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The Lonnrot Language

SIGNATURE

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A report written for the course of Compiler Design at ITESM

Contents

	About the Lonnrot Language	5
1	Tetragrammaton, or The Form	7
1.1	Basic Elements	7
1.2	Syntax	7
1.3	Syntax Diagrams	7
2	Red Scharlach, or The Meaning	9
2.1	Types	9
2.2	Unification	9
3	Rue de Toulon, or The Intermediate Code	11
4	Triste-le-Van-Roy, or The Target Language	13
	Conclusion	15
	Appendix	17
	Bibliography	18

About the Lonnrot Language

THE LONNROT LANGUAGE is an implementation of a compiler for a subset of Scheme extended with the core of miniKanren. As such, it belongs to the functional and relational paradigms of programming. This project is intended to be, above all things, *exploratory*. That implies several things, chief amongst which are that it is not the be-all end-all of implementations, nor is it a breakthrough or anything like that. It is quite simply a first approximation to compiler building (for me) and in that sense it synthesizes my learning from resources I've found and have yet to find along the way.

That being said, there *is* some sort of value proposition to this project. Mainly, most if not all implementations of miniKanren to date are interpreters or are DSL's for their respective host languages. This is understandable, especially when it comes to Lisps: extending the Lisp language via macros is a well documented tradition, and the resulting product is undeniably beautiful. However, there are things to be gained and interesting insights to be had: is it worth compiling miniKanren? Can we transfer our knowledge of methods used for other languages to this project? Can this shed light on how to optimize some of the workings that deal with the relational semantics?

I do not claim to have answers to these questions, and frankly I know better than to expect to have them four months from now. What I do know is that it is an interesting premise for a first incursion in this domain (again, for me): **if not know, when would I start?** In the same vein, I hope that this report embodies the philosophy of growing a body of knowledge, of allowing oneself to err and to be playful. Speaking of which ...

THIS REPORT IS DIVIDED into four chapters which cover the steps involved in writing the compiler. This organization is merely for editing purposes: the construction of Lonnrot is done following the ideas presented by Abdulaziz Ghuloum in *An Incremental Approach to Compiler Construction*. The main idea is to write multiple compilers, with each one covering a progressively larger language. This is opposed

For example, Will Byrd has talked about thread safety and the potential of parallelization in miniKanren [Byr15]

Lindsey Kuper [Kup19] talks about this approach and Kent Dybvig's "cousin" approach of writing the compiler back-to-front, making a language progressively more high-level, for those interested.

to the idea of writing one compiler, front to back, for the originally intended language. The details and implications of this approach are very interesting and I would do them a disservice by trying to explain them in a paragraph; I would encourage anyone to read up on them. For now it's enough to say that this project is a sort of mish-mash of ideas on compiler construction: from Ghuloum's approach, to what makes the WAM be the WAM, passing through what makes miniKanren different from Prolog.

In any case, that means that each chapter covers the progression of each part of the compiler. For example, Chapter 1 explores the lexicon and the grammar of the language, which at first will be restrained to numbers, maybe then symbols, and so on. Chapter 2 talks about the semantics of the language, so the first implementations will omit the relational aspect, eventually including it. The same idea applies for Chapters 3 and 4, which talk about intermediate representations and the target languages respectively.

LASTLY, THE LAST PART OF THIS REPORT comprises conclusions and some interesting miscellanea. The conclusion will naturally discuss the state of affairs by the time the course is over. The Appendix will have tidbits of information that might not fit the natural flow of the report. As of the time of this writing I'm not entirely sure what I want to include there, but stuff like the language's namesake will be explained there, for those who may be curious.

1

Tetragrammaton, or The Form

1.1 Basic Elements

1.2 Syntax

1.3 Syntax Diagrams

2

Red Scharlach, or The Meaning

2.1 Types

2.2 Unification

3

Rue de Toulon, or The Intermediate Code

4

Triste-le-Van-Roy, or The Target Language

Conclusion

Appendix

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