
# Complexity Theory
# More Complexity

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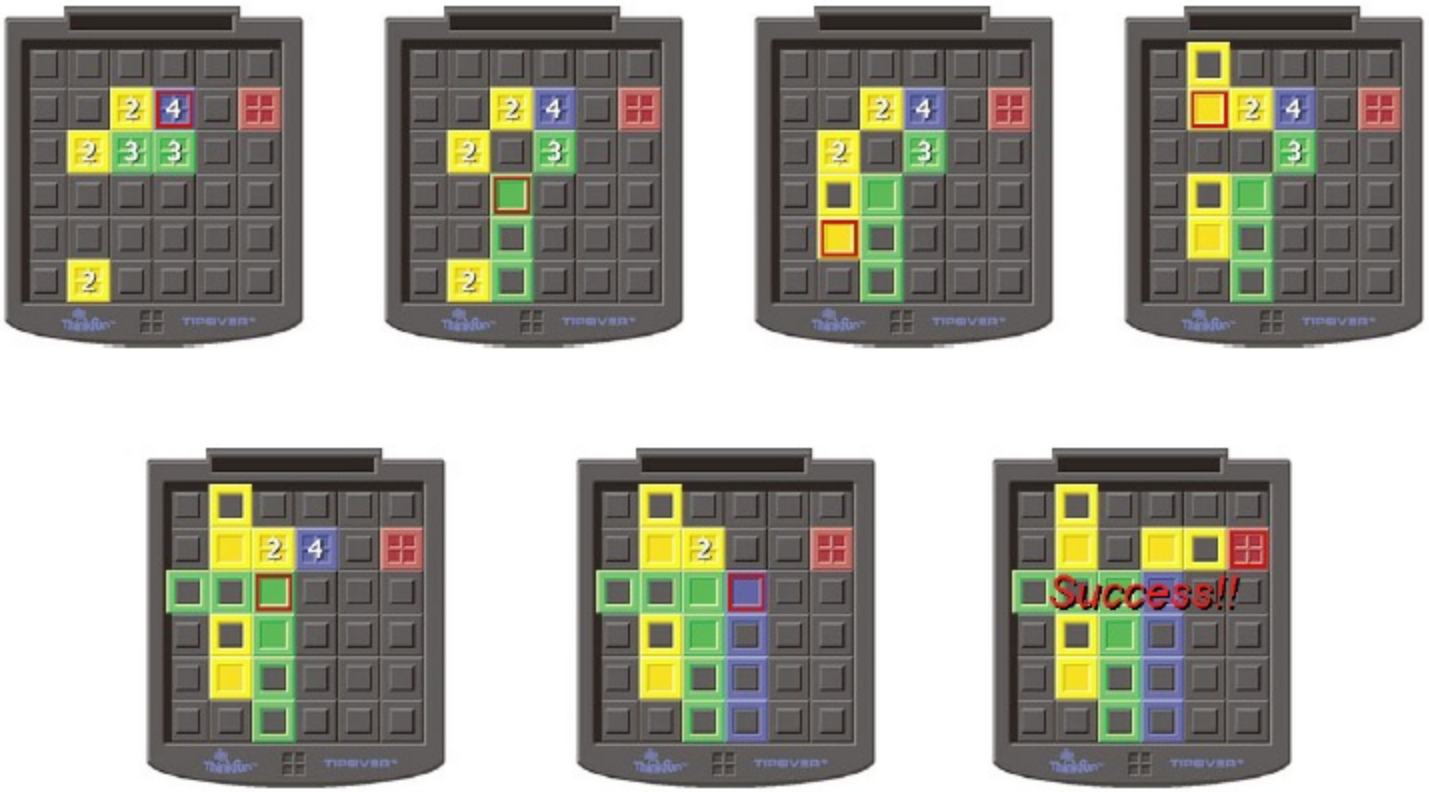
COT6410 – Spring 2022 Notes

