NOTATION · CHEAT SHEET

Events and Probability Rules: Notation at a Glance

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

SAMPLE SPACE

Ω	**OMEGA, THE SAMPLE SPACE** The set of every possible outcome.
$\omega \in \Omega$	**LITTLE OMEGA, ONE OUTCOME** Lowercase for one outcome, capital for all of them.
$A \subseteq \Omega$	**A IS AN EVENT** An event is any set of outcomes.

SETS IN PROBABILITY

$A \cup B$	**A OR B** At least one of them happens.
$A \cap B$	**A AND B** Both happen.
A^c	**NOT A** Every outcome outside A.
$A \setminus B$	**A BUT NOT B** A happens and B does not.

CONDITIONAL PROBABILITY

$P(A \mid B)$	**PROBABILITY OF A GIVEN B** Measured inside the world where B has happened.
$P(A \cap B)$	**PROBABILITY OF A AND B** The joint probability: the overlap of the two events.

INDEPENDENCE

$A \perp B$	**A IS INDEPENDENT OF B** $P(A \cap B) = P(A)\,P(B)$; also $P(A \mid B) = P(A)$.
$A \perp B \mid C$	**INDEPENDENT GIVEN C** The product rule holds inside the world where C holds.
$X_i \overset{\text{iid}}{\sim} F$	**INDEPENDENT, IDENTICALLY DISTRIBUTED** All independent, all with the same distribution F.

JOINT PROBABILITY

$P(X = x,\, Y = y)$	**X EQUALS X AND Y EQUALS Y** The comma means and.
$p(x, y),\ f_{X,Y}$	**JOINT MASS; JOINT DENSITY** One function of both variables.
$p_X(x) = \sum_y p(x, y)$	**THE MARGINAL OF X** Sum the joint over every value of y.

TOTAL PROBABILITY

$\bigcup B_i = \Omega$	**THE CASES COVER EVERYTHING** With $B_i \cap B_j = \emptyset$: a partition into cases.
$\sum_i P(A \mid B_i)\,P(B_i)$	**CHANCE IN EACH CASE, WEIGHTED** Equals $P(A)$; with a density, the sum becomes an integral.

BAYES' THEOREM

$P(B \mid A)$	**THE REVERSE CONDITIONAL** Not the same as $P(A \mid B)$; Bayes' theorem converts one into the other.
$P(A) \to P(A \mid B)$	**PRIOR TO POSTERIOR** The same event, measured again once B is known.
$O(A \mid B)$	**THE POSTERIOR ODDS OF A** Bayes in odds form: the likelihood ratio times the prior odds $O(A)$.

SAME MARKS, DIFFERENT JOB

$A \mid B$	Inside $P(\cdot)$, given; between integers, divides.
$\perp$	Independent here; perpendicular or orthogonal in geometry and linear algebra.
A^c	The complement event, not a power of A.
the comma	In $P(X = x, Y = y)$ it means and, not a list.