- Using properties of BLUP:
  solutions for $\hat{u}$ and $\hat{\beta}$:

$$\hat{u} = G Z^T V^{-1} (y - X\hat{\beta})$$

$$\hat{\beta} = (X^T V^{-1} X)^- X^T V^{-1} y$$

- Practical Problem: Large data sets (10^7 Mio records) ($6 \cdot 10^7$ Mio
  V^{-1}: cannot be computed

- Same solutions from system of equations:

$$\begin{bmatrix} X^T R^{-1} X & X^T R^{-1} Z \\ Z^T R^{-1} X & Z^T R^{-1} Z + G^{-1} \end{bmatrix} \begin{bmatrix} \hat{\beta} \\ \hat{u} \end{bmatrix} = \begin{bmatrix} X^T R^{-1} y \\ Z^T R^{-1} y \end{bmatrix}$$

- $R = I\sigma_e^2 \Rightarrow R^{-1} = I \cdot 1/\sigma_e^2$