cvpermute()) — Obtain all	permutations
-------------	----------------	--------------

Description Syntax Remarks and examples Conformability Diagnostics Also see

Description

cvpermute() returns all permutations of the values of column vector V, one at a time. If $V = (1 \setminus 2 \setminus 3)$, there are six permutations and they are $(1 \setminus 2 \setminus 3)$, $(1 \setminus 3 \setminus 2)$, $(2 \setminus 1 \setminus 3)$, $(2 \setminus 3 \setminus 1)$, $(3 \setminus 1 \setminus 2)$, and $(3 \setminus 2 \setminus 1)$. If $V = (1 \setminus 2 \setminus 1)$, there are three permutations and they are $(1 \setminus 1 \setminus 2)$, $(1 \setminus 2 \setminus 1)$, and $(2 \setminus 1 \setminus 1)$.

Vector V is specified by calling cvpermutesetup(),

```
info = cvpermutesetup(V)
```

info holds information that is needed by cvpermute() and it is *info*, not V, that is passed to cvpermute(). To obtain the permutations, repeated calls are made to cvpermute() until it returns J(0,1,.):

```
info = cvpermutesetup(V)
while ((p=cvpermute(info)) != J(0,1,.)) {
    ... p ...
}
```

Column vector p will contain a permutation of V.

cvpermutesetup() may be specified with one or two arguments:

info = cvpermutesetup(V)
info = cvpermutesetup(V, unique)

unique is usually not specified. If *unique* is specified, it should be 0 or 1. Not specifying *unique* is equivalent to specifying *unique* = 0. Specifying *unique* = 1 states that the elements of V are unique or, at least, are to be treated that way.

When the arguments of V are unique—for instance, $V = (1 \setminus 2 \setminus 3)$ —specifying *unique* = 1 will make cvpermute() run faster. The same permutations will be returned, although usually in a different order.

When the arguments of V are not unique—for instance, $V = (1 \setminus 2 \setminus 1)$ —specifying *unique* = 1 will make cvpermute() treat them as if they were unique. With *unique* = 0, there are three permutations of $(1 \setminus 2 \setminus 1)$. With *unique* = 1, there are six permutations, just as there are with $(1 \setminus 2 \setminus 3)$.

Syntax

```
info = cvpermutesetup(real colvector V [, real scalar unique])
real colvector cvpermute(info)
```

where info should be declared transmorphic.

Remarks and examples

Example 1

You have the following data:

v1	v2
22	29
17	33
21	26
20	32
16	35

You wish to do an exact permutation test for the correlation between v1 and v2.

That is, you wish to (1) calculate the correlation between v1 and v2—call that value r—and then (2) calculate the correlation between v1 and v2 for all permutations of v1, and count how many times the result is more extreme than r.

For the first step,

: X =	= (22, 29 \	
>	17, 33 \	
>	21, 26 \	
>	20, 32 \	
>	16, 35)	
: : com [symm	rrelation(X) metricl	
_ ,	1	2
1	1	
2	8468554653	1

The correlation is -0.846855. For the second step,

```
: V1 = X[,1]
: V2 = X[,2]
: num = den = 0
: info = cvpermutesetup(V1)
: while ((V1=cvpermute(info)) != J(0,1,.)) {
>
          rho = correlation((V1,V2))[2,1]
>
          if (rho<=-.846 | rho>=.846) num++
>
          den++
> }
: (num, den, num/den)
                  1
                                2
                                               3
  1
                13
                              120
                                     .1083333333
```

Of the 120 permutations, 13 (10.8%) were outside 0.846855 or -0.846855.

Example 2

You now wish to do the same thing but using the Spearman rank-correlation coefficient. Mata has no function that will calculate that, but Stata has a command that does—see [R] **spearman**—so we will use the Stata command as our subroutine.

This time, we will assume that the data have been loaded into a Stata dataset:

	var1	var2
1.	22	29
2.	17	33
з.	21	26
4.	20	32
5.	16	35

For the first step,

. spearman var1 var2 Number of observations = 5 Spearman's rho = -0.9000 Test of H0: var1 and var2 are independent Prob = 0.0468

For the second step,

```
: V1 = st_data(., "var1")
: info = cvpermutesetup(V1)
: num = den = 0
: while ((V1=cvpermute(info)) != J(0,1,.)) {
          st store(., "var1", V1)
>
          stata("quietly spearman var1 var2")
>
>
          rho = st numscalar("r(rho)")
          if (rho<=-.9 | rho>=.9) num++
>
>
          den++
> }
: (num, den, num/den)
                  1
                                2
                                               3
  1
                 2
                              120
                                     .0166666667
```

Only two of the permutations resulted in a rank correlation of at least 0.9 in magnitude.

In the code above, we obtained the rank correlation from r(rho) which, we learned from [R] spearman, is where spearman stores it.

Also note how we replaced the contents of var1 by using st_store(). Our code leaves the dataset changed and so could be improved.

Conformability

cvpermutesetup(V, unique):

V:	$n \times 1$	
unique:	1×1	(optional)
result:	$1 \times L$	

cvpermute(info):

info: $1 \times L$ *result*: $n \times 1$ or 0×1

where

$$L = \begin{cases} 3 & \text{if } n = 0 \\ 4 & \text{if } n = 1 \\ (n+3)(n+2)/2 - 6 & \text{otherwise} \end{cases}$$

The value of L is not important except that the *info* vector returned by cvpermutesetup() and then passed to cvpermute() consumes memory. For instance,

n	L	Total memory $(8 \times L)$	
5	22	176 bytes	
10	72	576	
50	1,372	10,560	
100	5,247	41,976	
1,000	502,497	4,019,976	

Diagnostics

cvpermute() returns J(0,1,.) when there are no more permutations.

Also see

[M-4] Statistical — Statistical functions

Stata, Stata Press, and Mata are registered trademarks of StataCorp LLC. Stata and Stata Press are registered trademarks with the World Intellectual Property Organization of the United Nations. StataNow and NetCourseNow are trademarks of StataCorp LLC. Other brand and product names are registered trademarks or trademarks of their respective companies. Copyright © 1985–2025 StataCorp LLC, College Station, TX, USA. All rights reserved.



For suggested citations, see the FAQ on citing Stata documentation.