NOTATION · CHEAT SHEET

Random Variable Notation at a Glance

The marks from the notation cards across the random-variable pages: how each is read and what it means. Every group links to the full card on its page.

RANDOM VARIABLES

$X : \Omega \to \mathbb{R}$	**X MAPS OUTCOMES TO NUMBERS** A random variable is a function, not a variable.
$\{X \le x\}$	**THE EVENT THAT X IS AT MOST X** Braces turn a condition into an event.
$X \sim \text{Bin}(n, p)$	**X IS DISTRIBUTED AS** Names the distribution and its parameters.

PROBABILITY FUNCTIONS

X vs x	**THE VARIABLE; A VALUE** Capital for the random variable, lowercase for a number it takes.
$P(\cdot)$	**THE PROBABILITY OF** Takes an event, returns a number in $[0, 1]$.
$p(x)$ vs $f(x)$	**MASS; DENSITY** p is a chance (discrete); f is a rate (continuous).

PMF

$\{x : p_X(x) > 0\}$	**THE SUPPORT OF X** Every value that carries probability.
$\sum_x p_X(x) = 1$	**THE MASSES ADD TO ONE** The sum runs over the support, not from a start to an end.

PDF

$f_X(x)$	**THE DENSITY OF X AT X** A density, not a probability; it can exceed 1.
$P(a \le X \le b)$	**X BETWEEN A AND B** The integral $\int_a^b f_X(x)\,dx$.
$P(X = a) = 0$	**A SINGLE POINT** For a continuous variable, always zero.

CDF

$F_X(x)$	**THE CDF OF X AT X** Equals $P(X \le x)$: everything up to and including x.
$F(b) - F(a)$	**F OF B MINUS F OF A** Equals $P(a < X \le b)$.

INDICATORS

$I_A,\ \mathbf{1}_A$	**THE INDICATOR OF A** 1 if A happens, 0 if not.
$\mathbf{1}\{X \le x\}$	**ONE IF THE CONDITION HOLDS** The brace form takes a statement instead of an event.
$N = \sum I_{A_i}$	**A COUNT OF EVENTS** How many of the A_i happened.

SAME MARKS, DIFFERENT JOB

P vs p	Capital P takes an event; lowercase p is a mass function of a value.
F vs f	Capital F accumulates (the CDF); lowercase f is the density.
$\sim$	Is distributed as; in linear algebra, row-equivalent or similar.
$\{X \le x\}$	An event, not a set of numbers.