



Complexity Theory

More Complexity

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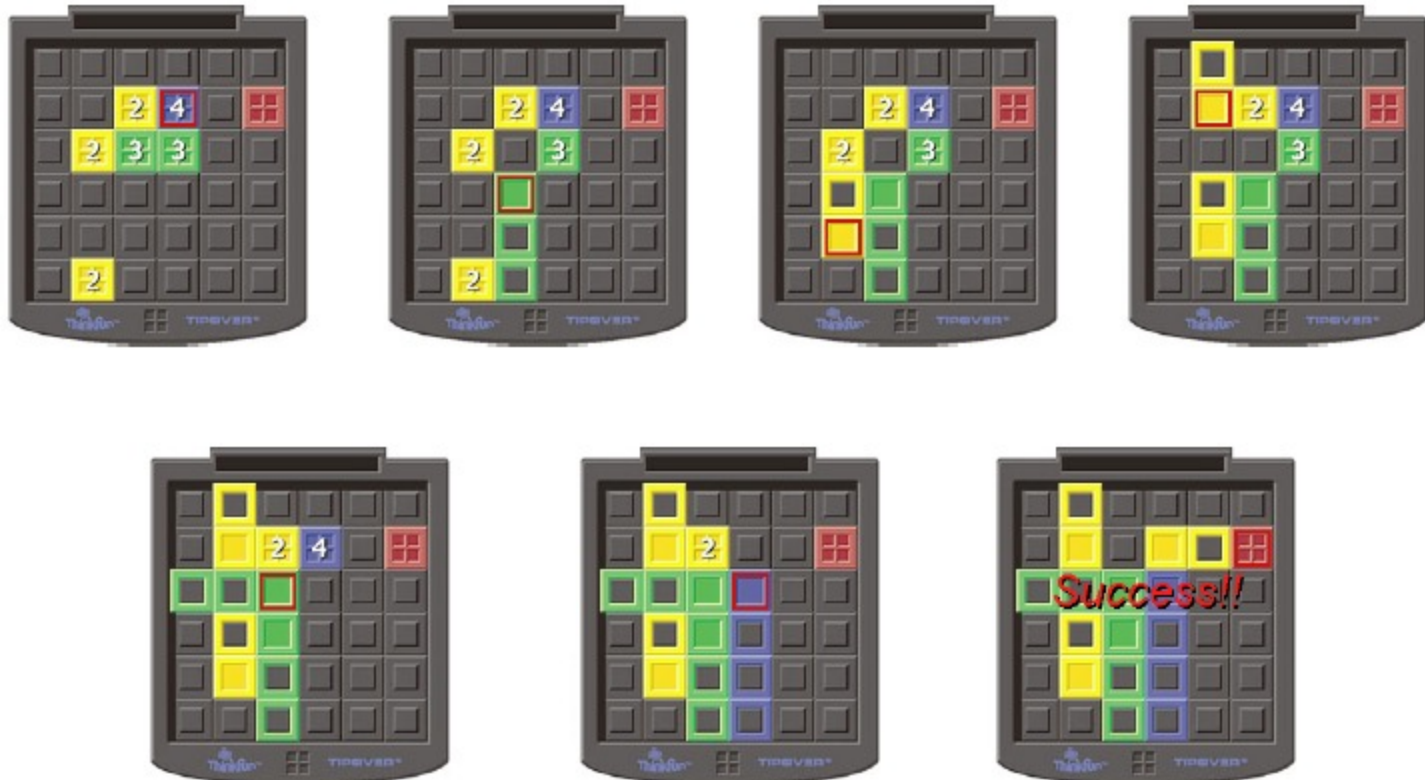
COT6410 – Spring 2021 Notes

