

# ZIMPL

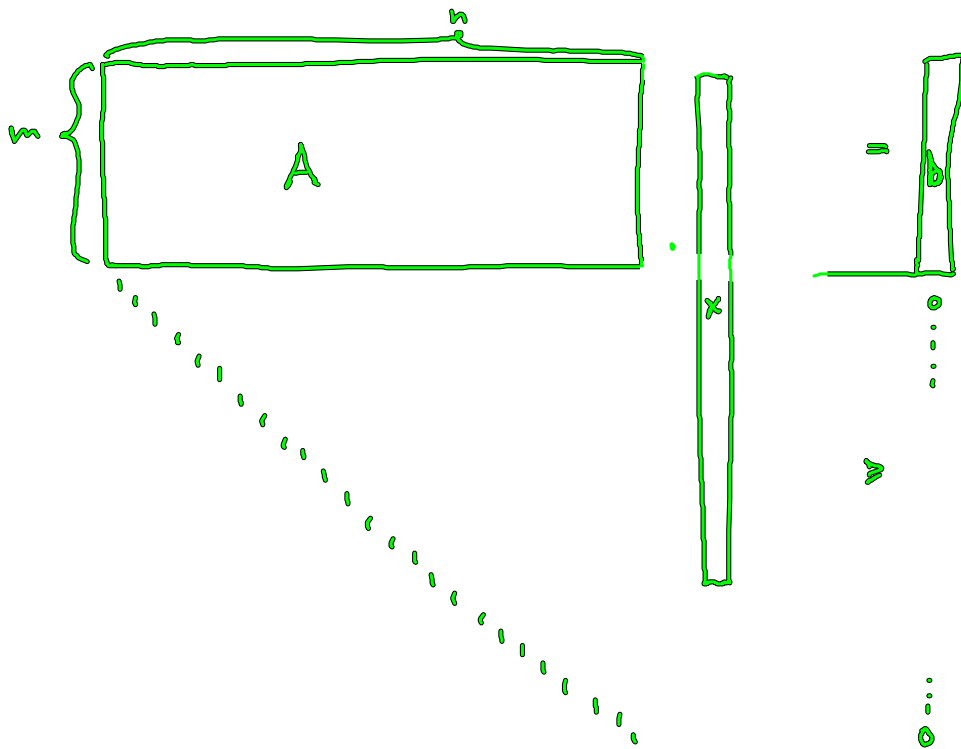
→ see Example

## Basic solutions in standard & general form

▶ basic solution  $x^* \in \mathbb{R}^n$  such that

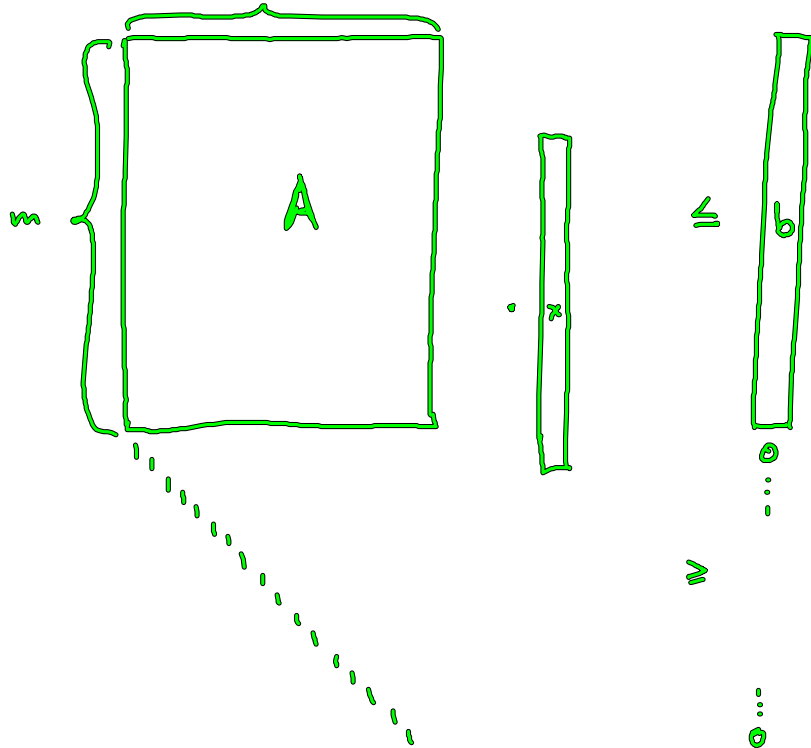
- all equality constraints are active
- at least  $n$  lin. indep. constraints are active

▶ LP in standard form:  $m$  constraints,  $n$  variables (w.l.o.g.  $m \leq n$ )



at  $x^*$ :  $\left. \begin{array}{l} m \text{ equality constraints active} \\ n-m \text{ nonneg. constr. active} \end{array} \right\} n \text{ active constr.}$   
→  $n - (n-m) = m$  nonneg. constr. remaining  
(BASIS!)

