CS 220: Survey of Programming Languages

Lecture Slides

Declarative Programming Languages

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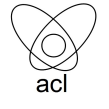
Session 7



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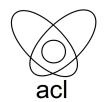

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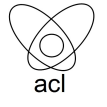

Procedural vs. declarative programming

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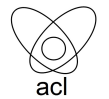

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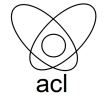

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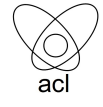

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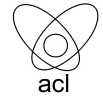

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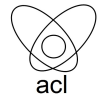

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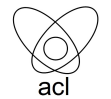
  - PLs that do this are called declarative languages
  - Though rules were formulated by the programmer, the language's system "do[es] not explicitly invoke those rules in order to achieve the goals"



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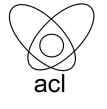

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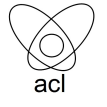

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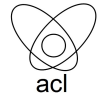

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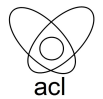

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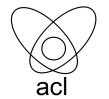

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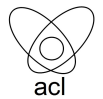
  - Detecting inconsistencies in any propositions (refutation complete) is an important property of resolution



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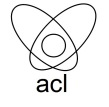
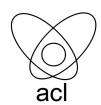


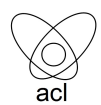
Background



RW Sebesta, Chapters 2.13 and 16.5

Background

- Stands for Programming Logic



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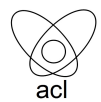

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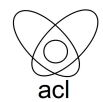

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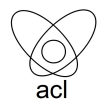

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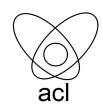

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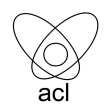

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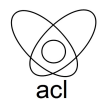
Evaluation

- Data types[2,3]



[2] http://www.cs.bham.ac.uk/~pjh/prolog_module/md1/md1_data_types.html

[3] http://pages.cpsc.ucalgary.ca/~denzinge/courses/449-winter2004/slides/17-TypesControl-handout.pdf

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- Data types[2,3]
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  - Lists, and in some variants bags and lists, as derived types

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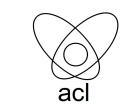

[4] https://github.com/simonkrenger/ch.bfh.bti7064.w2013.PrologParser/blob/master/doc/bnf-grammar.txt

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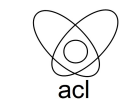

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  - Since the underlying mechanics of achieving the goals are not explicitly controlled by the programmer, several overlaps in functionalities are expected

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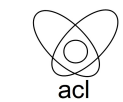

[7] http://faculty.simpson.edu/lydia.sinapova/www/cmsc310/Prolog/PrologLessons/LS01Rules.htm

[8] http://www.learnprolognow.org/lpnpage.php?pagetype=html&pageid=lpn-htmlse52

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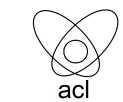

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    - The `use_module` predicate allows for importing modules
- Expressivity: Little to no add-on functionalities, but then again not really an issue in declarative programming

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[8] http://www.learnprolognow.org/lpnpage.php?pagetype=html&pageid=lpn-htmlse52

Evaluation

- Exception handling: SWI-Prolog has `try` and `catch` predicates to perform exception handling[9]

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[11] https://www.info.ucl.ac.be/~pvr/Peter.thesis/Peter.thesis.html
[12] https://www.info.ucl.ac.be/~pvr/Taylor.thesis.pdf

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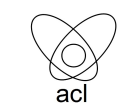

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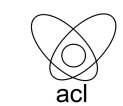
  - Can be compiled or interpreted (some variants at least)[10]

[9] http://www.swi-prolog.org/pldoc/man?section=exception
[10] http://www.cse.unsw.edu.au/~billw/cs9414/notes/prolog/ext-prolog.html
[11] https://www.info.ucl.ac.be/~pvr/Peter.thesis/Peter.thesis.html
[12] https://www.info.ucl.ac.be/~pvr/Taylor.thesis.pdf





Evaluation

- Exception handling: SWI-Prolog has `try` and `catch` predicates to perform exception handling[9]
- Restricted aliasing: No (explicit) aliasing being done
- Efficiency
  - Original Prolog had no (need for) type checking
  - Can be compiled or interpreted (some variants at least)[10]
  - Formal proofs exist proving that Prolog can be as fast as C[11,12]

[9] http://www.swi-prolog.org/pldoc/man?section=exception
[10] http://www.cse.unsw.edu.au/~billw/cs9414/notes/prolog/ext-prolog.html
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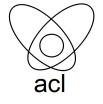
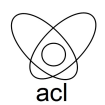
Declarative Programming Languages



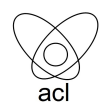
Background



http://self.gutenberg.org/articles/G%C3%B6del_(programming_language)

Background

- Gödel was developed by Patricia Hill and John Lloyd in 1992



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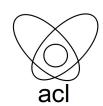
Background

- Gödel was developed by Patricia Hill and John Lloyd in 1992
- Named after Kurt Gödel, but also is an acronym which stands for "God's Own Declarative Language"



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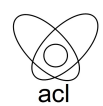

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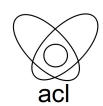
- "The control component of the program is concerned with the construction and pruning of search trees. Typically, the computation rule (which selects a subformula in a goal for an extension step) is partially specified by control declarations and the pruning of a search tree is specified by pruning operator."



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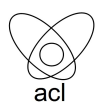
Evaluation

- Data types[14]



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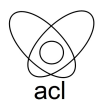
- Data types[14]
  - Integer, rational numbers, character and string as supported primitive data types



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Evaluation

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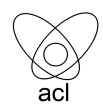
  - Lists, sets, and some other (unspecified) abstract data types bags and lists, as derived types



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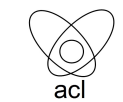
- Syntax design:



[15] http://www.comp.leeds.ac.uk/hill/GOEDEL/examples.html
[16] http://self.gutenberg.org/articles/G%C3%B6del_%28programming_language
[17] http://web.cecs.pdx.edu/~antoy/homepage/theses/D_Shapiro_thesis.pdf

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- Syntax design:
  - No grammar found, but looking at sample programs[15] and the basic features available[16], Prolog is relatively simpler than Gödel

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  - "Modularized" syntax (compared with Prolog) in that certain code sections must be declared to create the components (e.g.imported modules, predicates) needed for a program

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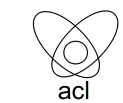
- Abstraction:[18]



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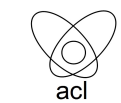
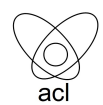


[20] http://self.gutenberg.org/articles/G%C3%B6del_%28programming_language

[21] http://www.scs.leeds.ac.uk/hill/GOEDEL/expgoedel.html

Evaluation

- Exception handling: No (explicit) exception handling mechanisms



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- Efficiency[20,21]
  - Employs both static and dynamic type-checking
  - Built on top of Prolog
  - Pruning mechanism employed is based on the commit operation of concurrent programming language

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END OF SESSION 7