Author(s) : F. James, K.S. Kölbig
Submitter :
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Library: MATHLIB
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Gamma or Chi-Square Random Numbers

Function subprogram RANGAM generates a positive random number x according to the gamma distribution with parameter $p > 0$, i.e., according to the density

$$P(t < x < t + dt) \;=\; \frac{1}{\Gamma(p)}\, t^{p-1} e^{-t} dt.$$

A special case is the χ^2-distribution with N degrees of freedom

$$\chi^2(t < 2x < t + dt) \;=\; \frac{1}{\sqrt{2^N}\,\Gamma(\frac{1}{2}N)}\, t^{\frac{1}{2}N-1}\, e^{-\frac{1}{2}t}\, dt.$$

Structure:

FUNCTION subprogram
User Entry Names: RNGAMA
External References: RANLUX (V115), RNORMX (V120)

Usage:

In any arithmetic expression,

```
RNGAMA(P)
```

has the value of a gamma-distributed random number, where $\mathtt{P} > 0$ is of type REAL. The value of P may vary from call to call without influencing the efficiency.

Method:

For integral values of $p \leq 15$, the logarithm of the product of p uniform random numbers is used. For any value of $p > 15$, the Wilson-Hilferty approximation (a transformed normal distribution) is used. For all other p, Johnk's algorithm is used.

Notes:

The routine is fast for small integer values of p, and for $p > 15$, (one Gaussian random number and one square root, plus a few multiplications). Non-integral values of $p < 15$ are rather slow.

Examples:

```
CHI2 = 2*RNGAMA(0.5*N)
```

sets CHI2 to a random number distributed as χ^2 with N degrees of freedom.

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