OpenCOBOL 1.1
[06FEB2009 Version]
Build Guide
For MinGW

Documentation prepared by:
Gary Cutler
CutlerGL@gmail.com

This document builds upon the instructions found in the
"**MinGW Open-Cobol Install**"
Documentation at http://sourceforge.net

Contents

Introduction

This document describes the process you will need to follow in order to build OpenCOBOL 1.1 using a Minimalist GNU for Windows (MinGW) environment.

OpenCOBOL was designed to run in a UNIX environment. This means that the compiler, run-time libraries and compiled object programs will expect to have certain UNIX services available.

The "Minimalist GNU For Windows" [MinGW] package is a very high-level UNIX emulation facility that provides the UNIX services OpenCOBOL and its compiled programs will require. It provides these services via a single DLL (**mingwm10.dll**[1]) which must be available on both the development systems upon which OpenCOBOL programs are compiled as well as the run-time systems upon which those compiled programs will be executed. The following statement was taken directly from the MinGW website:

[1] The number in the name of the DLL is a version number. It is quite possible that by the time you are actually using this document to create your own OpenCOBOL binaries, the version number of MinGW will have changed and you may have a DLL with a different number.

> "The MinGW base runtime package has been placed in the public domain, and is not governed by copyright. This basically means that you can do what you like with the code."

The "base runtime package" is the aforementioned DLL!

The MinGW package also includes the GNU Compiler Collection (GCC), and GNU binutils packages; these will provide a free C compiler and development environment with which the various OpenCOBOL components can be built.

Overview of the Process

The following is a brief overview of the general steps you will follow to create your own OpenCOBOL binaries and to package them for your use.

The version numbers shown reflect the versions of the software that have been successfully used to build OpenCOBOL. If you are able to locate these versions using the instructions provided, you're guaranteed of success! If not, get the latest version and cross your fingers!

1. **Install MinGW 5.1.6**

   This is a minimal Unix-emulation environment intended for use under Windows.

   MinGW has been placed in the public domain and is available free-of-charge and is freely distributable.

2. **Install MSYS 1.0.11**

   This is a Unix bash command shell environment for use under MinGW; it is needed to be able to run the various configuration, installation and verification scripts for OpenCOBOL and its co-requisite packages.

   Like MinGW, MSYS has been placed in the public domain and is available free-of-charge and is freely distributable.

   The version number (1.0.11) shown here is the last version with a Windows EXE installer. Even though it is NOT the most-recent version, it is sufficient to the task of building OpenCOBOL and it's related components.

3. **Download and Build the GNU Multiple-Precision Arithmetic (GMP) Package 5.0.1**

   GMP is a free library for arbitrary precision arithmetic, operating on signed integers, rational numbers, and floating point numbers. There is no practical limit to the precision except the ones implied by the available memory in the machine GMP runs on. GMP has a rich set of functions, and the functions have a regular interface.

   It is GMP that enables OpenCOBOL to perform the USAGE DISPLAY and USAGE COMPUTATIONAL-3 (packed decimal) arithmetic that we've all come to expect from any COBOL implementation.

This package is available free-of-charge and is licensed under the terms of the **GNU Lesser General Public License**.

4. **Download and Build the Public Domain Curses (PDCurses) Package 3.4**

   This is a runtime packages utilized by OpenCOBOL in support of the SCREEN SECTION and extended-function ACCEPT and DISPLAY statements.

   This package is available free-of-charge and is licensed under the terms of the **GNU Lesser General Public License**.

5. **Download and Build the Berkeley Database (BDB) Package 5.0.26**

   This is a runtime package that will be utilized by OpenCOBOL to support INDEXED files, the SORT statement and the MERGE statement.

   Although copyrighted to Oracle Corporation, BDB is made available free-of-charge and is redistributable under the terms set forth in its license. The following statement, along with the BDB copyright at the bottom of this page[2], satisfies the terms of that license:

   Source code to BDB is available from the BDB website. Source code to OpenCOBOL V1.1 is available from the OpenCOBOL website (**http://www.opencobol.org**).

   You will need to register with the Oracle website in order to download the software.