More Examples of NP Complete Problems

TipOver

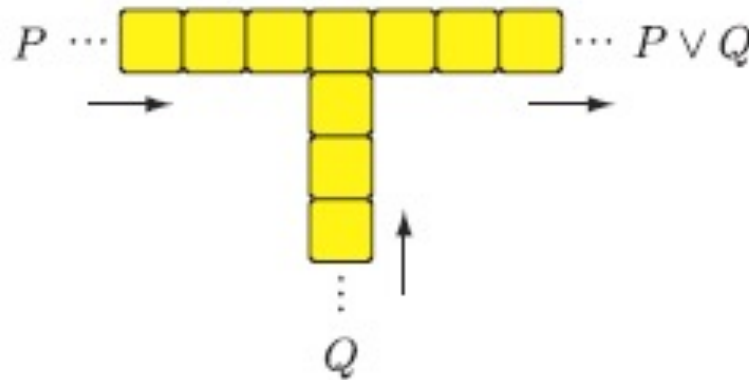


Rules of Game



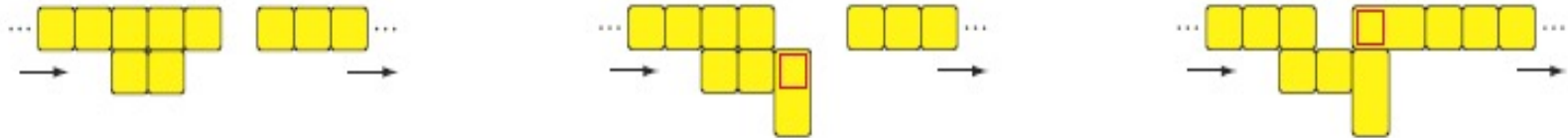
Numbers are height of crate stack;
If could get 4 high out of way we can attain goal

