

Quadratic forms الشكل التربيعي

A function $f(x_1, x_2, \dots, x_n)$ of n real variables x_1, x_2, \dots, x_n is defined to be quadratic form if

$$\begin{aligned} f(x_1, x_2, \dots, x_n) &= a_{11}x_1^2 + a_{22}x_2^2 + \dots + a_{nn}x_n^2 + \\ &\quad 2a_{12}x_1x_2 + 2a_{13}x_1x_3 + \dots + 2a_{1n}x_1x_n + \dots \\ &\quad \cancel{2a_{21}x_2x_1} + \cancel{2a_{23}x_2x_3} + \dots + 2a_{(n-1)n}x_{(n-1)}x_n \\ &= \sum_{i=1}^n \sum_{j=1}^n a_{ij}x_i x_j = \underline{X}' A \underline{X} \rightarrow \text{scalar} \end{aligned}$$

The ~~Symm.~~ matrix A is defined to be the matrix of (Q.F) where $A = [a_{ij}]$ $i, j = 1, 2, \dots, n$