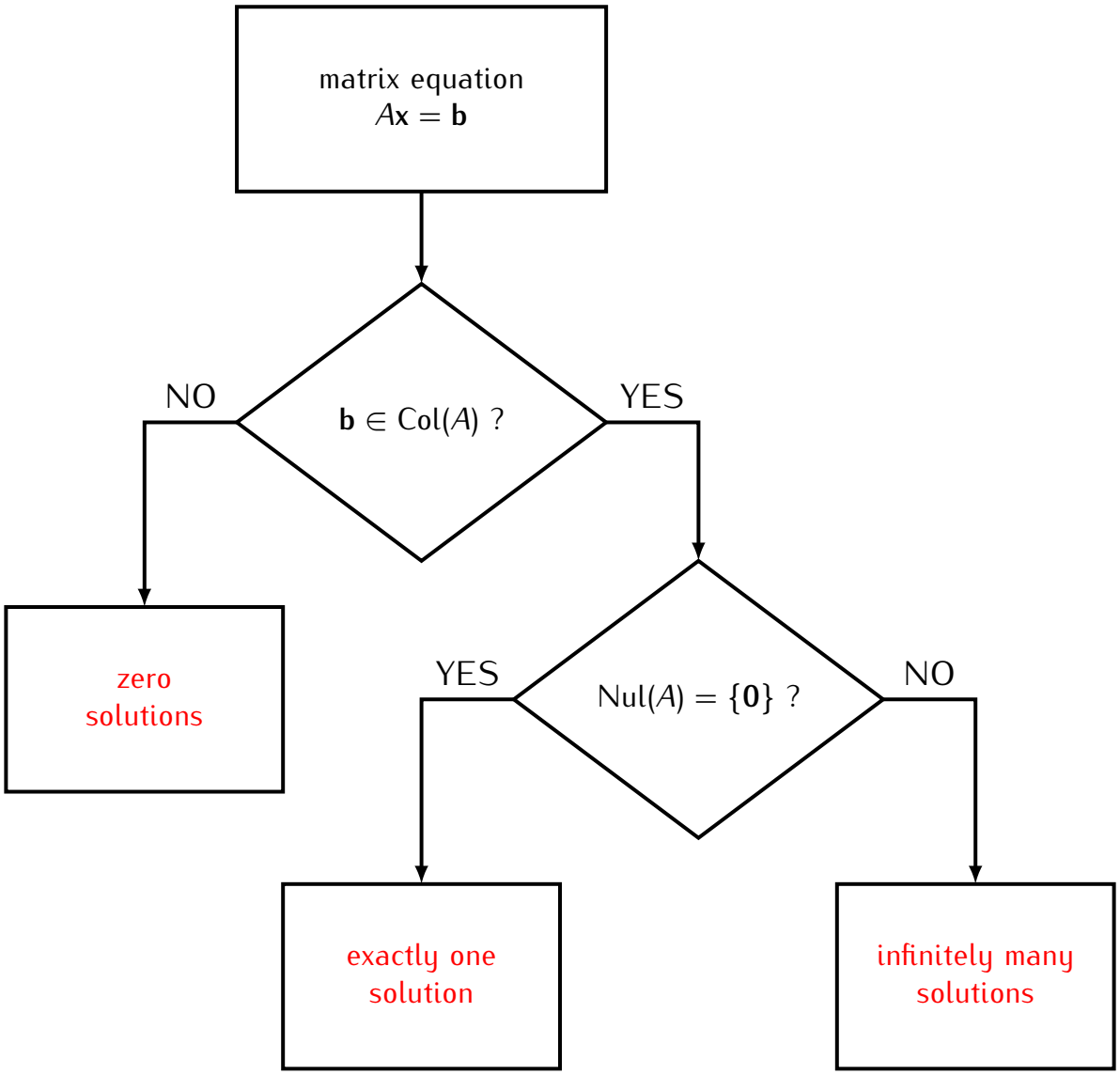
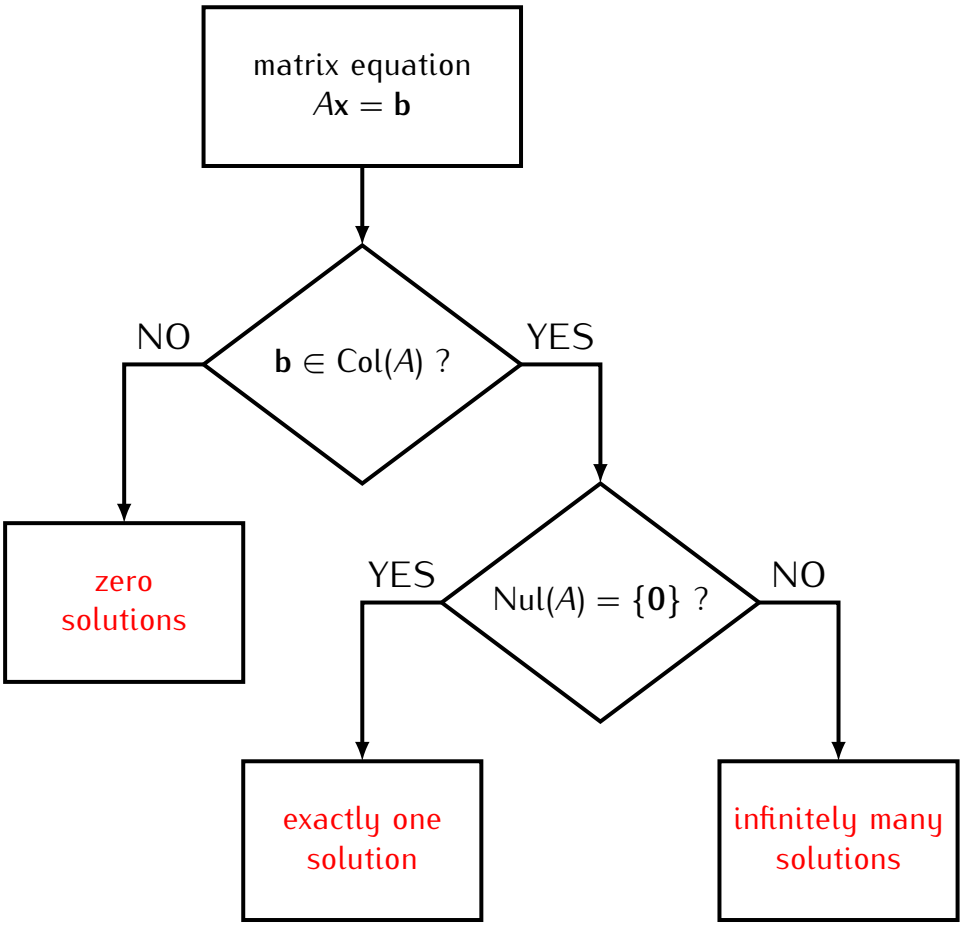
Upshot: how to find the number of solutions of a matrix equation



Recall:

1) We can multiply vectors by matrices.

2) Matrix equation: $A\mathbf{x} = \mathbf{b}$



$\mathrm{Col}(A)$ = (span of column vectors of A)

$\mathrm{Nul}(A)$ = (set of solutions of $A\mathbf{x} = \mathbf{0}$)

Recall: Nul(A) can be always described as a span of some vectors.

Example. Find the null space of the matrix

$$A = \begin{bmatrix} 1 & 1 & 0 & 2 \\ -2 & -2 & 1 & -5 \\ 1 & 1 & -1 & 3 \end{bmatrix}$$

Example. Solve the matrix equation $A\mathbf{x} = \mathbf{b}$ where

$$A = \begin{bmatrix} 1 & 1 & 0 & 2 \\ -2 & -2 & 1 & -5 \\ 1 & 1 & -1 & 3 \end{bmatrix} \qquad \mathbf{b} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$$