

# IP tricks (part I)

1) Assume we have  $0 \leq y_i \leq 1$ .

We want  $x = \begin{cases} 1 & \text{if } y_i > \frac{1}{2} \\ 0 & \text{if } y_i < \frac{1}{2} \\ 0 \text{ or } 1 & \text{if } y_i = \frac{1}{2} \end{cases}$ .

In other words

$$y_i > \frac{1}{2} \Rightarrow x = 1 \quad (a)$$

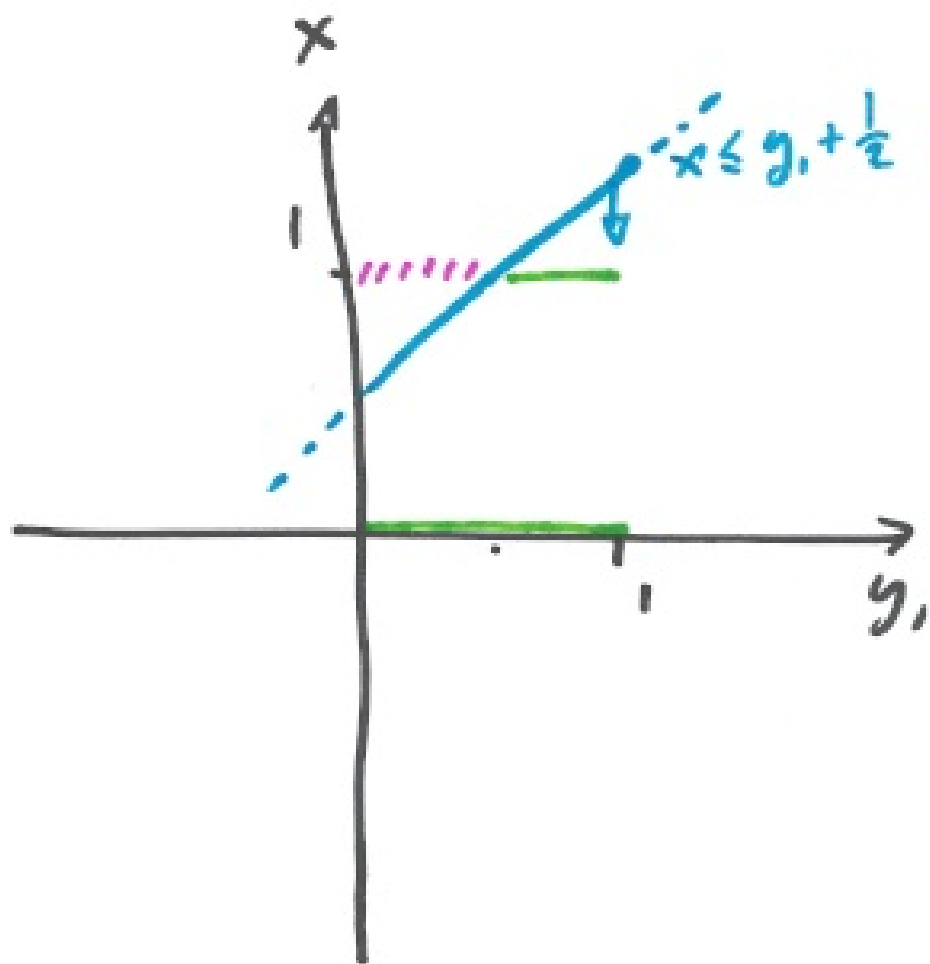
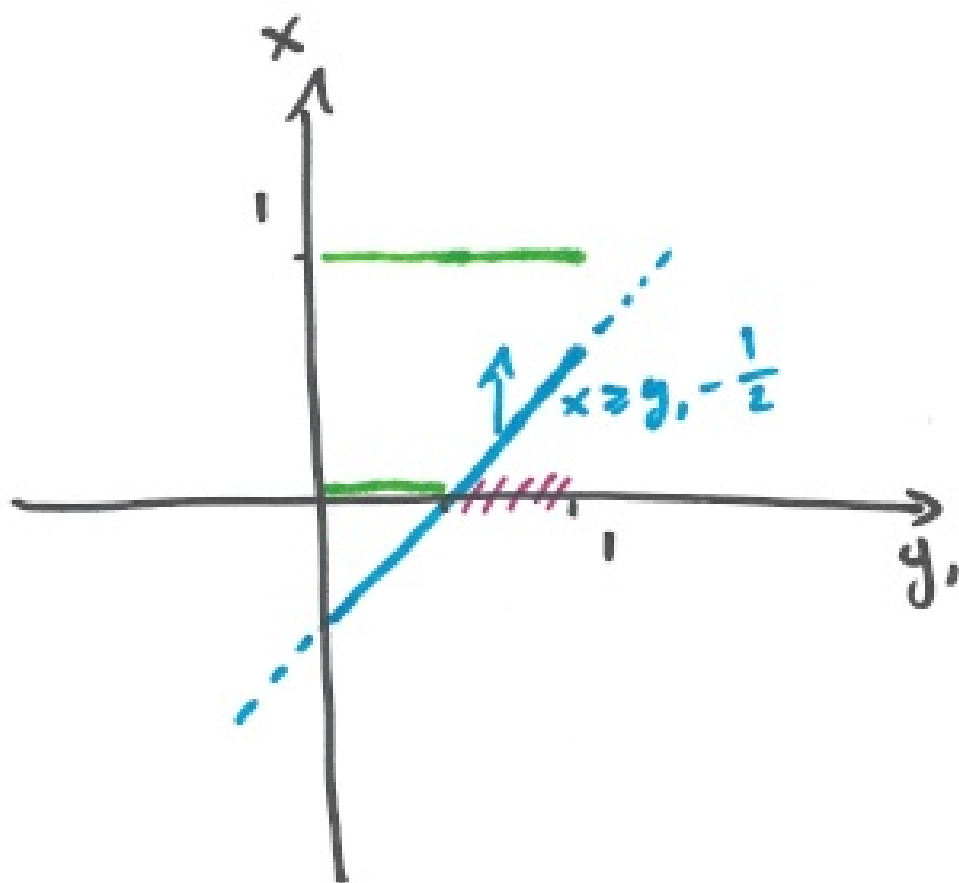
$$y_i < \frac{1}{2} \Rightarrow x = 0 \quad (b)$$

MODEL:

$$(a): \quad x \geq y_i - \frac{1}{2}$$

$$(b): \quad x \leq y_i + \frac{1}{2}$$

$$x \in \{0, 1\}$$



1.1)

$$\min C^T y + x$$

$$A y = b$$

$$x \geq y_1 - \frac{1}{2} \quad (d)$$

(b) not necessary)

1.2)

$$\min C^T y$$

$$A y = b$$

$$x \in \{0, 1\}$$

$$x \leq g^T y$$

$$\dots$$

$$x \leq h^T y$$

$$x \geq y_1 - \frac{1}{2} \quad (a)$$

(b) not necessary),  $x \in \{0, 1\}$

2) Assume we have  $0 \leq y \leq M$   
and  $z \in \{0, 1\}$ .

We want  $\begin{cases} x \geq y & \text{if } z = 1 \\ x \geq 0 & \text{if } z = 0 \end{cases}$

Nonlinear model

$$\begin{aligned} x &\geq y \cdot z \\ z &\in \{0, 1\} \end{aligned}$$

Linear model:

$$\begin{aligned} x &\geq y - M(1-z) \\ x &\geq 0 \end{aligned}$$

"big-M method"