Mixed Model Equations (MME):

Assume $\text{var}(e) = R = I \cdot \bar{\sigma}_e^2$

$$\begin{bmatrix} X^T X & X^T Z \\ Z^T X & Z^T Z + G^{-1} \cdot \bar{\sigma}_e^2 \end{bmatrix} \begin{bmatrix} \hat{\beta} \\ \hat{u} \end{bmatrix} = \begin{bmatrix} X^T y \\ Z^T y \end{bmatrix}$$

$$? \quad \text{var}(u) = G = \begin{bmatrix} \text{var}(u_1) & \text{cor}(u_1, u_2) & \text{---} \\ \text{cov}(u_2, u_1) & \text{var}(u_2) & \text{---} \\ & & \ddots \end{bmatrix}$$

$$\begin{cases} \text{var}(u_1) = (1 + F_1) \cdot \bar{\sigma}_u^2 \quad \text{where } F_1 \text{ is the } \underline{\text{inbreeding}} \\ \qquad\qquad\qquad\qquad\qquad \text{coefficient of animal 1} \\ \text{var}(u_2) = (1 + F_2) \cdot \bar{\sigma}_u^2 \\ \vdots \end{cases}$$

Chapter 6

if parents of animal are related

$$\text{cov}(u_1, u_2) = ? \quad ; \text{ if animal 1 and } \\ \qquad\qquad\qquad\qquad 2 \text{ are unrelated, then}$$

$$\text{cov}(u_1, u_2) = \emptyset$$

where relationship is defined by the pedigree
(Stammbaum)