GNU Gnulib

updated $Date: 2004/09/29 10:58:47 $

bug-gnulib@gnu.org

This manual is for GNU Gnulib (updated $Date: 2004/09/29 10:58:47 $), which is a library of common routines intended to be shared at the source level.

Copyright © 2004 Free Software Foundation, Inc.

> Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.1 or any later version published by the Free Software Foundation; with no Invariant Sections, with the Front-Cover Texts being "A GNU Manual," and with the Back-Cover Texts as in (a) below. A copy of the license is included in the section entitled "GNU Free Documentation License."
>
> (a) The FSF's Back-Cover Text is: "You have freedom to copy and modify this GNU Manual, like GNU software. Copies published by the Free Software Foundation raise funds for GNU development."

Table of Contents

1 Gnulib 1
1.1 Comments 1
1.2 Header files 1
1.3 ctime 2
1.4 inet_ntoa 2
1.5 Out of memory handling 2

2 Invoking gnulib-tool 4
2.1 Initial import 4
2.2 Importing updated files 6
2.3 Finishing touches 6

Appendix A Copying This Manual 8
A.1 GNU Free Documentation License 8
A.1.1 ADDENDUM: How to use this License for your documents 14

Index 15

1 Gnulib

This is not a real manual. It's just a place to store random notes until someone (you?) gets around to actually writing a manual.

Getting started:

- Gnulib is hosted at Savannah: `http://savannah.gnu.org/projects/gnulib`. Get the sources through CVS from there.
- The Gnulib home page: `http://www.gnu.org/software/gnulib/`.

1.1 Comments

Where to put comments describing functions: Because of risk of divergence, we prefer to keep most function describing comments in only one place: just above the actual function definition. Some people prefer to put that documentation in the .h file. In any case, it should appear in just one place unless you can ensure that the multiple copies will always remain identical.

1.2 Header files

It is a tradition to use CPP tricks to avoid parsing the same header file more than once, which might cause warnings. The trick is to wrap the content of the header file (say, '`foo.h`') in a block, as in:

```
#ifndef FOO_H
# define FOO_H
...
body of header file goes here
...
#endif /* FOO_H */
```

Whether to use `FOO_H` or `_FOO_H` is a matter of taste and style. The C89 and C99 standards reserve all identifiers that begin with an underscore and either an uppercase letter or another underscore, for any use. Thus, in theory, an application might not safely assume that `_FOO_H` has not already been defined by a library. On the other hand, using `FOO_H` will likely lead the higher risk of collisions with other symbols (e.g., `KEY_H`, `XK_H`, `BPF_H`, which are CPP macro constants, or `COFF_LONG_H`, which is a CPP macro function). Your preference may depend on whether you consider the header file under discussion as part of the application (which has its own namespace for CPP symbols) or a supporting library (that shouldn't interfere with the application's CPP symbol namespace).

Adapting C header files for use in C++ applications can use another CPP trick, as in:

```
# ifdef __cplusplus
extern "C"
{
# endif
...
body of header file goes here
...
# ifdef __cplusplus
```

```
}
# endif
```

The idea here is that `__cplusplus` is defined only by C++ implementations, which will wrap the header file in an '`extern "C"`' block. Again, whether to use this trick is a matter of taste and style. While the above can be seen as harmless, it could be argued that the header file is written in C, and any C++ application using it should explicitly use the '`extern "C"`' block itself. Your preference might depend on whether you consider the API exported by your header file as something available for C programs only, or for C and C++ programs alike.

1.3 ctime

The `ctime` function need not be reentrant, and consequently is not required to be thread safe. Implementations of `ctime` typically write the time stamp into static buffer. If two threads call `ctime` at roughly the same time, you might end up with the wrong date in one of the threads, or some undefined string. There is a re-entrant interface `ctime_r`, that take a pre-allocated buffer and length of the buffer, and return `NULL` on errors. The input buffer should be at least 26 bytes in size. The output string is locale-independent. However, years can have more than 4 digits if `time_t` is sufficiently wide, so the length of the required output buffer is not easy to determine. Increasing the buffer size when `ctime_r` return `NULL` is not necessarily sufficient. The `NULL` return value could mean some other error condition, which will not go away by increasing the buffer size.

A more flexible function is `strftime`. However, note that it is locale dependent.