6. **Download the OpenCOBOL Source**

   This is the full source code to the OpenCOBOL compiler and associated run-time library.

   The compiler is licensed under GNU General Public License.

   The run-time library is licensed under **GNU Lesser General Public License**.

7. **Build OpenCOBOL**

   This is the process of actually building the OpenCOBOL compiler and runtime library.

8. **Package it all Into an OpenCOBOL Folder**

   This is the process of preparing an "OpenCOBOL" folder that contains the binaries of OpenCOBOL and the co-requisite packages in a form that you may use and distribute with your OpenCOBOL apps.

Install MinGW 5.1.6

1. Go to "**sourceforge.net**" on the web.
2. Search for "MinGW"; you should find something resembling "**MinGW - Minimalist GNU for Windows**" (files seem to change names on sourceforge periodically). Click on it to bring up it's product page and then click it's "Download" button.
3. Once downloaded, run it (it's a Windows ".exe").

[2] Copyright (c) 1990-2006 Oracle Corporation. All rights reserved.

4. Accept the default installation directory (**C:\MinGW**).
5. When given the chance to choose the components to install, make sure "**MinGW Base Tools**" package is selected. All other components are optional – install them if you'd like, but neither OpenCOBOL nor any of its co-requisite packages need them.
6. (optional) - Once the installation is complete, feel free to delete the "**MinGW.5.1.6.exe**" file that you downloaded.
7. Copy "C:\MinGW\libexec\gcc\mingw32\3.4.5\cc1.exe"[3] to "C:\MinGW\bin\cc1.exe". This will (ultimately) allow C:\MinGW\bin to be the ONLY directory you'll need to have in your PATH in order to compile OpenCOBOL programs!
8. Verify that **C:\MinGW\bin** contains a file named **mingwm10.dll[4].**

Install MSYS 1.0.11

Having MinGW is a good start, but you need more than a few runtime service routines and UNIX command-line utilities – you need a full-blown UNIX "bash" shell environment too! The various configuration and installation scripts used by the various OpenCOBOL components were all written assuming the user is running them within a UNIX "bash" shell[5], so you'll need one!

Of course, this isn't a problem! You'll simply need to install the "MSYS" base system into your MinGW environment to have access to the UNIX shell you'll need. Nothing that's part of MSYS is needed to compile or execute OpenCOBOL programs – MSYS is needed only so that you can build OpenCOBOL and its co-requisite packages.

1. Return to "**sourceforge.net**" and once again search for "**MinGW**"; you should again find that same "something resembling '**MinGW - Minimalist GNU for Windows**'" that you found earlier. Click on it to bring up it's product page.
2. Click the "**View all Files**" button that appears next to the "Download" button.
3. A file list will appear. Click each of the following (as you click an item, others will appear underneath it):
    - **MSYS**
    - **BaseSystem**
    - **msys-core**
    - **msys-1.0.11**
    - **MSYS-1.0.11.exe** (this is the MSYS installer for Windows)

---

3 The "**3.4.5**" is the version number of the gcc package that is part of MinGW

4 The number in the name of the DLL is a version number. It is quite possible that by the time you are actually using this document to create your own OpenCOBOL binaries, the version number of MinGW will have changed and you may have a DLL with a different number.

5 "bash" is one of the more popular command shell environments in the Linux world

4. Once downloaded, run the MSYS installer. This IS an older version of MSYS, but it's adequate to build OpenCOBOL and it's A LOT EASIER to install than the newer versions are.
5. Click "Yes" and "Next" until you're asked for an installation directory.
6. Specify "**C:\MinGW\MSYS**" as the MSYS installation directory.
7. Once actual installation is complete, a command window should pop up asking for permission to run a post-install process - respond "y".
8. Next, use Windows Explorer to ensure that a directory named "**C:\MinGW\MSYS\etc**" exists and verify there's a file named "**fstab**" in it (no extension); If it exists, use Windows Explorer to "Open" the file with "Notepad" and make sure its contents are a single line:

   ```
   c:/mingw /mingw
   ```

   If there is no such file, or the contents are not "**c:/mingw /mingw**", create one with that single line as its contents (remember there's no extension after "fstab")[6].
9. An icon "**MSYS**" should have been created on your desktop - double-click it.
10. The window started by the "MSYS" icon resembles a Windows console, but is actually an MSYS "bash" shell; Use the window's "Properties" command as you would do with a normal window to change the window size to 190 columns by 60 rows - make sure the buffer size has a "height" of at least 600; you'll also want to change the font to something that enables that window to fit on your screen (I use "Lucida Console" with a "size" of "10").
11. If you are running Windows Vista or Windows 7, close the bash window and restart it again, this time giving it Administrator authority via "**Run As Administrator**".

