Likewise $\mathbf{W} = [w_{ij}]$ is a matrix ($r \times s$) with elements w_{ij} random variables in $\mathbb{R}$

Then $E[\mathbf{W}] = [E[w_{ij}]]$ defined elementwise

Definition

$$\text{Cov}(\mathbf{Y}) = E[(\mathbf{Y} - \boldsymbol{\mu})(\mathbf{Y} - \boldsymbol{\mu})^T] = \begin{matrix} \sigma_1 & \cdots & \sigma_{1n} \\ \vdots & \sigma_2 \cdots & \\ \vdots & \ddots & \vdots \\ \sigma_{n1} & \cdots & \sigma_n \end{matrix} \equiv \Sigma$$