Title

norm() — Matrix and vector norms

Syntax

real scalar `norm(`*numeric matrix A*`)`

real scalar `norm(`*numeric matrix A*`,` *real scalar p*`)`

Description

`norm(`*A*`)` returns `norm(`*A*`, 2)`.

`norm(`*A*`,` *p*`)` returns the value of the norm of A for the specified p. The possible values and the meaning of p depend on whether A is a vector or a matrix.

When A is a vector, `norm(`*A*`,` *p*`)` returns

`sum(abs(`*A*`):^`*p*`) ^ (1/`*p*`)`	if $1 \leq p < .$
`max(abs(A))`	if $p \geq .$

When A is a matrix, returned is

p	`norm(`*A*`,` *p*`)`
0	`sqrt(trace(conj(`*A*`)'`*A*`))`
1	`max(colsum(abs(`*A*`)))`
2	`max(svdsv(`*A*`))`
.	`max(rowsum(abs(`*A*`)))`

Remarks and examples

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`norm(`*A*`)` and `norm(`*A*`,` *p*`)` calculate vector norms and matrix norms. A may be real or complex and need not be square when it is a matrix.

The formulas presented above are not the actual ones used in calculation. In the vector-norm case when $1 \leq p < .$, the formula is applied to *A*`:/max(abs(`*A*`))` and the result then multiplied by `max(abs(`*A*`))`. This prevents numerical overflow. A similar technique is used in calculating the matrix norm for $p = 0$, and that technique also avoids storage of `conj(`*A*`)'`*A*.

Conformability

`norm(`*A*`)`:

A:	$r \times c$
result:	1×1

norm(A, p):

A:	$r \times c$
p:	1×1
result:	1×1

Diagnostics

The norm() is defined to return 0 if A is void and missing if any element of A is missing.

norm(A, p) aborts with error if p is out of range. When A is a vector, p must be greater than or equal to 1. When A is a matrix, p must be 0, 1, 2, or . (missing).

norm(A) and norm(A, p) return missing if the 2-norm is requested and the singular value decomposition does not converge, an event not expected to occur; see [M-5] **svd( )**.

Also see

[M-4] **matrix** — Matrix functions