Download and Build the GNU Multiple-Precision Arithmetic package (GMP) 5.0.1

From this point forward, you will no longer be simply running a Windows executable to install pre-compiled software. From now on, you'll be using the GNU Compiler Collection that was installed along with MinGW to actually compile the C source code of the remaining software packages. Fortunately, this isn't nearly as difficult as you might think because the authors of all those packages constructed special "configure" and "install" bash shell scripts that will use the Unix "make" command (installed as part of MSYS) to actually run the C compiler.

To acquire and build GMP:

[6] The "fstab" file defines a UNIX mount-point named "mingw" via which commands and shell scripts can reference the "**C:\MinGW**" directory. In UNIX, the "/" character is used to delimit layers in directory paths rather than the "\" character Windows uses. UNIX also prefers lower-case names for files and directories.

1. Go to the "**gmplib.org**" website, home of the GNU Multiple Precision arithmetic library routines [GMP].
2. Find the website's "download" area and download a file named "**gmp-5.0.1-tar.gz**".
3. Once downloaded, use Windows Explorer to copy it into your **C:\MinGW\MSYS** folder.
4. Uncompress and expand the file by issuing the following commands from your "bash" window:

```
cd /mingw/MSYS [7]
tar xzf gmp-*.tar.gz [8,9]
rm gmp-*.tar.gz [9,10]
```

5. Build GMP using these commands:

```
cd gmp*
./configure --prefix=/mingw --enable-shared --disable-static
make
make install
make check
```

   Expect LOTS of output from the last four commands; the "--enable-shared" and "--disable-static" options are CRITICAL because they will cause a DLL to be created for the GMP library. The last command is supposed to verify that GMP installed properly. Prior to version 5.0.1 it had failed EVERY SINGLE TIME for me and GMP still worked perfectly. Go figure! As of 5.0.1, however, all tests now PASS.

6. When all this is done, execute the following command to ensure that a DLL was generated for GMP:

```
ls /mingw/bin/*.dll
```

   You should see that a "**/mingw/bin/libgmp-10.dll**[11]" exists.

---

[7] Remember – when entering commands in the bash window, use "/", not "\".

[8] Compressed "tarballs" (.tar.gz files) are the UNIX equivalent to ".zip" files, and you use the "tar" command to create them as well as to uncompress and expand them

[9] The "*" will ask the bash shell to "fill in the middle part" of the filename automatically - neat, huh?

[10] The "rm" command deletes files; we no longer need the "tarball"

[11] As we've seen already with the MinGW DLL, the "10" shown here is actually a version number. You may find that it's different, depending on the version of GMP you acquired.

Download and Build the Public Domain Curses (PDCurses) Package 3.4

Acquire and build PDCurses as follows. NOTE: I do NOT recommend using the "PDCurses" package available for download from the "MinGW" product page on sourceforge – follow these instructions instead:

1. Go to the "**pdcurses.sourceforge.net**" website, home of the public-domain CURSES package [PDCurses].
2. Find the website's "download" area and download a file named "**PDCurses-3.4.tar.gz**".
3. Once downloaded, use Windows Explorer to copy it into your **C:\MinGW\MSYS** folder
4. Uncompress and expand the file by issuing the following commands from your "bash" window:

```
cd /mingw/MSYS
tar xzf PDC*.tar.gz
rm PDC*.tar.gz
```

5. Build PDCurses using these commands:

```
cd PDC*/win32
make -f gccwin32.mak DLL=Y [DEBUG=Y][12]
```

6. When this is done, execute the following command to ensure that a DLL was generated for PDCurses (if not, you must have forgotten the DLL=Y switch):

```
ls *.dll
```

   You should see that a "**pdcurses.dll**" exists.

