Title

norm() — Matrix and vector norms

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`)))`

Syntax

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

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

Remarks and examples

`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