

crossdev() — Deviation cross products

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Description

`crossdev()` makes calculations of the form

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

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

$$(X: -x)' \text{diag}(w) (X: -x)$$

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

`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

real matrix `crossdev(X, x, Z, z)`

real matrix `crossdev(X, x, w, Z, z)`

real matrix `crossdev(X, xc, x, Z, zc, z)`

real matrix `crossdev(X, xc, x, w, Z, zc, z)`

where

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

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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.

▷ 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()`.

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▷ 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 × v1  or  1 × 1,  1 × 1 treated as if n × 1
  xc:   1 × 1
        (optional)
  x:    1 × v1  or  1 × v1 + (xc ≠ 0)
  w:    n × 1   or  1 × n   or  1 × 1 (optional)
  Z:    n × v2
  zc:   1 × 1
        (optional)
  z:    1 × v2  or  1 × v2 + (zc ≠ 0)
  result: (v1 + (xc ≠ 0)) × (v2 + (zc ≠ 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

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

[M-4] **Utility** — Matrix utility functions

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

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