1.4 inet_ntoa

The `inet_ntoa` function need not be reentrant, and consequently is not required to be thread safe. Implementations of `inet_ntoa` typically write the time stamp into static buffer. If two threads call `inet_ntoa` at roughly the same time, you might end up with the wrong date in one of the threads, or some undefined string. Further, `inet_ntoa` is specific for IPv4 addresses.

A protocol independent function is `inet_ntop`.

1.5 Out of memory handling

The GSS API does not have a standard error code for the out of memory error condition. Instead of adding a non-standard error code, this library has chosen to adopt a different strategy. Out of memory handling happens in rare situations, but performing the out of memory error handling after almost all API function invocations pollute your source code and might make it harder to spot more serious problems. The strategy chosen improve code readability and robustness.

For most applications, aborting the application with an error message when the out of memory situation occur is the best that can be wished for. This is how the library behaves by default.

However, we realize that some applications may not want to have the GSS library abort execution in any situation. The GSS library support a hook to let the application regain control and perform its own cleanups when an out of memory situation has occured. The

application can define a function (having a `void` prototype, i.e., no return value and no parameters) and set the library variable `xalloc_fail_func` to that function. The variable should be declared as follows.

```
extern void (*xalloc_fail_func) (void);
```

The GSS library will invoke this function if an out of memory error occurs. Note that after this the GSS library is in an undefined state, so you must unload or restart the application to continue call GSS library functions. The hook is only intended to allow the application to log the situation in a special way. Of course, care must be taken to not allocate more memory, as that will likely also fail.

2 Invoking gnulib-tool

Run '`gnulib-tool --help`', and use the source. `gnulib-tool` is the way to import Gnulib modules.

2.1 Initial import

Gnulib assumes your project uses Autoconf and Automake. Invoking '`gnulib-tool --import`' will copy source files, create a '`Makefile.am`' to build them, and generate a '`gnulib.m4`' with Autoconf M4 macro declarations used by '`configure.ac`'.

Our example will be a library that uses Autoconf, Automake and Libtool. It calls `strdup`, and you wish to use gnulib to make the package portable to C89 (which doesn't have `strdup`).

```
~/src/libfoo$ gnulib-tool --import strdup
Module list with included dependencies:
  strdup
File list:
  lib/strdup.c
  lib/strdup.h
  m4/onceonly_2_57.m4
  m4/strdup.m4
Creating ./lib/Makefile.am...
Creating ./m4/gnulib.m4...
Finished.

Don't forget to add "lib/Makefile"
to AC_CONFIG_FILES in "./configure.ac" and to mention
"lib" in SUBDIRS in some Makefile.am.
~/src/libfoo$
```

By default, the source code is copied into '`lib/`' and the M4 macros in '`m4/`'. You can override these paths by using `--source-base=DIRECTORY` and `--m4-base=DIRECTORY`, or by adding '`gl_SOURCE_BASE(DIRECTORY)`' and '`gl_M4_BASE(DIRECTORY)`' to your '`configure.ac`'.

`gnulib-tool` will overwrite any pre-existing files, in particular '`Makefile.am`'. Unfortunately, separating the generated '`Makefile.am`' content (for building the gnulib library) into a separate file, say '`gnulib.mk`', that could be included by your handwritten '`Makefile.am`' is not possible, due to how variable assignments are handled by Automake.

Consequently, it can be a good idea to chose directories that are not already used by your projects, to separate gnulib imported files from your own files. This approach can also be useful if you want to avoid conflicts between other tools (e.g., `getextize` that also copy M4 files into your package. Simon Josefsson successfully uses a source base of '`gl/`', and a M4 base of '`gl/m4/`', in several packages.

A few manual steps are required to finish the initial import.

First, you need to make sure Autoconf can find the macro definitions in '`gnulib.m4`'. Use the `ACLOCAL_AMFLAGS` specifier in your top-level '`Makefile.am`' file, as in:

```
ACLOCAL_AMFLAGS = -I m4
```

Naturally, replace 'm4' with the value from `--m4-base` or `gl_M4_BASE`. If the M4 base is 'gl/m4' you would use:

```
ACLOCAL_AMFLAGS = -I gl/m4
```

You are now ready to call the M4 macros in `gnulib.m4` from 'configure.ac'. The macro `gl_EARLY` must be called as soon as possible after verifying that the C compiler is working. Typically, this is immediately after `AC_PROG_CC`, as in:

```
...
AC_PROG_CC
gl_EARLY
...
```