# More Examples of NP Complete Problems

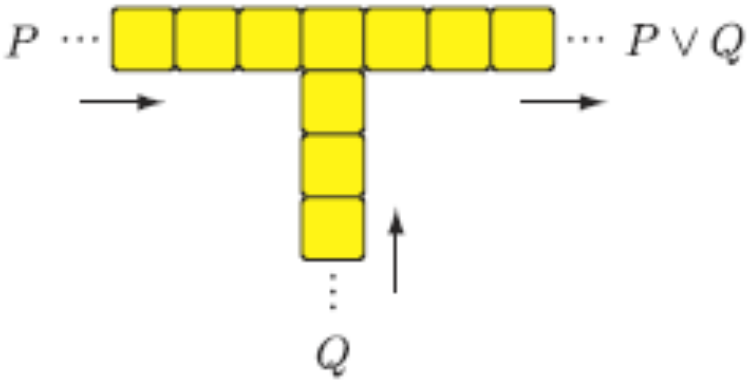
# TipOver

# Rules of Game



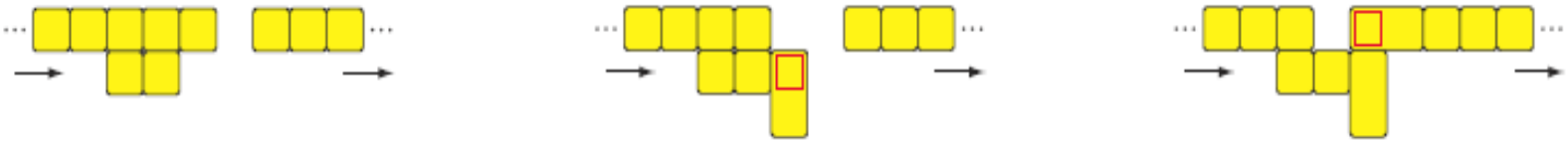

**Numbers are height of crate stack;**
**If could get 4 high out of way we can attain goal**

# Problematic OR Gadget



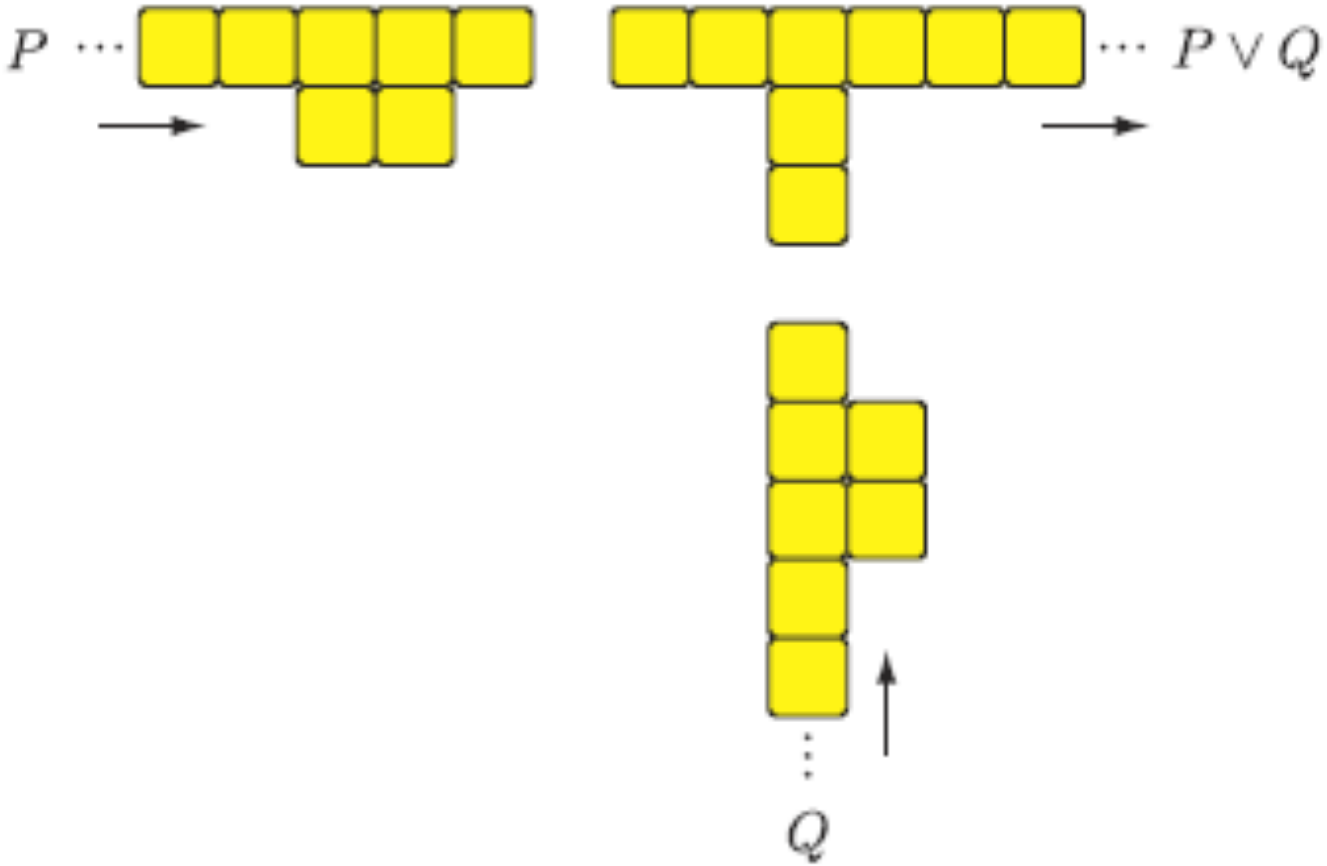

