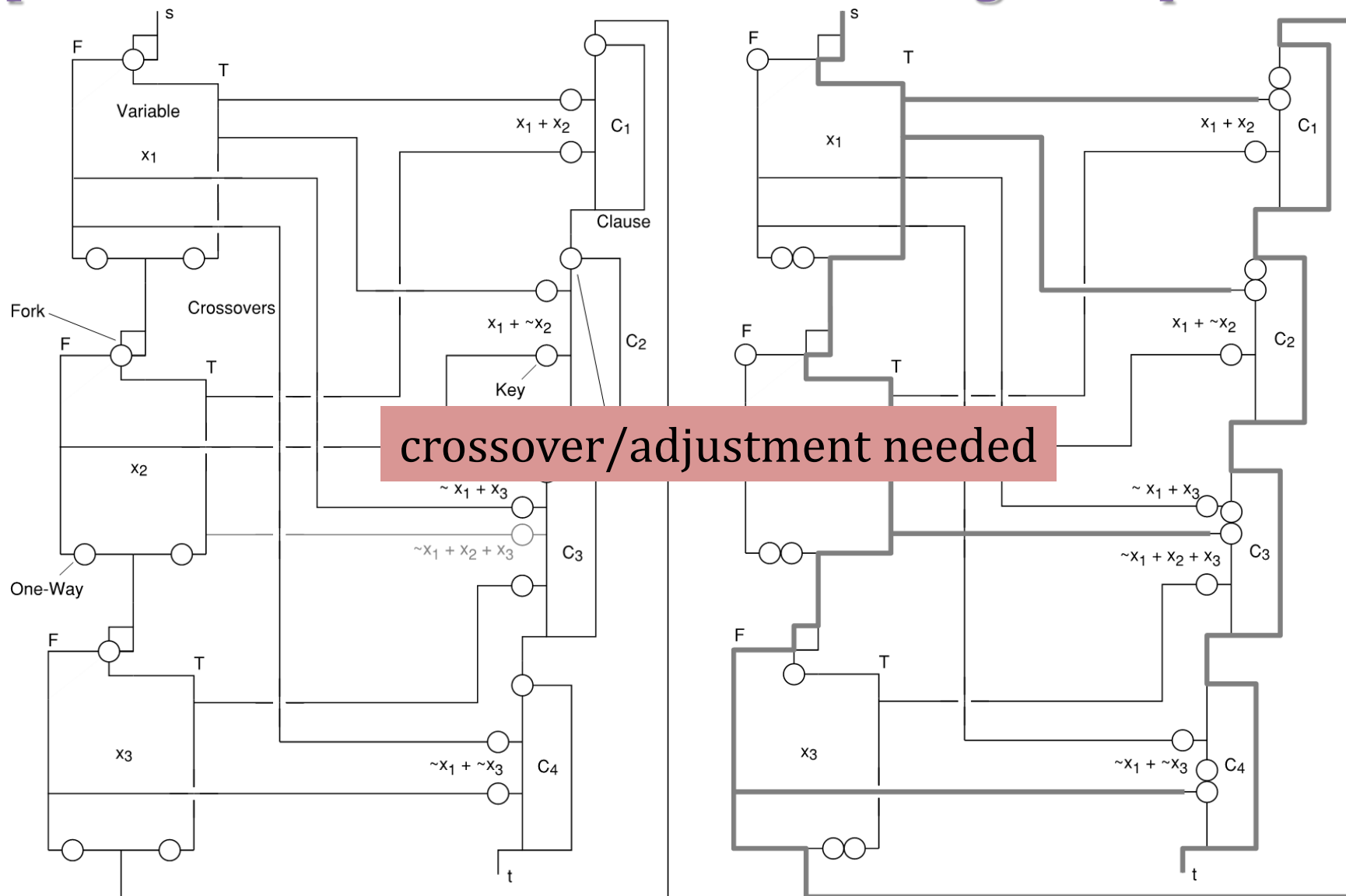
Reducing from Sided Linked Planar 3SAT-3



clause check line
 variable choice sequence

PushPush-1 is NP-hard in 3D

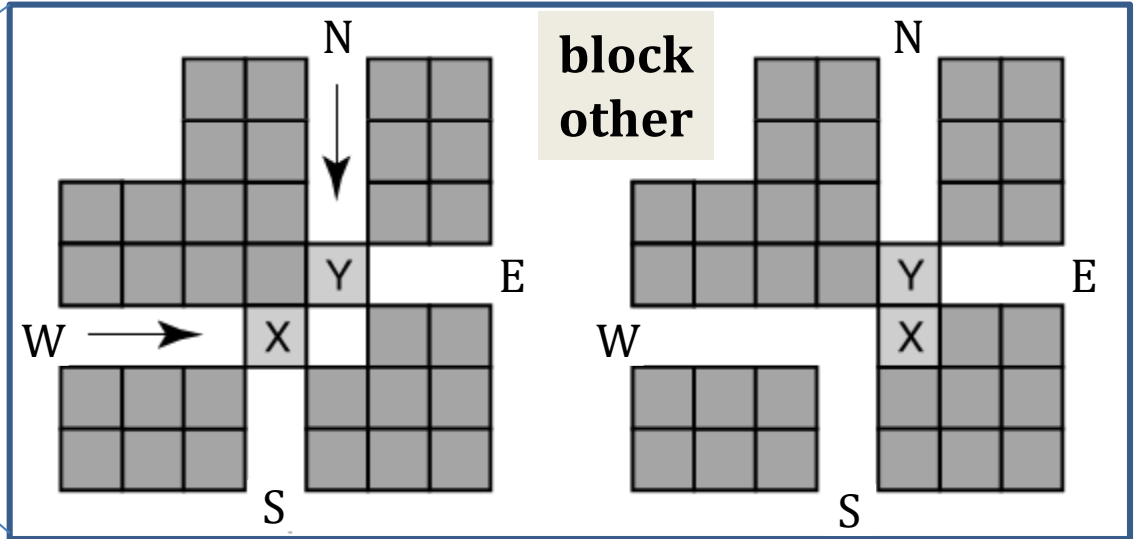
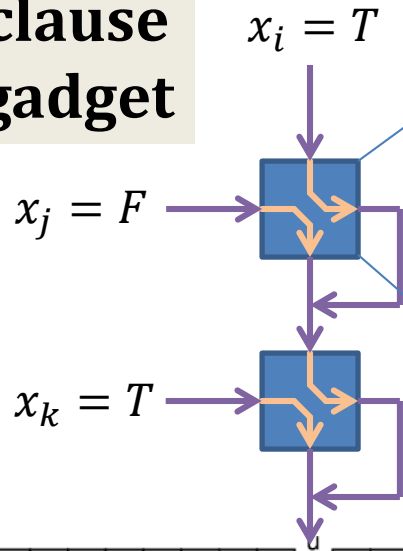
[O'Rourke & Smith Problem Solving Group 1999]



