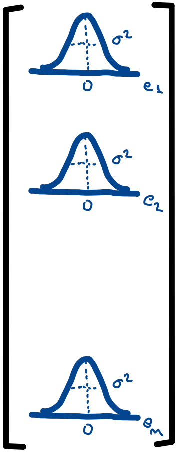
$$e = \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_n \end{bmatrix} =$$



$Cov(e_1, e_2) = 0$

because

Independent variables

$$E[e] = \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix} = 0$$

$$Cov(e) = \begin{bmatrix} \overset{Var(e_1)}{\cancel{Cov(e_1,e_1)}} & \overset{0}{\cancel{Cov(e_1,e_2)}} & \cdots & \overset{0}{\cancel{Cov(e_1,e_n)}} \\ \overset{0}{\cancel{Cov(e_2,e_1)}} & \overset{Var(e_2)}{\cancel{Cov(e_2,e_2)}} & & \vdots \\ \vdots & & \ddots & \vdots \\ \overset{0}{\cancel{Cov(e_1,e_n)}} & \cdots & & \overset{Var(e_n)}{\cancel{Cov(e_n,e_n)}} \end{bmatrix} = \sigma^2 I$$