

**spmatrix summarize** — Summarize weighting matrix stored in memory

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## Description

`spmatrix summarize` reports the summary values of the elements of a weighting matrix.

## Quick start

Display summary statistics for spatial weighting matrix `Wd`

```
spmatrix summarize Wd
```

## Menu

Statistics > Spatial autoregressive models

## Syntax

```
spmatrix summarize spmatname [ , generate(newvar) ]
```

*spmatname* is the name of a weighting matrix.

`collect` is allowed; see [U] [11.1.10 Prefix commands](#).

## Option

`generate(newvar)` adds new variable *newvar* to the data. It contains the number of neighbors for each observation. `generate()` may be specified only when `spmatrix summarize` or `spmatrix dir` report that the matrix is a contiguity matrix. See [SP] [Glossary](#) for a definition of [ex post contiguity matrices](#).

## Remarks and examples

We will again use the data from [\[SP\] Intro 7](#). `spmatrix summarize` produces output such as

```
. use tl_2016_us_county
. keep if STATEFP=="48"
  (output omitted)
. spmatrix create idistance Wd
. spmatrix create contiguity Wc
. spmatrix summarize Wd
```

Weighting matrix **Wd**

|               |           |
|---------------|-----------|
| Type          | idistance |
| Normalization | spectral  |
| Dimension     | 254 x 254 |
| Elements      |           |
| minimum       | 0         |
| minimum > 0   | .0008812  |
| mean          | .0038122  |
| max           | .0512134  |

```
. spmatrix summarize Wc
```

Weighting matrix **Wc**

|               |            |
|---------------|------------|
| Type          | contiguity |
| Normalization | spectral   |
| Dimension     | 254 x 254  |
| Elements      |            |
| minimum       | 0          |
| minimum > 0   | .1522758   |
| mean          | .0034177   |
| max           | .1522758   |
| Neighbors     |            |
| minimum       | 1          |
| mean          | 5.700787   |
| maximum       | 9          |

When a matrix is a contiguity matrix, a summary of the number of neighbors is added to the output. By contiguity matrix, we mean a contiguity matrix in the sense we describe below. A matrix created by `spmatrix create contiguity` does not necessarily qualify, and matrices created by other commands sometimes do.

We call this definition *ex post* contiguity. Such matrices 1) are symmetric and 2) have all elements equal to one of two values: 0 or  $c$ . In this case,  $c$  happens to be 0.1522758, but that is not important. What is important is that there are two values, one zero and the other nonzero. Spatial weighting matrices do not have a scale. If there are only two values, the matrix can be fully described as containing values such that “there is spillover” or “there is no spillover”. Those with spillover are what we call neighbors.

Matrices created by `spmatrix create contiguity` are not necessarily *ex post* contiguity matrices. For instance, typing

```
. spmatrix create contiguity W2, first second(.5)
```

would create a matrix containing three values—0, 0.05, and 1—before normalization and different values after normalization. If we wanted to count neighbors, we would need to count first- and second-order neighbors separately. Meanwhile, typing

```
. spmatrix create contiguity W1
```

and

```
. spmatrix create contiguity W12, first second
```

would produce ex post contiguity matrices.

spmatrix dir uses the word contiguity in the same way as spmatrix summarize, namely, ex post contiguity:

```
. spmatrix dir
```

| Weighting matrix name | N x N     | Type       | Normalization |
|-----------------------|-----------|------------|---------------|
| Wc                    | 254 x 254 | contiguity | spectral      |
| Wd                    | 254 x 254 | idistance  | spectral      |

Matrix Wc is an ex post contiguity matrix regardless of how it was created.

Normalization does not interfere with ex post contiguity. Normalization is performed on a spatial weighting matrix by dividing its elements by a constant, and thus a matrix that starts out with two distinct values still has two distinct values after normalization. Row normalization—`normalize(row)`—works differently. Each row is divided by potentially a different constant and thus does not satisfy the definition of ex post contiguity.

## Stored results

spmatrix summarize stores the following in `r()`:

Scalars

```
r(n)           number of rows (columns)
r(min)         elements: minimum value
r(mean)        elements: mean value
r(min0)        elements: minimum of elements>0
r(max)         elements: maximum value
```

Macros

```
r(type)        type of matrix: contiguity, idistance, or custom
r(normalization) type of normalization
```

If `r(type) = contiguity`, also stored are

Scalars

```
r(n_min)       neighbors: minimum value
r(n_mean)      neighbors: mean value
r(n_max)       neighbors: maximum values
```

## Also see

[SP] [spmatrix](#) — Categorical guide to the spmatrix command

[SP] [Intro](#) — Introduction to spatial data and SAR models