7. There is no "make install" available for PDCurses, so you'll have to deploy the PDCurses components yourself:

```
cp pdcurses.dll /mingw/bin/.
cp pdcurses.a /mingw/lib/libpdcurses.a
cd ..
cp *.h /mingw/include/.
cp curses.h /mingw/include/pdcurses.h [13]
```

---

[12] The optional DEBUG=Y switch can be provided to generate debugging code internal to the PDCurses package. I needed it once to diagnose a problem with screen I/O and it really helped! WARNING : using DEBUG=Y will really slow the PDCurses package down – I don't recommend it for normal use

[13] The OpenCOBOL 'configure' script and the 'cobc' command (OpenCOBOL compiler) expects 'curses.h' to be named 'pdcurses.h'

Download and Build the Berkeley Database (BDB) Package 5.0.26

Acquire and build BDB as follows:

1. Go to the "www.oracle.com/technology/products/berkeley-db/db/index.html" website, home of the BDB package.
2. Find the website's "download" area and download a file named "**Berkeley DB 5.0.26.NC.tar.gz**" (the "NC" indicates this is the "without encryption" version)
3. Once downloaded, use Windows Explorer to copy it into your **C:\MinGW\MSYS** folder
4. Uncompress and expand the file by issuing the following commands from your "bash" window:

```
cd /mingw/MSYS
tar xzf db*.tar.gz
rm db*.tar.gz
```

5. Install BDB using these commands:

```
cd db*/build_unix
../dist/configure --enable-mingw --prefix=/mingw --enable-compat185 LIBCSO_LIBS=-lwsock32
make
make install
```

6. When this is done, execute the following command to ensure that a DLL was generated for BDB:

```
ls /mingw/bin/*.dll
```

You should see that a "**libdb-5.0.dll**" exists.

Download the OpenCOBOL Source

And now we're ready to install OpenCOBOL:

1. Go to the "**opencobol.org**" website, home of the OpenCOBOL project.
2. Find the website's "download" area and download the 1.1 pre-release version of OpenCOBOL. At the time of publication of this document, the publically-available tarball for OpenCOBOL 1.1 is the 06FEB2009 version.
3. Once downloaded, use Windows Explorer to copy it into your **C:\MinGW\MSYS** folder

4. Uncompress and expand the file by issuing the following commands from your "bash" window:

```
cd /mingw/MSYS
tar xzf open*.tar.gz
rm open*.tar.gz
```

Apply Patches to the OpenCOBOL Source (Optional)

During the project that created the OpenCOBOL Programmer's Guide, I discovered several problems. Upon inspection of the compiler and/or runtime library C code, I was able to develop fixes for these problems. The OpenCOBOL 06FEB2009 tarball will have the problems corrected by the following fixes. I recommend that you edit the OpenCOBOL source code as documented below before proceeding.

I have confirmed that subsequent tarballs (not yet publically available) have these (or similar) corrections already made.

1. I found that neither the SCREEN SECTION nor the extended-format DISPLAY statement were able to support the use of colors on the screen. Upon inspection, I found that the "**screenio.c**" component of the run-time library was not properly initializing the color-pair array used by PDCurses, therefore causing white-on-black to be the color always used, regardless of what you specified in your OpenCOBOL programs.

   The change I made was to the "**cob_screen_init()**" routine in the "**screenio.c**" module, found in the **C:\MinGW\MSYS\open-cobol-1.1\libcob** folder.