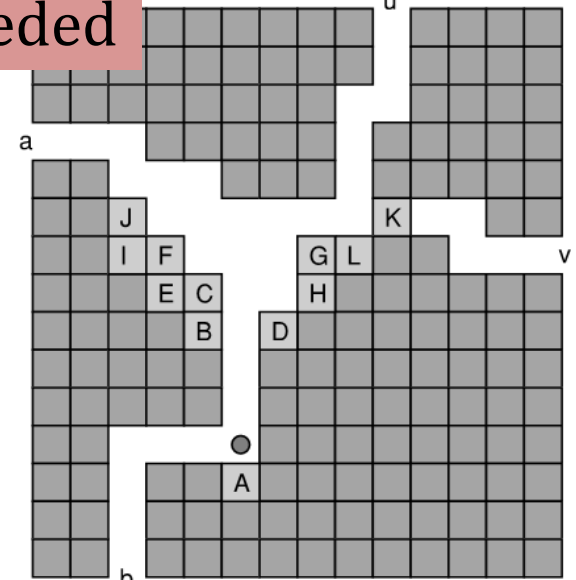
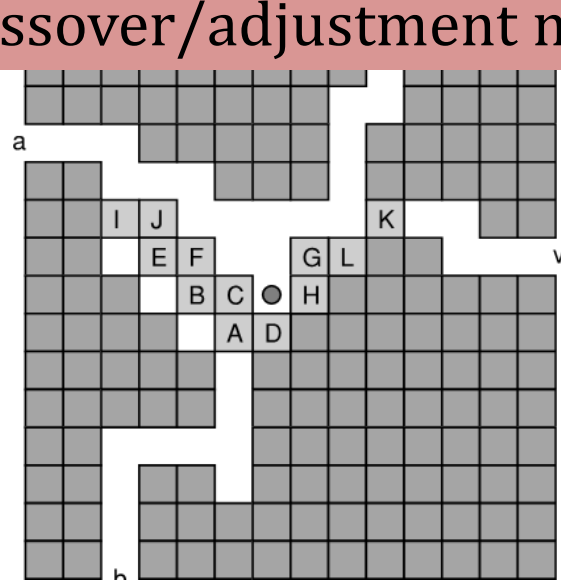
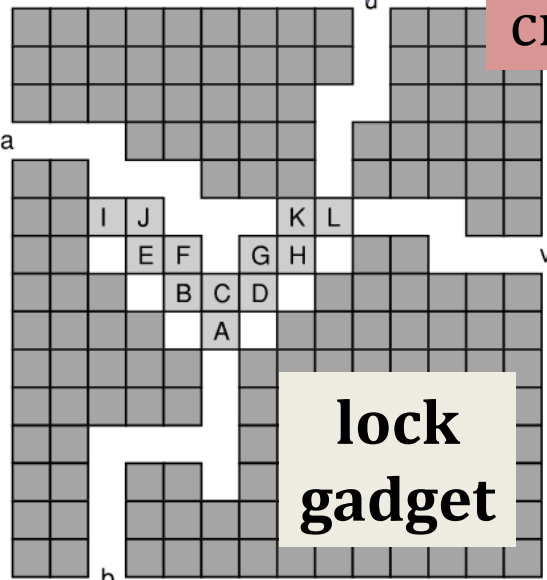
(Push)Push-1 is NP-hard in 2D

[Demaine, Demaine, O'Rourke 2000]

