MAT 042 – PROBABILIDAD Y ESTADÍSTICA INDUSTRIAL

Formulario Modelos de Probabilidad

$$\begin{aligned} X &\sim \text{Ber}(p)\\ \text{Rec}(X) &= \{0,1\}\\ f_X(x) &= p^x\,(1-p)^{1-x}\\ \mathbb{E}[X] &= p\\ \mathbb{V}[X] &= p(1-p)\end{aligned}$$

$$\begin{aligned} X &\sim \text{Bin}(n,p)\\ \text{Rec}(X) &= \{0,1,\ldots,n\}\\ f_X(x) &= \binom{n}{x} p^x\,(1-p)^{n-x}\\ \mathbb{E}[X] &= np\\ \mathbb{V}[X] &= np(1-p)\end{aligned}$$

$$\begin{aligned} X &\sim \text{Hip}(N,M,n)\\ \text{Rec}(X) &= \{\text{máx}(0,n+M-N),\ldots,\text{mín}(n,M)\}\\ f_X(x) &= \frac{\binom{M}{x}\binom{N-M}{n-x}}{\binom{N}{n}}\\ \mathbb{E}[X] &= n\,\tfrac{M}{N}\\ \mathbb{V}[X] &= n\tfrac{M}{N}\,\tfrac{N-M}{N}\,\tfrac{N-n}{N-1}\end{aligned}$$

$$\begin{aligned} X &\sim \text{Geo}(p)\\ \text{Rec}(X) &= \{1,2,\ldots\}\\ f_X(x) &= p\,(1-p)^{x-1}\\ \mathbb{E}[X] &= \tfrac{1}{p}\\ \mathbb{V}[X] &= \tfrac{1-p}{p^2}\\ F_X(x) &= 1-(1-p)^x\end{aligned}$$

$$\begin{aligned} X &\sim \text{BN}(r,p)\\ \text{Rec}(X) &= \{r,r+1,\ldots\}\\ f_X(x) &= \binom{x-1}{r-1} p^r\,(1-p)^{x-r}\\ \mathbb{E}[X] &= \tfrac{r}{p}\\ \mathbb{V}[X] &= \tfrac{r\,(1-p)}{p^2}\\ F_X(x) &= 1-\mathbb{P}[S_x \le r-1]\\ & \qquad S_x \sim \text{Bin}(x,p)\end{aligned}$$

$$\begin{aligned} X(t) &\sim \text{Poisson}(\theta t)\\ \text{Rec}(X(t)) &= \{0,1,\ldots\}\\ f_X(x) &= \frac{e^{-\theta t}\,(\theta t)^x}{x!}\\ \mathbb{E}[X(t)] &= \theta t\\ \mathbb{V}[X(t)] &= \theta t\\ F_X(x) &= \sum_{u=0}^{x} \frac{e^{-\theta t}\,(\theta t)^u}{u!}\end{aligned}$$

$$\begin{aligned} X &\sim \exp(\theta)\\ \text{Rec}(X) &= \mathbb{R}^+\\ f_X(x) &= \theta\,e^{-\theta x}\\ \mathbb{E}[X] &= \tfrac{1}{\theta}\\ \mathbb{V}[X] &= \tfrac{1}{\theta^2}\\ F_X(x) &= 1-e^{-\theta x}\end{aligned}$$

Función Gamma:

$$\begin{aligned} \Gamma(r) &= \int_0^\infty x^{r-1}\,e^{-x}\,dx\\ \Gamma(r) &= (r-1)!\\ \Gamma(r) &= (r-1)\,\Gamma(r-1)\\ \Gamma\left(\tfrac{1}{2}\right) &= \sqrt{\pi}\end{aligned}$$

$$\begin{aligned} X &\sim \text{Gamma}(r,\theta)\\ \text{Rec}(X) &= \mathbb{R}^+\\ f_X(x) &= \frac{\theta^r}{\Gamma(r)} x^{r-1}\exp(-\theta x)\\ \mathbb{E}[X] &= \tfrac{r}{\theta}\\ \mathbb{V}[X] &= \tfrac{r}{\theta^2}\\ F_X(x) &\overset{r\in\mathbb{N}}{=} 1-\mathbb{P}[N(t)\le r-1]\\ & \qquad N(t)\sim\text{Poisson}(\theta t)\end{aligned}$$

$$\begin{aligned} X &\sim \text{Unif}(a,b)\\ \text{Rec}(X) &= (a,b)\\ f_X(x) &= \frac{1}{b-a}\\ \mathbb{E}[X] &= \tfrac{1}{2}(a+b)\\ \mathbb{V}[X] &= \tfrac{1}{12}(b-a)^2\\ F_X(x) &= \frac{x-a}{b-a}\end{aligned}$$

$$\begin{aligned} X &\sim \text{Weibull}(\alpha,\lambda)\\ \text{Rec}(X) &= \mathbb{R}^+\\ f_X(x) &= \alpha\lambda^\alpha x^{\alpha-1}\,e^{-(\lambda x)^\alpha}\\ \mathbb{E}[X] &= \tfrac{1}{\lambda}\Gamma\left(1+\tfrac{1}{\alpha}\right)\\ \mathbb{V}[X] &= \tfrac{1}{\lambda^2}\left\{\Gamma\left(1+\tfrac{2}{\alpha}\right)-\left(\Gamma\left(1+\tfrac{1}{\alpha}\right)\right)^2\right\}\\ F_X(x) &= 1-e^{-(\lambda x)^\alpha}\end{aligned}$$

$$\begin{aligned} X &\sim \text{Normal}(\mu,\sigma^2)\\ \text{Rec}(X) &= \mathbb{R}\\ f_X(x) &= \frac{1}{\sqrt{2\pi}\,\sigma}\,e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}\\ \mathbb{E}[X] &= \mu\\ \mathbb{V}[X] &= \sigma^2\\ F_X(x) &= \Phi\left(\tfrac{x-\mu}{\sigma}\right)\end{aligned}$$

$$X\sim\mathcal{N}(\mu,\sigma^2)$$
$$Z=\frac{X-\mu}{\sigma}\sim\mathcal{N}(0,1)$$
$$F_Z(z)=\Phi(z)$$
$$\Phi(a)=1-\Phi(-a)$$

$$\begin{aligned} R(t) &= \mathbb{P}[T>t]\\ &= 1-F_T(t)\\ f_T(t) &= -R'(t)\\ r(t) &= \frac{f_T(t)}{R(t)}\end{aligned}$$

$$\begin{aligned} R_{\text{eq}}(t) &\overset{\text{Serie}}{=} \prod_{i=1}^{n} R_i(t)\\ R_{\text{eq}}(t) &\overset{\text{Paralelo}}{=} 1-\prod_{i=1}^{n}(1-R_i(t))\end{aligned}$$