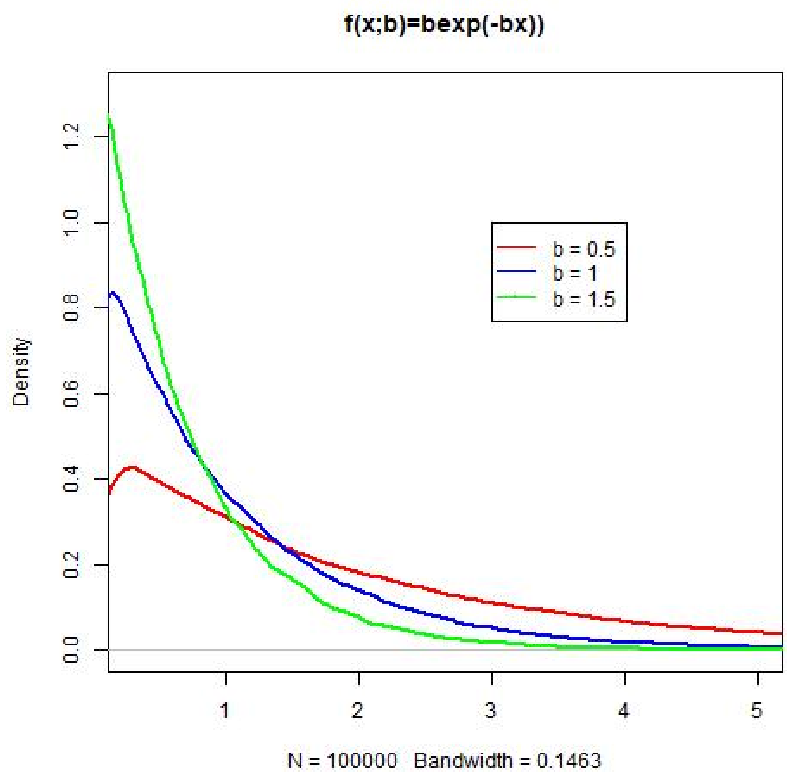
The exponential distribution

$$f(x;b) = be^{-bt}$$

Log-likelihood

$$ln(f(b;x_1,...,x_n)) = nln(b) - b\sum_{i=1}^{n} x_i$$



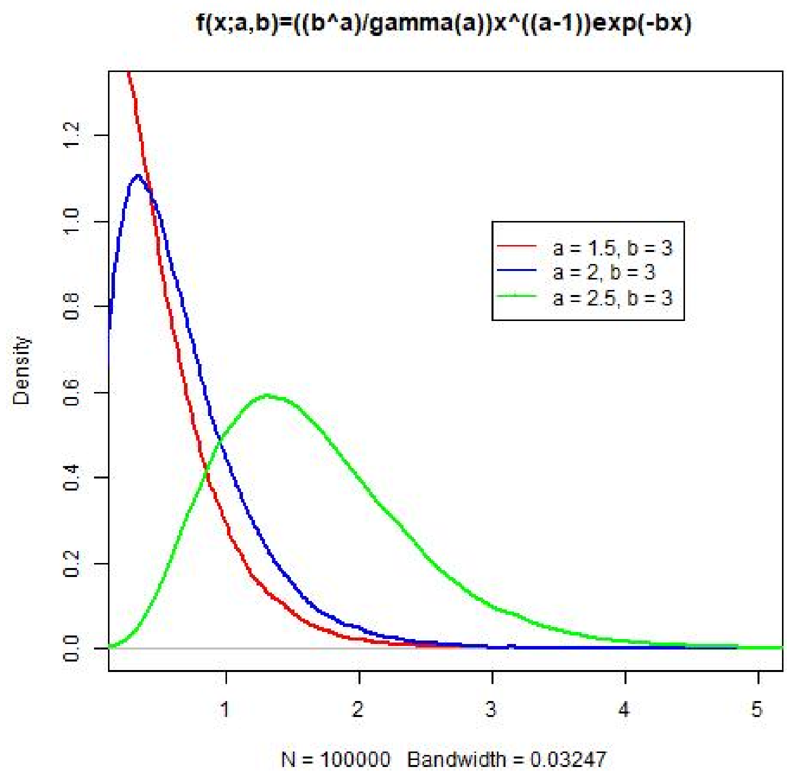
The exponential distribution is often used for the time between events, e.g. time between claims under the Lundberg-Cramer model.

