C99 Parser User Guide Matt Wette June 2019 With NYACC Version 1.04.1

### Introduction

This is a manual for the C99 parser provided with NYACC. It is a LALR(1) based parser written in Scheme as implemented in Guile. The grammar can be examined by looking at the source code in the file nyacc/lang/c99/mach.scm. The parser has been used to generate object code (see https://www.gnu.org/software/mes/) but it has options to make it useful for processing C code in other ways. For example, the FFI Helper included with NYACC uses the parser to generate FFI (foreign function interface) code for many C libraries. It does this by parsing the associated C header files.

```
parse-c99 [options] where options are
```

[Procedure]

#:cpp-defs defs-list

defs-list is a list of strings where each string is of the form NAME or NAME=VALUE.

#:inc-dirs dir-list

dir-list is a list of strings of paths to look for directories.

#:inc-help helpers

helpers is an a-list where keys are include files (e.g., "stdint.h") and the value is a list of type aliases or CPP define (e.g., "foo\_t" "FOO\_MAX=3"). The default helper is c99-def-help (see below).

#:mode mode

mode is one literal 'code, 'file, or 'decl. The default mode is 'code.

#:debug bool

If bool evaluates to true, print productions as they are reduced.

This will parse the content taken from the current input port until end if input is reached. A parse tree in the form of an SXML expression is returned. See below for the syntax. This needs to be explained in some detail. tdd = typedef dict: (("<time>" time\_t) ... ("<unistd.h>" ...)) Default mode is 'code.

```
(with-input-from-file "abc.c"
  (parse-c #:cpp-defs '("ABC=123"))
        #:inc-dirs '(("." "./incs" "/usr/include"))
        #:inc-help (append '("myinc.h" "foo_t" "bar_t") c99-std-help)
#:mode 'file))
```

Note: for file mode user still needs to make sure CPP conditional expressions can be fully evaluated, which may mean adding compiler generated defines (e.g., using gen-cpp-defs).

## **Include Helpers**

The C99 parsers can use "include helpers". This allows files to be parsed without reading full include files. The user provides typenames (types defined using typedef) and defines. The syntax for the include-helper optional argument to the parsers is

```
(define my-inc-helper
'(("foo.h" "foo_t" "ABC=123" "SUM(X,Y)=((X)+(Y))")
   ("bar.h" "bar_t" "DEF=456" "MAX(X,Y)=((X)>(Y)?(X):(Y))"))
```

The special helper "\_\_builtin" will be "included" automatically at the start of parsing. This allows one to generate definitions for compiler builtins like \_\_builtin\_va\_list.

```
(define inc-helper
  '(("__builtin" "__builtin_va_list=void*")))
```

If no inc-helper is provided, the default is c99-def-help, which is defined (in the module (nyacc lang c99 util)) as

The module (nyacc lang c99 util) also defines c99-std-help, which includes the above and typedefs and CPP defines for many standard includes (e.g., alloca.h, limits.h). See the source nyacc/lang/c99/util.scm for more detail.

#### Misc Items

The special symbol  $C99\_ANY$  can be used for symbols which you don't want to define. In the parser will handle this as XXX

## Stuff

Note on CPP replacement text: IIRC, C99 will remove comments from CPP statements before processing. I preserve this and remove inside the CPP parser.

### The Unit Parser

```
TALK ABOUT fixed-width-int-names
```

```
(parse-c #:cpp-defs '("ABC=123"))
    #:inc-dirs (append '("./incs") c99-std-dict)
    #:inc-help '(("myinc.h" "foo_t" "bar_t"))
    #:mode 'file))
```

#### Modes

There are several modes for parsing which affect the way the C preprocessor statements are handled, and how the parse tree is generated. The following list explains the intent behind these parsing modes. Later we mention some fine points.

- code mode (the default) In this mode, the proprocess works like a normal C compiler. The preprocessor statements are evaluated as they are read and macros in the code are expanded as they are read.
- decl mode This mode is intended to be used for tools which want to extract the declarations and definitions which are explicit in a file, but allow access to declarations and definitions in included files.
- file mode is intended to be used for tools which want to transform C files somehow. For example, one could parse a file and remove all comments. This will keep the CPP structure at the top level. Preprocessor statements at the top level are not evaluated. Note: There is a change in versions starting with 0.77.0. In these all defines required for evaluating CPP expressions in if-then have to be resolved.

Options are as follows

#:cpp-defs

This is a list of define strings (e.g., '("ABC=123").

#:inc-dirs

This is an ordered list of directories to search for include files.

#:inc-help

This is an a-list of include helpers, where keys are the include file or path (e.g., sys/types.h).

#:mode This is the mode: 'code, 'decl or 'file. The default is 'code.

#:xdef? This is a predicate function to determine whether to expand a definition (used in file mode). See below.

Note: The user needs to define "\_\_has\_include(X)=\_\_has\_include\_\_(X)" to enable has-include; "\_\_has\_include=\_\_has\_include\_\_" will not work. (Should I worry that it does not?)

```
name mode \Rightarrow \#t \mid \#f
```

[xdef?]

Given string name and mode indicate whether the parser should expand using CPP defines. The default is (lambda(name mode) (eqv? mode 'code)).

# **Expression Parser**

To be documented.

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