clause gadget

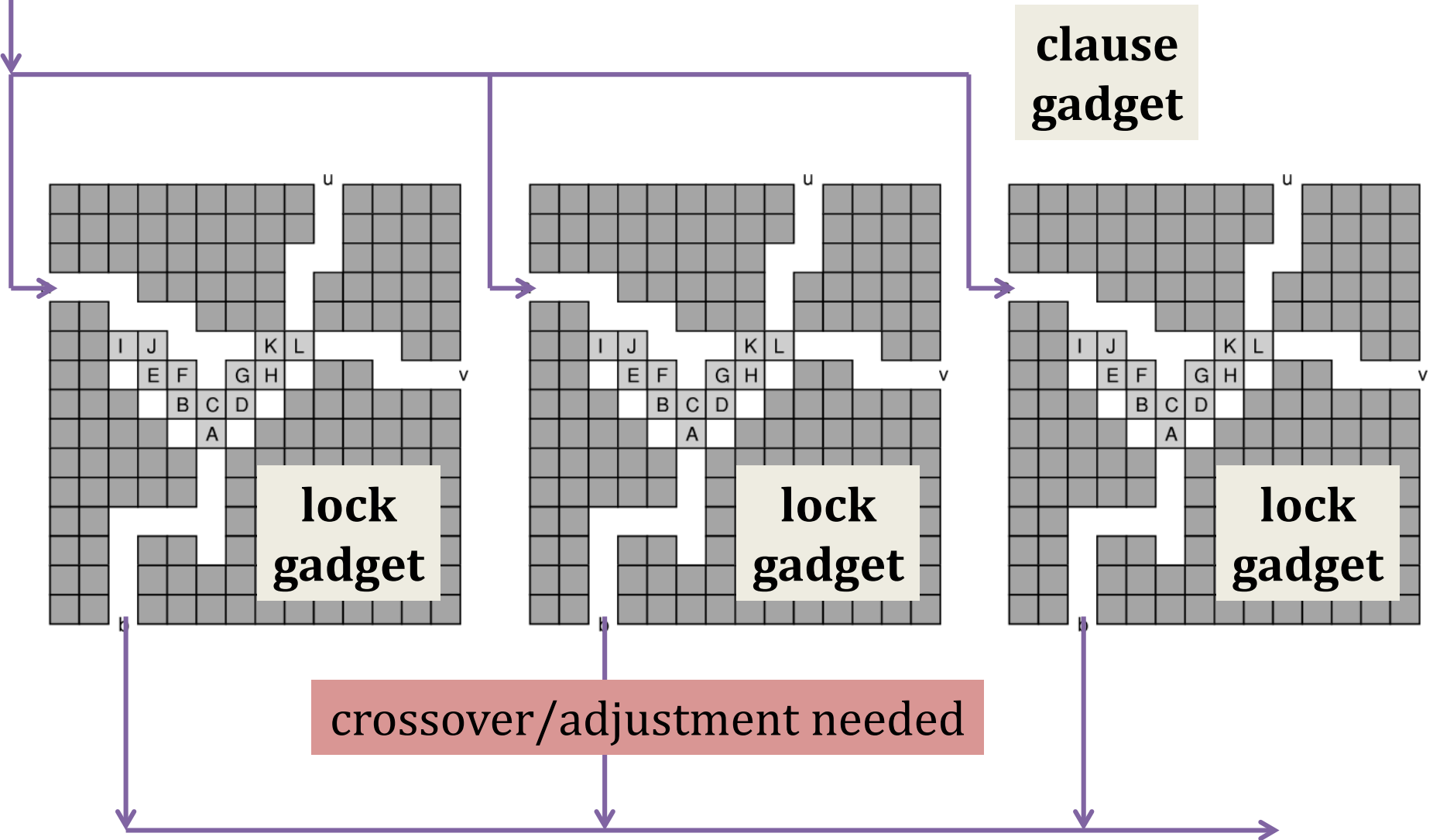


crossover/adjustment needed



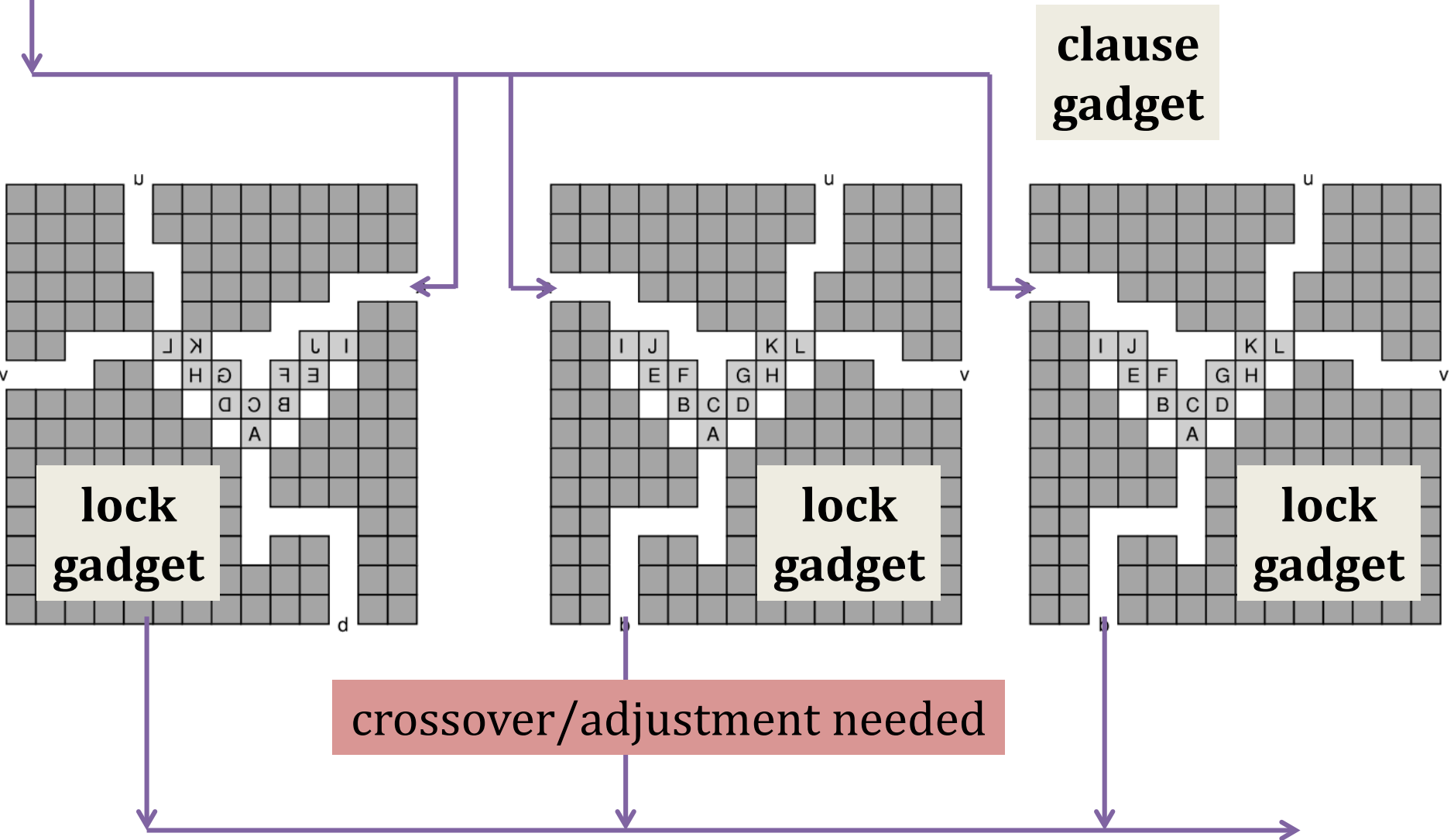
(Push)Push-1 is NP-hard in 2D

[Demaine, Demaine, O'Rourke 2000]



