### Description

\(\text{norm}(A)\) returns \(\text{norm}(A, 2)\).  

\(\text{norm}(A, p)\) 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, \(\text{norm}(A, p)\) returns

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

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

When \(A\) is a matrix, returned is

<table>
<thead>
<tr>
<th>(p)</th>
<th>norm(A, p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(\sqrt{\text{trace(conj(A)'A)}})</td>
</tr>
<tr>
<td>1</td>
<td>(\max(\text{colsum(abs(A))}))</td>
</tr>
<tr>
<td>2</td>
<td>(\max(\text{svdsv(A))})</td>
</tr>
<tr>
<td>.</td>
<td>(\max(\text{rowsum(abs(A))}))</td>
</tr>
</tbody>
</table>

### Syntax

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

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

### Remarks and examples

\(\text{norm}(A)\) and \(\text{norm}(A, p)\) 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 \(A : /\max(\text{abs}(A))\) 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 \(\text{conj}(A)'A\).
Conformability

\[ \text{norm}(A): \]
\[
A: \quad r \times c \\
\text{result:} \quad 1 \times 1
\]

\[ \text{norm}(A, p): \]
\[
A: \quad r \times c \\
p: \quad 1 \times 1 \\
\text{result:} \quad 1 \times 1
\]

Diagnostics

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

\text{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).

\text{norm}(A) \) and \text{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 \([M-5]\) \text{svd()}.

Also see

[M-4] \textbf{Matrix} — Matrix functions