

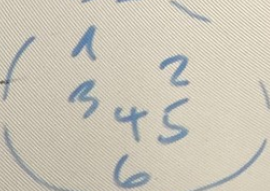
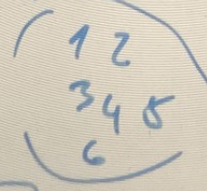
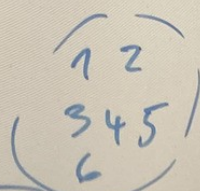
Solutions from Mixed Model Equations

$$R = I \cdot \sigma_e^2; G$$

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

$$G_{6 \times 6} = \text{var}(\underline{u}) = \begin{bmatrix} \text{var}(u_1) & \text{cov}(u_1, u_2) & \dots & \text{cov}(u_1, u_6) \\ \text{cov}(u_2, u_1) & \text{var}(u_2) & \dots & \text{cov}(u_2, u_6) \\ \vdots & \vdots & \ddots & \vdots \\ \text{cov}(u_6, u_1) & \text{cov}(u_6, u_2) & \dots & \text{var}(u_6) \end{bmatrix}$$

\* Source of  $\text{var}(u_i)$  and  $\text{cov}(u_i, u_j)$  is based on the so-called "large-sampling" concept

Universe 1	Universe 2	Universe 3
Population	Population	
		
$u_1, u_2, u_3, u_4, \dots$	$u_1, u_2, \dots, u_6$	$u_1, u_2, \dots, u_6$
		$E(u_2) = 0; \text{var}(u_2)$

$\Rightarrow u_i$  are random variable with given expectation and variance