$$F(x) = \int_{-\infty}^{x} \rho(x)\, dx \qquad \langle X \rangle = \sum_{n} x_n p_n$$

$$\langle X \rangle = \int x \rho(x)\, dx$$

$$\sigma^2 = \langle X^2 \rangle - \langle X \rangle^2 \qquad \langle X + Y \rangle = \langle X \rangle + \langle Y \rangle$$

$$= \int (x - \langle x \rangle)^2 \rho(x)\, dx \qquad \langle XY \rangle = \langle X \rangle \langle Y \rangle$$

$$\langle X^n \rangle = \int x^n \rho(x)\, dx \qquad \mu_n = \int (x - \langle x \rangle)^n \rho(x)\, dx$$

$$G_n(z) = \sum_{n=0}^{\infty} p_n z^n \qquad \langle X \rangle = G'(1)$$

$$G(1) = 1 \qquad \sigma^2(X) = G''(1) + G'(1) - G'(1)^2$$

$$f(t) = G(e^{it}) = \int e^{itx} \rho(x)\, dx$$

$$\rho(x) = \frac{1}{2\pi} \int e^{-itx} f(t)\, dt \qquad F(m) = \frac{1}{2}$$

$$\mathrm{Cov}(X, Y) = \langle XY \rangle - \langle X \rangle \langle Y \rangle \qquad \mathrm{Cov}(X, X) = \sigma^2(X)$$

$$P(A \mid B) = \frac{P(A \cup B)}{P(B)} \qquad P(B) = \sum_{i=1}^{n} P(B \mid A_i) P(A_i)$$

$$P(A_n \mid B) = \frac{P(B \mid A_n) P(A_n)}{\sum_{i=1}^{n} P(B \mid A_i) P(A_i)} = \frac{P(B \mid A_n) P(A_n)}{P(B)}$$

$$P(B) = P(B \mid A) P(A) + P(B \mid \bar{A}) P(\bar{A})$$

Egyenletes

$$P = \frac{1}{n} \qquad \rho(x) = \begin{cases} \dfrac{1}{x_2 - x_1} & x_1 \le x \le x_2 \\ 0 \end{cases} \qquad F(x) = \begin{cases} 0 & x < x_1 \\ \dfrac{x - x_1}{x_2 - x_1} & x_1 \le x \le x_2 \\ 1 & x > x_2 \end{cases}$$

$$\langle X \rangle = \frac{1}{n} \sum_k x_k \qquad \sigma^2 = \frac{1}{n} \sum_k x_k^2 - \left(\frac{1}{n} \sum_k x_k \right)^2$$

Binomiális

$$P = p_k = \binom{N}{k} p^k q^{N-k}$$

$$\langle X \rangle = Np \qquad \sigma^2(x) = Npq \qquad G(z) = (pz + q)^N$$

Geometriai

$$P = p_k = p q^{k-1}$$

$$\langle X \rangle = \frac{1}{p} \qquad \sigma^2(x) = \frac{q}{p^2} \qquad G(z) = \frac{pz}{1 - qz}$$

Hipergeometrikus

$$P = p_k = \frac{\binom{K}{k} \binom{N-K}{n-k}}{\binom{N}{n}}$$

$$\langle X \rangle = n \frac{K}{N} \qquad \sigma^2(x) = n \frac{K}{N} \frac{N-K}{N} \frac{N-n}{N-1}$$

Negatív binomiális

$$P = p_k = \binom{n+k-1}{k} p^k q^n = \binom{-n}{k} (-p)^k q^n$$

$$\langle X \rangle = \frac{np}{1-p} \qquad \sigma^2(x) = \frac{np}{(1-p)^2} \qquad G(z) = \left(\frac{1-p}{1-pz} \right)^n$$

Exponenciális

$$\rho(x) = \begin{cases} \lambda e^{-\lambda x} & x \ge 0 \\ 0 & x < 0 \end{cases} \qquad F(x) = \begin{cases} 1 - e^{-\lambda x} & x \ge 0 \\ 0 & x < 0 \end{cases}$$

$$\langle X \rangle = \frac{1}{\lambda} \qquad \sigma^2(x) = \frac{1}{\lambda^2} \qquad \varphi(t) = \frac{\lambda}{\lambda - it}$$

Gamma: exp. eloszlások összege, λ azonos

$Y = X_1 + \dots + X_n$ $\quad \Gamma(n) = (n-1)!$ $\quad \rho_n(x) = \dfrac{\lambda^n x^{n-1}}{(n-1)!} e^{-\lambda x}$

$$\langle Y \rangle = \frac{n}{\lambda} \qquad \sigma^2(Y) = \frac{n}{\lambda^2}$$

