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The Stata Journal

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Stata tip 37: And the last shall be first

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Mata's built-in function list contains many useful matrix operations, but I recently came upon one that was lacking: the ability to *flip* a matrix along its rows or columns. Either of those operations can readily be done as a Mata statement, but I'd rather not remember the syntax—or have to remember what it is meant to do when I reread the code. So I wrote these two simple functions:[1]

```
mata:
matrix function flipud(matrix X) {
       return(rows(X)>1 ? X[rows(X)..1,.] : X)
}


matrix function fliplr(matrix X) {
       return(cols(X)>1 ? X[.,cols(X)..1] : X)
}
end
```

These functions will flip a matrix `ud`—upside down (the first row becomes the last)—or `lr`, left to right (the first column becomes the last). Because the functions take a `matrix` argument, they may be applied to any of Mata's matrix types, including `string` matrices.

Users have asked why one would want to flip a matrix "upside down". As it happens, doing so becomes a handy tool when creating a two-sided linear filter. Say that we have defined a vector `x`, containing a declining set of weights: a one-sided linear filter. We can turn `x` into a two-sided set of weights by using `flipud()`:

```
. mata:
------------------------------------------------- mata (type end to exit) -----
: x = (1\0.5\0.25\0.125\0.0625) ; x
           1

  1 |      1
  2 |     .5
  3 |    .25
  4 |   .125
  5 |  .0625
```

1. I thank Mata's principal architect, William Gould, for improvements he suggested that make the code more general.

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```
: x = (flipud(x[2..rows(x)]) \ x); x
          1
  +-------+
1 |  .0625 |
2 |   .125 |
3 |    .25 |
4 |     .5 |
5 |       1 |
6 |     .5 |
7 |    .25 |
8 |   .125 |
9 |  .0625 |
  +-------+

: end
```

To decipher that statement, note that `2..rows(x)` refers to the second through last rows of vector `x`. The statement thus flips those rows of `x` upside down and concatenates them to the original `x` by using the *column-join* operator (see [M-2] **op_join**).

As a second example, consider applying both functions to a string matrix:

```
. mata:
                                       mata (type end to exit)
: Greek2me = ("alpha","beta","gamma"\"delta","epsilon","zeta"\"eta","theta",
> "iota"\"kappa","lambda","mu"\"nu","xi","omicron"\"pi",
> "rho","sigma"\"tau","upsilon","phi"\"chi","psi","omega")
: Greek2me
            1         2         3
  +-------------------------------+
1 |    alpha      beta     gamma  |
2 |    delta   epsilon      zeta  |
3 |      eta     theta      iota  |
4 |    kappa    lambda        mu  |
5 |       nu        xi   omicron  |
6 |       pi       rho     sigma  |
7 |      tau   upsilon       phi  |
8 |      chi       psi     omega  |
  +-------------------------------+

: lastFirst = fliplr(flipud(Greek2me)); lastFirst
            1         2         3
  +-------------------------------+
1 |    omega       psi       chi  |
2 |      phi   upsilon       tau  |
3 |    sigma       rho        pi  |
4 |  omicron        xi        nu  |
5 |       mu    lambda     kappa  |
6 |     iota     theta       eta  |
7 |     zeta   epsilon     delta  |
8 |    gamma      beta     alpha  |
  +-------------------------------+

: end
```