The core part of the gnulib checks are done by the macro `gl_INIT`. Place it further down in the file, typically where you normally check for header files or functions. Or in a separate section with other gnulib statements, such as `gl_SOURCE_BASE`. For example:

```
...
# For gnulib.
gl_INIT
...
```

You must also make sure that the gnulib library is built. Add the `Makefile` in the gnulib source base directory to `AC_CONFIG_FILES`, as in:

```
AC_CONFIG_FILES(... lib/Makefile ...)
```

If your gnulib source base is 'gl', you would use:

```
AC_CONFIG_FILES(... gl/Makefile ...)
```

You must also make sure that `make` work in the gnulib directory. Add the gnulib source base directory to a `SUBDIRS` Makefile.am statement, as in:

```
SUBDIRS = lib
```

or if you, more likely, already have a few entries in `SUBDIRS`, you can add something like:

```
SUBDIRS += lib
```

If you are using a gnulib source base of `gl`, you would use:

```
SUBDIRS += gl
```

Finally, you have add C flags and LD flags, so that you can make use of the gnulib library. For example:

```
...
AM_CPPFLAGS = -I$(top_srcdir)/lib
...
LIBADD = lib/libgnu.la
...
```

Don't forget to `#include` the various header files. In this example, you would need to make sure that '`#include <strdup.h>`' is evaluated when compiling all source code files, that want to make use of `strdup`.

2.2 Importing updated files

From time to time, you may want to invoke '`gnulib-tool --import`' to update the files in your package. Once you have set up your package for gnulib, this step is quite simple. For example:

```
~/src/libfoo$ gnulib-tool --import --source-base gl --m4-base gl/m4 strdup
Module list with included dependencies:
  strdup
File list:
  lib/strdup.c
  lib/strdup.h
  m4/onceonly_2_57.m4
  m4/strdup.m4
Creating ./lib/Makefile.am...
Creating ./m4/gnulib.m4...
Finished.

Don't forget to add "lib/Makefile"
to AC_CONFIG_FILES in "./configure.ac" and to mention
"lib" in SUBDIRS in some Makefile.am.
~/src/libfoo$
```

If you don't recall how you invoked the tool last time, the commands used (and the operations it resulted in) are placed in comments within the generated '`Makefile.am`' and '`gnulib.m4`', as in:

```
...
# Invoked as: gnulib-tool --import strdup
# Reproduce by: gnulib-tool --import --dir=. --lib=libgnu --source-base=lib --m4-base=
...
```

2.3 Finishing touches

Invoking '`gnulib-tool --import`' with the proper parameters (e.g., '`--m4-base gl/m4`') and list of modules (e.g., '`strdup snprintf getline minmax`') can be tedious. To simplify this procedure, you may put the command line parameters in your '`configure.ac`'. For example:

```
...
AC_PROG_CC
gl_EARLY
...
# For gnulib.
gl_SOURCE_BASE(gl)
gl_M4_BASE(gl/m4)
gl_LIB(libgl)
gl_MODULES(getopt progname strdup dummy exit error getpass-gnu getaddrinfo)
gl_INIT
...
```

This illustrate all macros defined in '`gnulib.m4`'. With the above, importing new files are as simple as running '`gnulib-tool --import`' with no additional parameters.

The macros `gl_EARLY`, `gl_INIT`, `gl_SOURCE_BASE`, and `gl_M4_BASE` have been discussed earlier. The `gl_LIB` macro can be used if you wish to change the library name (by default '`libgnu.a`' or '`libgnu.la`' if you use libtool). The `gl_MODULES` macro is used to specify which modules to import.

Appendix A Copying This Manual

A.1 GNU Free Documentation License

Version 1.2, November 2002

Copyright © 2000,2001,2002 Free Software Foundation, Inc.
59 Temple Place, Suite 330, Boston, MA 02111-1307, USA

Everyone is permitted to copy and distribute verbatim copies
of this license document, but changing it is not allowed.

0. PREAMBLE

The purpose of this License is to make a manual, textbook, or other functional and useful document *free* in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or non-commercially. Secondarily, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

1. APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. Such a notice grants a world-wide, royalty-free license, unlimited in duration, to use that work under the conditions stated herein. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you". You accept the license if you copy, modify or distribute the work in a way requiring permission under copyright law.

A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (Thus, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The "Invariant Sections" are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License. If a section does not fit the above definition of Secondary then it is not allowed to be designated as Invariant. The Document may contain zero Invariant Sections. If the Document does not identify any Invariant Sections then there are none.

