

③

min $(\max \{x_1, x_2, x_3\})$

s.t. $3x_1 + 2x_2 - 5x_3 \leq 8$

minimize M

s.t. $x_1 \leq M$

$x_2 \leq M$

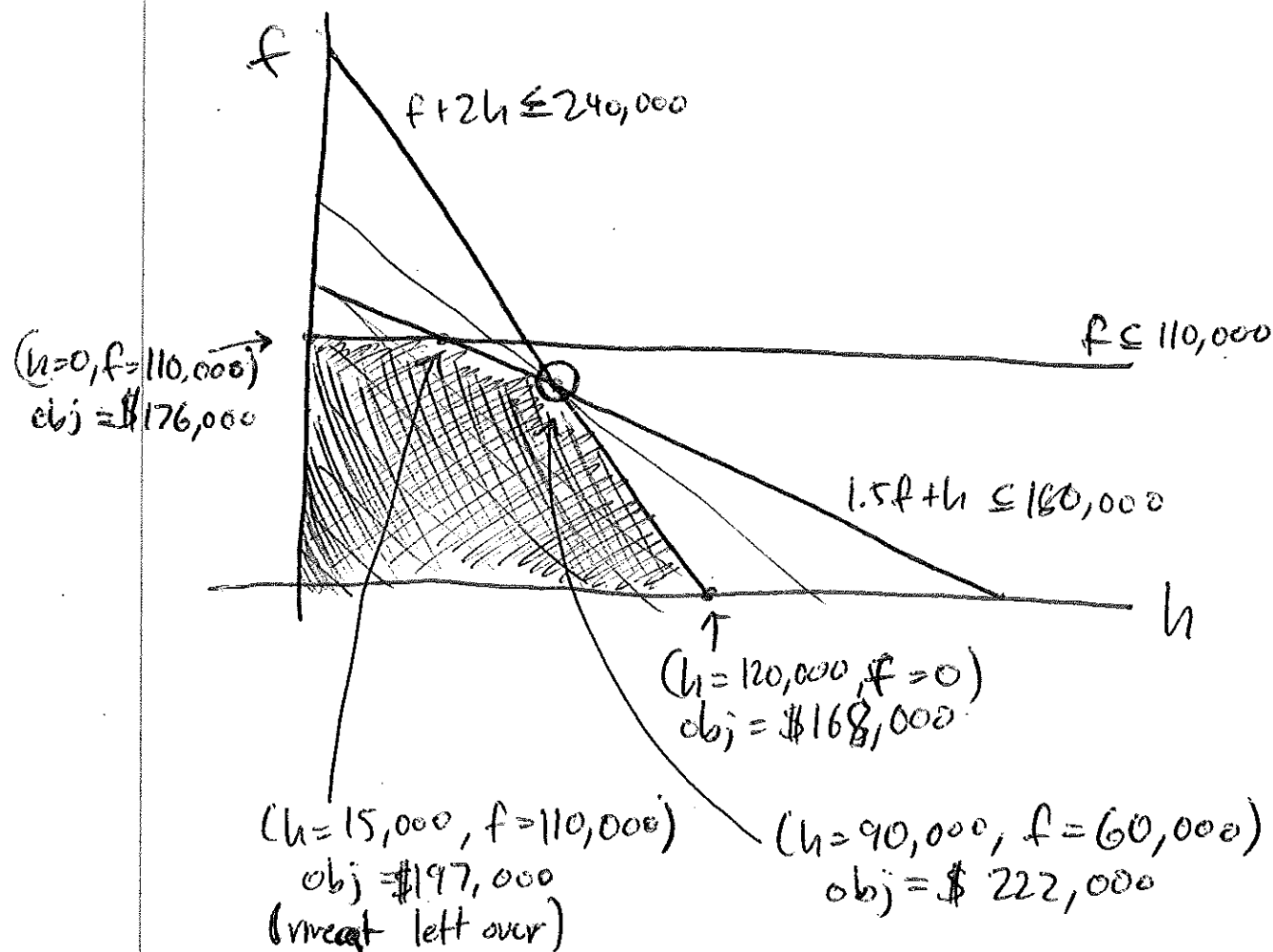
$x_3 \leq M$

$3x_1 + 2x_2 - 5x_3 \leq 8$

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$$\begin{aligned} \text{maximize: } & f(7 - 1 \cdot e' - 1.5(m)^2 - 1.40) \\ & + h(6 - 2 \cdot e' - 1(m)^2 - 0.60) \\ & = 1.6f + 1.4h \end{aligned}$$

$$\begin{aligned} \text{Subject to: } & \text{num}_e = 1 \cdot f + 2 \cdot h \leq 240,000 \\ & \text{num}_m = 1.5f + 1 \cdot h \leq 180,000 \end{aligned}$$



⑤ budget B , list of n items w/ v_i, w_i

$$x_i \in \mathbb{Z} \geq 0$$

$$\text{maximize } \sum_{i=1}^n x_i v_i$$

$x_i: i=1, \dots, n$

$$\text{s.t. } \sum_{i=1}^n x_i w_i \leq B$$

$$\rightarrow x_i \geq 0 \quad \forall i=1, \dots, n$$

⑥ hitting set: $\{S_1, S_2, \dots, S_n\}$, budget b

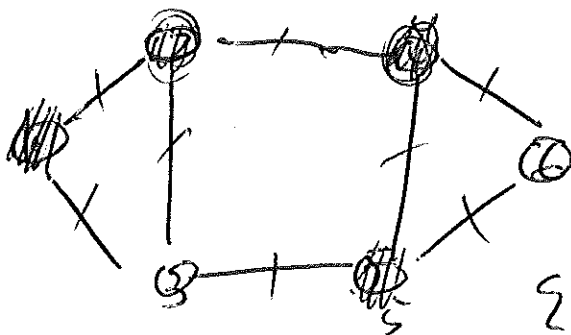
Find H , where $|H| \leq b$

$$\forall_i H \cap S_i \neq \emptyset$$

ex: $\{1, 2, \textcircled{3}\}, \{ \textcircled{3}, 4\}, \{ \textcircled{5}, 6\}$

$H = \{3, 5\}, b=2$

⑦ Vertex Cover: $G=(V, E)$ budget b



$$\underline{\{1, 2, 4, 5\}}$$

6 cont.

Show vertex cover \leq_p hitting set.

~~and~~

• given $G = (V, E)$

• take every edge $e_i \in E$, where
 e_i touches 2 vertices (u, v)

\Rightarrow produce ~~set~~ ~~set~~ $S_i = \{u, v\}$

$S_1, S_2, \dots, S_{|E|}$, where $|S_i| = 2$

• give $S_1, S_2, \dots, S_{|E|}$, b to
hitting set solver.

• get output. ~~the~~ solution S .

\Rightarrow

\Leftarrow

Solution to hitting set S is our vertex cover.

~~if solution~~ iff ~~the~~ solution S can be found.

"if we have a vertex cover, then the hitting set solver can find S "

"if S can be found, then it is our vertex cover".

Bonus

$$c_{MN} = 4 \quad c_{MC} = 1 \quad c_{KN} = 2 \quad c_{KC} = 3$$

Objective: minimize $4 \cdot (MN) + 1 \cdot MC + 2 \cdot KN + 3 \cdot KC$

Subj to:

$$KN + KC \leq 15$$

$$MN + MC \leq 8$$

$$MN + KN \leq 10$$

$$MC + KC \leq 13$$