

The Welkin Standard

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Conventions

- Artifacts must be copied **identically**. They are listed below.
 - `bootstrap.welkin` is located in Appendix A.
 - `derivation.welkin` is located in Appendix B.
- We write (n) for the n -th line in the bootstrap file.
- Every definition is explicitly written. **Every definition MUST exclude Peano Arithmetic.**

Syntax

Terminals

- Logic
- Symbols (1): $0, 1$
- Concatenation \cdot
- Implication \Rightarrow
- Table of US-ASCII:

Symbol	Encoding
{	173
}	175

- A **word** is recursively defined.
 - Base case (5):
 - 0 is a word.
 - 1 is a word.
 - Recursion (6): let w be a word.
 - $w \cdot 0$ is a word.
 - $w \cdot 1$ is a word.

Atoms

- Strings are words with delimiters: $d_1.w.d_2$, where $d_1 \not\in w$ and $d_2 \not\in w$.
- Identifiers are strings without white space.
- Numbers are a subset of strings with an injective function $q : \text{NUMBER} \rightarrow Q$.
 - Q is set of strings formed by scientific notation.

Grammar

- LALR
 - Not ambiguous
- Welkin Grammar:

Semantics

Equality on Terms

- Two strings are equal if they contain the same strings, in order.
- Two numbers are equal if $q(a) = q(b)$.

Valid Strings

- No relative members at toplevel (with length 2).
- No duplicate members, graphs, or connections.

Welkin Information Graphs

A **Welkin Information Graph (WIG)** is a structure $G = (T, H, L)$ with:

- A tree T ,
- A hypergraph H ,
- A tree L isomorphic to T called the **label tree**.

AST ()

- Units:
- Members are words of units
- Connections are WIGs with
- Graphs are WIGs with
 - Derived terms as children
 - Ordered triples are arcs.

Encoding

The **encoding** $E(G)$ of the WIG G is the unique string where

- All nodes are listed in breadth-first order
- Leaves are terms ending with “#”
- Edges are enumerated, starting from 0. They are included in nodes:
 - s means source,
 - c means connector,
 - t means target.

Bootstrap

Theorem. The Bootstrap File (Appendix A) has the encoding

.

We prove this in the following calculations:

$$(1) 0, 1 \Rightarrow \{0, 1\}$$

$$(3) \text{ start} - \{0, 1\} \rightarrow \text{word} \Rightarrow (\text{start}, \{0, 1\}, \text{word})$$

Appendix A: Bootstrap File