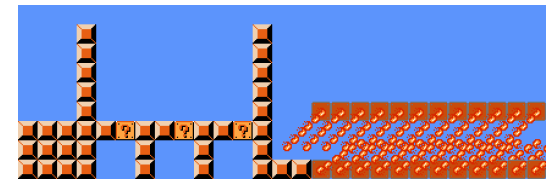
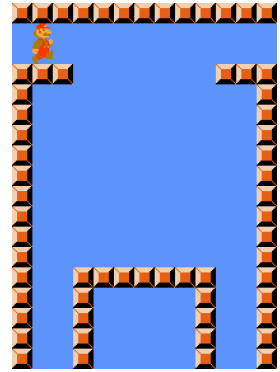
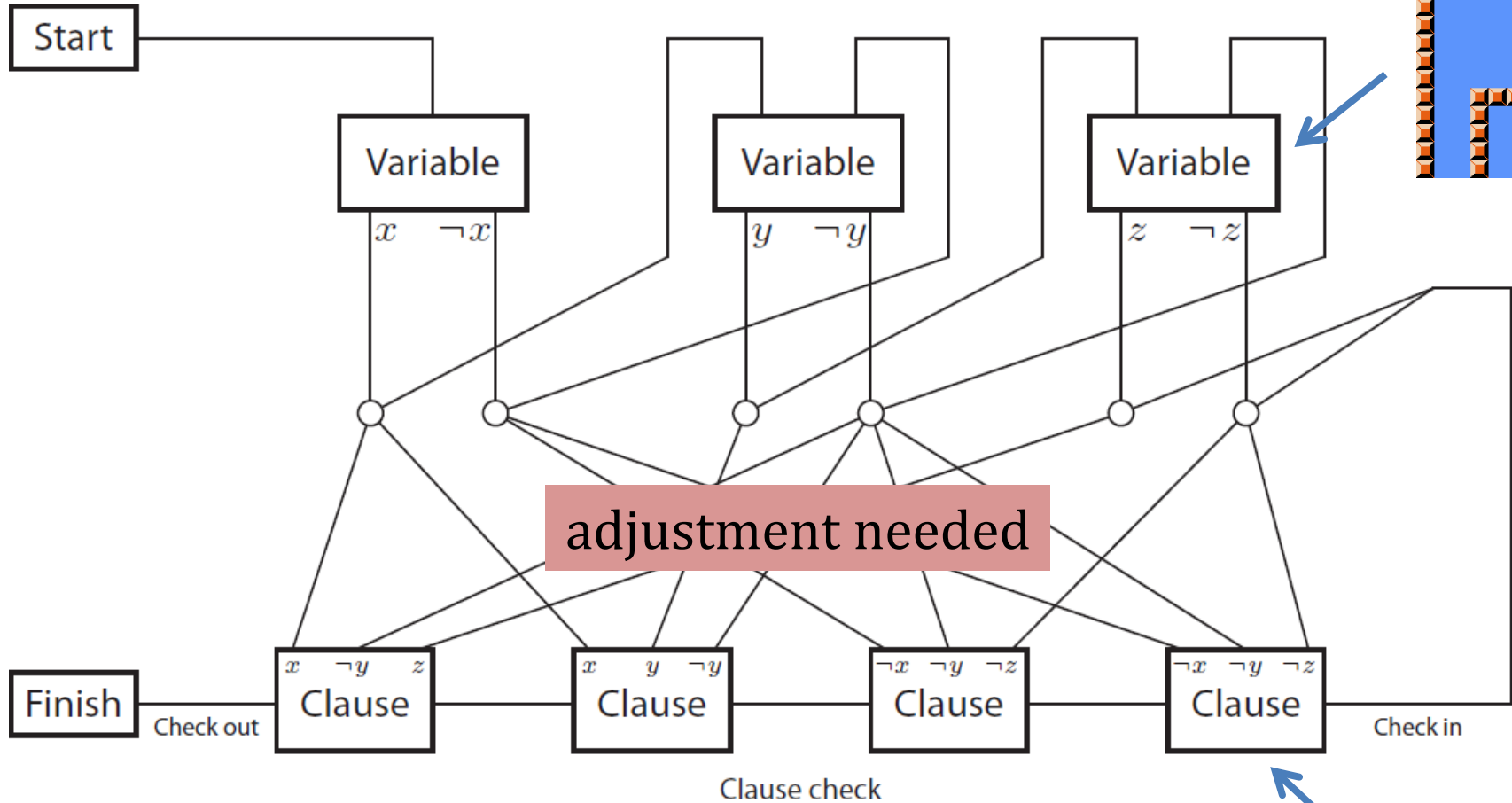
(Push)Push-1 is NP-hard in 2D

[Demaine, Demaine, O'Rourke 2000]



Super Mario Bros. is NP-Hard

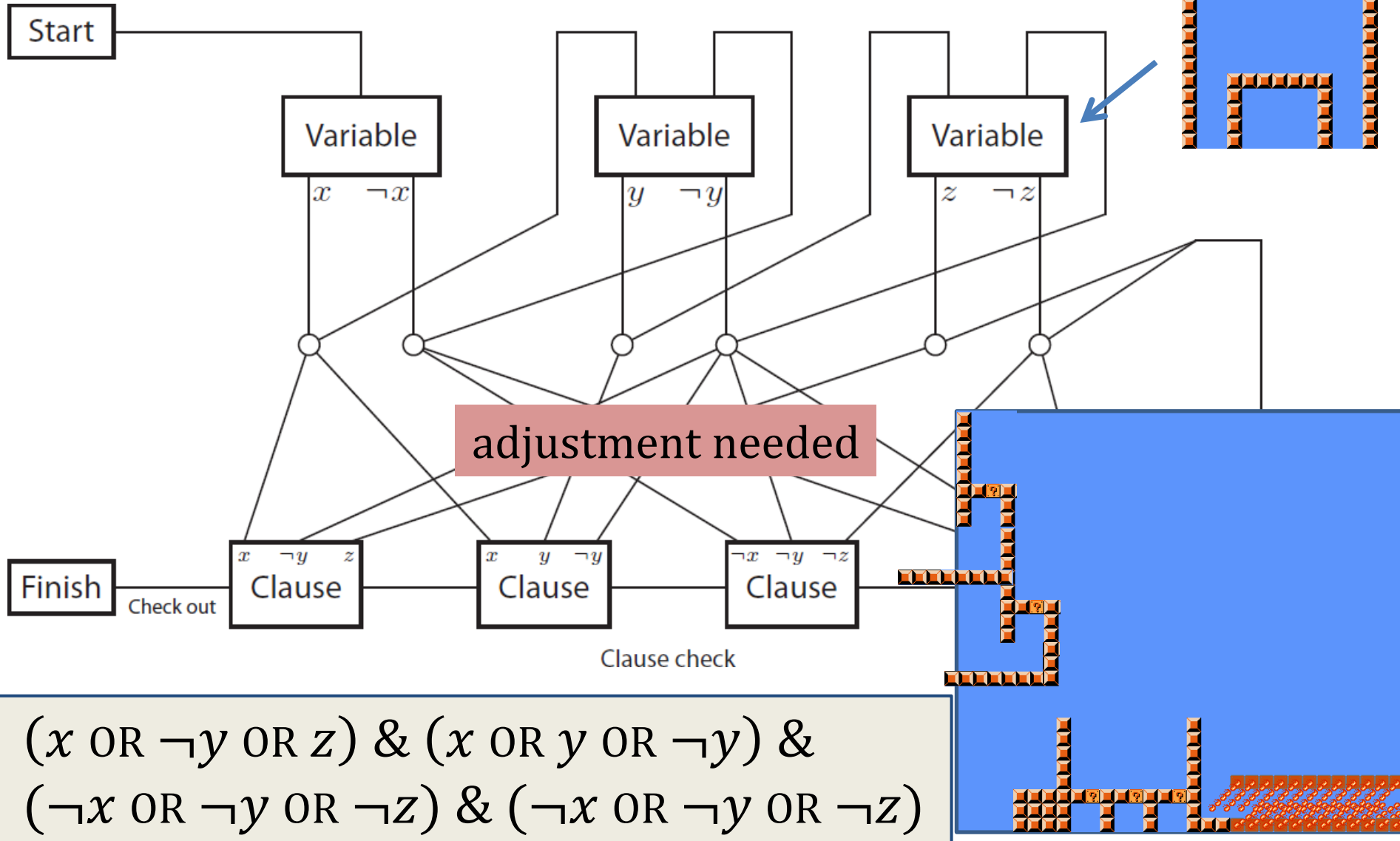
[Aloupis, Demaine, Guo, Viglietta 2014]



