Table 1: **TABELLA VARIABILI ALEATORIE (Probabilità e Statistica - a.a. 2023-2024 - Matematica per l'Ingegneria)**

Variabile Aleatoria	**Densità**	**Media**	**Varianza**	**F. Caratteristica**
Binomiale (n,p)	$p_X(k)=\binom{n}{k}p^k(1-p)^{n-k},\ k\in\{0,\dots,n\}$	np	$np(1-p)$	$\Phi_X(t)=((1-p)+pe^{it})^n$
Geometrica(p)	$p_X(k)=p(1-p)^{k-1},\ k\geq 1$	$\frac{1}{p}$	$\frac{1-p}{p^2}$	$\Phi_X(t)=\frac{pe^{it}}{1-(1-p)e^{it}}$
Pascal(r,p)	$p_X(k)=\binom{k-1}{r-1}p^r(1-p)^{k-r},\ k\geq r$	$\frac{r}{p}$	$\frac{r(1-p)}{p^2}$	$\Phi_X(t)=\left(\frac{pe^{it}}{1-(1-p)e^{it}}\right)^r$
Ipergeometrica(N,K,n)	$p_X(k)=\frac{\binom{K}{k}\binom{N-K}{n-k}}{\binom{N}{n}}, k\leq K, 0\leq n-k\leq N-K$	$n\frac{K}{N}$	$n\frac{K}{N}(1-\frac{K}{N})\frac{N-n}{N-1}$	
Poisson(λ)	$p_X(k)=e^{-\lambda}\frac{\lambda^k}{k!},\ k\geq 0$	λ	λ	$\Phi_X(t)=\exp\left(\lambda(e^{it}-1)\right)$
Uniforme(a,b)	$f_X(x)=\frac{1}{b-a}\mathbb{1}_{(a,b)}(x)$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	$\Phi_X(t)=\frac{e^{itb}-e^{ita}}{it(b-a)}$
Esponenziale(λ)	$f_X(x)=\lambda e^{-\lambda x}\mathbb{1}_{(0,+\infty)}(x)$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$\Phi_X(t)=\frac{\lambda}{\lambda-it}$
Gamma(α,λ)	$f_X(x)=\frac{\lambda^\alpha}{\Gamma(\alpha)}\ x^{\alpha-1}e^{-\lambda x}\mathbb{1}_{(0,+\infty)}(x)$	$\frac{\alpha}{\lambda}$	$\frac{\alpha}{\lambda^2}$	$\Phi_X(t)=\left(\frac{\lambda}{\lambda-it}\right)^\alpha$
Beta(α,β)	$f_X(x)=\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)}\ x^{\alpha-1}(1-x)^{\beta-1}\mathbb{1}_{(0,1)}(x)$	$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$	
Normale $\mathcal{N}(\mu,\sigma^2)$	$f_X(x)=(2\pi\sigma^2)^{-\frac{1}{2}}\exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$	μ	σ^2	$\Phi_X(t)=\exp\left(it\mu-\frac{\sigma^2t^2}{2}\right)$
Normale $\boldsymbol{\mathcal{N}}_d(\boldsymbol{\mu},\boldsymbol{\Sigma})$	$f_{\mathbf{X}}(\mathbf{x})=(2\pi)^{-\frac{d}{2}}(\det\boldsymbol{\Sigma})^{-\frac{1}{2}}\exp\left(-\frac{1}{2}(\mathbf{x}-\boldsymbol{\mu})^t\boldsymbol{\Sigma}^{-1}(\mathbf{x}-\boldsymbol{\mu})\right)$	$\boldsymbol{\mu}$	$\boldsymbol{\Sigma}$	$\Phi_{\mathbf{X}}(\mathbf{t})=\exp\left(i\mathbf{t}^t\boldsymbol{\mu}-\frac{1}{2}\mathbf{t}^t\boldsymbol{\Sigma}\mathbf{t}\right)$
Multinomiale $(n,\mathbf{p})$	$p_{\mathbf{X}}(n_1...n_N)=\frac{n!}{n_1!...n_N!n_{N+1}!}\ p_1^{n_1}...p_N^{n_N}\ p_{N+1}^{n_{N+1}}$, $n_{N+1}=n-\sum_{j=1}^N n_j,\ p_{N+1}=1-\sum_{j=1}^N p_j$ $n_1...n_N\in\{0,\dots,n\},\sum_{j=1}^N n_j\leq n,$			$\Phi_X(t)=\left((1-\sum_{j=1}^N p_j)+\sum_{j=1}^N p_je^{it_j}\right)^n$