Geometric: failures (p) $x = 0, 1, \ldots$ A $\otimes$ ●

Hypergeometric (N, K, n) $x = \max\{n - N + K, 0\}, \ldots, \min\{K, n\}$

Bernoulli (p) $x = 0, 1$ A, B, P

Standard Discrete Uniform (n) $x = 0, 1, \ldots, n$

Discrete Uniform $(x_1, \ldots, x_n)$ $x = x_1, x_2, \ldots, x_n$

$X + 1$

$N \to \infty$, $K/N \to p$

$n = 1$, $\sum_{i=1}^{n} X_i$, iid

$a = 0$, $b = n$, $c = 1$

$x_1 = a$, $x_n = b$, $x_i - x_{i-1} = c$

Geometric: trials (p) $x = 1, 2, \ldots$ A $\otimes$ ●

$k = 1$, $\sum_{i=1}^{k} X_i$, iid

Pascal, Negative Binomial (k, p) $x = k, k+1, \ldots$ C_p

Binomial (n, p) $x = 0, 1, 2 \ldots, n$ C_p

$np = \mu$, $n \to \infty$, $p \to 0$

Poisson (μ) $x = 0, 1, 2 \ldots$ C

Equal-Spaced Uniform (a, b, c) $x = a, a+c, \ldots, b$

$\lim_{k\to\infty} \dfrac{X - (k/p)}{\sqrt{k(1-p)/p^2}}$

$\lim_{n\to\infty} \dfrac{X - np}{\sqrt{np(1-p)}}$

$\lim_{\mu\to\infty} \dfrac{X - \mu}{\sqrt{\mu}}$

$\sum_{i=1}^{v} X_i^2$, iid

Normal (μ, σ^2) $-\infty < x < \infty$ L

$\mu + \sigma X$, $(X - \mu)/\sigma$

Standard Normal $-\infty < x < \infty$

$v \to \infty$

Student's t, t(v) $-\infty < x < \infty$

X^2, $v_1 = 1$, $v_2 = v$

F (v_1, v_2) $x > 0$ I

$\dfrac{X_1/v_1}{X_2/v_2}$ indep

Chi-Squared (v) $x > 0$ C

$\ln X$, $\mu = \ln m$, $\sigma = \alpha$

$[\ln(X/m)]/\alpha$

$\lim_{\alpha\to\infty}(X - \alpha\beta)/\sqrt{\alpha\beta^2}$

(1) $\alpha = v/2, \beta = 2$
(2) $2X/\beta, \nu = 2\alpha$

$n = 1 + \dfrac{b - a}{c}$, $n \to \infty$

Weibull (α, β) $x > 0$ ● A, S

e^X

Log Normal (m, α) $x > 0$ P

Gamma (α, β) $x > 0$ C_β, S

$\dfrac{X_1}{X_1 + X_2}$, indep, $X_i \sim \text{Gamma}(\alpha_i, \beta)$, $i = 1, 2$

Beta (α_1, α_2) $0 < x < 1$

Triangular (a, m, b) $a < x < b$ ●

$\alpha = 2$, $\alpha = 1$, $\beta^{1 - \frac{1}{\alpha}} X^{1/\alpha}$

$\alpha = 1$

$\alpha = k$, integer

$\alpha_1 = \alpha_2 = 1$

$(X_1 + X_2)/2$, iid, $m = (a + b)/2$

Rayleigh (β) $x > 0$ ● A, S

$\sqrt{\beta X}$, X^2/β

Exponential (β) $x > 0$ $\otimes$ ● A, S

$k = 1$, $\sum_{i=1}^{k} X_i$, iid

Erlang (k, β) $x > 0$ S

Standard Uniform $0 < x < 1$ ●

$a = 0, b = 1$, $a + (b - a)X$

Rectangular, Uniform (a, b) $a < x < b$ ●

$-\beta \ln(1 - X)$

Note 1. Solid lines (⟶) show transformations or special cases, and dashed lines (− − ➤) show asymptotic relationships.

Note 2. Self-directed arrows (↘) include A: Minimum, B: Maximum, C: Convolution, I: Inverse, L: Linear Combination, P: Product, S: Scaling. (Source random variables: A and B require iid; C, L, and P require independent; C_β, C_β require "variational iid".)

Note 3. ● denotes the "closed-form inverse cdf" property, and ⊗ denotes the "memoryless" property.

Figure 1: Relationships among 25 Distributions (Song, W.-M. T. and Chen, Yi-chun (2011), Eighty Univariate Distributions and their Relationships Displayed in a Matrix Format, *IEEE Transactions on Automatic Control*, Vol. 56, No. 8, pp. 1979-1984.)