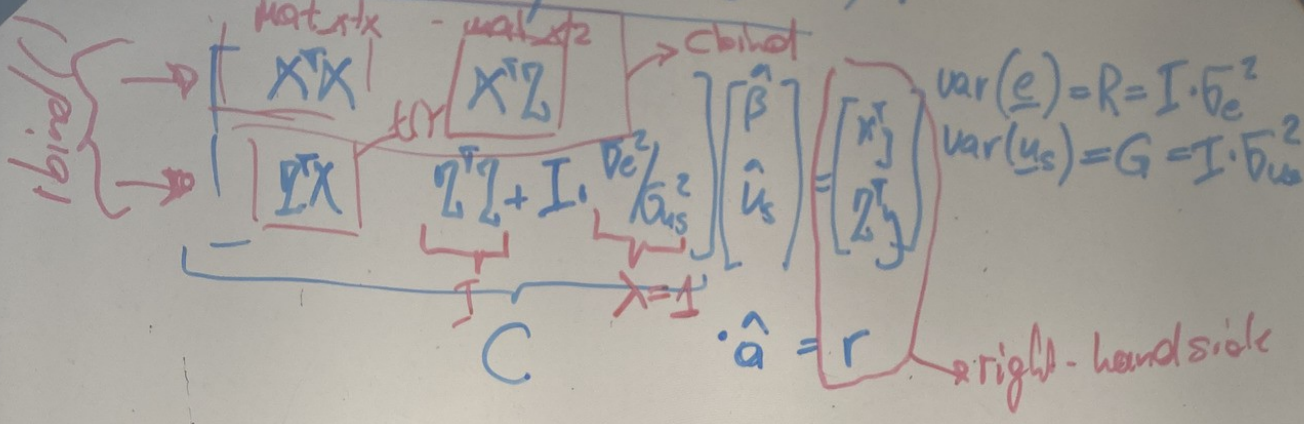
Mixed Model Equations (MME):



$\text{var}(\underline{e}) = R = I \cdot \sigma_e^2$

$\text{var}(\underline{u}_s) = G = I \cdot \sigma_{us}^2$

Goal: $\hat{a}$ as a solution to $C \cdot \hat{a} = r$

- Multiply by C^{-1}: $C^{-1}C \cdot \hat{a} = C^{-1}r$

$I \quad \hat{a} = C^{-1} \cdot r$

solve(mat_C, mat_R)

$(X^TZ)^T = Z^T(X^T)^T = Z^TX$

$C^{-1} = \text{solve}(\text{mat\_C})$

mat_a_hat ← solve(mat_C) %*% mat_R

Example II: $y = X\beta + Zu_s + e$

$E(\underline{e}) = \underline{0}$, $E(\underline{u}_s) = \underline{0}$, $E(\underline{y}) = X\underline{\beta}$