The Gamma distribution

$$f(x;a,b) = \frac{b^a}{\gamma(a)} x^{a-1} e^{-bx}$$

Log-likelihood

$$ln\big(f(a,b;,x_1,...,x_n)\big) = (a-1)\sum_{i=1}^{n} x_i - nln\gamma(a) - naln(b) - \frac{1}{b}\sum_{i=1}^{n} x_i$$



The Gamma distribution is sort of the same as the Binomial is for the Bernoulli distribution, so if the Exponential looks at e.g. time between say plane landings, then the Gamma distribution gives us the time after n plane landings.

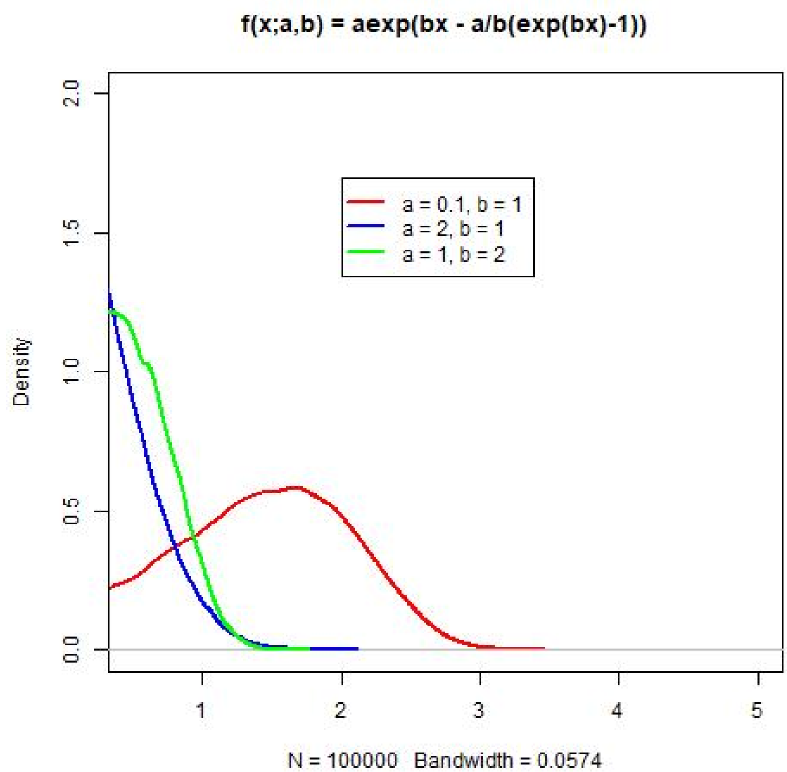
It is also used for e.g. insurance claim sizes, because of its shape.

The Gompertz distribution

$$f(x;a,b) = e^{-\frac{a}{b}(e^{bx}-1)}ae^{bx}$$

Log-likelihood

$$ln\big(f(a,b;,x_1,...,x_n)\big) = \sum_{i=1}^{n}\Big(-\frac{a}{b}(e^{bx}-1)+ln(a)+bx\Big)$$



