Alg User Manual

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Chapter 1

Introduction

Alg is a program for enumeration of finite models of algebraic theories. An algebraic theory is given by a signature (a list of constants and operations) and axioms expressed in first-order logic.[1] Examples of algebraic theories include groups, lattices, rings, fields, and many others. Alg can do the following:

- list or count all non-isomorphic models of a given theory,
- list or count all non-isomorphic indecomposable[2] models of a given theory.

Currently alg has the following limitations:

- only unary and binary operations are accepted,
- it is assumed that constants denote pairwise distinct elements.

This manual describes how to install and use alg. For a quick start you need Ocaml 3.12 or higher. Compile alg with

```
make
```

and run

```
./alg.native --size 8 theories/unital_commutative_ring.th
```

For usage information type `./alg.native -help` and for examples of theories see the `theories` subdirectory.

Alg is released under the open source simplified BSD License, as detailed in the next section.

[1] Strictly speaking, the axioms of an algebraic theory must be equations, but alg can handle all of first-order logic.

[2] A model is indecomposable if it cannot be written as a non-trivial product of two smaller models.

Chapter 2

Copyright and License

Chapter 3

Installation

3.1 Downloading alg

Alg is available at `http://hg.andrej.com/alg/`. You have three options:

1. download the ZIP file with source code from

   `http://hg.andrej.com/alg/archive/tip.zip`

2. clone the repository with the Mercurial revision control system:

   ```
   hg clone http://hg.andrej.com/alg/
   ```

3. download a precompiled executable for your architecture from

   `http://hg.andrej.com/alg/file/tip/precompiled`

   if one is available. If you choose this option, make sure that you still obtain the ZIP file because the `theories` subdirectory contains a number of useful examples.

3.2 Installation for Linux and MacOS

To compile alg you need the Make utility and Ocaml 3.12 or higher.[1] Just type `make` at the command line. If all goes well Ocamlbuild will generate a subdirectory `_build` and in it the `alg.native` executable. It will also create a link to `_build/alg.native` from the top directory. To test alg type

```
./alg.native --count --size 8 theories/group.th
```

It should tell you within seconds that there are 5 groups of size 8.

We provided only a very rudimentary installation procedure for alg. First edit the `INSTALL_DIR` setting in `Makefile` to set the directory in which alg should be installed, then run

[1] Ocaml is available from `http://www.ocaml.org/`.

```
sudo make install
```

This will simply copy `_build/alg.native` to `$(INSTALL_DIR)/alg`. You may also wish to stash the `theories` subdirectory somewhere for future reference.

3.3 Installation for Microsoft Windows

Sorry, this has not been written yet. But if you have Make and Ocaml 3.12 or alter, you should be able to just follow the instructions for Linux.

Chapter 4

The Format of Input Files

Chapter 5

Command-line Options

Chapter 6

Optimization