LP Equivalent: ℓ_1 - Norm Approximation

-
$$\ell_1$$
 - Norm: $||y||_1 = \sum_i |y_i| = \sum_i \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i, y_i) + \max(-y_i, y_i) + \max(-y_i, y_i) = \max(-y_i,$

- Fitting/Approximation Problem:

minimize
$$||Ax - b||_1$$

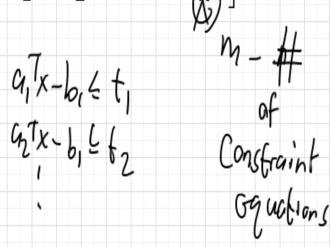


-- Need to add an auxiliary vector: $t = [t_1]$

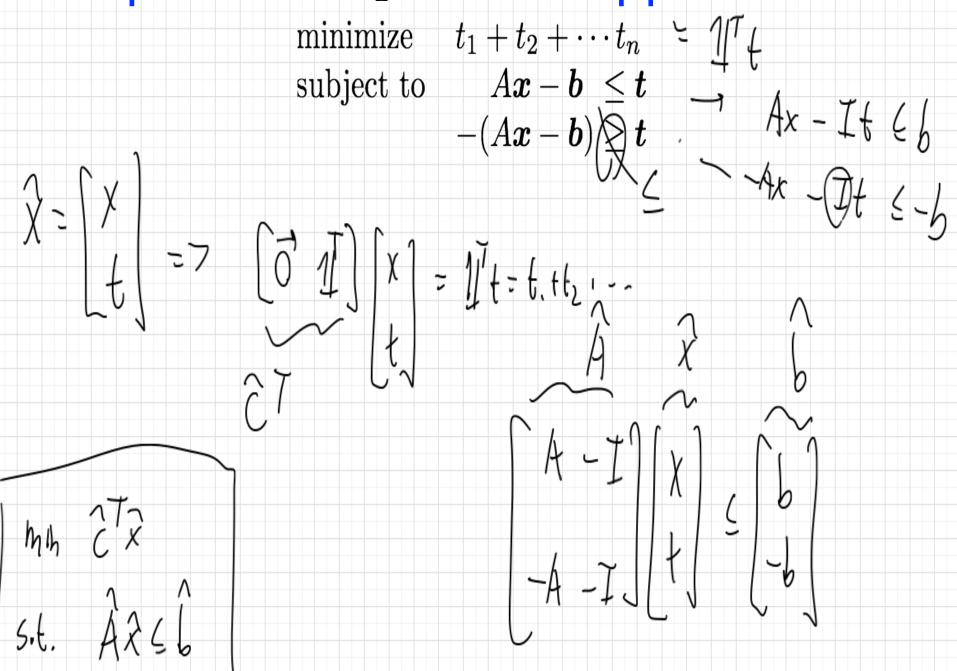
minimize
$$t_1 + t_2 + \cdots t_n$$
subject to $Ax - b \le t$

$$(-(Ax - b)) \ge t$$

$$Ax + b \le t$$



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- Matrix Form:

minimize
$$\begin{bmatrix} \mathbf{0} & \mathbf{1} \end{bmatrix}^T \begin{bmatrix} \mathbf{x} \\ \mathbf{t} \end{bmatrix}$$
subject to $\begin{bmatrix} A & -I \\ -A & -I \end{bmatrix} \begin{bmatrix} \mathbf{x} \\ \mathbf{t} \end{bmatrix} \leq \begin{bmatrix} \mathbf{b} \\ -\mathbf{b} \end{bmatrix}$