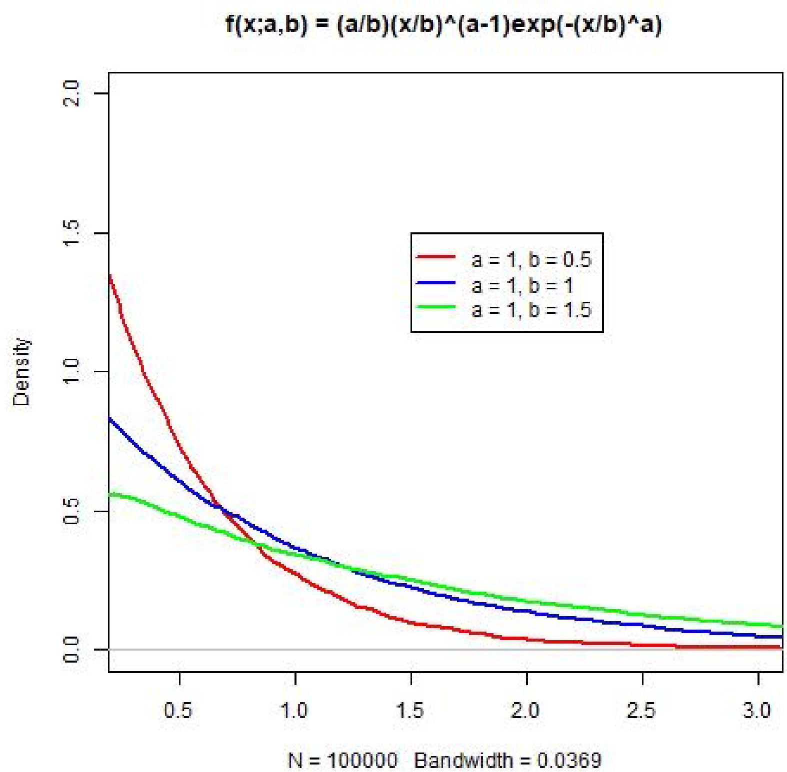
The Gompertz distribution can be used to study age mortality.

The Weibull distribution

$$f(x;a,b) = e^{-(ax)^b} a^b b x^{b-1}$$

Log-likelihood

$$ln\big(f(a,b;,x_1,...,x_n)\big) = \sum_{i=1}^{n} \Big(ln(b) - bln(a) + (b-1)ln(x) - (x/a)^b\Big)$$



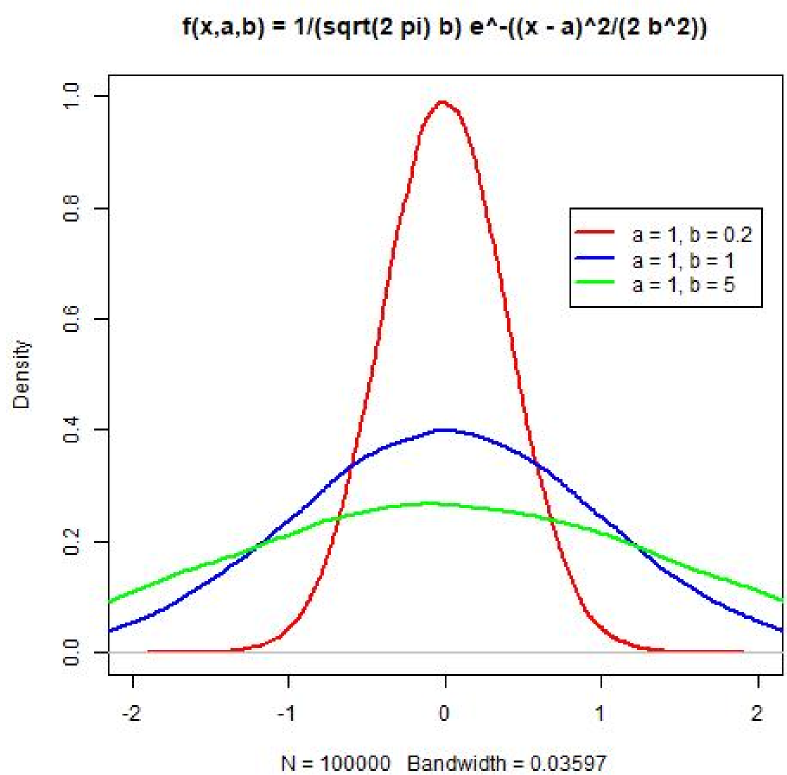
The Weibull distribution is like the Gompertz distribution, used to to study life behaviours

