$B(n, p)$

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 $\frac{q-p}{\sqrt{npq}}$

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

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

Poisson (λ)

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

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

mean λ

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

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

variance λ

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

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

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

$U(a, b)$

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

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

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

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

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

mean μ

median μ

mode μ

variance σ^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

σ is finite
μ is finite
$t > 0$

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

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

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

$\star$

95% percentile <=

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