$(x \text{ OR } \neg y \text{ OR } z) \ \& \ (x \text{ OR } y \text{ OR } \neg y) \ \& \ (\neg x \text{ OR } \neg y \text{ OR } \neg z) \ \& \ (\neg x \text{ OR } \neg y \text{ OR } z)$

Super Mario Bros. is NP-Hard

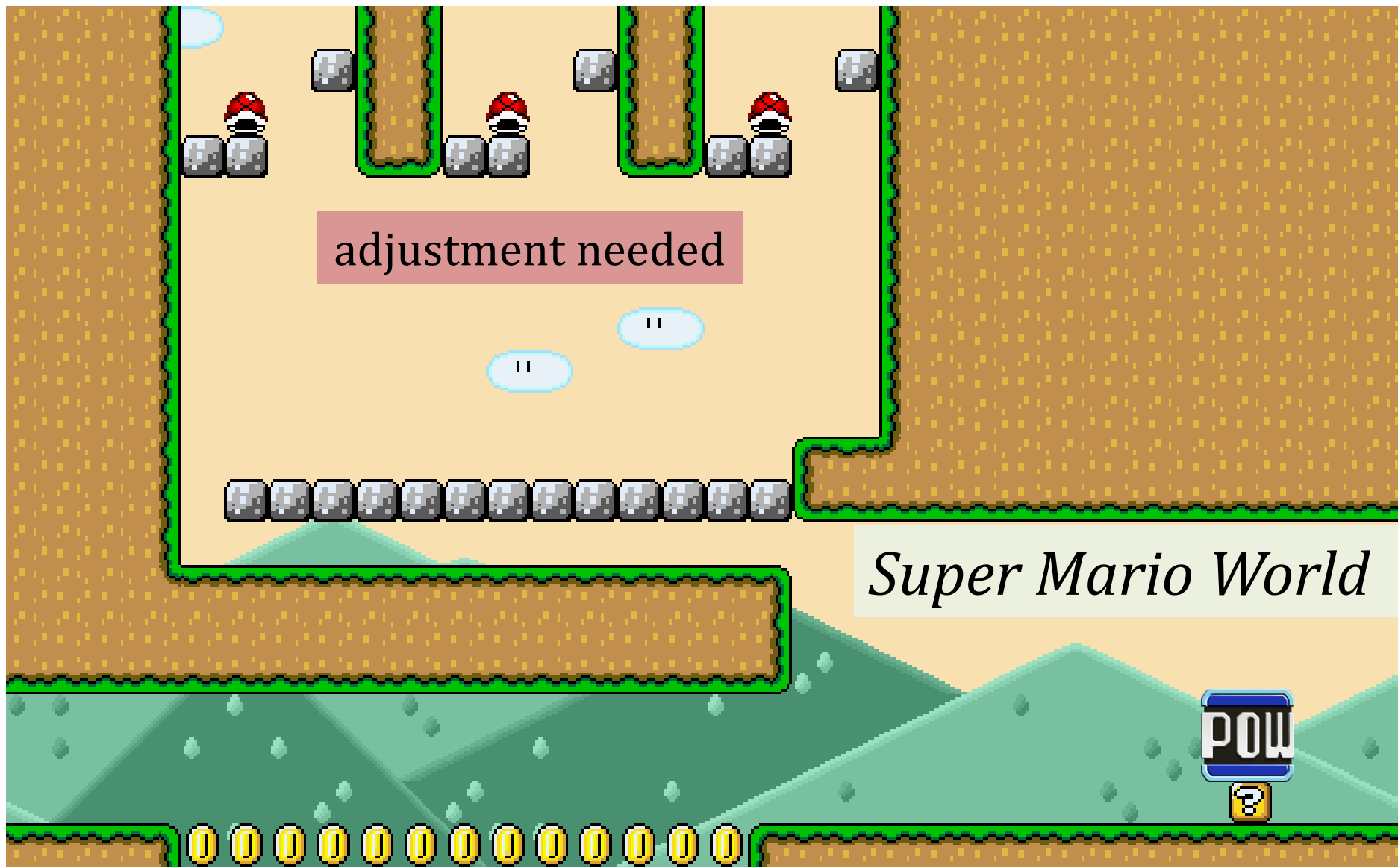
[Aloupis, Demaine, Guo, Viglietta 2014]



Super Mario World is NP-Hard

[Aloupis, Demaine, Guo 2012]

clause



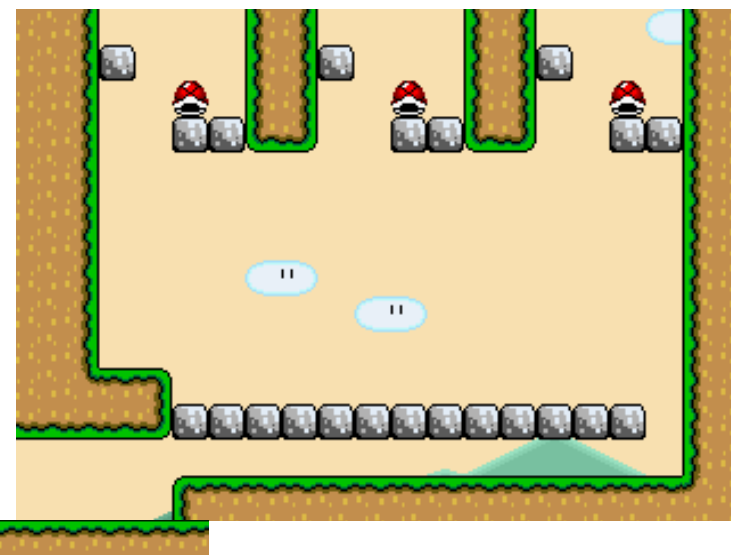
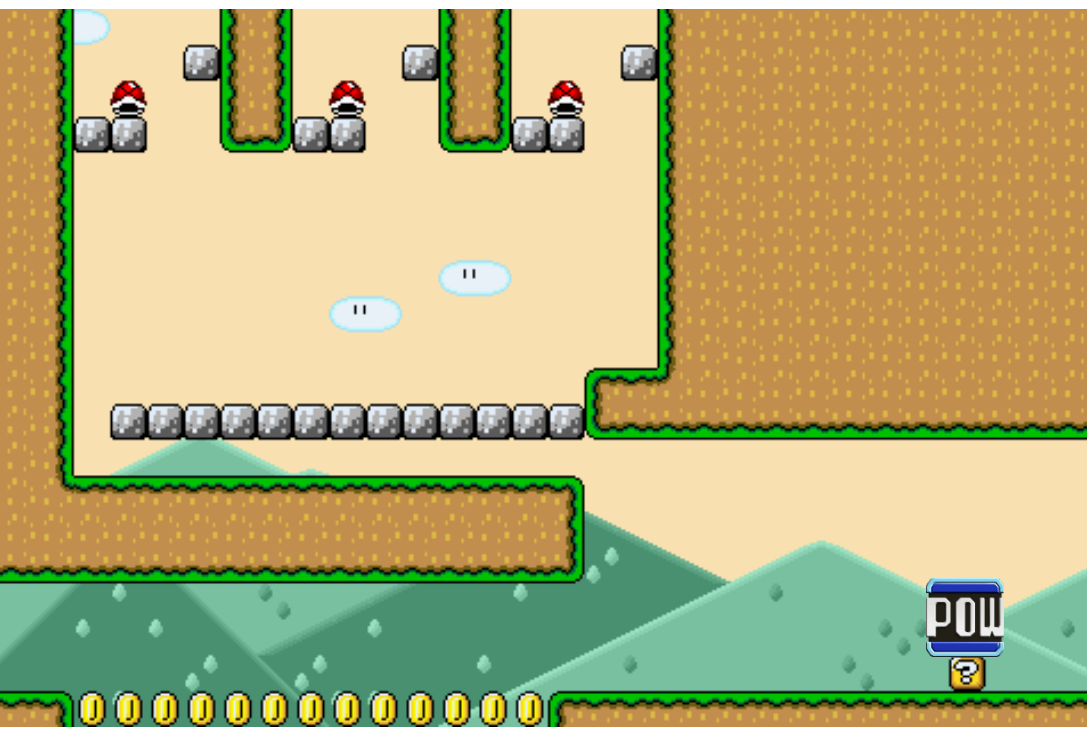