The Normal distribution

$$f(x;a,b) = \frac{1}{\sqrt{2\pi b^2}} e^{\frac{-(x-a)^2}{2b^2}}$$

Log-likelihood

$$ln\big(f(a,b;,x_1,...,x_n)\big) = -\frac{n}{2}ln(2\pi) - \frac{n}{2}ln(b^2) - \frac{1}{2b^2}\sum_{i=1}^{n}(x_i - a)^2$$



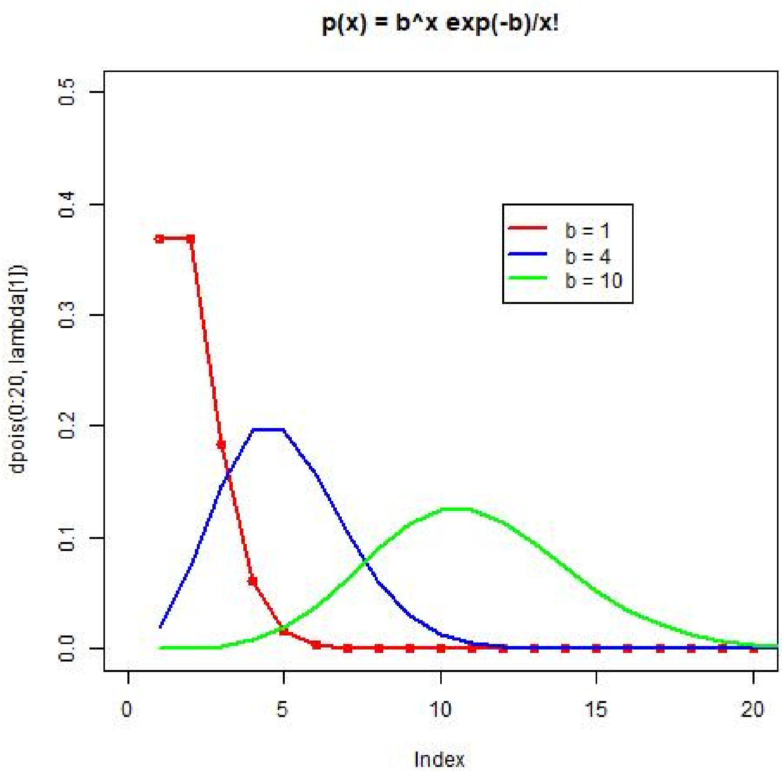
The Normal distribution is used in many different areas, some are heights, blood pressure, measurement error and IQ scores.

The Poisson distribution

$$f(x;b) = \frac{b^x}{x!}e^{-b}$$

Log-likelihood

$$ln\big(f(b;,x_1,...,x_n)\big) = -nb - \sum_{i=1}^{n} ln(x_i!) + ln(b)\sum_{i=1}^{n} x_i$$



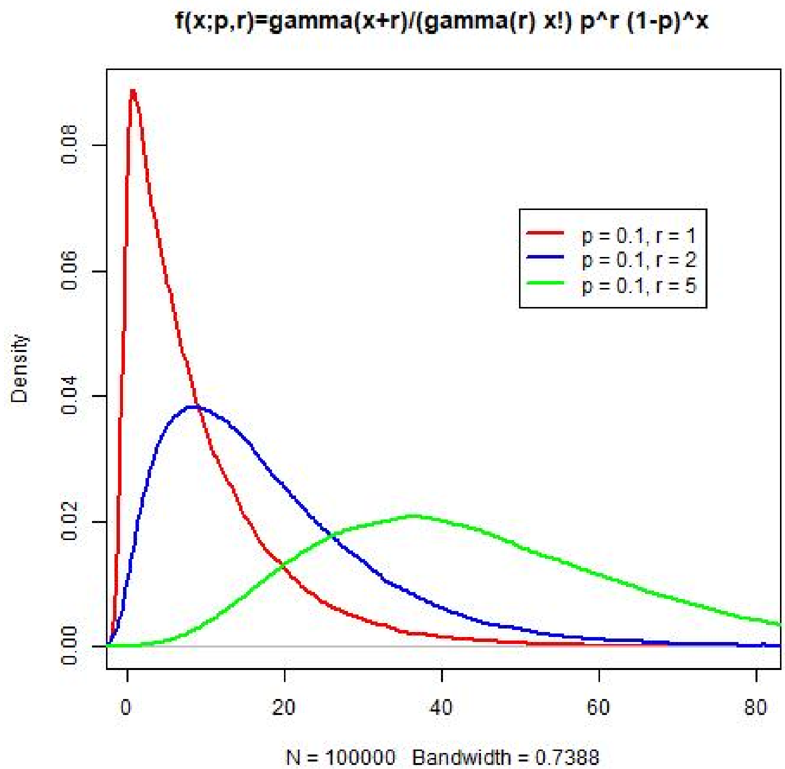
The Poisson distribution can be used to count number of claims that occurs over t years for instance.

