Discrete Distributions

Probabilities

Distribution	PMF	CDF
Bernoulli	$p^k(1-p)^{1-k}, \quad k \in \{0,1\}$	$\begin{cases} 0 & k < 0 \\ 1-p & 0 \leq k < 1 \\ 1 & k \geq 1 \end{cases}$
Binomial	$\binom{n}{k} p^k (1-p)^{n-k}$	-
Geometric	$p(1-p)^{k-1}$	$1-(1-p)^k$
Poisson	$\frac{\lambda^k e^{-k}}{k!}$	-

Moments

Distribution	Expectation	Variance	MGF
Bernoulli	p	$p(1-p)$	$(1-p)+pe^t$
Binomial	np	$np(1-p)$	$(1-p+pe^t)^n$
Geometric	$\frac{1}{p}$	$\frac{1-p}{p^2}$	$\frac{pe^t}{1-(1-p)e^t}$
Poisson	λ	λ	$e^{\lambda(e^t-1)}$

Continuous Distributions

Probabilities

Distribution	PDF	CDF
Uniform	$\frac{1}{b-a}$	$\frac{x-a}{b-a}$
Exponential	$\lambda e^{-\lambda x}$	$1-e^{-\lambda x}$
Normal	$\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$	$\Phi(x)$
Erlang	$\frac{\lambda^k x^{k-1} e^{-\lambda x}}{(k-1)!}$	$1-\sum_{n=0}^{k-1} \frac{1}{n!} e^{-\lambda x}(\lambda x)^n$

Moments

Distribution	Expectation	Variance	MGF
Uniform	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	$\frac{e^{tb}-e^{ta}}{t(b-a)}$
Exponential	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$\frac{\lambda}{\lambda-t}$
Normal	μ	σ^2	$e^{\mu t+\frac{\sigma^2 t^2}{2}}$
Erlang	$\frac{k}{\lambda}$	$\frac{k}{\lambda^2}$	$\left(1-\frac{t}{\lambda}\right)^{-k}$

Derived Distributions

1. If $X_1, X_2, \ldots, X_N \sim \text{Exp}(\lambda_i)$ are independent, then $\min X_i \sim \text{Exp}(\sum \lambda_i)$.
2. If $X_1, X_2, \ldots, X_N \sim \text{Exp}(\lambda_i)$ are independent, then $P(X_i = \min X_k) = \frac{\lambda_i}{\sum \lambda_k}$.

Assorted Facts

1. If X is a random variable, then $P(X=0) \leq \frac{Var(X)}{\mathbb{E}[X]^2}$
2. If $(N_t)_{t\geq 0}$ is a Poisson Proccess with rate λ, then the time from the most recent arrival to the current "random" time is $t_0 - T_i \sim \text{Exp}(\lambda)$