TERMINOLOGY CHEATSHEET - All Synonyms

Probability Theory Final Exam — December 16, 2025

!! CRITICAL !!

Gaussian = **Normal** = N(μ,σ^2)
Gaussian vector = **MVN** = Multivariate Normal
Independent components = $\rho = 0$ = Independence (MVN!)
Mean θ (Exp) $\Rightarrow \lambda = 1/\theta$
$\psi(t)$ = MGF = $M_X(t)$

DISTRIBUTIONS

Normal: Gaussian, N(μ,σ^2), Bell curve → Sec 3.3
Standard Normal: N(0,1), Z dist → Sec 3.3
Bivariate Normal: Gaussian vector, MVN, Jointly normal → Sec 4.5
Exponential: Exp(λ), Memoryless, Waiting time → Sec 3.4
Poisson: Counting process, Arrival process, Rate λ → Sec 2.3
Binomial: n trials, Success/failure → Sec 2.2
Geometric: First success, Trials until → Sec 2.4
Lognormal: $\ln X \sim N$, e^X where $X \sim N$, Stock price → Sec 7.3
Beta: Beta(α,β), Conjugate prior → Sec 3.6
Gamma: Gamma(r,λ), Sum of exp → Sec 3.5

PROCESSES

i.i.d.: Independent identically distributed, Same distribution
Arrival process: Poisson process → Sec 2.3
Waiting time: Inter-arrival → Exponential
Memoryless: Exponential (cont.), Geometric (disc.)

OPERATIONS

Conditional on: Given that, |, Restricting to
Marginal: Integrate out, Sum out → Sec 4.2
Joint: Together, Simultaneously → Sec 4.1
Transformation: Change of variable, Jacobian → Sec 4.6
Sum of: Convolution, MGF method → Sec 5.2

QUESTION KEYWORDS

"Find distribution" → CDF or MGF method
"Compute probability" → CDF, PMF, or PDF
"Approximate" → CLT (Sec 6.1)
"Large n" → CLT (Sec 6.1)
"Update belief" → Bayesian (Sec 7.2)
"Prior/Posterior" → Bayesian (Sec 7.2)
"Max/Min of n" → Order Stats (Sec 4.7)
"E[X—Y]" → Cond. Expectation (Sec 7.1)

BAYESIAN

Prior: $\pi(\theta)$, Initial belief, Before data
Posterior: $\pi(\theta|x)$, Updated belief, After data
Likelihood: $L(x|\theta)$, $P(\text{data}|\theta)$
Conjugate: Same family, Easy update → Beta-Binomial
Predictive: Future observation

STATISTICS

Sample mean: $\bar{X}$, $\bar{X}_n$, Average
Order statistic: $X_{(k)}$, k-th smallest
Indicator: I_A, $\mathbf{1}_A$, 1 if A else 0

LIMITS

CLT: Central Limit Theorem, Normal approx
LLN: Law of Large Numbers
Convergence: $\xrightarrow{d}$ in distribution, $\xrightarrow{P}$ in probability

KEY FORMULAS

Covariance: Cov(X,Y) = $E[XY] - E[X]E[Y]$
Correlation: $\rho = \text{Cov}/\sigma_X\sigma_Y$
Variance: Var(X) = $E[X^2] - (E[X])^2$
MGF: $M_X(t) = E[e^{tX}] = \psi(t)$

PROFESSOR NOTATION

$\psi(t)$ = MGF
$g_1(x|y)$ = conditional PDF of X|Y
$\pi(\theta)$ = prior
$\pi(\theta|x)$ = posterior
$L(x|\theta)$ = likelihood
H_i = hypothesis i
$\Phi(z)$ = std normal CDF
z_α = quantile

FINANCE

Stock price: S_t, Lognormal, S_0e^Z
Log returns: Normal, $\ln(S_t/S_0)$
Risk-neutral: $E[e^{-r}S] = S_0$