

- 3SAT
- 3SAT-3 each clause occurs at most 3 clauses
- E3SAT-4 each clause has exactly 3 vars, each var occurs ≤ 4 times
- Monotone 3SAT-3 each clause has vars either all \rightarrow or all $+$
- MAX2SAT Can you satisfy $\geq k$ clauses

• Planar Monotone Rectilinear 3SAT

Each clause is either all positive or all negative.

+ clauses all above var axis
- clauses all below var axis and its planar.

• Planar In3SAT

Connect vars in cycle
(could also connect vars + clauses in cycle, altho must be interleaving, in 3 relation.)

- 1-in-3 SAT clauses are now "exactly 1 of the 3 literals is true"
- Positive 1-in-3 SAT No negations all literals \oplus .
- NAE 3SAT
- Positive NAE 3SAT all literals positive.

- Planar Positive 1-in-3 SAT : no negations
- Rectilinear-Planar Pos 1-in-3 SAT

Planar X3C

Planar 3DM

Planar Vertex Cover

Planar Hamilton Cycle

Planar Dominating Set

- Linked Planar 3SAT-3
- Var-clause bipartite graph + cycle that visits all vars, and then all clauses is planar.

- Also for Monotone (each clause all + or all -)
- OR Sided (+/- edges on opposite sides of cycle)
- (But not both) @ same time
- Sided interleaved Planar Monotone 3SAT
- cycle thru clauses & vars, clauses occur after their vars, pos/neg edges opp. sides of cycle.
- Also for E3SAT
- Positive 1-in-3 SAT.

All these probs are NPhard

Opening Doors:

planar motion planning is NPhard given

- Branching hallways
- One way mechanism:
 - diode
 - Crumbler (close after traverse)
- No return: prevent \leftarrow immediately after \rightarrow .
- opening door w/ 2 buttons

Closing Doors

- Branch
- Distant Closing:

choice

Merge

Clause clock: open, open, open

- ① Dual Rail: Var gadget forces XOR of 2 wires.
- ② Binary Logic
 - wire gadget 2 types of soln
 - split gadget copy (not) (terminator) (true terminator)
- turn \rightarrow
- Crossover
- Shift