crossdev() — Deviation cross products

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Description

crossdev() makes calculations of the form

$$(X:-x)'(X:-x)$$

 $(X:-x)'(Z:-z)$
 $(X:-x)' \operatorname{diag}(w)(X:-x)$
 $(X:-x)' \operatorname{diag}(w)(Z:-z)$

crossdev() is a variation on [M-5] **cross()**. crossdev() mirrors cross() in every respect except that it has two additional arguments: x and z. x and z record the amount by which X and Z are to be deviated. x and z usually contain the (appropriately weighted) column means of X and Z.

Syntax

where

```
real matrix \operatorname{crossdev}(X, x, Z, z)
real matrix \operatorname{crossdev}(X, x, w, Z, z)
real matrix \operatorname{crossdev}(X, xc, x, Z, zc, z)
real matrix \operatorname{crossdev}(X, xc, x, w, Z, zc, z)
X: real matrix X
xc: real scalar xc
```

X: real matrix X
xc: real scalar xc
x: real rowvector x
w: real vector w
Z: real matrix Z
zc: real scalar zc
z: real rowvector z

Remarks and examples

x usually contains the same number of rows as X but, if $xc \neq 0$, x may contain an extra element on the right recording the amount from which the constant 1 should be deviated.

The same applies to z: it usually contains the same number of rows as Z but, if $zc \neq 0$, z may contain an extra element on the right.

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Example 1: Linear regression using one view

```
: M = .
: st_view(M, ., "mpg weight foreign", 0)
:
: means = mean(M, 1)
: CP = crossdev(M,means, M,means)
: XX = CP[|2,2 \ .,.|]
: Xy = CP[|2,1 \ .,1|]
: b = invsym(XX)*Xy
: b = b \ means[1] - means[|2\.|]*b
```

Compare this solution with example 3 in [M-5] cross().

Example 2: Linear regression using subviews

```
: M = X = y = .
: st_view(M, ., "mpg weight foreign", 0)
: st_subview(y, M, ., 1)
: st_subview(X, M, ., (2\.))
:
: xmean = mean(X, 1)
: ymean = mean(y, 1)
: XX = crossdev(X,xmean, X,xmean)
: Xy = crossdev(X,xmean, y,ymean)
: b = invsym(XX)*Xy
: b = b \ ymean - xmean*b
```

Compare this solution with example 4 in [M-5] cross().

Example 3: Weighted linear regression

```
: M = X = y = w = .
: st_view(M, ., "w mpg weight foreign", 0)
: st_subview(w, M, ., 1)
: st_subview(y, M, ., 2)
: st_subview(X, M, ., (3\.))
:
: xmean = mean(X, w)
: ymean = mean(y, w)
: XX = crossdev(X,xmean, w, X,xmean)
: Xy = crossdev(X,xmean, w, y,ymean)
: b = invsym(XX)*Xy
: b = b \ ymean - xmean*b
```

Compare this solution with example 6 in [M-5] cross().

Example 4: Variance matrix

```
: X = .
: st_view(X, ., "mpg weight displ", 0)
:
: n = rows(X)
: means = mean(X, 1)
: xx = crossdev(X,means, X,means)
: cov = xx:/(n-1)
```

This is exactly what variance() does; see [M-5] mean(). Compare this solution with example 12 in [M-5] cross().

Example 5: Weighted variance matrix

```
: M = w = X = .
: st_view(M, ., "w mpg weight displ", 0)
: st_subview(w, M, ., 1)
: st_subview(X, M, ., (2\.))
:
: n = colsum(w)
: means = mean(X, w)
: cov = crossdev(X,means, w, X,means) :/ (n-1)
```

This is exactly what variance() does with weighted data; see [M-5] mean(). Compare this solution with example 14 in [M-5] cross().

Conformability

```
crossdev(X, xc, x, w, Z, zc, z):
               X:
                      n \times v_1 or 1 \times 1, 1 \times 1 treated as if n \times 1
               xc:
                                                                (optional)
                        1 \times v_1 or 1 \times v_1 + (xc \neq 0)
                    n \times 1 or 1 \times n or 1 \times 1 (optional)
               w:
                Z:
                      n \times v_2
                        1 \times 1
               zc:
                                                                (optional)
                       1 \times v_2 or 1 \times v_2 + (zc \neq 0)
                z:
           result: (v_1 + (xc \neq 0)) \times (v_2 + (zc \neq 0))
```

Diagnostics

crossdev (X, xc, x, w, Z, zc, z) omits rows in X and Z that contain missing values.

Also see

```
[M-5] cross() — Cross products
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[M-5] quadcross() — Quad-precision cross products

[M-4] Utility — Matrix utility functions

[M-4] **Statistical** — Statistical functions

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