qrinv() — Generalized inverse of matrix via QR decomposition

Syntax

diagnostic

Description


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(A,...) returns the inverse or generalized inverse of real or complex matrix A: m × n, m ≥ 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.

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 × n, m ≥ 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(\(A\), \(\text{rank}\), \(\text{tol}\)):

input:

\(A\): \(m \times n\), \(m \geq n\)
\(\text{tol}\): \(1 \times 1\) (optional)

output:

\(\text{rank}\): \(1 \times 1\) (optional)
\(\text{result}\): \(n \times m\)

\_qrinv(\(A\), \(\text{tol}\)):

input:

\(A\): \(m \times n\), \(m \geq n\)
\(\text{tol}\): \(1 \times 1\) (optional)

output:

\(\text{A}\): \(n \times m\)
\(\text{result}\): \(1 \times 1\) (containing rank)

Diagnostics

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

\(\text{qrinv}(A, \ldots)\) and \(\_qrinv(A, \ldots)\) return a result containing missing values if \(A\) contains missing values.

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

See [M-5] qrsolve() and [M-1] tolerance for information on the optional \(\text{tol}\) argument.

Also see

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