

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

$$\text{sum}(\text{abs}(A) : ^p) \wedge (1/p) \quad \text{if } 1 \leq p < .$$

$$\text{max}(\text{abs}(A)) \quad \text{if } p \geq .$$

When A is a matrix, returned is

p	<code>norm(A, p)</code>
0	<code>sqrt(trace(conj(A)'A))</code>
1	<code>max(colsum(abs(A)))</code>
2	<code>max(svdsv(A))</code>
.	<code>max(rowsum(abs(A)))</code>

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 $A : / \text{max}(\text{abs}(A))$ 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

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