Super Mario World is NP-Hard

[Aloupis, Demaine, Guo 2012]

clause

adjustment needed





Legend of Zelda is NP-hard

[Aloupis, Demaine, Guo 2012]

A Link to the Past

adjustment needed



variable

clause

crossover

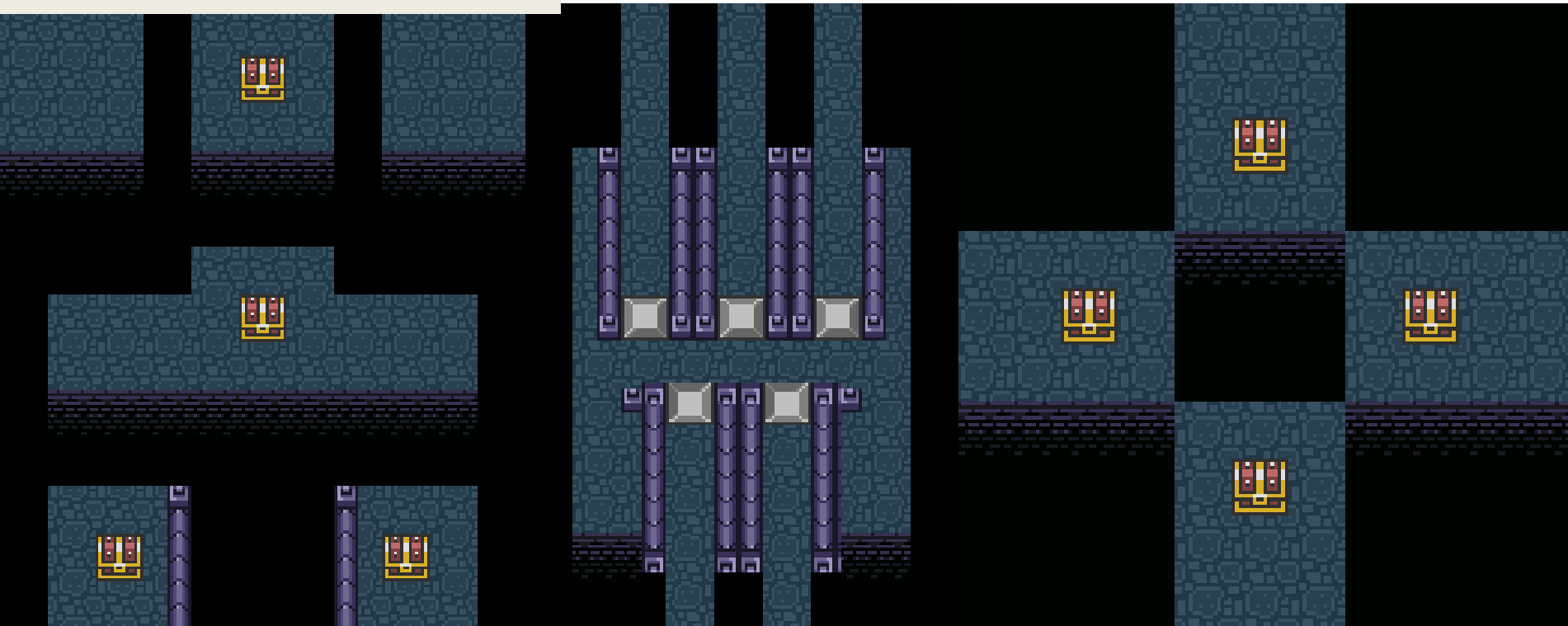


Legend of Zelda is NP-hard

[Aloupis, Demaine, Guo 2012]

