- First example: Sire Model

$$y = Xb + Zs + e$$

s: vector random sire effects

- Example data: 3 Sires: 1, 3, 4

$\Rightarrow$ s has 3 elements $s^T = [s_1, s_3, s_4]$

- Put information from data into model:

$$y = \begin{bmatrix} 4.5 \\ 2.9 \\ 3.9 \\ 3.5 \\ 5.0 \end{bmatrix} \rightarrow M \quad ; \quad b = \begin{bmatrix} b_M \\ b_F \end{bmatrix} \quad ; \quad s = \begin{bmatrix} s_1 \\ s_3 \\ s_4 \end{bmatrix}, \quad e = \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_5 \end{bmatrix}$$

X and Z are design matrices

$$X = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 1 \\ 1 & 0 \\ b_M & b_F \end{bmatrix} \qquad Z = \begin{array}{c} \begin{matrix} s_1 & s_3 & s_4 \end{matrix} \\ \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \end{array}$$