**Can go out where did not enter**

# Directional gadget

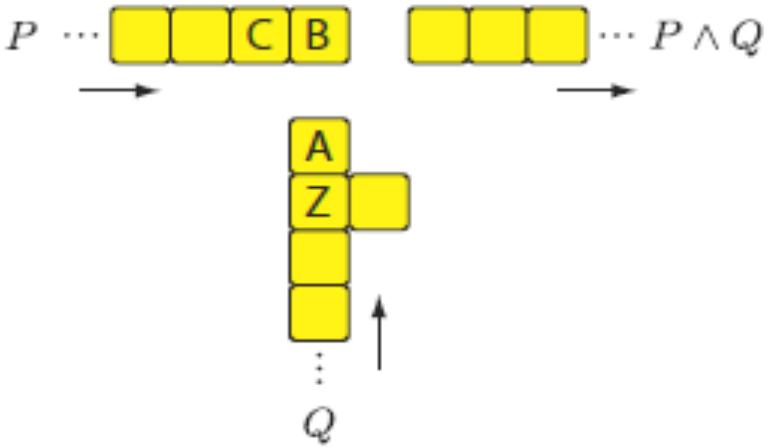


**Single stack is two high;**
**tipped over stack is one high, two long;**
**red square is location of person travelling the towers**

