Distributions

Here, we provide the PDFs for several distributions that we use throughout the book.

Beta Distribution The probability of observing the random variable x under the Beta distribution with shape parameters $\alpha \in (0, \infty)$ and $\beta \in (0, \infty)$ is

$$f(x|\alpha, \beta) = \frac{\Gamma(\alpha)\Gamma(\beta)}{\Gamma(\alpha + \beta)} x^{\alpha-1}(1 - x)^{\beta-1}$$

where $\Gamma(x) = (x - 1)!$.

Binomial Distribution In n trials, the binomial distribution defines the probability of observing $x = \{0, 1, \ldots, n\}$ successes as

$$f(x|p, n) = \binom{n}{x} p^x (1 - p)^{n-x},$$

where the probability of a single-trial success is the parameter $p \in [0, 1]$.

Gamma Distribution The probability of observing the random variable x under the Gamma distribution with shape parameter $k \in (0, \infty)$ and scale parameter $\theta \in (0, \infty)$ is

$$f(x|k, \theta) = \frac{1}{\Gamma(k)\theta^k} x^{k-1} \exp\left(-\frac{x}{\theta}\right).$$