   If this problem is corrected in your version, you should find code similar to what is shown here. If not, correct your copy of screenio.c using any text editor to include the code shown in **red**.

```
static void COB_NOINLINE
cob_screen_init (void)
{
   char    *s;
#ifdef HAVE_LIBPDCURSES
   short i;
#endif
   if (!cob_screen_initialized) {
      s = getenv ("COB_SCREEN_EXCEPTIONS");
      if (s) {
         if (*s == 'Y' || *s == 'y') {
            cob_extended_status = 1;
            s = getenv ("COB_SCREEN_ESC");
            if (s) {
               if (*s == 'Y' || *s == 'y') {
                     cob_use_esc = 1;
               }
            }
         }
      }
      fflush (stdout);
      fflush (stderr);
      if (!initscr ()) {
         cob_runtime_error ("Failed to initialize curses");
         cob_stop_run (1);
      }
      cbreak ();
      keypad (stdscr, 1);
      nl ();
      noecho ();
      if (has_colors ()) {
         start_color ();
         pair_content ((short)0, &fore_color, &back_color);
         if (COLOR_PAIRS) {
            cob_has_color = 1;
         }
#ifdef HAVE_LIBPDCURSES
         for (i = 1; i < (size_t)COLOR_PAIRS; i++) {
            init_pair ((short)i, (short)0, (short)0);
         }
#endif
      }
      attrset (A_NORMAL);
      getmaxyx (stdscr, cob_max_y, cob_max_x);
      cob_screen_initialized = 1;
   }
}
```

2. A problem exists with both the **NUMVAL** and **NUMVAL-C** intrinsic functions where they both refuse to acknowledge the existence of a "CR" or "DB" symbol in a string being processed. To fix this bug, you'll have to apply a fix to the **intrinsic.c** module (found in the **C:\MinGW\MSYS\open-cobol-1.1\libcob** folder).

   In both the "**cob_intr_numval**" and "**cob_intr_numval_c**" function definitions in **intrinsic.c** you'll see a section of code like the following (part of the character-by-character scan of the string being converted):

```
for (i = 0; i < srcfield->size; ++i) {
   if (i < (srcfield->size - 2)) {
      if (strcasecmp ((char *)&srcfield->data[i], "CR") == 0
          || strcasecmp ((char *)&srcfield->data[i], "DB") == 0) {
         sign = 1;
         break;
      }
   }
```

   To fix the problem, change each of those two code snippets to the following:

```
for (i = 0; i < srcfield->size; ++i) {
   if (i < (srcfield->size - 1)) {
      if (strcasecmp ((char *)&srcfield->data[i], "CR") == 0
          || strcasecmp ((char *)&srcfield->data[i], "DB") == 0) {
         sign = 1;
         break;
      }
   }
```

3. The ACCEPT … FROM DAY-OF-WEEK statement is non-functional on MinGW versions of OpenCOBOL. To fix this, find the "**cob_accept_day_of_week**" function in the **common.c** module (found in the **C:\MinGW\MSYS\open-cobol-1.1\libcob** folder):

```
void
cob_accept_day_of_week (cob_field *f)
{
   time_t  t;
   char    s[4];
   t = time (NULL);
#if defined(_MSC_VER)
   sprintf(s, "%d", localtime(&t)->tm_wday + 1);
#else
   strftime (s, 2, "%u", localtime (&t));
#endif
   cob_memcpy (f, (ucharptr)s, 1);
}
```

and make the changes shown in **red**:

```
void
cob_accept_day_of_week (cob_field *f)
{
   time_t  t;
   char      s[4];
   t = time (NULL);
   s[0] = (char)(localtime(&t)->tm_wday);
   if(s[0] == 0) s[0] = 7;
   s[0] += '0';
   cob_memcpy (f, (ucharptr)s, 1);
}
```

4. When a statement such as this:

   ACCEPT INPUT-FIELD FROM CONSOLE

   Is executed in a program that contains no SCREEN SECTION, or in which no data item defined in the SCREEN SECTION has yet been ACCEPTed or DISPLAYed, the field receiving the ACCEPTed value may be corrupted by having a trailing ASCII carriage-return character (X'0D') appended to its value. This will occur only in situations where the data read from the console is shorter in length than the length of the receiving field (INPUT-FIELD in the example).