The Negative Binomial distribution

$$f(x; r, p) = \binom{x + r - 1}{x} p^r (1 - p)^x$$

Log-likelihood

$$ln\big(f(r, p; , x_1, ..., x_n)\big) = \sum_{i=1}^{n} ln\binom{x_i + r - 1}{x_i} + rln(p) + x_i ln(1 - p)$$



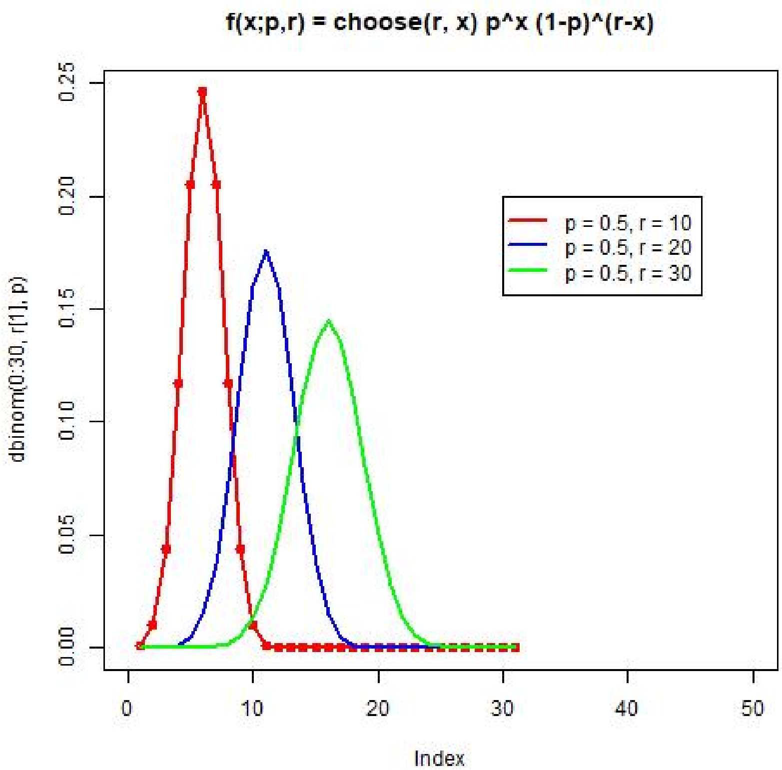
The negative binomial distribution is a generalization of the Poisson as used to study the distribution of accidents and events at the individual level, for instance number of car crashes, which also depends on how good the driver is at driving.

The Binomial distribution

$$f(x;r,p) = \binom{r}{p} p^x (1-p)^{r-x}$$

Log-likelihood

$$ln\big(f(r,p;,x_1,...,x_n)\big) = \sum_{i=1}^{n} \left(ln\binom{r}{p} + xln(p) + (r-x_i)ln(1-p)\right)$$



Used to check number of failures vs number of successes, for instance, either a new drug cures the patient, or it doesn't. Do this many times and you will get a binomial distribution with a certain probability, and r number of trials.