IsgImsolve() — Solves a general Gauss-Markov linear model problem

Description Syntax Remarks and examples Conformability Diagnostics Also see

Description

lsglmsolve (A, B, d, x, y) finds the solution to a general Gauss-Markov linear model: $\min_x ||y||_2$ subject to d = Ax + By with no return value.

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

 $_{\rm lsglm_lapacke}(A, B, d, x, y)$ 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 $_{\rm lsglm_lapacke}()$ 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

void lsglmsolve(A, B, d, x, y)real scalar $_{lsglmsolve(A, B, d, x, y)}$ real scalar $_{lsglm_{lapacke}(A, B, d, x, y)}$

where inputs are

A: $n \times m$ numeric matrix B: $n \times p$ numeric matrix

d: $n \times 1$ or $1 \times n$ numeric vector

and outputs are

x: $m \times 1$ numeric vector y: $p \times 1$ numeric vector result: real scalar

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

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

Remarks and examples

Remarks are presented under the following headings:

Introduction Examples

Introduction

The above functions solve a general Gauss–Markov linear model: $\min_{x} ||y||_2$ subject to d = Ax + By.

To obtain a unique solution, the functions require that

- 1. $m \le n \le m + p$,
- 2. the rank of matrix A is m, and
- 3. the rank of the following matrix is n:

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

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

Examples

Example 1: Least squares with equality constraints

Given A, B, and d, we can find x and y, satisfying $\min_{x} ||y||_2$ subject to Ax + By = d using

: A =
$$(3, 2 \setminus 2, 10 \setminus 1, 1.5)$$

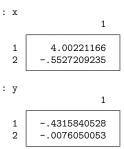
:
$$B = (2, 5 \setminus 1, 6 \setminus 5, 2)$$

$$: d = (10 \setminus 2 \setminus 1)$$

: A

$$\begin{array}{c|cccc} & & 1 & & 2 \\ & & & \\ 1 & & & 3 & & 2 \\ 2 & & 2 & & 10 \\ 3 & & & 1 & & 1.5 \end{array}$$

: lsglmsolve(A, B, d, x = ., y = .)



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

```
: A = (3, 2 \setminus 2, 10 \setminus 1, 1.5)
: B = (2, 5 \setminus 1, 6 \setminus 5, 2)
: d = (10 \setminus 2 \setminus 1)
: _{\text{lsglmsolve}}(A, B, d, x = ., y = .)
: x
                        1
  1
            4.00221166
  2
         -.5527209235
: у
                        1
  1
         -.4315840528
         -.0076050053
```

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Conformability

```
lsglmsolve(A, B, d, x, y):
      input:
                         A:
                                    n \times m
                         B:
                                    n \times p
                         d:
                                    n \times 1 or 1 \times n
      output:
                                    m \times 1
                         x:
                         \nu:
                                    p \times 1
_{\text{lsglmsolve}}(A, B, d, x, y):
      input:
                         A:
                                    n \times m
                         B:
                                    n \times p
                                    n \times 1 or 1 \times n
                         d:
      output:
                         x:
                                    m \times 1
                         v:
                                    p \times 1
                    result:
                                    1 \times 1
_{\text{lsglm\_lapacke}}(A, B, d, x, y) :
      input:
                         A:
                                    n \times m
                         B:
                                    n \times p
                         d:
                                    n \times 1 or 1 \times n
      output:
                                    m \times 1
                         x:
                                    p \times 1
                         y:
                                    1 \times 1
                    result:
```

Diagnostics

lsglmsolve(A, B, ...), _lsglmsolve(A, B, ...), and _lsglm_lapacke(A, B, ...) return a result containing missing if A, B, or d contains missing values. If the conditions in *Introduction* above are not satisfied, 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.

```
_lsglmsolve(A, B, ...) and _lsglm_lapacke(A, B, ...) abort with error if A, B, or d is a view. _lsglm_lapacke(A, B, ...) aborts with error if A, B, and d are not all real or all complex. _lsglm_lapacke(A, B, ...) should not be used directly; use _lsglmsolve().
```

Also see

- [M-5] **cholsolve()** Solve AX=B for X using Cholesky decomposition
- [M-5] **Isesolve()** Solve Ax=c for x with equality constraints using least-squares method
- [M-5] **Issolve()** Solve AX=B for X using least-squares method
- [M-5] lusolve() Solve AX=B for X using LU decomposition
- [M-5] **grsolve()** Solve AX=B for X using QR decomposition
- [M-5] _solvemat() Solve AX=B for X
- [M-5] **sysolve()** 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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