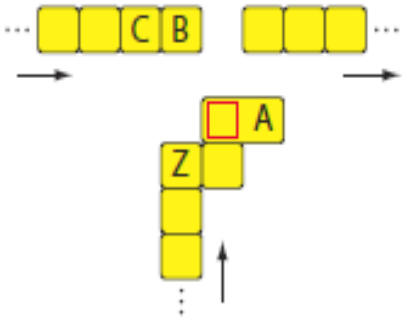
# One directional Or gadget

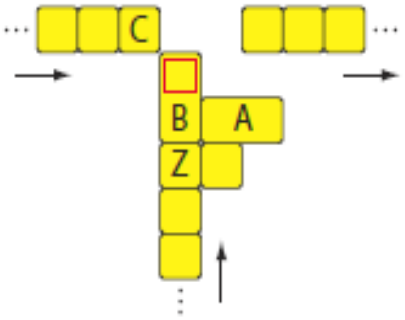


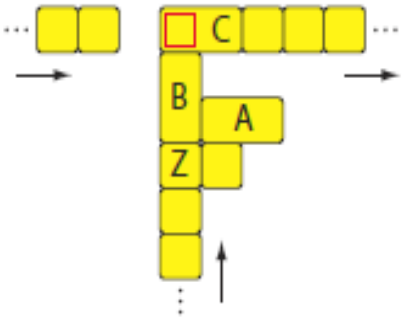
# AND Gadget



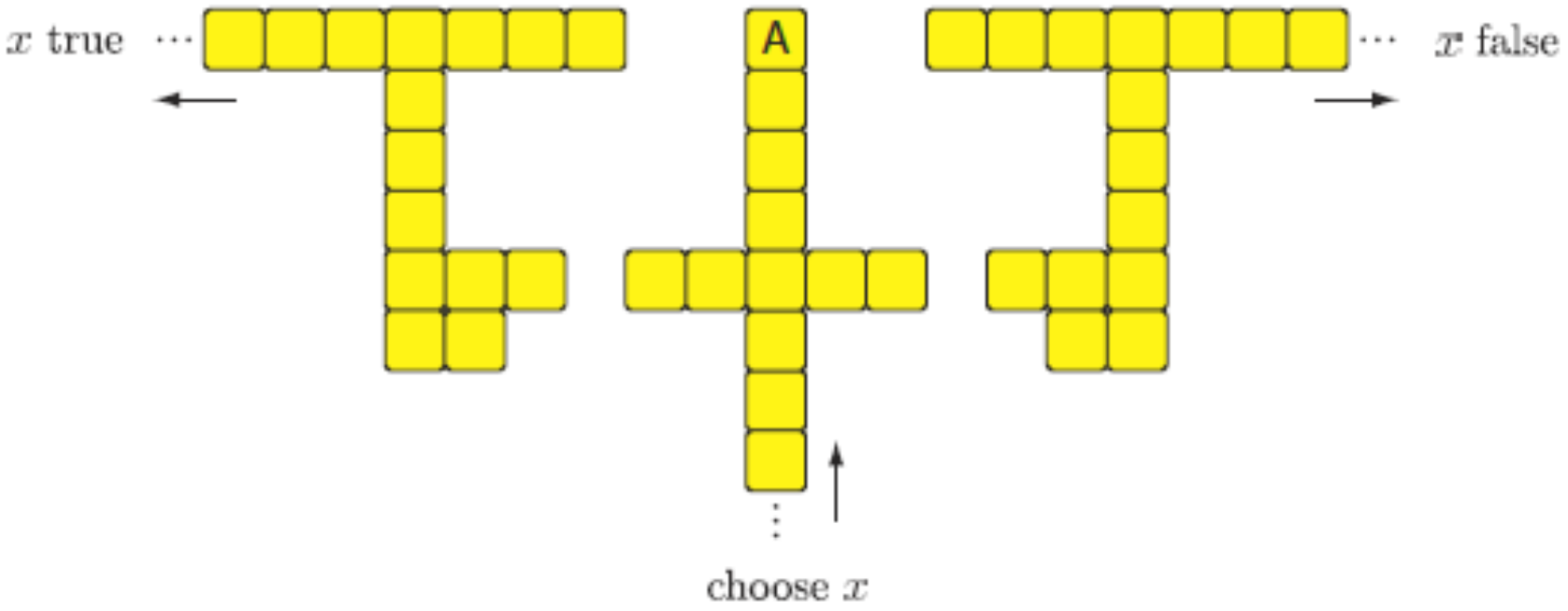

