

## Contents

[M-5] Manual entry	Function	Purpose
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	Pseudorandom variates	
<b>runiform()</b>	<code>runiform()</code>	uniform random variates
	<code>rnormal()</code>	normal (Gaussian) random variates
	<code>rseed()</code>	obtain or set the random-variate seed
	<code>rngstate()</code>	obtain or set the random-number generator state
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	<code>rbeta()</code>	beta random variates
	<code>rbinomial()</code>	binomial random variates
	<code>rcauchy()</code>	Cauchy random variates
	<code>rchi2()</code>	$\chi^2$ random variates
	<code>rdiscrete()</code>	discrete random variates
	<code>rexponential()</code>	exponential random variates
	<code>rgamma()</code>	gamma random variates
	<code>rhypergeometric()</code>	hypergeometric random variates
	<code>rigaussian()</code>	inverse Gaussian random variates
	<code>rlaplace()</code>	Laplace random variates
	<code>rlogistic()</code>	logistic random variates
	<code>rnbinomial()</code>	negative binomial random variates
	<code>rpoisson()</code>	Poisson random variates
	<code>rt()</code>	Student's $t$ random variates
	<code>runiformint()</code>	uniform random integer variates
	<code>rweibull()</code>	Weibull random variates
	<code>rweibullph()</code>	Weibull (proportional hazards) random variates

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Means, variances, & correlations

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<b>mean()</b>	mean() variance() quadvariance() meanvariance() quadmeanvariance() correlation() quadcorrelation()	mean variance quad-precision variance mean and variance quad-precision mean and variance correlation quad-precision correlation
<b>cross()</b>	cross()	$X'X, X'Z, X'\text{diag}(w)Z$ , etc.
<b>corr()</b>	corr()	make correlation from variance matrix
<b>crossdev()</b>	crossdev()	$(X: -x)'(X: -x)$ , $(X: -x)'(Z: -z)$ , etc.
<b>quadercross()</b>	quadcross() quadcrossdev()	quad-precision cross() quad-precision crossdev()

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Factorial & combinations

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<b>factorial()</b>	factorial() lnfactorial() gamma() lngamma() digamma() trigamma()	factorial natural logarithm of factorial gamma function natural logarithm of gamma function derivative of lngamma() second derivative of lngamma()
<b>comb()</b>	comb()	combinatorial function $n$ choose $k$
<b>cvpermute()</b>	cvpermutesetup() cvpermute()	permutation setup return permutations, one at a time

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Densities & distributions

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<b>normal()</b>	normalden() normal() invnormal() lnnormalden() lnnormal()	normal density cumulative normal inverse cumulative normal logarithm of the normal density logarithm of the cumulative normal
	binormal()	cumulative binormal
	lnmvnrmalden()	logarithm of the multivariate normal density
	betaden() ibeta()	beta density cumulative beta;
	ibetatail() invbeta() invbetatail()	a.k.a. incomplete beta function reverse cumulative beta inverse cumulative beta inverse reverse cumulative beta
	binomialp() binomial() binomialtail() invbinomial() invbinomialtail()	binomial probability cumulative binomial reverse cumulative binomial inverse cumulative binomial inverse reverse cumulative binomial
	cauchyden() cauchy() cauchytail() invcauchy() invcauchytail() lncauchyden()	Cauchy density cumulative Cauchy reverse cumulative Cauchy inverse cumulative Cauchy inverse reverse cumulative Cauchy logarithm of the Cauchy density
	chi2() chi2den() chi2tail() invchi2() invchi2tail()	cumulative $\chi^2$ $\chi^2$ density reverse cumulative $\chi^2$ inverse cumulative $\chi^2$ inverse reverse cumulative $\chi^2$
	dunnettprob() invdunnettprob()	cumulative multiple range; used in Dunnett's multiple comparison inverse cumulative multiple range; used in Dunnett's multiple comparison

