

op_logical — Logical operators

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Description

The operators above perform logical comparisons, and operator `!` performs logical negation. All operators evaluate to 1 or 0, meaning true or false.

Syntax

<code>a == b</code>	true if <i>a</i> equals <i>b</i>
<code>a != b</code>	true if <i>a</i> not equal to <i>b</i>
<code>a > b</code>	true if <i>a</i> greater than <i>b</i>
<code>a >= b</code>	true if <i>a</i> greater than or equal to <i>b</i>
<code>a < b</code>	true if <i>a</i> less than <i>b</i>
<code>a <= b</code>	true if <i>a</i> less than or equal to <i>b</i>
<code>!a</code>	logical negation; true if $a=0$ and false otherwise
<code>a & b</code>	true if $a!=0$ and $b!=0$
<code>a b</code>	true if $a!=0$ or $b!=0$
<code>a && b</code>	synonym for <code>a & b</code>
<code>a b</code>	synonym for <code>a b</code>

Remarks and examples

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Remarks are presented under the following headings:

[Introduction](#)
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Introduction

The operators above work as you would expect when used with scalars, and the comparison operators and the not operator have been generalized for use with matrices.

$a==b$ evaluates to true if *a* and *b* are p-conformable, of the same type, and the corresponding elements are equal. Of the same type means *a* and *b* are both numeric, both strings, or both pointers. Thus it is not an error to ask if a 2×2 matrix is equal to a 4×1 vector or if a string variable is equal to a real variable; they are not. Also $a==b$ is declared to be true if *a* or *b* are p-conformable and the number of rows or columns is zero.

$a!=b$ is equivalent to $!(a==b)$. $a!=b$ evaluates to true when $a==b$ would evaluate to false and evaluates to true otherwise.

The remaining comparison operators `>`, `>=`, `<`, and `<=` work differently from `==` and `!=` in that they require a and b be p-conformable; if they are not, they abort with error. They return true if the corresponding elements have the stated relationship, and return false otherwise. If a or b is complex, the comparison is made in terms of the length of the complex vector; for instance, $a > b$ is equivalent to $\text{abs}(a) > \text{abs}(b)$, and so $-3 > 2+0i$ is true.

`!a`, when a is a scalar, evaluates to 0 if a is not equal to zero and 1 otherwise. Applied to a vector or matrix, the same operation is carried out, element by element: `!(-1,0,1,2,.)` evaluates to `(0,1,0,0,0)`.

`&` and `|` (*and* and *or*) may be used with scalars only. Because so many people are familiar with programming in the C language, Mata provides `&&` as a synonym for `&` and `||` as a synonym for `|`.

Use of logical operators with pointers

In a pointer expression, `NULL` is treated as false and all other pointer values (address values) are treated as true. Thus the following code is equivalent

<pre>pointer x ... if (x) { ... }</pre>	<pre>pointer x ... if (x!=NULL) { ... }</pre>
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The logical operators $a==b$, $a!=b$, $a\&b$, and $a|b$ may be used with pointers.

Conformability

$a==b$, $a!=b$:

a :	$r_1 \times c_1$
b :	$r_2 \times c_2$
<i>result</i> :	1×1

$a > b$, $a \geq b$, $a < b$, $a \leq b$:

a :	$r \times c$
b :	$r \times c$
<i>result</i> :	1×1

`!a`:

a :	$r \times c$
<i>result</i> :	$r \times c$

$a\&b$, $a|b$:

a :	1×1
b :	1×1
<i>result</i> :	1×1

Diagnostics

$a==b$ and $a!=b$ cannot fail.

$a > b$, $a \geq b$, $a < b$, $a \leq b$ abort with error if a and b are not p-conformable, if a and b are not of the same general type (numeric and numeric or string and string), or if a or b are pointers.

$!a$ aborts with error if a is not real.

$a\&b$ and $a|b$ abort with error if a and b are not both real or not both pointers. If a and b are pointers, pointer value NULL is treated as false and all other pointer values are treated as true. In all cases, a real equal to 0 or 1 is returned.

Also see

[M-2] [exp](#) — Expressions

[M-2] [Intro](#) — Language definition