TERMINOLOGY CHEATSHEET - All Synonyms

Probability Theory Final Exam — December 16, 2025

CRITICAL

Gaussian = **Normal** = N(μ,σ^2)
Gaussian vector = **MVN** = Multivariate Normal = Jointly Normal
Independent components = $\rho = 0$ = Independence (for 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 distribution
→ 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
= Fixed trials
→ Sec 2.2
Geometric
= First success
= Trials until
= Memoryless (discrete)
→ 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
= Proportion model
→ Sec 3.6
Gamma
= Gamma(r,λ)
= Sum of exponentials
= Erlang (integer r)
→ Sec 3.5

PROCESSES

i.i.d.
= Independent identically distributed
= Same distribution
= Independent copies
Arrival process
= Poisson process
= Counting events
→ Sec 2.3
Waiting time
= Inter-arrival
= Time until event
→ Exponential
Memoryless
= Exponential (cont.)
= Geometric (disc.)
→ Sec 3.4, 2.4

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
= Find distribution of $g(X)$
= Jacobian method
→ Sec 4.6
Sum of
= Convolution
= MGF method
→ Sec 5.2

QUESTIONS

"Find distribution"
→ CDF or MGF method
"Compute probability"
→ CDF, PMF, or integrate 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 Statistics (Sec 4.7)
"E[X—Y]"
→ Conditional 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
= Weighted by posterior

STATISTICS

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

LIMITS

CLT
= Central Limit Theorem

= Normal approximation
= Large sample

LLN
= Law of Large Numbers
= Converges to mean

Convergence
$\xrightarrow{d}$ = in distribution
$\xrightarrow{P}$ = in probability

FORMULAS

Covariance
= Cov(X,Y)
$= E[XY] - E[X]E[Y]$

Correlation
$= \rho$
$= \text{Cov}/\sigma_X\sigma_Y$
$= -1 \leq \rho \leq 1$

Variance
= Var(X)
$= \sigma^2$
$= E[X^2] - (E[X])^2$

MGF
= Moment Generating Function
$= M_X(t) = E[e^{tX}]$
$= \psi(t)$ (Prof.)

PROFESSOR

$\psi(t)$ = 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
$= S_0 e^Z$

Log returns
= Normal
$= \ln(S_t/S_0)$

Risk-neutral
$= E[e^{-r}S] = S_0$