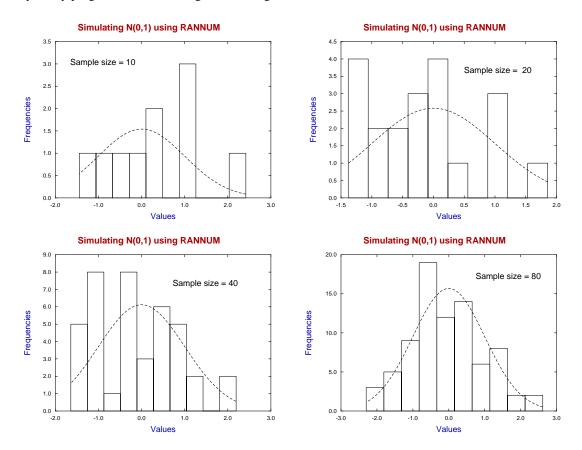*Simfit*

Tutorials and worked examples for simulation, curve fitting, statistical analysis, and plotting.
http://www.simfit.org.uk

A sample of pseudo–random numbers can be generated using program **rannum** after selecting the distribution, parameters required, and sample size.

For instance, selecting [Simulate] from the main SᴍFɪT menu, then choosing to simulate a normal distribution with $\mu = 0$ and $\sigma^2 = 1$ for sample sizes of 10, 20, 40, and 80 created four vector files. These were then analyzed by program **normal** leading to the histograms shown below.

In these histograms we can see that a sample size of ten generates a sample that bears little comparison to the theoretical distribution shown as a dotted curve. Even a sample size of twenty does not look convincingly like the theoretical distribution and a sample size of eighty is required before the histogram does really suggest the theoretical distribution.

Of course this is merely a warning not to the use the shape of a histogram to suggest the parent distribution unless the sample size is sufficiently large, and in any case the shape of histograms depend on the number of bins used and are therefore to a degree arbitrary. Of course program **normal** provides many graphical and statistical techniques to determine if a sample can be regarded as coming from a normal distribution.

There follows a list of distributions available using program **rannum**.

Distributions and their density/mass functions

Cauchy: parameters A and B, where $B > 0$

$$f(x) = \frac{1}{B\pi[1 + ((x - A)/B)^2]}$$

Chi-square: N degrees of freedom, where $N > 0, x > 0$

$$f(x) = \frac{x^{N/2-1}\exp(-x/2)}{2^{N/2}(N/2 - 1)!}$$

Negative exponential: mean A, where $A > 0, x > 0$

$$f(x) = (1/A)\exp(-x/A)$$

Gamma: parameters A and B, where $A > 0, B > 0, x > 0$

$$f(x) = \frac{x^{A-1}\exp(-x/B)}{B^A\Gamma(A)}$$

Logistic: mean A, spread B, where $B > 0$

$$f(x) = \frac{\exp[(x - A)/B]}{B(1 + \exp[(x - A)/B])^2}$$

Lognormal: parameters A and B, where $B > 0, x > 0$

$$f(x) = \frac{1}{Bx\sqrt{2\pi}}\exp{-\frac{1}{2}\left(\frac{\log(x) - A}{B}\right)^2}$$

Normal: mean A, standard deviation B, where $B > 0$

$$f(x) = \frac{1}{B\sqrt{2\pi}}\exp{-\frac{1}{2}\left(\frac{x - A}{B}\right)^2}$$

Uniform: real parameters A and B, where $B > A$

$$f(x) = \frac{1}{B - A}$$

Weibull: parameters A and B, where $A > 0, B > 0, x > 0$

$$f(x) = \frac{Ax^{A-1}}{B}\exp{-\left(\frac{x^A}{B}\right)}$$

F: M (numerator), N (denominator) degrees of freedom, where $x > 0$

$$f(x) = \frac{\Gamma((M + N)/2)(M/N)^{M/2}x^{M/2-1}}{\Gamma(M/2)\Gamma(N/2)[1 + (M/N)x]^{(M+N)/2}}$$

t: N degrees of freedom

$$f(x) = \frac{\Gamma((N + 1)/2)}{\Gamma(N/2)\sqrt{N\pi}}\left(1 + \frac{x^2}{N}\right)^{-(N+1)/2}$$

Binomial: parameters N and p, where $N \geq 1, 0 \leq p \leq 1$

$$f(x) = \binom{N}{x}p^x(1 - p)^{N-x}$$

Poisson: mean T, where $T > 0$

$$f(x) = \frac{T^x\exp(-T)}{x!}$$

Uniform: integer parameters M and N, where $N > M$

$$f(x) = \frac{1}{N - M + 1}$$