1/6/22
Thursday, January 6, 2022 4:29 PM

intro to R & R studio...

q<dist>: give quantile cutoff location

p<dist>: give probability below quantile

d<dist>: give density

r<dist>: GENERATE random samples.

mean<samples>; sd<samples>; hist<samples>

store to variable: x ← thing to store.

* store a vector to a variable: v ← c(vector coords.)

Remember) 'Exp(λ)': $f_X(x) = \lambda e^{-(\lambda x)}$

$E(X) = \frac{1}{\lambda}$; $V(X) = \frac{1}{\lambda^2}$ or $f_Y(y) = \frac{e^{-(y/\beta)}}{\beta}$ ← $\lambda = \frac{1}{\beta}$

$E(Y) = \beta$; $V(Y) = \beta^2$

Gamma Function: $\Gamma(p) = \int^{\infty} x^{p-1} e^{-x} dx = (p-1)!$

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Gamma RV: params$(\alpha, \beta) \longrightarrow X \sim \text{gamma}(\alpha, \beta)$

then; $f_X(x) = \frac{1}{\Gamma(\alpha)\beta^\alpha} \cdot x^{(\alpha-1)} \cdot e^{-(x/\beta)}$

when $\alpha = 1$; $\text{Gamma}(1, \beta) = \text{Exponential}(\beta)$

If we have $X_1 + \dots + X_n \sim \text{Exponential}(\beta)$

Then $Y = X_1 + \dots + X_n$ means $Y \sim \text{Gamma}(\alpha = n, \beta)$

$X \sim \text{Exp}(\beta) \longrightarrow m_X(t) = \frac{1}{1-\beta t}$

$Y \sim \text{Gamma}(\alpha, \beta) \longrightarrow m_Y(t) = \left(\frac{1}{1-\beta t}\right)^\alpha$

The Beta distribution (params $= (\alpha, \beta)$

$X \sim \text{Beta}(\alpha, \beta)$: $f_X(x) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} \cdot x^{(\alpha-1)} \cdot (1-x)^{(\beta-1)}$

$X \sim Beta(\alpha, \beta)$, $f_X(x) = \frac{\quad}{\Gamma(\alpha)\Gamma(\beta)} \cdot x \quad \cdot (1-x)$

Classical vs. Bayesian Statistics

Classical

$\downarrow$

Estimate μ & σ for the normal dist.

μ & σ numbers

Bayesian

$\hookrightarrow$ think of μ & σ as random variables with a joint distribution "$p(\mu, \sigma)$" of which is called the "prior" distribution.

• Then gather data that is generated by our distribution; of which we will use to then update our predictions of μ & σ