The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License. A Front-Cover Text may be at most 5 words, and a Back-Cover Text may be at most 25 words.

A "Transparent" copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, that is suitable for revising the document straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup, or absence of markup, has been arranged to thwart or discourage subsequent modification by readers is not Transparent. An image format is not Transparent if used for any substantial amount of text. A copy that is not "Transparent" is called "Opaque".

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML, PostScript or PDF designed for human modification. Examples of transparent image formats include PNG, XCF and JPG. Opaque formats include proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML, PostScript or PDF produced by some word processors for output purposes only.

The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, "Title Page" means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.

A section "Entitled XYZ" means a named subunit of the Document whose title either is precisely XYZ or contains XYZ in parentheses following text that translates XYZ in another language. (Here XYZ stands for a specific section name mentioned below, such as "Acknowledgements", "Dedications", "Endorsements", or "History".) To "Preserve the Title" of such a section when you modify the Document means that it remains a section "Entitled XYZ" according to this definition.

The Document may include Warranty Disclaimers next to the notice which states that this License applies to the Document. These Warranty Disclaimers are considered to be included by reference in this License, but only as regards disclaiming warranties: any other implication that these Warranty Disclaimers may have is void and has no effect on the meaning of this License.

2. VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

3. COPYING IN QUANTITY

   If you publish printed copies (or copies in media that commonly have printed covers) of the Document, numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

   If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

   If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a computer-network location from which the general network-using public has access to download using public-standard network protocols a complete Transparent copy of the Document, free of added material. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

   It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

4. MODIFICATIONS

   You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

   A. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any,

be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.

B. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.

C. State on the Title page the name of the publisher of the Modified Version, as the publisher.

D. Preserve all the copyright notices of the Document.

E. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.

F. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.

G. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.

H. Include an unaltered copy of this License.

I. Preserve the section Entitled "History", Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section Entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.

J. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.

K. For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.

L. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.

M. Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.

N. Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.

O. Preserve any Warranty Disclaimers.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their

titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section Entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties—for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

5. COMBINING DOCUMENTS

   You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.

   The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

   In the combination, you must combine any sections Entitled "History" in the various original documents, forming one section Entitled "History"; likewise combine any sections Entitled "Acknowledgements", and any sections Entitled "Dedications". You must delete all sections Entitled "Endorsements."

6. COLLECTIONS OF DOCUMENTS

   You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

   You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

7. AGGREGATION WITH INDEPENDENT WORKS

   A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an "aggregate" if the copyright resulting from the compilation is not used to limit the legal rights of the compilation's users beyond what the individual works permit. When the Document is included in an aggregate, this License does not apply to the other works in the aggregate which are not themselves derivative works of the Document.

   If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document's Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.

8. TRANSLATION

   Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this License and the original versions of those notices and disclaimers. In case of a disagreement between the translation and the original version of this License or a notice or disclaimer, the original version will prevail.

   If a section in the Document is Entitled "Acknowledgements", "Dedications", or "History", the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.

9. TERMINATION

   You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this License. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

10. FUTURE REVISIONS OF THIS LICENSE

    The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See `http://www.gnu.org/copyleft/`.

    Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License "or any later version" applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation.

A.1.1 ADDENDUM: How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

```
Copyright (C)  year  your name.
Permission is granted to copy, distribute and/or modify this document
under the terms of the GNU Free Documentation License, Version 1.2
or any later version published by the Free Software Foundation;
with no Invariant Sections, no Front-Cover Texts, and no Back-Cover
Texts.  A copy of the license is included in the section entitled ``GNU
Free Documentation License''.
```

If you have Invariant Sections, Front-Cover Texts and Back-Cover Texts, replace the "with...Texts." line with this:

```
with the Invariant Sections being list their titles, with
the Front-Cover Texts being list, and with the Back-Cover Texts
being list.
```

If you have Invariant Sections without Cover Texts, or some other combination of the three, merge those two alternatives to suit the situation.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.

Index

A

Aborting execution 2

C

C++ header files 1
comments describing functions 1
`ctime` 2

D

describing functions, locating 1
double inclusion of header files 1

F

FDL, GNU Free Documentation License 8

G

`gnulib-tool` 4

H

header file include protection 1
Header files and C++ 1

I

`inet_ntoa` 2
initial import 4
invoking `gnulib-tool` 4

M

Memory allocation failure 2

O

Out of Memory handling 2