Poisson

$$P = p_n = \frac{\lambda^n}{n!} e^{-\lambda}$$

$$\langle X \rangle = \lambda \qquad \sigma^2(X) = \lambda \qquad G(z) = e^{-\lambda(1-z)}$$

Normális:

$$\rho(x) = \frac{1}{\sqrt{2\pi}\,\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \qquad F(x) = \frac{1}{2}\left[1 + \mathrm{erf}\left(\frac{x-\mu}{\sqrt{2}\,\sigma}\right)\right]$$

$$\langle X \rangle = \mu \qquad \sigma^2(x) = \sigma^2 \qquad f(t) = e^{-\frac{\sigma^2 t^2}{2} + i\mu t}$$

Standard normális: $\mu = 0$, $\sigma = 1$ Norm $\qquad \mathrm{erf} = \dfrac{1}{\sqrt{\pi}} \displaystyle\int_{-x}^{x} e^{-t^2} dt = \dfrac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$

$$\rho(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} \qquad F(x) = \frac{1}{2}\left[1 + \mathrm{erf}\left(\frac{x}{\sqrt{2}}\right)\right]$$

$$\langle X \rangle = 0 \qquad \sigma^2 = 1 \qquad f(t) = e^{-\frac{t^2}{2}}$$

Lognormális: $Y = \ln X$ Norm

$$\rho(x) = \frac{1}{\sqrt{2\pi}\,\sigma_0 x} e^{-\frac{(\ln x - \mu_0)^2}{2\sigma_0^2}} \qquad F(x) = \frac{1}{2}\left[1 + \mathrm{erf}\left(\frac{\ln x - \mu_0}{\sqrt{2}\,\sigma_0}\right)\right]$$

$$\langle X \rangle = e^{\mu_0 + \frac{\sigma_0^2}{2}} \qquad \sigma^2(X) = e^{2\mu_0 + \sigma_0^2}\left(e^{\sigma_0^2} - 1\right)$$

χ^2, standard normális eloszlások négyzetösszege

$$y = x^2 \qquad \rho(y) = \frac{1}{\sqrt{2\pi y}} e^{-\frac{y}{2}} = \frac{1}{\Gamma\left(\frac{n}{2}\right) 2^{\frac{n}{2}}} x^{\frac{n}{2}-1} e^{-\frac{x}{2}}$$

$$\langle \chi^2 \rangle = n \qquad \sigma^2(\chi^2) = 2n \qquad f_n(t) = \frac{1}{(1-2it)^{\frac{n}{2}}}$$

χ : χ^2 gyöke

$y = \sqrt{x}$

$$\rho(y) = \frac{1}{\Gamma\left(\frac{n}{2}\right) 2^{\frac{n}{2}-1}} y^{n-1} e^{-\frac{y^2}{2}}$$

$$\langle x \rangle = \sqrt{2} \frac{\Gamma\left(\frac{n+1}{2}\right)}{\Gamma\left(\frac{n}{2}\right)} \qquad \sigma^2(\chi) = n - 2 \frac{\Gamma\left(\frac{n+1}{2}\right)^2}{\Gamma\left(\frac{n}{2}\right)^2}$$

Student : $X_1 \dots X_n, Y$ standard norm $\to$ $t = \frac{\sqrt{n}\, Y}{\sqrt{X_1 \dots X_n}} \xrightarrow{\text{Student}} = \frac{\sqrt{n}\, Y}{\chi}$

$$\rho(x) = \frac{1}{\sqrt{n\pi}} \frac{\Gamma\left(\frac{n+1}{2}\right)}{\Gamma\left(\frac{n}{2}\right)} \frac{1}{\left(1 + \frac{x^2}{n}\right)^{\frac{n+1}{2}}} = S_n(x)$$

$$\langle x \rangle = \begin{cases} 0 & n > 1 \\ \emptyset & n = 1 \end{cases} \qquad \sigma^2(t) = \begin{cases} \frac{n}{n-2} & n > 0 \\ \emptyset & n \leq 2 \end{cases}$$

Cauchy : $n = 1$ Student

$$\rho(x) = \frac{1}{\pi} \frac{1}{1+x^2} = C(\cdot x) = \frac{1}{\pi} \frac{C}{C^2 + x^2}$$

$$\langle x \rangle = \emptyset \qquad \sigma^2(x) = \emptyset \qquad f(x) = e^{-|t|}$$

Hatványszerű lecsengő

$$\rho(x) \sim \frac{1}{|x|^\alpha}$$

$\alpha \leq 3 \to \sigma^2 = \emptyset \qquad \alpha \leq 2 \to \mu = \emptyset$