NOTATION · CHEAT SHEET

Expectation and Spread: Notation at a Glance

The marks from the notation cards across the pages on expected value, variance, covariance, median and mode: how each is read and what it means. Every group links to the full card on its page.

EXPECTED VALUE

$E[X],\ \mathbb{E}[X]$	**THE EXPECTED VALUE OF X** Takes a whole random variable, returns one number.
μ	**MU, THE MEAN** The same number as a constant: $\mu = E[X]$.
$E[g(X)]$	**EXPECTED VALUE OF G OF X** Weights $g(x)$, not x; in general not $g(E[X])$.

VARIANCE

$\mathrm{Var}(X)$	**THE VARIANCE OF X** The expected squared distance from the mean.
σ^2	**SIGMA SQUARED** The variance as a constant; never negative.
$\sigma,\ \mathrm{SD}(X)$	**THE STANDARD DEVIATION** The square root of the variance, in the units of X.

COVARIANCE

$\mathrm{Cov}(X, Y)$	**THE COVARIANCE OF X AND Y** How two variables move together.
σ_{XY}	**SIGMA X Y** The covariance as a constant; $\sigma_{XX} = \sigma_X^2$.
ρ_{XY}	**RHO, THE CORRELATION** Covariance over $\sigma_X \sigma_Y$: always in $[-1, 1]$.

MEDIAN

$\mathrm{median}(X),\ m$	**THE MEDIAN OF X** The middle value: half the probability on each side.
$\tilde{x}$	**X TILDE** The sample median, as $\bar{x}$ is the sample mean.
$Q_2 = F^{-1}(0.5)$	**THE SECOND QUARTILE** The median as the 0.5 quantile.

MODE

$\mathrm{mode}(X)$	**THE MODE OF X** The most likely value.
$\arg\max_x f(x)$	**WHERE F IS LARGEST** The location of the peak, not its height.
$\{k_1, \ldots, k_m\}$	**SEVERAL MODES** Braces when values tie: the mode need not be unique.

SAME MARKS, DIFFERENT JOB

$\bar{x}$ vs $\tilde{x}$	The bar marks the sample mean, the tilde the sample median.
σ^2 vs σ	Variance in squared units against standard deviation in the units of X.
$\max$ vs $\arg\max$	The height of the peak against where it stands.
F^{-1}	The quantile function, not $\frac{1}{F}$.