▶ LP in general form:  $m$  inequalities,  $n$  variables



at  $x^*$ ;  $n$  constraints active  
(lin. indep. !)

► from general to standard form

general form  
nonnegativity constr.  
"normal" constr.



standard form

nonneg. constr.



equality constr.  
plus a slack variable  
(↔ nonneg. constr.)



$m$  "normal" constr.  
 $n$  variables  
active "normal" constr.



$m$  equalities  
 $m+n$  variables



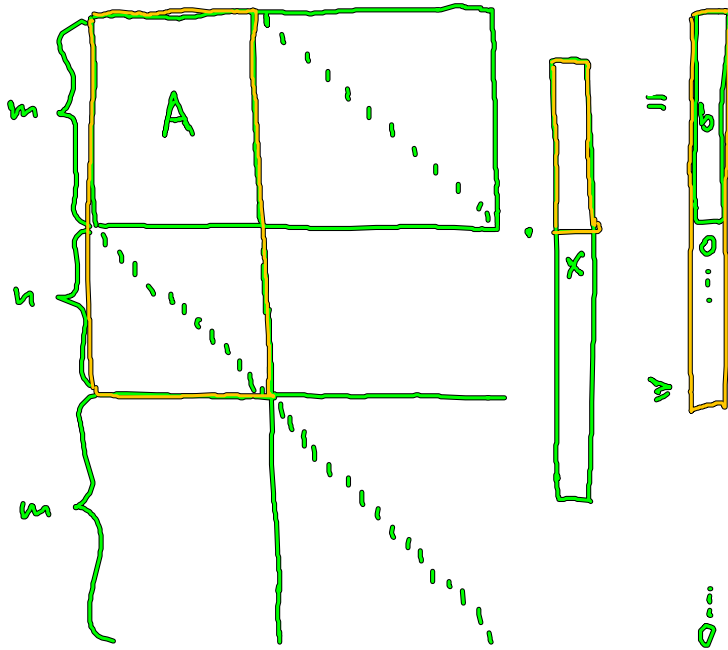
(active equality constr.)  
plus active nonneg. constr.

at  $x^*$ :  $n$  lin. indep. active constr.

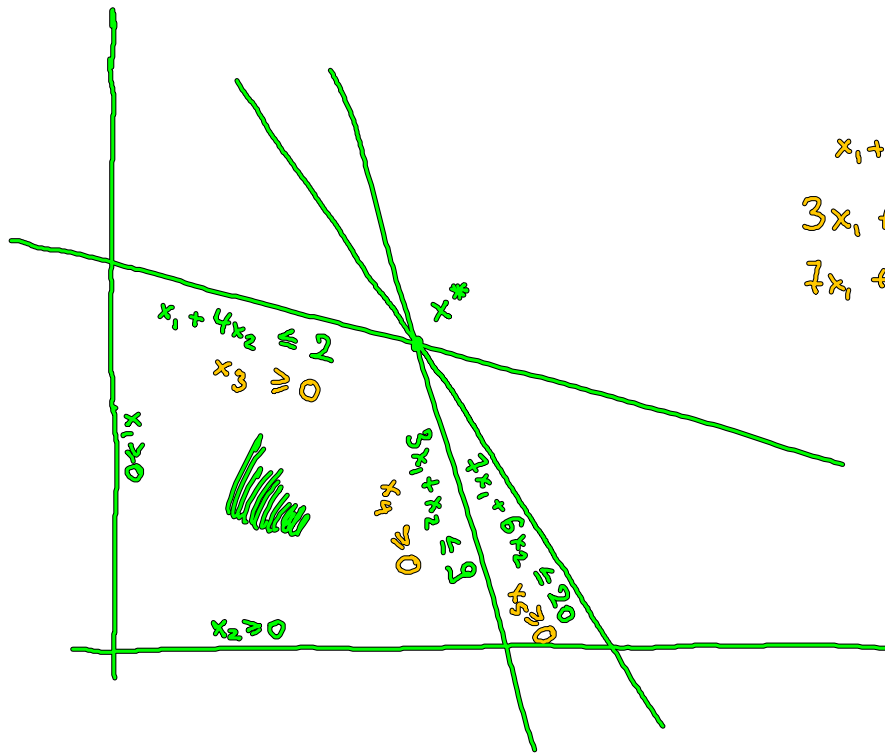


$n+n$  lin. indep. active constr.





► Example



$$\begin{aligned} x_1 + 4x_2 + x_3 &= 2 \\ 3x_1 + x_2 + x_4 &= 9 \\ 7x_1 + 6x_2 + x_5 &= 20 \end{aligned}$$

$x^*$  basic solution

basis:  $x_1, x_2, x_3 \rightarrow$  basis matrix:  $\begin{pmatrix} 1 & 4 & 1 \\ 3 & 1 & 0 \\ 7 & 6 & 0 \end{pmatrix}$

2 more bases for  $x^*$  !