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<b>normal()</b> , continued	<code>exponentialden()</code>	exponential density
	<code>exponential()</code>	cumulative exponential
	<code>exponentialtail()</code>	reverse cumulative exponential
	<code>invexponential()</code>	inverse cumulative exponential
	<code>invexponentialetail()</code>	inverse reverse cumulative exponential
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	<code>Fden()</code>	<i>F</i> density
	<code>F()</code>	cumulative <i>F</i>
	<code>Ftail()</code>	reverse cumulative <i>F</i>
	<code>invF()</code>	inverse cumulative <i>F</i>
	<code>invFtail()</code>	inverse reverse cumulative <i>F</i>
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	<code>gammaden()</code>	gamma density
	<code>gammap()</code>	cumulative gamma; a.k.a. incomplete gamma function
	<code>gammaptail()</code>	reverse cumulative gamma;
	<code>invgammap()</code>	inverse cumulative gamma
	<code>invgammaptail()</code>	inverse reverse cumulative gamma
	<code>dgammadpa()</code>	$\partial P(a, x)/\partial a$ , where $P(a, x) = \text{gammap}(a, x)$
	<code>dgammadpx()</code>	$\partial P(a, x)/\partial x$ , where $P(a, x) = \text{gammap}(a, x)$
	<code>dgammadada()</code>	$\partial^2 P(a, x)/\partial a^2$ , where $P(a, x) = \text{gammap}(a, x)$
	<code>dgammadadx()</code>	$\partial^2 P(a, x)/\partial a \partial x$ , where $P(a, x) = \text{gammap}(a, x)$
	<code>dgammadidx()</code>	$\partial^2 P(a, x)/\partial x^2$ , where $P(a, x) = \text{gammap}(a, x)$
	<code>lnigammaden()</code>	logarithm of the inverse gamma density
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	<code>hypergeometriccp()</code>	hypergeometric probability
	<code>hypergeometric()</code>	cumulative hypergeometric
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	<code>igaussianden()</code>	inverse Gaussian density
	<code>igaussian()</code>	cumulative inverse Gaussian
	<code>igaussiantail()</code>	reverse cumulative inverse Gaussian
	<code>invigaussian()</code>	inverse cumulative of inverse Gaussian
	<code>invigaussiantail()</code>	inverse reverse cumulative of inverse Gaussian
	<code>lnigaussianden()</code>	logarithm of the inverse Gaussian density
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	<code>laplaceden()</code>	Laplace density
	<code>laplace()</code>	cumulative Laplace
	<code>laplacetail()</code>	reverse cumulative Laplace
	<code>invlaplace()</code>	inverse cumulative Laplace
	<code>invlaplacetail()</code>	inverse reverse cumulative Laplace
	<code>lnlaplaceden()</code>	logarithm of the Laplace density

<b>normal()</b> , continued	logisticden() logistic() logistictail() invlogistic() invlogistictail()	logistic density cumulative logistic reverse cumulative logistic inverse cumulative logistic inverse reverse cumulative logistic
	nbetaden() nibeta() invnibeta()	noncentral beta density cumulative noncentral beta inverse cumulative noncentral beta
	nbinomialp() nbinomial() nbinomialtail() invnbinomial() invnbinomialtail()	negative binomial probability cumulative negative binomial reverse cumulative negative binomial inverse cumulative negative binomial inverse reverse cumulative negative binomial
	nchi2() nchi2den() nchi2tail() invnchi2() invnchi2tail()  npnchi2()	cumulative noncentral $\chi^2$ noncentral $\chi^2$ density reverse cumulative noncentral $\chi^2$ inverse cumulative noncentral $\chi^2$ inverse reverse cumulative noncentral $\chi^2$  noncentrality parameter of nchi2()
	nF() nFden() nFtail() invnF() invnFtail() npnF()	cumulative noncentral $F$ noncentral $F$ density reverse cumulative noncentral $F$ inverse cumulative noncentral $F$ inverse reverse cumulative noncentral $F$ noncentrality parameter of nF()
	nt() ntden() nttail() invnt() invnntail() npnt()	cumulative noncentral Student's $t$ noncentral Student's $t$ density reverse cumulative noncentral $t$ inverse cumulative noncentral $t$ inverse reverse cumulative noncentral $t$ noncentrality parameter of nt()
	poissonp() poisson() poissontail() invoisson() invoissontail()	Poisson probability cumulative Poisson reverse cumulative Poisson inverse cumulative Poisson inverse reverse cumulative Poisson

