

# Unstable-Languages-beta: SIMPLE-THR-2-Expressions \*

The PPlanCompS Project

SIMPLE-THR-2-Expressions.cbs | PLAIN | PRETTY

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*Language* "SIMPLE-THR"

## 2 Expressions

*Syntax*  $Exp : exp ::=$

- | `'(' exp ')'`
- | `value`
- | `lexp`
- | `lexp '=' exp`
- | `'++' lexp`
- | `'-' exp`
- | `exp '(' exps? ')'`
- | `'sizeof' '(' exp ')'`
- | `'read' '(' ')'`
- | `exp '+' exp`
- | `exp '-' exp`
- | `exp '*' exp`
- | `exp '/' exp`
- | `exp '%' exp`
- | `exp '<' exp`
- | `exp '<=' exp`
- | `exp '>' exp`
- | `exp '>=' exp`
- | `exp '==' exp`
- | `exp '!=' exp`
- | `'!' exp`
- | `exp '&&' exp`
- | `exp '||' exp`
- | `'spawn' block`

*Rule*  $\llbracket '(' Exp ')' \rrbracket : exp = \llbracket Exp \rrbracket$

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\*Suggestions for improvement: [plancomps@gmail.com](mailto:plancomps@gmail.com).  
Reports of issues: <https://github.com/plancomps/CBS-beta/issues>.

```

Semantics
Rule  rval[ _ : exp ] : => values
Rule  rval[ V ] = val[ V ]
Rule  rval[ LExp ] = assigned(lval[ LExp ])
Rule  rval[ LExp '=' Exp ] =
    give(
        rval[ Exp ],
        sequential(
            assign(lval[ LExp ], given),
            given))
Rule  rval[ '++' LExp ] =
    give(
        lval[ LExp ],
        sequential(
            assign(given, integer-add(assigned(given), 1)),
            assigned(given)))
Rule  rval[ '-' Exp ] = integer-negate(rval[ Exp ])
Rule  rval[ Exp '(' Exprs? ')' ] = apply(rval[ Exp ], tuple(rvals[ Exprs? ]))
Rule  rval[ 'sizeof' '(' Expr ')' ] = length(vector-elements(rval[ Expr ]))
Rule  rval[ 'read' '(' ')' ] = read
Rule  rval[ Exp1 '+' Exp2 ] = integer-add(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '-' Exp2 ] = integer-subtract(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '*' Exp2 ] = integer-multiply(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '/' Exp2 ] = checked integer-divide(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '%' Exp2 ] = checked integer-modulo(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '<' Exp2 ] = is-less(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '<=' Exp2 ] = is-less-or-equal(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '>' Exp2 ] = is-greater(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '>=' Exp2 ] = is-greater-or-equal(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '==' Exp2 ] = is-equal(rval[ Exp1 ], rval[ Exp2 ])
Rule  rval[ Exp1 '!=' Exp2 ] = not(is-equal(rval[ Exp1 ], rval[ Exp2 ]))
Rule  rval[ '!' Exp ] = not(rval[ Exp ])
Rule  rval[ Exp1 '&&' Exp2 ] = if-else(rval[ Exp1 ], rval[ Exp2 ], false)
Rule  rval[ Exp1 '||' Exp2 ] = if-else(rval[ Exp1 ], true, rval[ Exp2 ])

```

SIMPLE uses natural numbers to identify threads; the use of `allocate-index(.)` below associates a natural number with the thread-id given by `thread-activate`. The use of `postpone-after-effect(.)` supports automatic release of locks when threads terminate.

```

Rule   $\text{rval} \llbracket \text{'spawn' } Block \rrbracket =$ 
    allocate-index
    thread-activate thread-joinable
    thunk closure
    postpone-after-effect
     $\text{exec} \llbracket Block \rrbracket$ 

```

*Syntax*  $Exps : \text{exps} ::= \text{exp } (', ' \text{exps})?$

*Semantics*  $\text{rvals}[\_ : \text{expr}^?] : (\Rightarrow \text{values})^*$

*Rule*  $\text{rvals}[\ ] = ( )$

*Rule*  $\text{rvals}[\text{Exp}] = \text{rval}[\text{Exp}]$

*Rule*  $\text{rvals}[\text{Exp } ', ' \text{Exps}] = \text{rval}[\text{Exp}], \text{rvals}[\text{Exps}]$

*Syntax*  $L\text{Exp} : \text{lexp} ::= \text{id} \mid \text{lexp } '[ \text{exprs } ']'$

*Rule*  $\llbracket L\text{Exp } '[ \text{Exp } ', ' \text{Exps } ']' \rrbracket : \text{lexp} =$

$\llbracket L\text{Exp } '[ \text{Exp } ']' '[ \text{Exps } ']' \rrbracket$

*Semantics*  $\text{lval}[\_ : \text{lexp}] : \Rightarrow \text{variables}$

*Rule*  $\text{lval}[\text{Id}] = \text{bound}(\text{id}[\text{Id}])$

*Rule*  $\text{lval}[\llbracket L\text{Exp } '[ \text{Exp } ']' \rrbracket] =$

$\text{checked\_index}(\text{integer-add}(1, \text{rval}[\text{Exp}]), \text{vector-elements}(\text{rval}[\llbracket L\text{Exp } \rrbracket]))$