

Laconic Operation Documentation

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This document enumerates all the primitive operations in Laconic. It is recommended that users start by reading `laconic_quick_start.pdf` to get a sense for how Laconic works.

Remember that operations can be combined into complex expressions (i.e. $(a+b)*c$) but that full parenthesization is required! Also, recall that `ints` are signed integers with no maximum or minimum value, `lists` are Python-style lists of `ints`, and `list2s` are Python-style lists of `lists`.

1 Integer Operations

Assume in the operations below that `x` and `y` are variables of type `int` with values x and y , respectively.

All the operations below yield values of type `int`.

1.1 Addition

The expression `x+y` yields the value $x + y$.

1.2 Subtraction

The expression `x-y` yields the value $x - y$.

1.3 Multiplication

The expression `x*y` yields the value xy .

1.4 Integer Division

The expression x/y yields the value $s(xy) \left\lfloor \left| \frac{x}{y} \right| \right\rfloor$, where $s()$ is the sign function. In plain English, integer division in Laconic rounds numbers to the lowest-magnitude adjacent number. This means that $3/2$ would yield the value 1, and $(0-3)/2$ would yield the value -1 .

If y is 0, Laconic will throw a runtime error if interpreted, and the compiled TMD or Turing machine will enter an infinite loop.

1.5 Negation

The expression $\sim x$ yields the value $-x$. Note the strange negation operator.

1.6 Equality

The expression $x==y$ yields the value 1 if $x = y$, and the value 0 otherwise.

1.7 Inequality

The expression $x!=y$ yields the value 1 if $x \neq y$, and the value 0 otherwise.

1.8 Greater Than

The expression $x>y$ yields the value 1 if $x > y$, and the value 0 otherwise.

1.9 Less Than

The expression $x<y$ yields the value 1 if $x < y$, and the value 0 otherwise.

1.10 Greater or Equal

The expression $x>=y$ yields the value 1 if $x \geq y$, and the value 0 otherwise.

1.11 Less Than or Equal

The expression $x<=y$ yields the value 1 if $x \leq y$, and the value 0 otherwise.

1.12 And

The expression $x\&y$ yields the value 1 if $x > 0$ and $y > 0$, and the value 0 otherwise. Note that negative values of x and y are interpreted as “false” values for the purposes of “boolean” operations.

1.13 Or

The expression `x|y` yields the value 1 if $x > 0$ or $y > 0$, and the value 0 otherwise.

1.14 Not

The expression `!x` yields the value 1 if $x \leq 0$, and the value 0 otherwise.

2 List and List2 Operations

Assume in the operations below that `x` is a variable of type `int`, `l` is a variable of type `list`, and that `L` is a variable of type `list2`. Assume that these variables have values of x , l , and L , respectively.

2.1 Indexing

The expression `l@x` yields the `int` value of the x^{th} element of l , assuming 0-indexing. If $x \leq |l|$, a runtime error is thrown in both the interpreted and compiled versions of the code.

The expression `L@*x` yields the `list` value of the x^{th} element of L , assuming 0-indexing. If $x \leq |L|$, a runtime error is thrown in both the interpreted and compiled versions of the code.

In general, `list2` operations use the same symbol as the corresponding `list` operations, but with a `*` at the end.

2.2 Appending

The expression `l^x` yields the `list` value of $l||[x]$, where `||` denotes the concatenation operation.

The expression `L^*l` yields the `list2` value of $L||[l]$, where `||` denotes the concatenation operation.

2.3 Length

The expression `#l` yields the `int` value of $|l|$.

The expression `#*L` yields the `int` value of $|L|$.

2.4 Concatenation

In the expressions below, the variables `l1`, `l2`, `L1`, and `L2` have types `list`, `list`, `list2`, and `list2`, with values of l_1 , l_2 , L_1 , and L_2 , respectively.

The expression `l1 || l2` yields the `list` value of $l_1 || l_2$, where `||` denotes the concatenation operation.

The expression `L1 || *L2` yields the `list2` value of $L_1 || L_2$, where `||` denotes the concatenation operation.

2.5 Explicit Description

To explicitly enumerate a `list`, put the elements of the `list` between brackets and separated by commas. For example, `[x, 1, y]` would yield the `list` value $[x, 1, y]$.

To explicitly enumerate a `list2`, put the elements of the `list2` between colons and separated by commas. For example, `:[x, 1, y], l1, []:` would yield the `list2` value $[[x, 1, y], l_1, []]$.