quadcross() — Quad-precision cross products

**Description**

quadcross() makes calculations of the form

\[ X'X \]
\[ X'Z \]
\[ X'\text{diag}(w)X \]
\[ X'\text{diag}(w)Z \]

This function mirrors cross() (see [M-5] cross()), the difference being that sums are formed in quad precision rather than in double precision, so quadcross() is more accurate.

quadcrossdev() makes calculations of the form

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

This function mirrors crossdev() (see [M-5] crossdev()), the difference being that sums are formed in quad precision rather than in double precision, so quadcrossdev() is more accurate.

**Syntax**

```plaintext
real matrix quadcross(X, Z)
real matrix quadcross(X, w, Z)
real matrix quadcross(X, xc, Z, zc)
real matrix quadcross(X, xc, w, Z, zc)
real matrix quadcrossdev(X, x, Z, z)
real matrix quadcrossdev(X, x, w, Z, z)
real matrix quadcrossdev(X, xc, x, Z, zc, z)
real matrix quadcrossdev(X, xc, x, w, Z, zc, z)
```

1
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

The returned result is double precision, but the sum calculations made in creating that double-precision result were made in quad precision.

### Conformability

quadcross() has the same conformability requirements as cross(); see [M-5] cross().

quadcrossdev() has the same conformability requirements as crossdev(); see [M-5] crossdev().

### Diagnostics

See Diagnostics in [M-5] cross() and Diagnostics in [M-5] crossdev().

### Also see

- [M-5] cross() — Cross products
- [M-5] crossdev() — Deviation cross products
- [M-4] Statistical — Statistical functions
- [M-4] Utility — Matrix utility functions