NOTATION · CHEAT SHEET

Inequalities and Limit Theorems: Notation at a Glance

The marks from the notation cards across the pages on probability inequalities and limit theorems: how each is read and what it means. Every group links to the full card on its page.

MARKOV'S INEQUALITY

$P(X \geq a)$

A RIGHT-TAIL PROBABILITY
The chance that X reaches the threshold a.

$\leq \dfrac{E[X]}{a}$

AT MOST THE MEAN OVER A
The bound, for $X \geq 0$ and any distribution.

$\leq \dfrac{1}{k}$

K TIMES THE MEAN
The same bound for the threshold $a = kE[X]$.

CHEBYSHEV'S INEQUALITY

$|X - \mu| \geq k\sigma$

K STANDARD DEVIATIONS AWAY
Both tails at once.

$\leq \dfrac{1}{k^2}$

AT MOST ONE OVER K SQUARED
Or $\frac{\sigma^2}{\varepsilon^2}$, with $\varepsilon = k\sigma$.

$\geq 1 - \dfrac{1}{k^2}$

WITHIN K STANDARD DEVIATIONS
The same fact through the complement.

LAW OF LARGE NUMBERS

$\xrightarrow{P}$, $\xrightarrow{\text{a.s.}}$

IN PROBABILITY; ALMOST SURELY
The label on the arrow names the kind of convergence.

$P(|\bar{X}_n - \mu| > \varepsilon)$

CHANCE OF MISSING BY EPSILON
Goes to 0: the weak law.

$P(\lim \bar{X}_n = \mu) = 1$

WITH PROBABILITY ONE
The strong law: the limit sits inside P.

CENTRAL LIMIT THEOREM

$\bar{X}_n,\ S_n$

THE SAMPLE MEAN; THE SUM
Of n observations; capital, because both are random.

$\xrightarrow{d}$

CONVERGES IN DISTRIBUTION
The shape converges, not the values.

$Z_n \xrightarrow{d} \mathcal{N}(0,1)$

THE STANDARDIZED MEAN
$Z_n = \frac{\bar{X}_n - \mu}{\sigma/\sqrt{n}}$ approaches the standard normal.

SAME MARKS, DIFFERENT JOB

$\rightarrow$ with a label	P, a.s. and d are three different kinds of convergence.
S_n	A sum of random variables here; a partial sum on the sequence pages.
$\bar{X}_n$ vs $\bar{x}$	The sample mean as a random variable against one observed value.