A summary of major probability distributions [1]

Distribution	**Probability Density Function**	**Mean**	**Variance**	**Moment Generation Function** ($M(t)$)
Uniform $U(a,b)$	$U(x) = \frac{1}{b-a}, a \leq x \leq b$	$\frac{b+a}{2}$	$\frac{(b-a)^2}{12}$	$\frac{e^{tb}-e^{ta}}{(b-a)t}, t \neq 0$
Normal $N(\mu,\sigma)$	$N(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp \frac{(x-\mu)^2}{2\sigma^2}, -\infty < x < \infty$	μ	σ^2	$\exp^{\mu t + \frac{1}{2}\sigma^2 t^2}$
Exponential $f(\lambda)$	$f(x) = \lambda e^{-\lambda x}, x \geq 0$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$M_X(t) = \frac{\lambda}{\lambda - t}, t < \lambda$
Gamma $f(\lambda, r)$	$f(x) = \frac{\lambda^k}{\Gamma(k)} x^{k-1} e^{-x\lambda}, x > 0$	$\frac{k}{\lambda}$	$\frac{k}{\lambda^2}$	$(\frac{\lambda}{\lambda - t})^k, t < \lambda$
Chi-square $\chi^2(n)$	$\frac{1}{2^{\frac{k}{2}}\Gamma\left(\frac{k}{2}\right)} x^{\frac{k}{2}-1} e^{-\frac{x}{2}}, x > 0$	k	$2k$	$\frac{1}{(1-2t)^{-\frac{k}{2}}}$
Binomal $f(n,p)$	$\binom{n}{k} p^k (1-p)^{n-k}$	np	$np(1-p)$	$(1-p+pe^t)^n$
Poisson $Pois(\lambda)$	$\frac{\lambda^k}{k!} \cdot e^{-\lambda}$	λ	λ	$\exp(\lambda(e^t - 1))$
Student's t $f(x)$	$\frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\sqrt{\nu\pi}\,\Gamma\left(\frac{\nu}{2}\right)} \left(1 + \frac{x^2}{\nu}\right)^{-\frac{\nu+1}{2}}$	0	$\frac{\nu}{\nu-2}$, if $\nu > 2$	undefined
Bernoulli $f(k;p)$	$\begin{cases} q = (1-p) & \text{for } k = 0 \\ p & \text{for } k = 1 \end{cases}$	p	$p(1-p)$	$q + pe^t$
Dirichlet $f(x_1, \ldots, x_{K-1}; \alpha_1, \ldots, \alpha_K)$	$\frac{1}{\mathrm{B}(\boldsymbol{\alpha})} \prod_{i=1}^K x_i^{\alpha_i - 1}$, where $\mathrm{B}(\boldsymbol{\alpha}) = \frac{\prod_{i=1}^K \Gamma(\alpha_i)}{\Gamma(\sum_{i=1}^K \alpha_i)}$ and $\boldsymbol{\alpha} = (\alpha_1, \ldots, \alpha_K)$	$\mathrm{E}[X_i] = \frac{\alpha_i}{\sum_k \alpha_k}$	$\mathrm{Var}[X_i] = \frac{\alpha_i(\alpha_0 - \alpha_i)}{\alpha_0^2(\alpha_0 + 1)}$	undefined

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