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Matrix-Vector Notation

- Data-set sorted according to Factor breed
- Define vector y as the vector of all body weights

$$y = \begin{bmatrix} 471 \\ 465 \\ 470 \\ \vdots \\ 491 \end{bmatrix}; \text{ vector } b = \begin{bmatrix} b_0 \\ b_{Angus} \\ b_{Limousin} \\ b_{Simmental} \end{bmatrix}, \quad e = \begin{bmatrix} e_1 \\ \vdots \\ e_{10} \end{bmatrix}$$

$$\text{Matrix } X = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ \vdots & & & \\ 1 & 0 & 0 & 1 \end{bmatrix}$$

Design-matrix
Links observations to their fixed breed effects.

- Model $y = X \cdot b + e$
- Goal: Estimate of unknown b using least squares
- $SSQR = (y - Xb)^T (y - Xb)$
- In regression: $\hat{b}_{Rg} = (X^TX)^{-1} X^Ty$
- (X^TX) cannot be inverted