Problematic OR Gadget



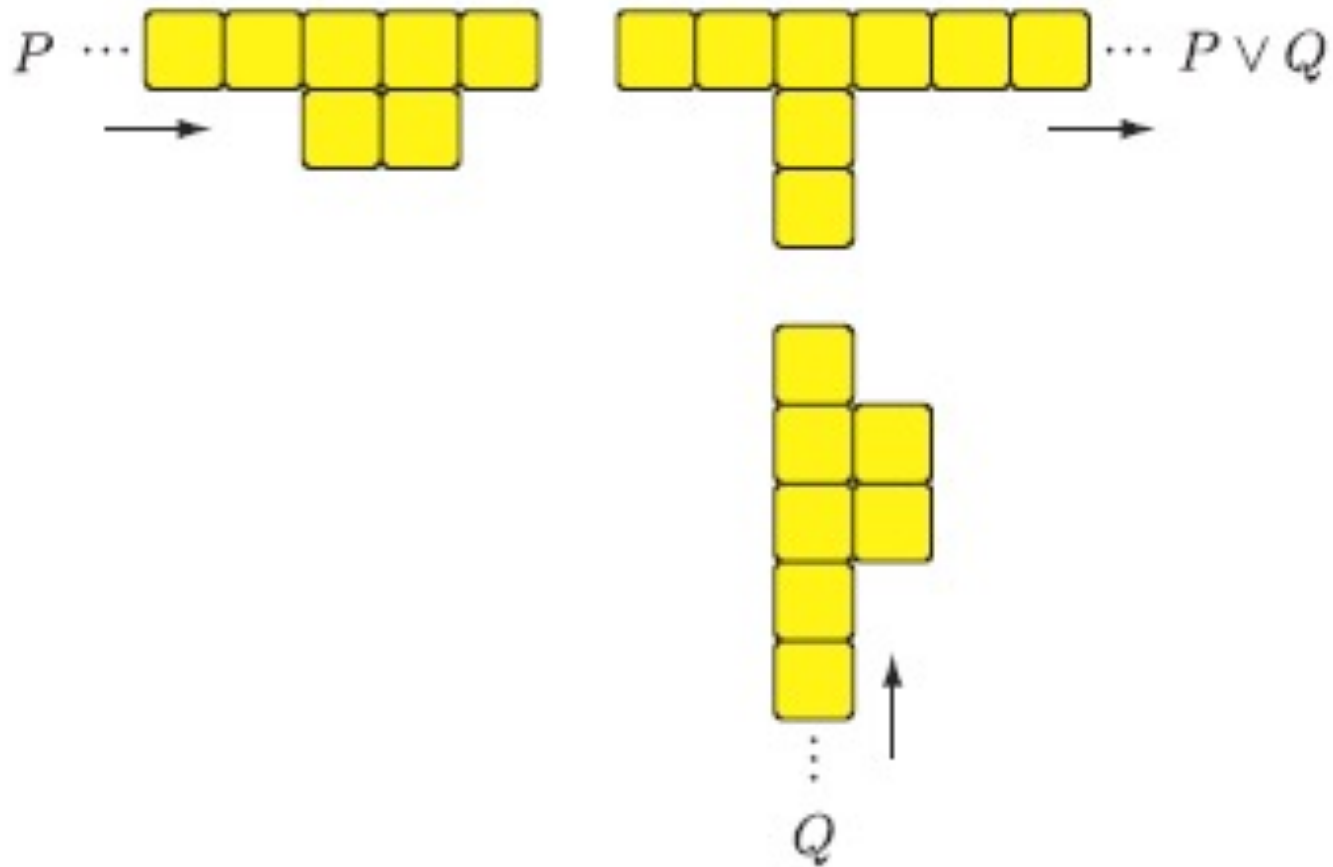
Can go out where did not enter

Directional gadget

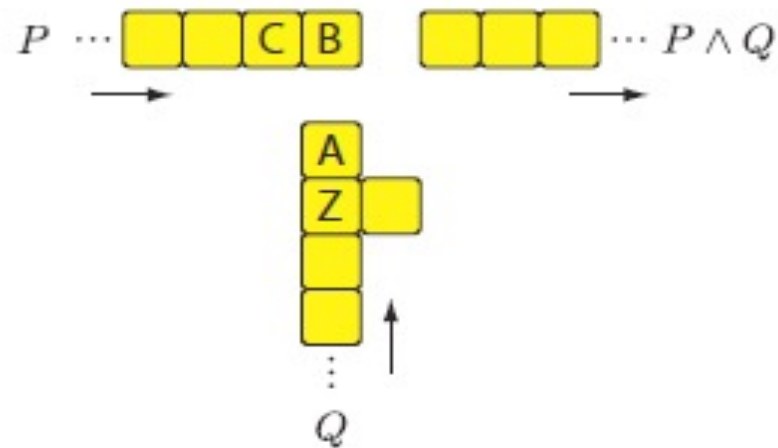


Single stack is two high;
tipped over stack is one high, two long;
red square is location of person travelling the towers

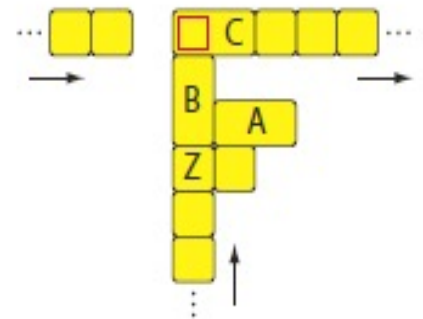
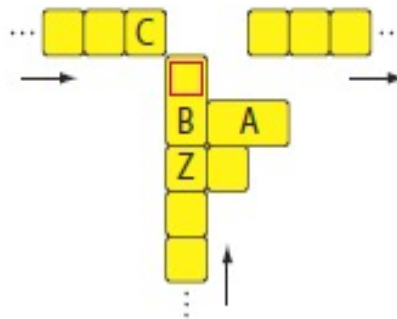
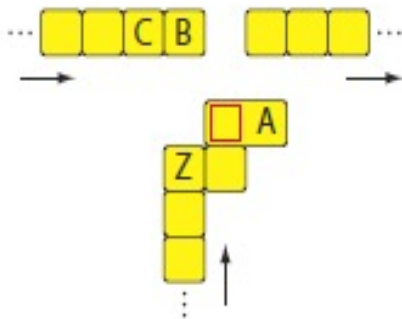
One directional Or gadget



