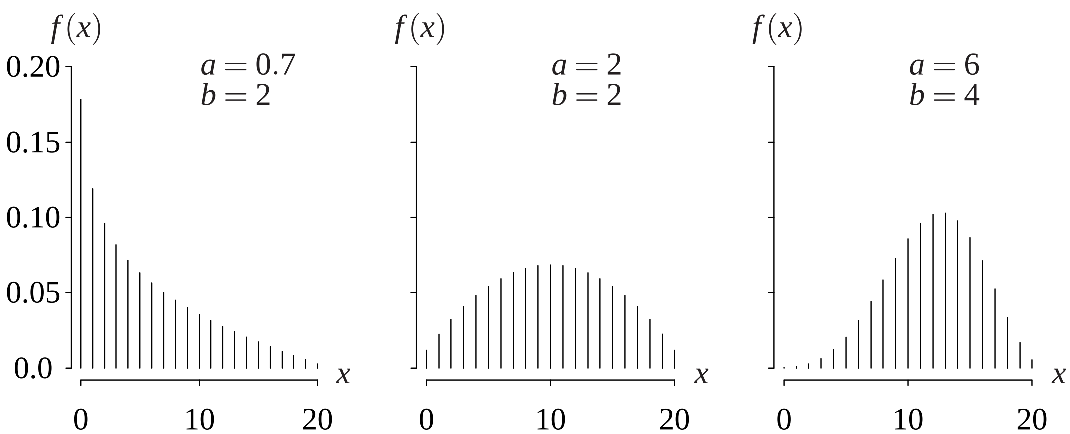
Beta-binomial distribution (from `http://www.math.wm.edu/~leemis/chart/UDR/UDR.html`)
The shorthand $X \sim \text{betabinomial}(a,b,n)$ is used to indicate that the random variable X has the beta-binomial distribution with parameters a, b, and n where $a,b > 0$ and n is a positive integer. A beta-binomial random variable X with parameters a, b, and n has probability mass function

$$f(x) = \frac{\Gamma(x+a)\,\Gamma(n-x+b)\,\Gamma(a+b)\,\Gamma(n+2)}{(n+1)\,\Gamma(a+b+n)\,\Gamma(a)\,\Gamma(b)\,\Gamma(x+1)\,\Gamma(n-x+1)} \qquad x = 0,1,\ldots,n.$$

A beta-binomial random variable is a binomial random variable with a random parameter p which has the beta distribution with parameters a and b. The probability mass function for $n = 20$ and three different parameter settings is illustrated below.



The cumulative distribution function, survivor function, hazard function, cumulative hazard function, inverse distribution function, moment generating function, and characteristic function on the support of X are mathematically intractable.

The population mean, variance, and skewness of X are

$$E[X] = \frac{na}{a+b} \qquad V[X] = \frac{nab(a+b+n)}{(a+b)^2(a+b+1)}$$

$$E\left[\left(\frac{X-\mu}{\sigma}\right)^3\right] = \frac{(a+b+2n)(b-a)}{(a+b+2)}\sqrt{\frac{1+a+b}{nab(n+a+b)}}.$$

The population kurtosis of X is mathematically intractable.