Reduction gadget designs

Wednesday, May 14, 2025 12:59 PM

Administrivia

- WS 5/13 merged w/ HW6 (to come). WS 5/15 reductions.
- Quiz next Mon on reductions.
- Guest lectures next week! (No formal work sessions)

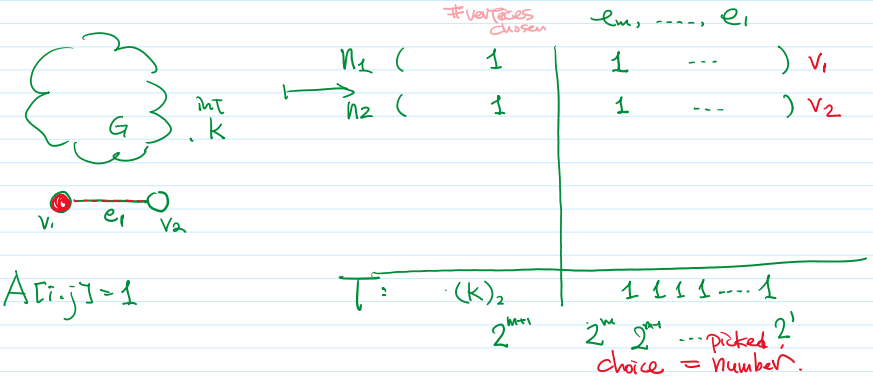
SUBSET SUM

input: set X of positive integers, target $T > 0$

output: Is there subset $Y \subseteq X$ s.t. $\sum_{y \in Y} y = T$?

MIN VERTEX COVER. $\leq$ SUBSET SUM

(G, k) $\quad$ (X, T)



Vertex v_i $\longmapsto$ binary number.

$n_i[j] = 1$ if edge e_j incident to v_i

$n_i[m+1] = 1$ always.

$T = k \cdot 2^{m+1} + \sum_{j=1}^{m} 2^j$

X3DM

EXACT 3D MATCHING

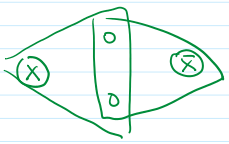
input: set S, collection $\mathcal{U}$ of triples in S.

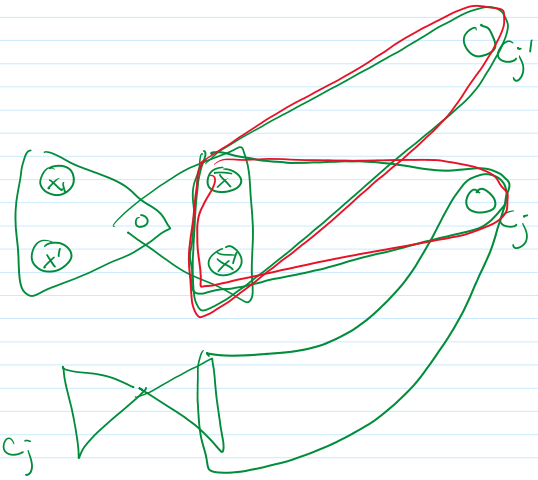
output: Is there disjoint subcollection of triples covering S?

3SAT $\leq$ X3DM

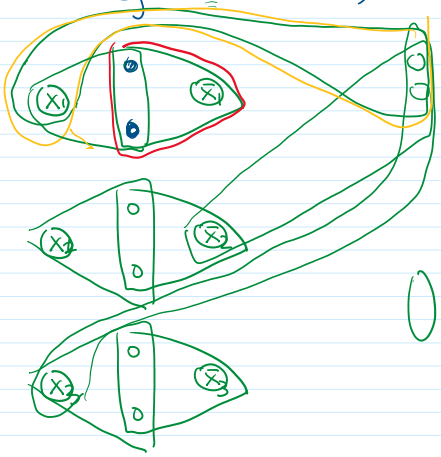
3-CNF ϕ (S, U)

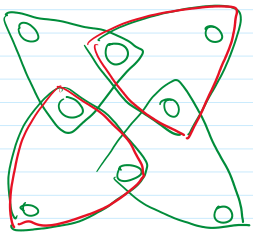
- variable

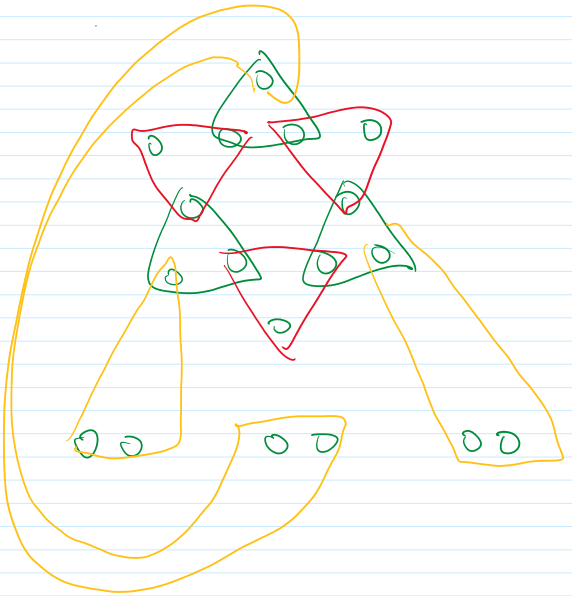




- clause $C_j = (x_1 \vee \bar{x}_2 \vee x_3)$







MAX 2SAT

input: CNF ϕ, parameter k

output: Is #satisfied clauses $\geq k$?