

norm() — Matrix and vector norms

Description
Diagnostics

Syntax
Also see

Remarks and examples

Conformability

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

$$\begin{aligned} \text{sum}(\text{abs}(A) : ^p)^{1/p} & \quad \text{if } 1 \leq p < \infty \\ \max(\text{abs}(A)) & \quad \text{if } p \geq \infty \end{aligned}$$

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

stata.com

`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 $1 \leq p < \infty$, the formula is applied to $A : / \max(\text{abs}(A))$ and the result then multiplied by $\max(\text{abs}(A))$. 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