<b>normal()</b> , continued	<b>t()</b>	cumulative Student's <i>t</i> Student's <i>t</i> density
	<b>tden()</b>	reverse cumulative Student's <i>t</i>
	<b>ttail()</b>	inverse cumulative Student's <i>t</i>
	<b>invt()</b>	inverse reverse cumulative Student's <i>t</i>
	<b>invttail()</b>	
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	<b>tukeyprob()</b>	cumulative multiple range; used in Tukey's multiple comparison
	<b>invtukeyprob()</b>	inverse cumulative multiple range; used in Tukey's multiple comparison
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	<b>weibullden()</b>	Weibull density
	<b>weibull()</b>	cumulative Weibull
	<b>weibulltail()</b>	reverse cumulative Weibull
	<b>invweibull()</b>	inverse cumulative Weibull
	<b>invweibulltail()</b>	inverse reverse cumulative Weibull
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	<b>weibullphden()</b>	Weibull (proportional hazards) density
	<b>weibullph()</b>	cumulative Weibull (proportional hazards)
	<b>weibullphtail()</b>	reverse cumulative Weibull (proportional hazards)
	<b>invweibullph()</b>	inverse cumulative Weibull (proportional hazards)
	<b>invweibullphtail()</b>	inverse reverse cumulative Weibull (proportional hazards)
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	<b>lnwishartden()</b>	logarithm of the Wishart density
	<b>lniwishartden()</b>	logarithm of the inverse-Wishart density
<b>mvnormal()</b>	<b>mvnormal()</b>	multivariate normal probabilities (correlation specified)
	<b>mvnormalcv()</b>	multivariate normal probabilities (covariance specified)
	<b>mvnormalqp()</b>	<b>mvnormal()</b> with specified quadrature points
	<b>mvnormalcvqp()</b>	<b>mvnormalcv()</b> with specified quadrature points
	<b>mvnormalderiv()</b>	derivatives of <b>mvnormal()</b>
	<b>mvnormalcvderiv()</b>	derivatives of <b>mvnormalcv()</b>
	<b>mvnormaldrvqp()</b>	<b>mvnormalderiv()</b> with specified quadrature points
	<b>mvnormalcvderivqp()</b>	<b>mvnormalcvderiv()</b> with specified quadrature points

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Maximization & minimization

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<b>optimize()</b>	optimize() optimize_evaluate() optimize_init() optimize_init_*( optimize_result_*( optimize_query()	function maximization and minimization evaluate function at initial values begin optimization set details access results report settings
<b>moptimize()</b>	moptimize() moptimize_evaluate() moptimize_init() moptimize_init_*( moptimize_result_*( moptimize ado_cleanup() moptimize_query() moptimize_util_*( )	function optimization evaluate function at initial values begin setup of optimization problem set details access moptimize() results perform cleanup after ado report settings utility functions for writing evaluators and processing results
<b>LinearProgram()</b>	LinearProgram()	linear programming

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Logits, odds, & related

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<b>logit()</b>	logit() invlogit() cloglog() invcloglog()	log of the odds ratio inverse log of the odds ratio complementary log–log inverse complementary log–log
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Multivariate normal

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<b>ghk()</b>	ghk() ghk_init() ghk_init_*( ghk() ghk_query_npts()	GHK multivariate normal (MVN) simulator GHK MVN initialization set details perform simulation return number of simulation points
<b>ghkfast()</b>	ghkfast() ghkfast_init() ghkfast_init_*( ghkfast() ghkfast_i() ghk_query_*( )	GHK MVN simulator GHK MVN initialization set details perform simulation results for the $i$ th observation display settings

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## Description

The above functions are statistical, probabilistic, or designed to work with data matrices.

## Remarks and examples

Concerning data matrices, see

[\[M-4\] Stata](#)      Stata interface functions

and especially

[\[M-5\] st\\_data\(\)](#)      Load copy of current Stata dataset

[\[M-5\] st\\_view\(\)](#)      Make matrix that is a view onto current Stata dataset

For other mathematical functions, see

[\[M-4\] Matrix](#)      Matrix mathematical functions

[\[M-4\] Scalar](#)      Scalar mathematical functions

[\[M-4\] Mathematical](#)      Important mathematical functions

## Also see

[\[M-4\] Intro](#) — Categorical guide to Mata functions

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