A Link to the Past

adjustment needed



variable

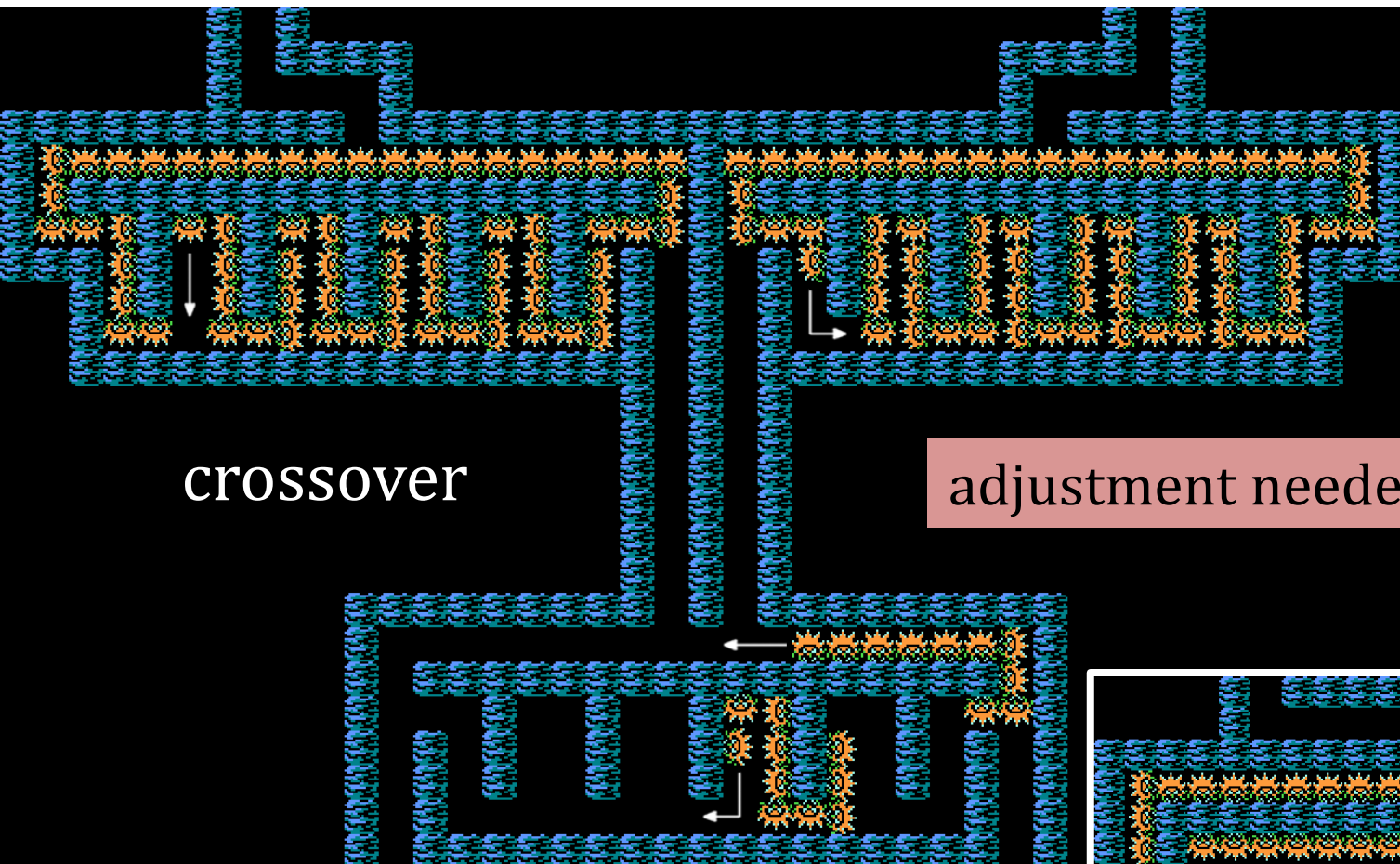
clause

crossover



Metroid is NP-complete

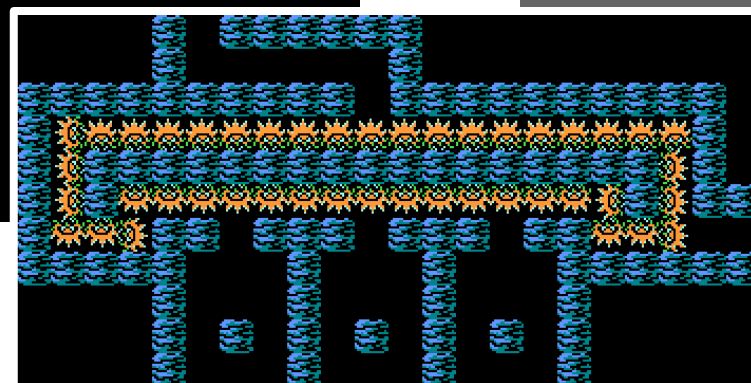
[Aloupis, Demaine, Guo, Viglietta 2014]



