Title

qrinv( ) — Generalized inverse of matrix via QR decomposition

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Description

qrinv(A, ...) returns the inverse or generalized inverse of real or complex matrix A: $m \times n$, $m \geq n$. If optional argument *rank* is specified, the rank of A is returned there.

_qrinv(A, ...) does the same thing except that, rather than returning the result, it overwrites the original matrix A with the result. _qrinv() returns the rank of A.

In both cases, optional argument *tol* specifies the tolerance for determining singularity; see *Remarks and examples* below.

Syntax

numeric matrix qrinv(numeric matrix A)

numeric matrix qrinv(numeric matrix A, *rank*)

numeric matrix qrinv(numeric matrix A, *rank*, *real scalar tol*)

real scalar _qrinv(numeric matrix A)

real scalar _qrinv(numeric matrix A, *real scalar tol*)

where the type of *rank* is irrelevant; the rank of A is returned there.

Remarks and examples

qrinv() and _qrinv() are most often used on square and possibly rank-deficient matrices but may be used on nonsquare matrices that have more rows than columns. Also see [M-5] **pinv( )** for an alternative. See [M-5] **luinv( )** for a more efficient way to obtain the inverse of full-rank, square matrices, and see [M-5] **invsym( )** for inversion of real, symmetric matrices.

When A is of full rank, the inverse calculated by qrinv() is essentially the same as that computed by the faster luinv(). When A is singular, qrinv() and _qrinv() compute a generalized inverse, $A*$, which satisfies

$$A(A*)A = A$$

$$(A*)A(A*) = A*$$

This generalized inverse is also calculated for nonsquare matrices that have more rows than columns and, then returned is a least-squares solution. If A is $m \times n$, $m \geq n$, and if the rank of A is equal to n, then $(A*)A = I$, ignoring roundoff error.

qrinv(A) is implemented as qrsolve(A, I(rows(A))); see [M-5] **qrsolve( )** for details and for use of the optional *tol* argument.

Conformability

qrinv(A, *rank*, *tol*):

input:			
	A:	$m \times n$,	$m \geq n$
	tol:	1×1	(optional)
output:			
	rank:	1×1	(optional)
	result:	$n \times m$	

_qrinv(A, *tol*):

input:			
	A:	$m \times n$,	$m \geq n$
	tol:	1×1	(optional)
output:			
	A:	$n \times m$	
	result:	1×1	(containing rank)

Diagnostics

The inverse returned by these functions is real if A is real and is complex if A is complex.

qrinv(A, ...) and _qrinv(A, ...) return a result containing missing values if A contains missing values.

_qrinv(A, ...) aborts with error if A is a view.

See [M-5] **qrsolve()** and [M-1] **Tolerance** for information on the optional *tol* argument.

Also see

[M-5] **cholinv()** — Symmetric, positive-definite matrix inversion

[M-5] **invsym()** — Symmetric real matrix inversion

[M-5] **luinv()** — Square matrix inversion

[M-5] **pinv()** — Moore–Penrose pseudoinverse

[M-5] **qrsolve()** — Solve AX=B for X using QR decomposition

[M-5] **solve_tol()** — Tolerance used by solvers and inverters

[M-4] **Matrix** — Matrix functions

[M-4] **Solvers** — Functions to solve AX=B and to obtain A inverse

For suggested citations, see the FAQ on citing Stata documentation.