Package 'tensor'

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Title Tensor Product of Arrays

Description The tensor product of two arrays is notionally an outer product of the arrays collapsed in specific extents by summing along the appropriate diagonals.

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Author Jonathan Rougier [aut, cre]

Maintainer Jonathan Rougier <j.c.rougier@bristol.ac.uk>

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`tensor` *Tensor product of arrays*

Description

The tensor product of two arrays is notionally an outer product of the arrays collapsed in specific extents by summing along the appropriate diagonals. For example, a matrix product is the tensor product along the second extent of the first matrix and the first extent of the second. Thus `A %*% B` could also be evaluated as `tensor(A, B, 2, 1)`, likewise `A %*% t(B)` could be `tensor(A, B, 2, 2)`.

Usage

```
tensor(A, B, alongA = integer(0), alongB = integer(0))
```

Arguments

A, B	Numerical vectors, matrices or arrays
alongA	Extents in A to be collapsed
alongB	Extents in B to be collapsed

Details

This code does the 'obvious' thing, which is to perm the "along" extents to the end (for A) and beginning (for B) of the two objects and then do a matrix multiplication and reshape.

Value

Generally, an array with dimension comprising the remaining extents of A concatenated with the remaining extents of B.

If both A and B are completely collapsed then the result is a scalar **without** a dim attribute. This is quite deliberate and consistent with the general rule that the dimension of the result is the sum of the original dimensions less the sum of the collapse dimensions (and so could be zero). A 1D array of length 1 arises in a different set of circumstances, eg if A is a 1 by 5 matrix and B is a 5-vector then tensor(A, B, 2, 1) is a 1D array of length 1.

Shortcuts

Some special cases of tensor may be independently useful, and these have got shortcuts as follows.

%*t%	Matrix product A %*% t(B)
%t*%	Matrix product t(A) %*% B
%t*t%	Matrix product t(A) %*% t(B)

Author(s)

Jonathan Rougier, <J.C.Rougier@durham.ac.uk>

See Also

matmult, aperm

Examples

```
A <- matrix(1:6, 2, 3)
dimnames(A) <- list(happy = LETTERS[1:2], sad = NULL)
B <- matrix(1:12, 4, 3)
stopifnot(A %*% t(B) == tensor(A, B, 2, 2))

A <- A %o% A
C <- tensor(A, B, 2, 2)
stopifnot(all(dim(C) == c(2, 2, 3, 4)))
D <- tensor(C, B, c(4, 3), c(1, 2))
stopifnot(all(dim(D) == c(2, 2)))
```

```
E <- matrix(9:12, 2, 2)
s <- tensor(D, E, 1:2, 1:2)
stopifnot(s == sum(D * E), is.null(dim(s)))
```

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