Classical discrete laws

Name	Notation	Law	Expectation	Variance	Interpretation
Bernoulli parameter $p \in [0,1]$	$\mathsf{Ber}(p)$	$\mathbb{P}(X=1)=p$ $\mathbb{P}(X=0)=1-p$	p	$p(1-p)$	Experiment with a success probability p
Binomial parameters $n \geq 1$, $p \in [0,1]$	$\mathsf{B}(n,p)$ or $\mathsf{Bin}(n,p)$	$\mathbb{P}(X=k)=\binom{n}{k}p^k(1-p)^{n-k}$ $0 \leq k \leq n$	np	$np(1-p)$	Number of successes for n experiments as above
Geometric parameter $p \in (0,1]$	$\mathcal{G}(p)$	$\mathbb{P}(X=k)=p(1-p)^{k-1}$ $k \geq 1$	$\frac{1}{p}$	$\frac{1-p}{p^2}$	Number of trials when the first success happens
Poisson parameter $\lambda > 0$	$\mathcal{P}(\lambda)$	$\mathbb{P}(X=k)=e^{-\lambda}\frac{\lambda^k}{k!}$ $k \geq 0$	λ	λ	Models the number of occurrences of a rare event

Classical continuous laws

⋆ If X has density p on $\mathbb{R}_+$, then

$$\mathbb{E}[X] = \int_0^\infty p(x)\mathrm{d}x \quad \in \quad \mathbb{R}_+ \cup \{+\infty\}$$

is always well defined.

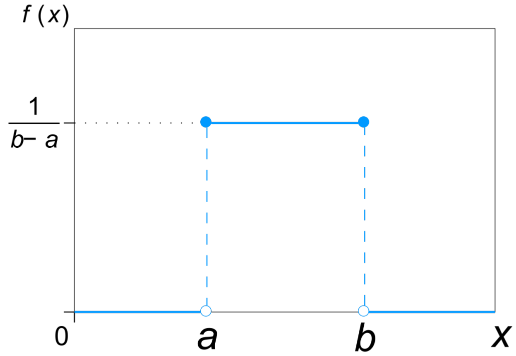
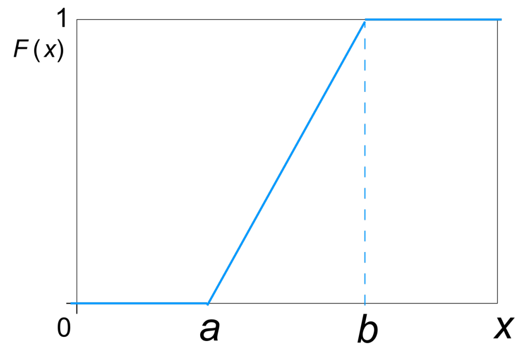
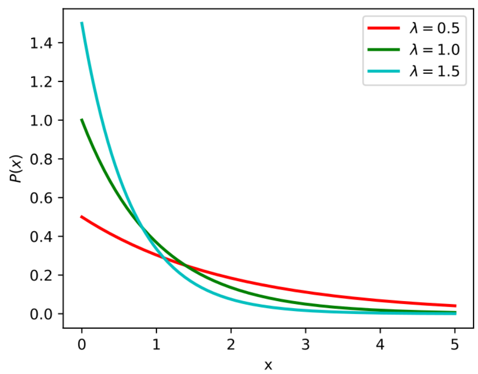
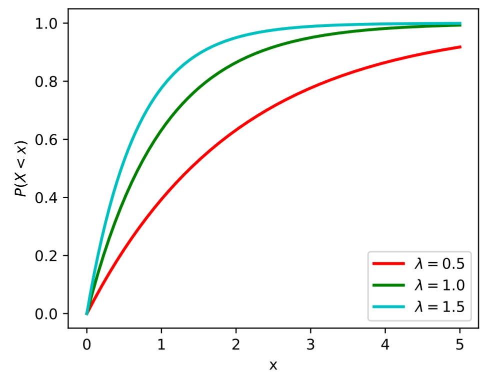
⋆ If X has density p on $\mathbb{R}$, then $\mathbb{E}[X] \in \mathbb{R}$ is well defined when X is integrable, meaning that

$$\mathbb{E}[|X|] = \int_{\mathbb{R}} |x|p(x)\mathrm{d}x < \infty,$$

and then

$$\mathbb{E}[X] = \int_{\mathbb{R}} xp(x)\mathrm{d}x.$$

Name	Notation	Density	Expectation	Variance	Interpretation
Uniform on $[a,b]$	$\mathcal{U}[a,b]$	$\frac{1}{b-a}\mathbb{1}_{[a,b]}(x)$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	Choosing a number uniformly at random
Exponential parameter $\lambda > 0$	$\mathcal{E}(\lambda)$	$\lambda e^{-\lambda x}\mathbb{1}_{[0,\infty)}(x)$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	Memoryless property
Gaussian parameters $m \in \mathbb{R}$ and $\sigma^2 > 0$	$\mathcal{N}(m,\sigma^2)$	$\frac{1}{\sqrt{2\pi\sigma^2}}e^{-\frac{(x-m)^2}{2\sigma^2}}$	m	σ^2	Models fluctuations around a value

Name	Density	Cumulative Distribution Function (cdf)
Uniform on $[a, b]$		
Exponential parameter $\lambda > 0$		
Gaussian parameters $\mu \in \mathbb{R}$, $\sigma^2 > 0$