Greek Letters		Common Usages
Αα	Alpha	α: Constant in regression/statistics: $y = \alpha + \beta x + \varepsilon$; also type I error
Ββ	Beta	β: Coefficient in regression/statistics, often subscripted to indicate different coefficients: $y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$; also type II error; related, $1 - \beta$ is called the "power" of a statistical test.
Γγ	Gamma	Γ: A particular statistical distribution; also used to denote a game.
Δδ	Delta	Δ: Means "change" or "difference", as in the equation of a line's slope: $\frac{\Delta y}{\Delta x} = \frac{y_1 - y_2}{x_1 - x_2}$. δ: Known in game theory as the "discount parameter" and is used for repeated games.
Εε	Epsilon	ε: "Error term" in regression/statistics; more generally used to denote an arbitrarily small, positive number.
∈	(Variant Epsilon)	This version of epsilon is used in set theory to mean "belongs to" or "is in the set of": $x \in \mathbf{X}$; similarly used to indicate the range of a parameter: $x \in [0, 1]$. "$x \notin \varnothing$" means "the element *x* does *not* belong to the empty set".
Ζζ	Zeta	
Ηη	Eta	
Θθ	Theta	θ: The fixed probability of success parameter in a Binomial Distribution and related distributions.
ϑ	(Script Theta)	
Ιι	Iota	
Κκ	Kappa	
Λλ	Lambda	$\lambda = n\theta$: Parameter in the Poisson Distribution.
Μμ	Mu	μ: In statistics, the mean of a distribution. In game theory, often used as the probability of belief.
Νν	Nu	
Ξξ	Xi	
Οο	Omicron	
Ππ	Pi	∏: Product symbol, as in $\prod_{i=3}^{5} i = 60$. π: Mathematical constant (3.14159…); also used in game theory to denote an actor's belief as a probability.
Ρρ	Rho	ρ: Correlation coefficient in some statistical analyses.
Σσ	Sigma	Σ: Summation symbol, as in $\sum_{i=3}^{5} i = 12$. σ: Standard Deviation of a distribution; also used to denote an actor's mixed strategy. σ^2: Variance of a distribution.
ς	(Final Sigma)	
Ττ	Tau	
Υυ	Upsilon	
Φφ	Phi	$\Phi(z)$: The cumulative density function (cdf) for the standard normal distribution. $\phi(z)$: The probability density function (pdf) for the same.
φ	(Script Phi)	
Χχ	Chi	χ^2: A particular statistical distribution.
Ψψ	Psi	
Ωω	Omega	Ω : The "positive definite matrix" in regression/statistics.
ϖ	(Variant Omega)	

Mathematical Constants

e ≈ 2.718281828...	π ≈ 3.141592653...	$i = \sqrt{-1}$ (imaginary numbers)

