| | **Distribution** | **Mean($E[X]$)** | **Variance($Var(X)$)** | **p.m.f/p.d.f** | **c.d.f** | **p.g.f** | **m.g.f.** | **Median** | **Mode** | **Fisher Information** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Discrete** | Bernoulli | $p$ | $p(1-p)$ | $\begin{cases} 1-p & if\ x=0 \\ p & if\ x=1 \end{cases}$ | $\begin{cases} 0 & if\ x<0 \\ 1-p & if\ 0 \leq x<1 \\ 1 & if\ x \geq 1 \end{cases}$ | $1-p+ps$ | $1-p+p^t$ | $\begin{cases} 0 & if\ p<\frac{1}{2} \\ [0,1] & if\ p=\frac{1}{2} \\ 1 & if\ p>\frac{1}{2} \end{cases}$ | $\begin{cases} 0 & if\ p<\frac{1}{2} \\ 0,1 & if\ p=\frac{1}{2} \\ 1 & if\ p>\frac{1}{2} \end{cases}$ | $\frac{1}{p(1-p)}$ |
| | $X \sim Bin(n,p)$ | $np$ | $np(1-p)$ | $\binom{n}{x} p^x (1-p)^{n-x}$ | $\sum_{i=0}^{\lfloor x \rfloor} p.m.f$ or Check the table. | $(1-p+pz)^n$ | $(1-p+pe^t)^n$ | $\lfloor np \rfloor$ or $\lceil np \rceil$ | $\lfloor (n+1)p \rfloor$ or $\lceil (n+1)p \rceil - 1$ | $\frac{n}{p(1-p)}$, for fixed $n$ |
| | $X \sim Geom(p)$ | $\frac{1}{p}$ | $\frac{1-p}{p^2}$ | $(1-p)^{x-1}p$ | $1-(1-p)^x$ | $\frac{pz}{1-(1-p)z}$ | $\frac{pe^t}{1-(1-p)e^t}$, for $t<-\ln(1-p)$ | $\lceil \frac{-1}{log_2(1-p)} \rceil$ | 1 | |
| | $X \sim Pois(\lambda)$ | $\lambda$ | $\lambda$ | $\lambda^x \frac{e^{-\lambda}}{x!}$ | Check the table. When $n$ is large ($n \geq 20$) and $p$ is small ($p \leq 0.05$) for Binomial Distribution, $\lambda = np$. | $e^{\lambda(z-1)}$ | $e^{\lambda(e^t-1)}$ | $\approx \lfloor \lambda + \frac{1}{3} - \frac{0.02}{\lambda} \rfloor$ | $\lceil \lambda \rceil - 1, \lfloor \lambda \rfloor$ | $\frac{1}{\lambda}$ |
| | $X \sim NB(r,p)$ | $\frac{r}{p}$ | $\frac{r(1-p)}{p^2}$ | $\binom{k-1}{r-1} p^r (1-p)^{k-r}$ | | | | | | |
| | Discrete Uniform | $\frac{a+b}{2}$ | $\frac{n^2-1}{12}$ | $\frac{1}{n}$ | $\frac{\lfloor k \rfloor - a + 1}{n}$ | $\frac{s^a - s^{b+1}}{n(1-s)}$ | $\frac{a+b}{2}$ | NA | | |
| | Hyper-geometric | $\frac{An}{A+B}$ | $\frac{ABn(A+B-n)}{(A+B)^2(A+B-1)}$ | $\frac{\binom{A}{k}\binom{B}{n-k}}{\binom{A+b}{n}}$ | | | | | | |
| **Continuous** | $\mathrm{X} \sim U(a,b)$ | $\frac{a+b}{2}$ | $\frac{(b-a)^2}{12}$ | $\begin{cases} \frac{1}{b-a} & if\ x \in [a,b] \\ 0 & otherwise \end{cases}$ | $\begin{cases} 0 & if\ x<a \\ \frac{x-a}{b-a} & if\ x \in [a,b] \\ 1 & if\ x>b \end{cases}$ | | $\frac{a+b}{2}$ | any value in $(a,b)$ | | |
| | Exponential | $\frac{1}{\lambda}$ | $\frac{1}{\lambda^2}$ | $\begin{cases} \lambda e^{-\lambda x} & if\ x \geq 0 \\ 0 & if\ x<0 \end{cases}$ | $\begin{cases} 1-e^{-\lambda x} & if\ x \geq 0 \\ 0 & if\ x<0 \end{cases}$ | | $\frac{ln2}{\lambda}$ | 0 | | |
| | $X \sim N(\mu,\sigma^2)$ | $\mu$ | $\sigma^2$ | $\frac{1}{\sqrt{2\pi}\sigma} e^{\frac{-(x-\mu)^2}{2\sigma^2}}$ | Check the table | | $\mu$ | $\mu$ | | |
| | $X \sim Gamma(\alpha,\beta)$ | $\frac{\alpha}{\beta}$ | $\frac{\alpha}{\beta^2}$ | $\begin{cases} \frac{\beta^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\beta x} if\ x \geq 0 \\ 0 \quad if\ x<0 \end{cases}$ | $\frac{1}{\Gamma(\alpha)} \gamma(\alpha, \beta x)$ | | NA | $\frac{\alpha-1}{\beta}$ for $\alpha \geq 1$ | | |
| | $X \sim Beta(\mu,\sigma^2)$ | $\frac{\alpha}{\alpha+\beta}$ | $\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$ | $\begin{cases} \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1}(1-x)^{\beta-1} & if\ x \in (0,1) \\ 0 & otherwise \end{cases}$ | | | | | | |