crossover

adjustment needed

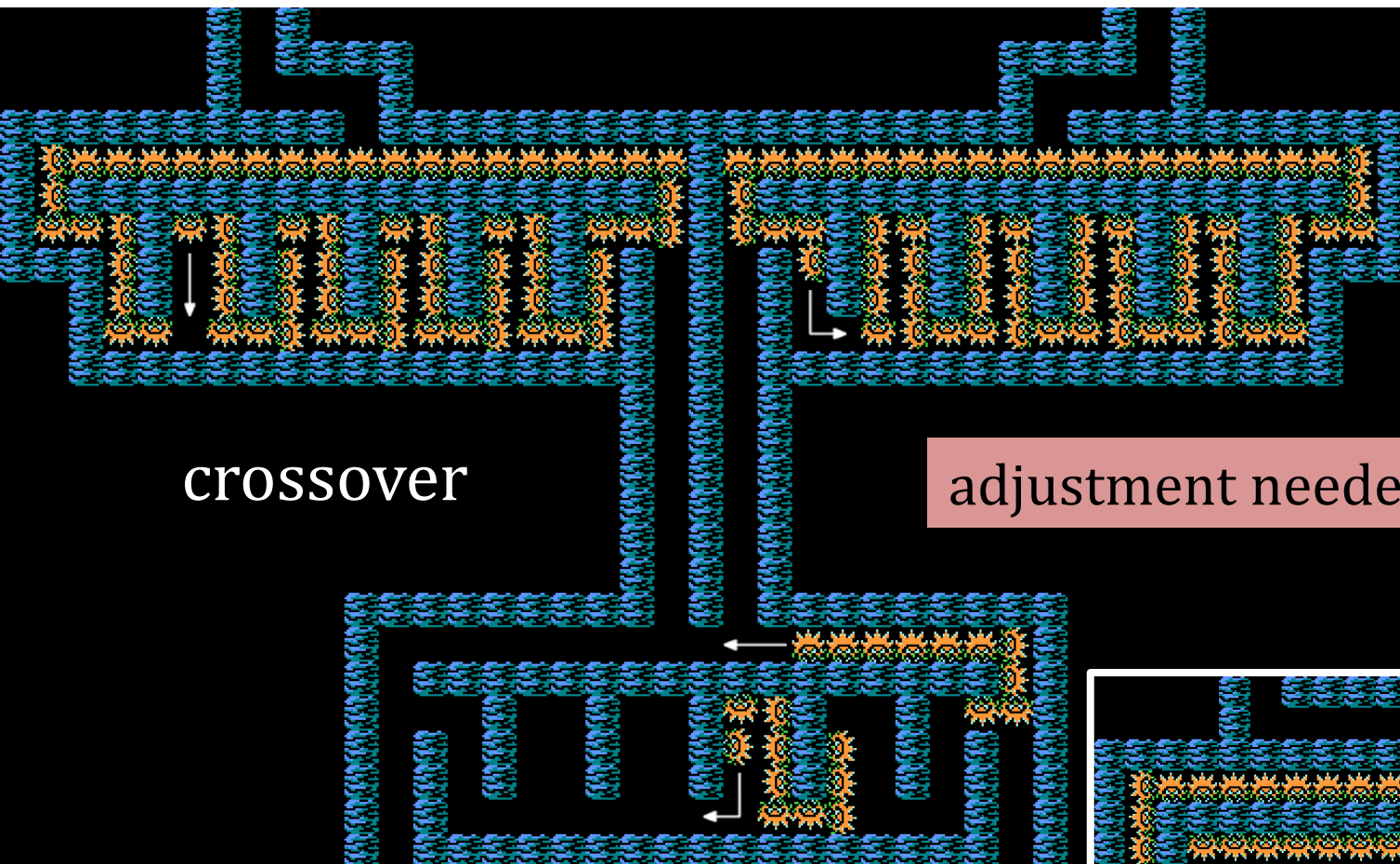
clause





Metroid is NP-complete

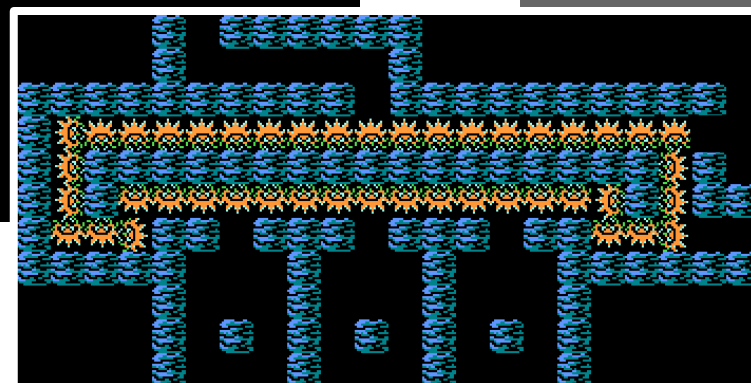
[Aloupis, Demaine, Guo, Viglietta 2014]



crossover

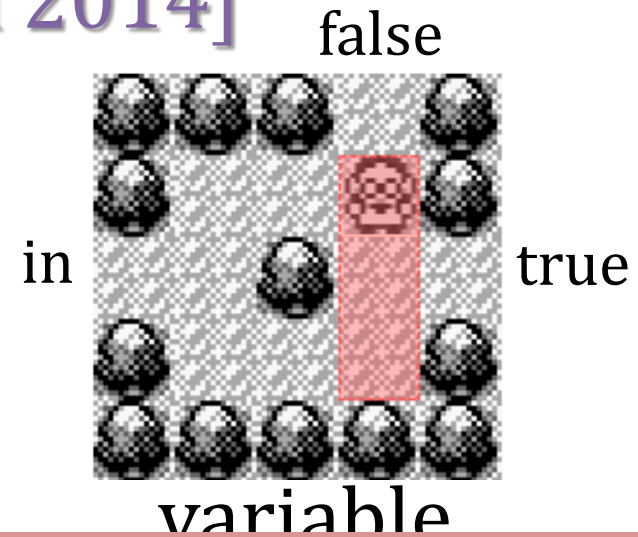
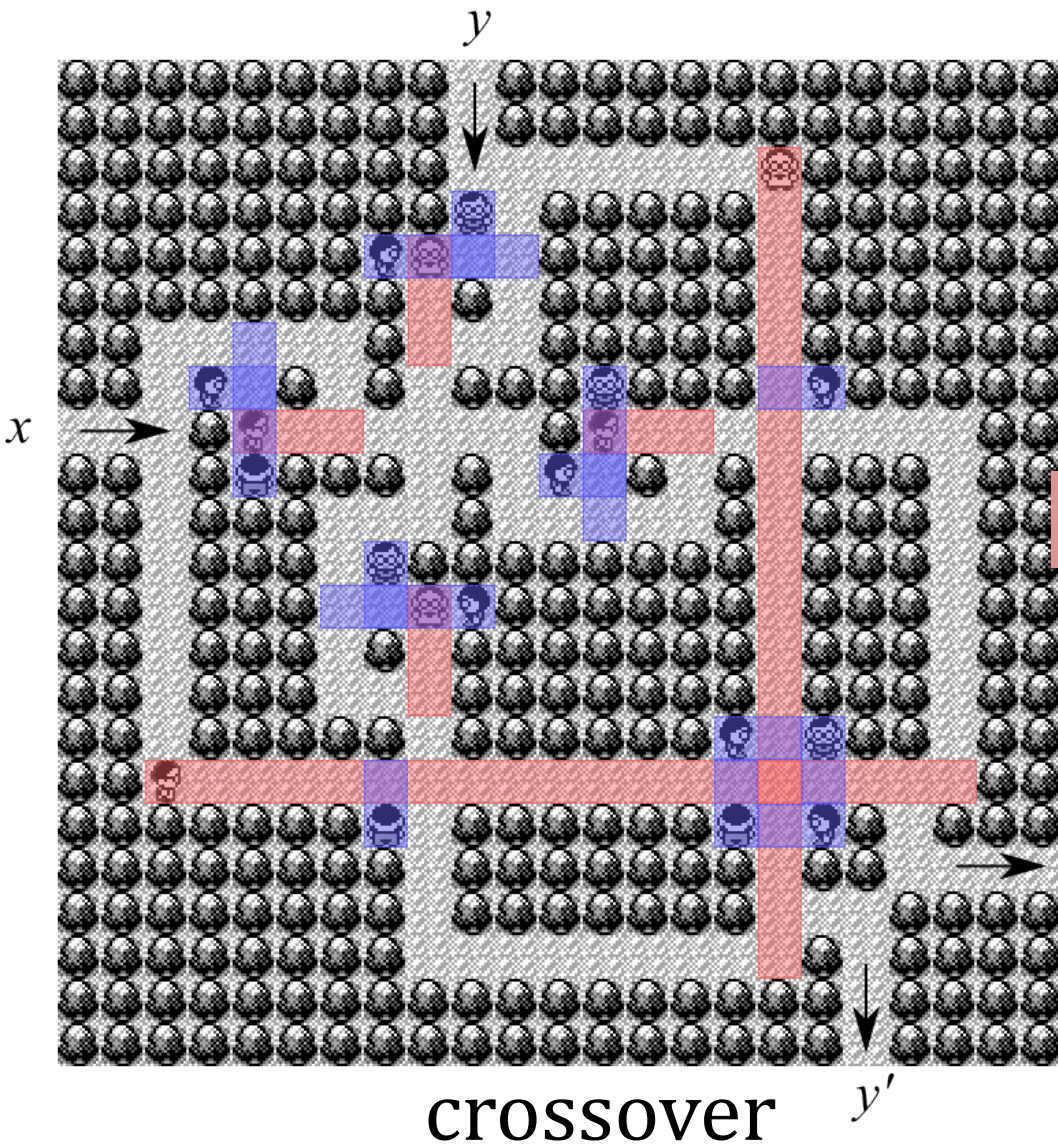
adjustment needed

clause



POKÉMON is NP-Hard

[Aloupis, Demaine, Guo, Viglietta 2014]



crossover/adjustment needed

