$\underset{\sim}{X}$ $\quad \vec{X}$ $\quad \tilde{X}$

$$\left[(n\times 1)-(n\times 1)\right] = \left[n\times 1\right]$$

$$(n\times 1)\times(n\times 1) = \text{no go}$$

$$(n\times 1)\times(1\times n) = (n\times n)$$

$\underset{\sim}{X} = \begin{pmatrix} X_1 \\ X_2 \end{pmatrix}$ What's the $\text{var}(X_1)$, $\text{var}(X_2)$, $\text{cov}(X_1, X_2)$?

- $E\left[(X_1 - E(X_1))^2\right]$
- $\cdots$ 2 $\cdots$ 2
- $E\left[(X_1 - E(X_1))(X_2 - E(X_2))\right]$

row vector: $\left(X_1 - E(X_1),\ X_2 - E(X_2)\right) \begin{pmatrix} X_1 - E(X_1) \\ X_2 - E(X_2) \end{pmatrix}$

Gauss – Markov :

- $E(e_i) = 0 \quad \forall i$ $\qquad E(\underset{\sim}{e}) = \underset{\sim}{0}$
- $\text{var}(e_i)$ const $\forall i$
- e_i's uncorrelated

$\rightarrow \text{var}(\underset{\sim}{e}) = \sigma^2 I$

- e_i's normally dist'd. $\qquad \underset{n\times 1}{\underset{\sim}{e}} \sim N(\underset{n\times 1}{\underset{\sim}{0}}, \underset{n\times n}{\sigma^2 I})$

c.f.: $X \sim N(\mu, \sigma^2)$