Isesolve() — Solve Ax=c for x with equality constraints using least-squares method

Description Syntax Remarks and examples Conformability Diagnostics Also see

Description

lsesolve(A, B, c, d) finds the minimum-norm least-squares solution for min $||A x - c||_2$ subject to B x = d and returns x. A does not have to be a square matrix.

lsesolve(A, B, c, d, x) does the same thing except that it overwrites x with the solution and returns 0 if a solution was found and 1 otherwise. If 1 is returned, x is overwritten with a vector of missing values.

 $_lse_lapacke(A, B, c, d, x)$ is the interface to the LAPACK routines that do the work. It returns 0 if a solution was found and 1 otherwise. Direct use of $_lse_lapacke()$ is not recommended.

Note that these functions can be used only when set lapack_mkl on is in effect on Windows or Linux or when set lapack_openblas on is in effect on Mac; see [M-1] LAPACK.

Syntax

numeric vector	lsesolve(A, B, c, d)
real scalar	$_$ lsesolve(A , B , c , d , x)
real scalar	$lse_lapacke(A, B, c, d, x)$

where inputs are

A:	m imes n numeric matrix
<i>B</i> :	$p \times n$ numeric matrix
c:	$m \times 1$ or $1 \times m$ numeric vector
d:	$p \times 1$ or $1 \times p$ numeric vector

and outputs are

x: $n \times 1$ numeric vector result: real scalar

where $p \le n \le m + p$, the rank of matrix B is p, and the rank of the following matrix is n:

$$\begin{bmatrix} A \\ m \times n \\ B \\ p \times n \end{bmatrix}$$

Remarks and examples

Remarks are presented under the following headings:

Introduction Examples

Introduction

The above functions solve A x = c subject to equality constraints B x = d via the least-squares method. A need not be square.

To obtain a unique solution, the functions require that

1. $p \le n \le m + p$,

- 2. the rank of matrix B is p, and
- 3. the rank of the following matrix is *n*:

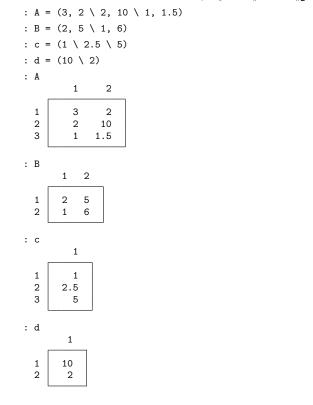
$$\begin{bmatrix} A \\ m \times n \\ B \\ p \times n \end{bmatrix}$$

The solution is found with the underlying LAPACK routines using a generalized RQ factorization of (B, A).

Examples

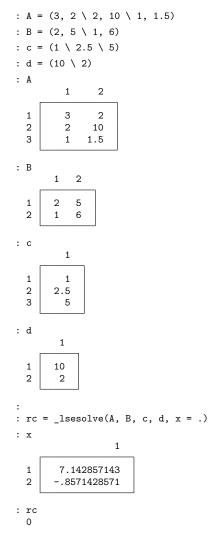
Example 1: Least squares with equality constraints

Given A, B, c, and d, we can find x, satisfying min $||A x - c||_2$ subject to B x = d using



```
: x = lsesolve(A, B, c, d)
: x
1
1 7.142857143
2 -.8571428571
```

We can also use the _lsesolve() function to get the same solution as above and a return code of 0:



Conformability

<pre>lsesolve(A, B, c, d):</pre>			
input:			
A:	$m \times n$		
<i>B</i> :	$p \times n$		
с:	$m \times 1$ or $1 \times m$		
d:	$p \times 1$ or $1 \times p$		
output:			
<i>x</i> :	$n \times 1$		
$_$ lsesolve(A , B , c , d , x):			
input:			
A:	$m \times n$		
<i>B</i> :	$p \times n$		
С:	$m \times 1$ or $1 \times m$		
d:	$p \times 1$ or $1 \times p$		
output:			
<i>x</i> :	$n \times 1$		
result:	1×1		
$lse_lapacke(A, B, c, d, x):$			
input:			
A:	$m \times n$		
<i>B</i> :	$p \times n$		
С:	$m \times 1$ or $1 \times m$		
d:	$p \times 1$ or $1 \times p$		
output:			
<i>x</i> :	$n \times 1$		
result:	1×1		

Diagnostics

 $lsesolve(A, B, ...), _lsesolve(A, B, ...), and _lse_lapacke(A, B, ...) return a result con$ taining missing if A, B, c, or d contains missing values. If the conditions in*Introduction*above are notsatisfied, the functions will try to find a solution, which will either produce unstable results or abort with $error. The functions abort with error if set lapack_mkl on is not in effect on Windows or Linux or$ $when set lapack_openblas on is not in effect on Mac.$

 $_$ lsesolve(A, B, ...) and $_$ lse $_$ lapacke(A, B, ...) abort with error if A, B, c, or d is a view.

 $lse_lapacke(A, B, ...)$ aborts with error if A, B, c, and d are not all real or all complex. $lse_lapacke(A, B, ...)$ should not be used directly; use lsesolve().

Also see

- [M-5] cholsolve() Solve AX=B for X using Cholesky decomposition
- [M-5] lsglmsolve() Solves a general Gauss-Markov linear model problem
- [M-5] lssolve() Solve AX=B for X using least-squares method
- [M-5] lusolve() Solve AX=B for X using LU decomposition
- [M-5] qrsolve() Solve AX=B for X using QR decomposition
- [M-5] _solvemat() Solve AX=B for X
- [M-5] svsolve() Solve AX=B for X using singular value decomposition
- [M-4] Matrix Matrix functions
- [M-4] Solvers Functions to solve AX=B and to obtain A inverse

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