$B(n,p)$

PMF: $\binom{n}{k}p^k q^{n-k}$

CDF: $I_q(n-\lfloor k\rfloor, 1+\lfloor k\rfloor)$

mean: $np$

median: $\lfloor np\rfloor$ or $\lceil np\rceil$

mode: $\lfloor (n+1)p\rfloor$ or $\lceil (n+1)p\rceil - 1$

variance $npq = np(1-p)$

skewness $\dfrac{q-p}{\sqrt{npq}}$

MGF $(q+pe^t)^n$

excess k $\dfrac{1-6pq}{npq}$

Unif$(a,b)$

PDF $\begin{cases} \frac{1}{b-a} & \text{for } x \in [a,b] \\ 0 & \text{otherwise} \end{cases}$

CDF $\begin{cases} 0 & \text{for } x < a \\ \frac{x-a}{b-a} & \text{for } x \in [a,b] \\ 1 & \text{for } x > b \end{cases}$

mean $\frac{1}{2}(a+b)$

median $\frac{1}{2}(a+b)$

mode any value in $(a,b)$

variance $\frac{1}{12}(b-a)^2$

skewness $0$

excess kurtosis $-\frac{6}{5}$

MGF $\begin{cases} \frac{e^{tb}-e^{ta}}{t(b-a)} & \text{for } t \neq 0 \\ 1 & \text{for } t = 0 \end{cases}$

Poisson $(\lambda)$

PMF $\dfrac{\lambda^k e^{-\lambda}}{k!}$

CDF $e^{-\lambda}\sum_{j=0}^{\lfloor k\rfloor} \dfrac{\lambda^j}{j!}$

mean $\lambda$

median $\approx \lfloor \lambda + \frac{1}{3} - \frac{1}{50\lambda} \rfloor$

mode $\lceil\lambda\rceil - 1$, $\lfloor\lambda\rfloor$

variance $\lambda$

skewness $\dfrac{1}{\sqrt{\lambda}}$

excess kurtosis $\dfrac{1}{\lambda}$

MGF $\exp[\lambda(e^t - 1)]$

$N(\mu, \sigma^2)$

PDF $\dfrac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\dfrac{(x-\mu)^2}{2\sigma^2}\right)$

CDF $\Phi\left(\dfrac{x-\mu}{\sigma}\right) = \frac{1}{2}\left[1 + \operatorname{erf}\left(\dfrac{x-\mu}{\sigma\sqrt{2}}\right)\right]$

quantile $\mu + \sigma\sqrt{2}\operatorname{erf}^{-1}(2p-1)$

mean $\mu$

median $\mu$

mode $\mu$

variance $\sigma^2$

skewness $0$

excess kurtosis $0$

MGF $\exp(\mu t + \sigma^2 t^2/2)$

Poisson limit theorem

$$p_n \in [0,1]$$

If $np_n \to \lambda$ as $n \to +\infty$

$$\lim_{n\to\infty} \binom{n}{k} p_n^k (1-p_n)^{n-k} = \frac{\lambda^k e^{-\lambda}}{k!}$$

n large, p small

Poisson distribution with $\lambda = np$ closely approximately binomial distribution

$$Z = \frac{X-\mu}{\sigma} \sim N(0,1)$$

Chebyshev's inequality

$$P(|X-\mu| \geq t) \leq \frac{\sigma^2}{t^2}$$

$\sigma$ is finite
$\mu$ is finite
$t > 0$

$$P(\mu - k\sigma < X < \mu + k\sigma) \geq 1 - \frac{1}{k^2}$$

outlier
$\leq Q1 - 1.5\, IQR$
$\geq Q3 + 1.5\, IQR$

*

95% percentile <=

$$= \frac{1}{2} X_{\lfloor np + 0.5 \rfloor} + X_{\lceil np + 0.5 \rceil}$$