Mathematical Symbols		Usage
!	Factorial	$n! = \prod_{i=1}^{n} i$; e.g., 5! = 5 · 4 · 3 · 2 · 1 = 120
^	"carrot" or "hat"	3^2 = 3^2 = 9. Also used in statistics to denote estimates: $\hat{\sigma}$
$\overline{\mathbf{X}}$	*x* "bar"	Sample mean of **X** = $(\Sigma x)/n$, where *n* is the number of observations.
$\forall$	All	$\forall x$; for all *x*, something is true.
$\exists$	Exists	$\exists x = 1$; there exists some *x* equal to 1.
$\rightarrow$	Implies	$p \rightarrow q$; if *p* is true (or occurs), then *q* is true (or will occur).
$\therefore$	Therefore	Indicating a logical result: $p \rightarrow q$ and $q \rightarrow r$, $\therefore p \rightarrow r$.
|	Given, Conditional	P(**E**|**F**); The probability of **E** given (or within the set of) **F**.
| |	Absolute Value	$\|-x\| = x$
~	Not	~C; not to cooperate. (Also used in geometry to mean "similar".)
$\leq$	Less than or equal to	
$\geq$	Greater than or equal to	
∞	Infinity	
$\pm$	Plus or minus	
$\propto$	Proportional to	$x \propto 1/f$
∂	Derivative	Calculus notation; $\frac{\partial}{\partial x}(y = mx + b) = m$
$\neq$	Not equal to	
$\equiv$	Identically equal to	$x \equiv x$; sometimes a way proving something; also a way of denoting a definition.
$\approx$	Approximately equal to	$\pi \approx 3.14$
$\Re$, **R**, or $\mathbb{R}$	Set of Real Numbers	
$\varnothing$	Empty Set	**X** = $\varnothing$; The set **X** is empty. **X** $\neq \varnothing$; The set **X** is not empty.
$\cap$	Conjunction; And	$\{1, 2, 3, 4\} \cap \{4, 5, 6, 7\} = \{4\}$
$\cup$	Union; Or	$\{1, 2, 3, 4\} \cup \{4, 5, 6, 7\} = \{1, 2, 3, 4, 5, 6, 7\}$
√	Square root	$\sqrt{2} \approx 1.414$; $\sqrt{4} = 2$
P(·)	Probability of	P(HH) = ½ · ½ = ¼; the probability of landing two heads in successive coin flips; sometimes Pr(·).
L	Likelihood	Used in Maximum Likelihood Estimation in statistics.
L(·)	Lottery (in game theory)	L(*B*, *W*; *p*) is a lottery between winning one's best outcome, *B*, with probability *p* and "winning" one's worst outcome, *W*, with probability 1 – *p*.
E(·)	Expectation of	E(**X**) = Σ *x*· P(*x*); also as expected utility: EU(L(1, 0; ¼)) = 1 · ¼ + 0 · ¾ = ¼.
ln or LN	Natural log	(ln(*x*) = b) ≡ (e^b = x), where e is the mathematical constant.
lim	Limit	$\lim_{x\to\infty} \frac{1}{x} = 0$; The limit of 1/*x* as *x* goes to (or approaches) infinity equals zero.
$\int$	Integral	Calculus notation; $\int x\,dx = \frac{1}{2}x^2$ and $\int_a^b \frac{1}{a+b}dx = \frac{b-a}{a+b}$
J	Jacobian	**J**: a particular matrix; *J*: Determinant of a Jacobian matrix.

Rules of Logic

Addition

$$\begin{array}{l} p \\ \hline \therefore\ p \cup q \end{array}$$

Conjunction

$$\begin{array}{l} p \\ q \\ \hline \therefore\ p \cap q \end{array}$$

Simplification

$$\begin{array}{l} p \cap q \\ \hline \therefore\ p \\ \therefore\ q \end{array}$$

Elimination

$$\begin{array}{l} p \cup q \\ \sim p \\ \hline \therefore\ q \end{array}$$

Double Negation

$$\begin{array}{l} \sim(\sim p) \\ \hline \therefore\ p \end{array}$$

De Morgan’s Rule

$$\begin{array}{l} \sim(p \cup q) \\ \hline \therefore\ \sim p \cap \sim q \end{array} \qquad \begin{array}{l} \sim(p \cap q) \\ \hline \therefore\ \sim p \cup \sim q \end{array}$$

Implication

$$\begin{array}{l} p \rightarrow q \\ \hline \therefore\ \sim p \cup q \end{array} \qquad \begin{array}{l} p \rightarrow q \\ \hline \therefore\ \sim(p \cap \sim q) \end{array}$$

Modus Ponens

$$\begin{array}{l} p \rightarrow q \\ p \\ \hline \therefore\ q \end{array}$$

Modus Tollens

$$\begin{array}{l} p \rightarrow q \\ \sim q \\ \hline \therefore \sim p \end{array}$$

Contrapositive or Transposition

$$\begin{array}{l} p \rightarrow q \\ \hline \therefore\ \sim q \rightarrow \sim p \end{array} \qquad \begin{array}{l} \sim q \rightarrow \sim p \\ \hline \therefore\ p \rightarrow q \end{array}$$

Chain Rule

$$\begin{array}{l} p \rightarrow q \\ q \rightarrow r \\ \hline \therefore\ p \rightarrow r \end{array}$$

Biconditional

$$\begin{array}{l} p \leftrightarrow q \\ \hline \therefore\ p \rightarrow q \\ \therefore\ q \rightarrow p \end{array} \qquad \begin{array}{l} p \rightarrow q \\ q \rightarrow p \\ \hline \therefore\ p \leftrightarrow q \end{array}$$