

LCL: Liga Control Language

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1 Introduction

The analysis and translation of an attribute grammar by the LIGA system may be influenced in various ways. For that purpose the user specifies certain options in the LIGA Control Language LCL. You can introduce options to the ELI system in a file ending in `.ctl`. A default is assumed for each option if it is not set or if no LCL specification is given. The denotations of the options are headed by a prefix indicating one of the liga phases the option mainly refers to.

LCL has a simple, keyword-oriented syntax. Each keyword consists solely of upper-case letters and underscores. Comments are enclosed in `'/*'` and `'*/'`, and must not be nested.

```

Options ::= ( Option ';' )*
Option  ::= 'EXPAND' ':' ExpandOpts /
           'ORDER'  ':' OrderOpts /
           'OPTIM'  ':' OptimOpts

ExpandOpts ::= ExpandOpt ',' ExpandOpts / ExpandOpt
OrderOpts  ::= OrderOpt  ',' OrderOpts / OrderOpt
OptimOpts  ::= OptimOpt  ',' OptimOpts / OptimOpt

Expandopt  ::= 'INFO' / 'INCLUDING_SEPARATE' /
              'INCLUDING' 'ON' / 'INCLUDING' 'OFF'

OrderOpt   ::= 'PARTITION' Strategy / 'TOPOLOGICAL' Strategy /
              'GRAPH' Type ( ident ) * /
              'ARRANGE' arrangePart

Strategy   ::= 'EARLY' / 'LATE'
Type       ::= 'DIRECT_SYMBOL' / 'TRANSITIVE_SYMBOL' / 'INDUCED_SYMBOL' /
              'DIRECT_RULE' / 'TRANSITIVE_RULE' / 'INDUCED_RULE' /
              'PARTITIONED_RULE' / 'PARTITION' / 'VISIT_SEQUENCE'

arrangePart ::= 'AUTOMATICALLY' / 'FAST' /
               'FOR' 'SYMB' ident 'EVAL' ident 'BEFORE' ident /
               'IN' 'RULE' ident 'EVAL' ident '[' intval ']' '.' ident
               'BEFORE' ident '[' intval ']' '.' ident

OptimOpt   ::= 'OFF' / 'INFO' / 'MORE_GLOBALS' /
              'NO_VARIABLES' / 'NO_STACKS' / 'GROUPING' 'VARIABLE' /
              'ATTRSPEZ' Type ( symbname '[' ( ident ) + ']' ) *

symbname   ::= ident / 'ANYSYMBOL'
Type       ::= 'GLOBAL VAR' / 'GLOBAL STACK' / 'TREE_NODE' /
              'GROUP VAR' / 'GROUP STACK'

```

Figure 1: Context-free grammar for LCL

The next four sections of this manual describe the detailed syntax and effects of the options.

2 Expand Options

Options introduced by "Expandopt" influence the expansion of used shorthands.

```
Expandopt ::= 'INFO' / 'INCLUDINGS_SEPARATE' /
            'INCLUDING' 'ON' / 'INCLUDING' 'OFF'
```

'INFO'

If this option is set, additional information on the expansion results is included in the listing. The default is not to produce the additional information. This option affects REPLINCL and EXPAND. This option can be included automatically in Eli by using the derivation `:ExpInfo`.

'INCLUDINGS_SEPARATE'

In the default case, identical `INCLUDING` constructs are expanded by one single set of generated attributes. The number of new attributes is thereby reduced, and in some situations OAG-conflicts are avoided. This option is recommended for debugging purposes. If it is set, each `INCLUDING`-construct is expanded separately.

'INCLUDING' 'OFF'

In the default case values are propagated by global variables from the `INCLUDING` sources to their destinations.

'INCLUDING' 'ON'

With this option you can specify that attributes are generated for propagating `INCLUDING` values through the tree.

3 Order Options

Options introduced by "Orderopt" control the general strategies applied by Order.

```

OrderOpt      ::= 'PARTITION' Strategy /
                'GRAPH' Type ( ident ) * / 'ARRANGE' arrangePart
Strategy      ::= 'EARLY' / 'LATE'
Type          ::= 'DIRECT_SYMBOL' / 'TRANSITIVE_SYMBOL' / 'INDUCED_SYMBOL' /
                'DIRECT_RULE' / 'TRANSITIVE_RULE' / 'INDUCED_RULE' /
                'PARTITIONED_RULE' / 'PARTITION' / 'VISIT_SEQUENCE'
arrangePart  ::= 'AUTOMATICALLY' / 'FAST' /
                'FOR' 'SYMB' ident 'EVAL' ident 'BEFORE' ident /
                'IN' 'RULE' ident 'EVAL' ident '[' intval ']' '.' ident
                'BEFORE' ident '[' intval ']' '.' ident

```

'PARTITION' Strategy

This option is used to specify the strategy for computation of attribute partitions.

