The Welkin Standard

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Conventions

- Each topic uses content from `bootstrap.welkin`. This text is available Appendix A.
- We write (n) for the n-th line in the bootstrap file.
- Every definition is explicitly written.

Syntax

Terminals

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

Symbol	Encoding
{	173
}	175

- A **word** is recursively defined (1).
  - Base case:
    - 0 is a word.
    - 1 is a word.
  - Recursion: let w be a word.
    - $w.0$ is a word.
    - $w.1$ is a word.
- Concatenation
  - Base case: $w.\varepsilon = w$.
  - Recursion:
    - $w.(u.0) = (w.u).0$
    - $w.(u.1) = (w.u).1$

Atoms

- Strings are words with delimiters: $d_1.\text{w}.d_2$, where $d_1 \not\subset w$ and $d_2 \not\subset w$.
- Identifiers are strings without white space.
- Numbers are a subset of strings with an injective function $q : \text{NUMBER} \to Q$.
  - 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.

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: Boostrap File