Title

trace() — Trace of square matrix

Description

`trace(`A`)` returns the sum of the diagonal elements of A. Returned result is real if A is real, complex if A is complex.

`trace(`A`,` B`)` returns trace(AB), the calculation being made without calculating or storing the off-diagonal elements of AB. Returned result is real if A and B are real and is complex otherwise.

`trace(`A`,` B`,` t`)` returns trace(AB) if $t = 0$ and returns trace($A'B$) otherwise, where, if either A or B is complex, transpose is understood to mean conjugate transpose. Returned result is real if A and B are real and is complex otherwise.

Syntax

numeric scalar `trace(`*numeric matrix A*`)`

numeric scalar `trace(`*numeric matrix A*`,` *numeric matrix B*`)`

numeric scalar `trace(`*numeric matrix A*`,` *numeric matrix B*`,` *real scalar t*`)`

Remarks and examples

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`trace(`A`,` B`)` returns the same result as `trace(`A`*`B`)` but is more efficient if you do not otherwise need to calculate A*B.

`trace(`A`,` B`, 1)` returns the same result as `trace(`$A'B$`)` but is more efficient.

For real matrices A and B,

$$\text{trace}(A') = \text{trace}(A)$$

$$\text{trace}(AB) = \text{trace}(BA)$$

and for complex matrices,

$$\text{trace}(A') = \text{conj}(\text{trace}(A))$$

$$\text{trace}(AB) = \text{trace}(BA)$$

where, for complex matrices, transpose is understood to mean conjugate transpose.

Thus for real matrices,

To calculate	Code
trace(AB)	`trace(`A`, `B`)`
trace($A'B$)	`trace(`A`, `B`, 1)`
trace(AB')	`trace(`A`, `B`, 1)`
trace($A'B'$)	`trace(`A`, `B`)`

and for complex matrices,

To calculate	Code
trace(AB)	`trace(`A`, `B`)`
trace($A'B$)	`trace(`A`, `B`, 1)`
trace(AB')	`conj(trace(`A`, `B`, 1))`
trace($A'B'$)	`conj(trace(`A`, `B`))`

Transpose in the first column means conjugate transpose.

Conformability

`trace(`A`)`:

A:	$n \times n$
result:	1×1

`trace(`A`, `B`)`:

A:	$n \times m$
B:	$m \times n$
result:	1×1

`trace(`A`, `B`, `t`)`

A:	$n \times m$ if $t = 0$, $m \times n$ otherwise
B:	$m \times n$
t:	1×1
result:	1×1

Diagnostics

`trace(`A`)` aborts with error if A is not square.

`trace(`A`, `B`)` and `trace(`A`, `B`, `t`)` abort with error if the matrices are not conformable or their product is not square.

The trace of a 0×0 matrix is 0.

Also see

[M-4] **Matrix** — Matrix functions

For suggested citations, see the FAQ on citing Stata documentation.