## How AND Works



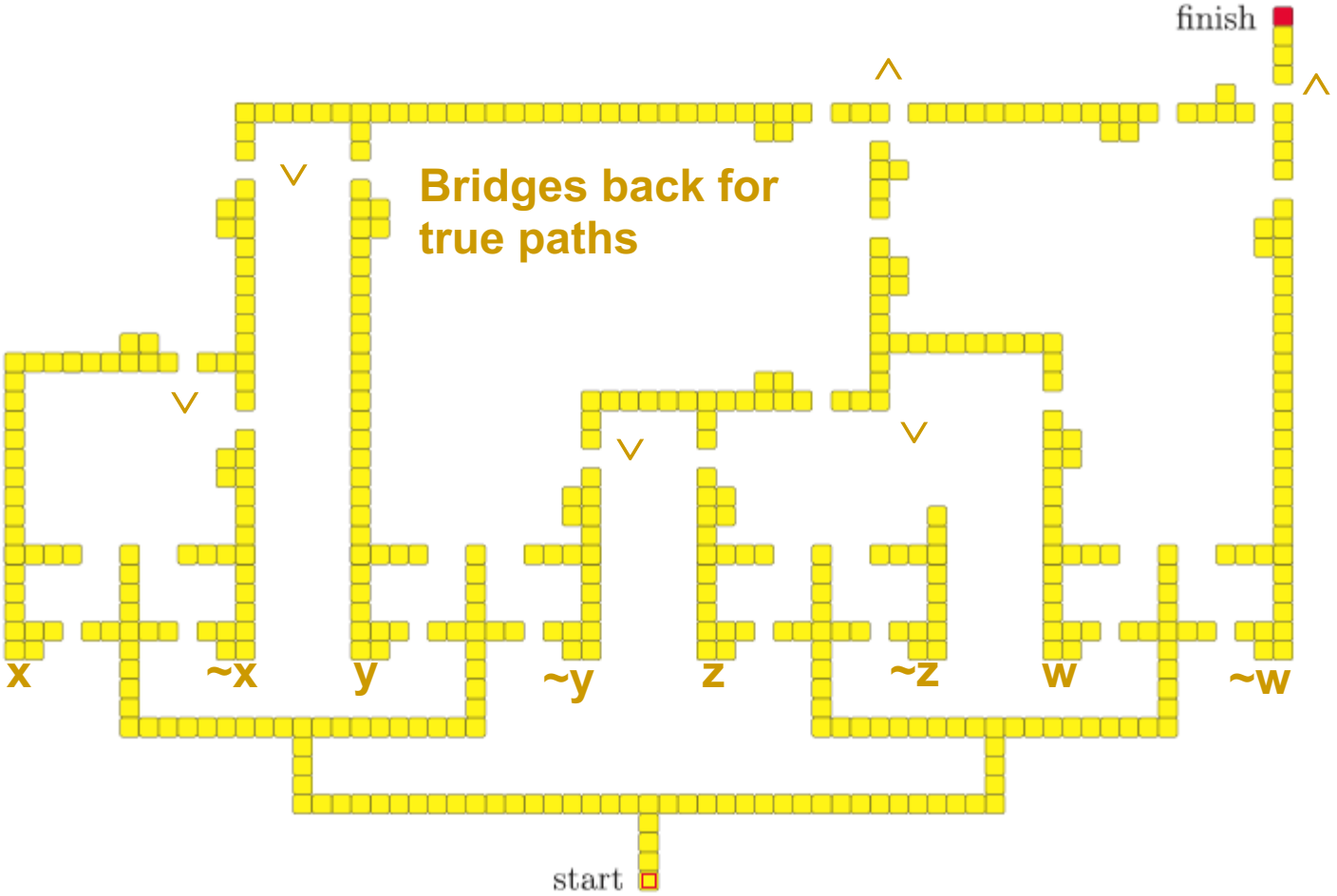



# Variable Select Gadget




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

# ((x∨~x∨y)∧(~y∨z∨w)∧~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**