'GRAPH' Type (ident) *

This option is used to obtain additional information about specific attribute dependencies. It is most useful for tracking down dependency cycles. The dependency graphs for the given symbols and rules are listed. If the `Identlist` is empty, then the graphs for all symbols or rules are listed. The default for this option is to provide no listings of any dependency graphs.

'TREE' 'COMPLETE' and 'TREE' 'BOTTOM_UP'

These options are outdated. They are still accepted, but do not have any effect. If some computations are to be executed while the tree is being built, they are specified `BOTTOMUP` in the LIDO text. See also [Section "Computations" in *LIDO - Reference Manual*](#).

'ARRANGE' arrangePart

This option is used to fix the evaluation order of attributes of a single symbol or of a single rule. If an attribute grammar is not ordered, but may be well-defined –i.e. cycles do not occur before computation of the partitioned rule graphs – these specifications may be used to constrain the admissible partitions.

`AUTOMATICALLY` invokes an additional algorithm that tries to avoid cycles while computing the visit-sequences. `FAST` avoids to invoke that algorithm, speeding up the analysis and increasing the risk not to find suitable visit-sequences in certain cases. The default is `AUTOMATICALLY`. By specifying another arrange option a certain evaluation sequence is explicitly requested.

4 Optim Options

Options introduced by "Optimopt" control the strategy for attribute optimization applied by Optim.

```

OptimOpt      ::= 'OFF' / 'INFO' / 'MORE_GLOBALS' /
                  'NO_VARIABLES' / 'NO_STACKS' / /
                  'NO_GROUPING' / 'GROUPING VARIABLE'
                  'ATTRSPEZ' Type ( symbname '[' ( ident ) + ']' ) *
symbname      ::= ident / 'ANYSYMBOL'
Type          ::= 'GLOBAL VAR' / 'GLOBAL STACK' / 'TREE_NODE' /
                  'GROUP VAR' / 'GROUP STACK'

```

'OFF'

This option suppresses the optimization entirely.

'INFO'

This option produces a listing of the results of the optimization that gives all attribute storage decisions and the visit-sequences as modified by stack operations. Attribute evaluations that are omitted due to optimization are marked by the string **IS DELETED**.

This option can be included automatically in Eli by using the derivation `:OptimInfo`.

'MORE_GLOBALS'

If this option is set, a second optimization algorithm is started. This algorithm takes the attributes which are classified as tree nodes by the first optimization algorithm and tries to globalize them too.

'NO_VARIABLES'

No attributes are implemented as global variable. Instead all attributes which can be globalized are implemented as global stack.

'NO_STACKS'

No attributes are implemented as global stack. Instead all attributes which could be implemented by global stack are allocated in the tree.

'NO_GROUPING'

If this option is set, all grouping of variables is suppressed, including the grouping requested by system internal grouping directives for CHAIN attributes. This option usually leads to increased memory and time requirements of the generated processor. It is only recommended during the development of language processors for large specifications, since it may decrease the time required for processor generation.

'GROUPING VARIABLE'

If this option is set, different attributes which can be implemented by a global variable each are possibly grouped to one global variable.

'ATTRSPEZ' Type (symbname '[' (ident) + ']') *

This option requires a particular storage decision for the specified attributes.

Type 'GLOBAL VAR' requires global variables.

Type 'GLOBAL STACK' requires global stacks.

Type 'TREE_NODE' requires allocation in the tree.

Type 'GROUP VAR' requires allocation to a single global variable.

Type 'GROUP STACK' requires allocation to a single global stack.

symbname specifies a symbolname and *ident* an attributname. If 'ANY_SYMBOL' is used instead, all attributes with corresponding attribute name are taken.

Optim will try to fulfill the above given specifications. It will ignore those that would result in incorrect computation. A specified group will not be enlarged by an attribute not belonging to this specification; an attribute specified but not in a group will not be put in any group; and a group specification consisting of n attributes will result in a set of groups within these n attributes, which is the best found by the algorithm.

Any attributes which are not appearing in any ATTRSPEZ specification will be optimized as usual.

To specify the ATTRSPEZ-specifications, the tool Gorto can be used, see *Graphical Dependency Analyzer*.