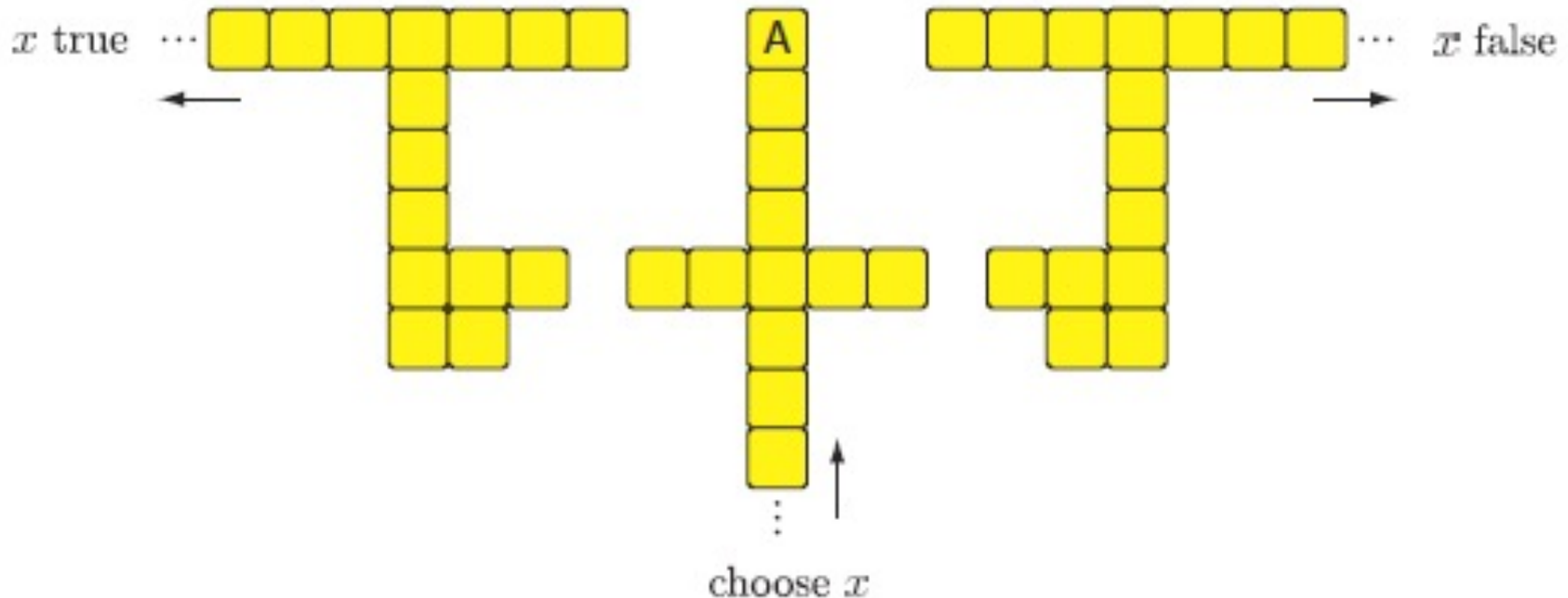
AND Gadget



How AND Works

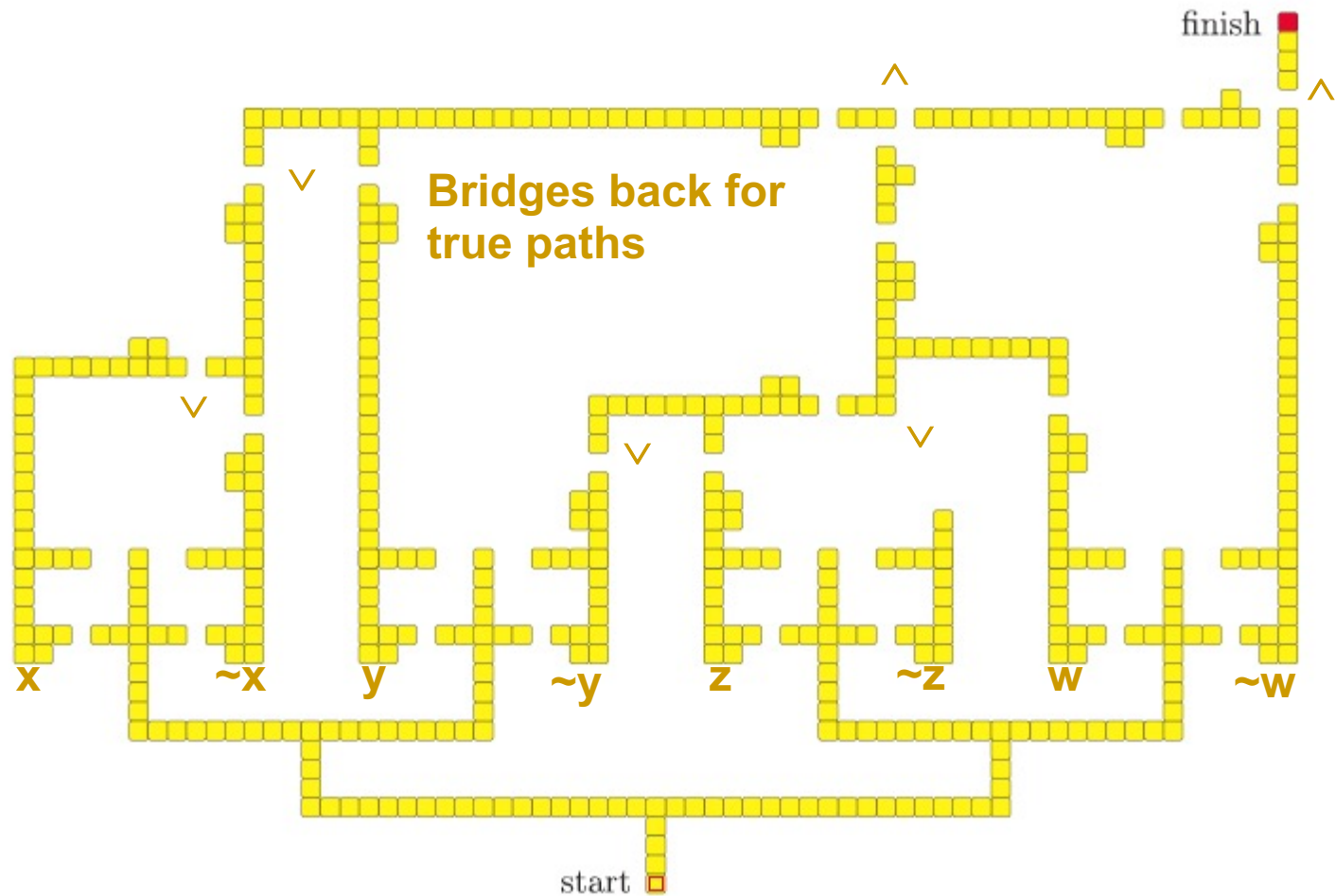


Variable Select Gadget



Tip A left to set x true; right to set x false
Can build bridge to go back but never to change choice

$$((x \vee \sim x \vee y) \wedge (\sim y \vee z \vee w) \wedge \sim w)$$



Win Strategy is NP-Complete

- **TipOver** win strategy is **NP-Complete**
- **Minesweeper** consistency is **NP-Complete**
- **Phutball** single move win is **NP-Complete**
 - Do not know complexity of winning strategy
- **Checkers** is really interesting
 - Single move to **King** is in **P**
 - Winning strategy is **PSpace-Complete**