More Examples of NP Complete Problems
TipOver
Numbers are height of crate stack; If could get 4 high out of way we can attain goal
Directional gadget

Single stack is two high; tipped over stack is one high, two long; red square is location of person travelling the towers
Note that there is a pathway back as well as forward
One directional Or gadget

Note that there is a pathway back as well as forward
AND Gadget

How AND Works

Note that there is a pathway back as well as forward
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
\(((x \lor \neg x \lor y) \land (\neg y \lor z \lor w) \land \neg w)\)
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 general winning strategy
  - Determining from a fixed setup if a win is possible is **PSPACE-Hard** (may not be in **PSPACE**)
- **Checkers** is really interesting
  - Single move to **King** is in **P**
  - Winning strategy is **PSPACE-Complete**