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- Approximate solution of linear equations w/ multiple RHS's
  - Suppose  $A$  is invertible
  - Seek  $x$  s.t.  $Ax \approx b_i$   $i=1, \dots, k$
  - Bob proposes a multi-objective least squares approach
$$x^{\text{Bob}} = \arg \min_x \|Ax - b_1\|^2 + \dots + \|Ax - b_k\|^2$$
  - Alice proposes to first average the  $b$ 's to get
$$b = \frac{1}{k} (b_1 + \dots + b_k)$$
Then choose  $x$  by solving one system of linear equations.
$$Ax^{\text{Alice}} = b$$
  - Oscar says that the 2 approaches sound different, but  $x^{\text{Bob}} = x^{\text{Alice}}$ , Is Oscar right?

Alice's approach





● Nearest vector w/ a given average

•  $a \in \mathbb{R}^n$ ,  $\beta \in \mathbb{R}$

• find  $x$  that is closest to  $a$  among all  $n$ -vectors that have an average value of  $\beta$