   To correct this, find the "**cob_accept**" function in the **termio.c** module (found in the **C:\MinGW\MSYS\open-cobol-1.1\libcob** folder):

```
void
cob_accept (cob_field *f)
{
/* RXW
   size_t     size;
*/
   cob_field_attr  attr;
   cob_field   temp;

   if (cob_screen_initialized) {
      cob_field_accept (f, NULL, NULL, NULL, NULL, NULL, 0);
      return;
   }
   temp.data = term_buff;
   temp.attr = &attr;
   COB_ATTR_INIT (COB_TYPE_ALPHANUMERIC, 0, 0, 0, NULL);
   /* read a line */
   if (fgets ((char *)term_buff, COB_MEDIUM_BUFF, stdin) == NULL) {
      temp.size = 1;
      term_buff[0] = ' ';
      term_buff[1] = 0;
   } else {
      temp.size = strlen ((char *)term_buff) - 1;
   }
   if (COB_FIELD_TYPE(f) == COB_TYPE_NUMERIC_DISPLAY) {
      if (temp.size > f->size) {
         temp.size = f->size;
      }
   }
   cob_move (&temp, f);
/* RXW
   if (isatty (fileno (stdin))) {
      temp.size = strlen ((char *)term_buff) - 1;
      cob_move (&temp, f);
   } else {
      size = strlen ((char *)term_buff) - 1;
      if (size > f->size) {
         size = f->size;
      }
      memcpy (f->data, term_buff, size);
      memset (f->data + size, ' ', f->size - size);
   }
*/
}
```

And make the correction shown in **red**:

```
void
cob_accept (cob_field *f)
{
/* RXW
   size_t     size;
*/
   cob_field_attr  attr;
   cob_field   temp;

   if (cob_screen_initialized) {
      cob_field_accept (f, NULL, NULL, NULL, NULL, NULL, 0);
      return;
   }
   temp.data = term_buff;
   temp.attr = &attr;
   COB_ATTR_INIT (COB_TYPE_ALPHANUMERIC, 0, 0, 0, NULL);
   /* read a line */
   if (fgets ((char *)term_buff, COB_MEDIUM_BUFF, stdin) == NULL) {
      temp.size = 1;
      term_buff[0] = ' ';
      term_buff[1] = 0;
   } else {
      temp.size = strlen ((char *)term_buff) - 1;
      if ( term_buff[temp.size] ==  '\n' ) {
         temp.size--;
      }
   }
   if (COB_FIELD_TYPE(f) == COB_TYPE_NUMERIC_DISPLAY) {
      if (temp.size > f->size) {
         temp.size = f->size;
      }
   }
   cob_move (&temp, f);
/* RXW
   if (isatty (fileno (stdin))) {
      temp.size = strlen ((char *)term_buff) - 1;
      cob_move (&temp, f);
   } else {
      size = strlen ((char *)term_buff) - 1;
      if (size > f->size) {
         size = f->size;
      }
      memcpy (f->data, term_buff, size);
      memset (f->data + size, ' ', f->size - size);
   }
*/
}
```

Build OpenCOBOL

Build OpenCOBOL using these commands:

```
cd /mingw/MSYS/open*
./configure --prefix=/mingw
make
make install
```

Packaging it all Into an OpenCOBOL Folder

You now have everything you need to build your own "OpenCOBOL" folder suitable for program compilation and execution. At a minimum, you'll need to follow these steps (these steps assume that the directory "C:\OpenCOBOL" does not yet exist):

```
mkdir C:\OpenCOBOL
copy C:\MinGW\bin                          C:\OpenCOBOL
copy C:\MinGW\share\open-cobol\config      C:\OpenCOBOL\config
copy C:\MinGW\share\open-cobol\copy        C:\OpenCOBOL\Copy
copy C:\MinGW\lib                          C:\OpenCOBOL\lib
copy C:\MinGW\include                      C:\OpenCOBOL\include
```

Use the "**Configuring OpenCOBOL**" instructions presented at the beginning of this document to establish this folder as your OpenCOBOL "production" environment.

Using Your OpenCOBOL Folder

Follow these simple steps to allow the OpenCOBOL folder you just created to be usable. Make the following mandatory ENVIRONMENT variable changes to the "User Variables" for your userid:[14]

a. Add a new environment variable named **COB_CONFIG_DIR** and set it's value to **C:\OpenCOBOL\config**

b. Modify the PATH variable to add **C:\OpenCOBOL\bin** to the folder list (if there isn't a userid-local PATH variable yet, create one with **C:\OpenCOBOL\bin** as its value)

c. Add a new environment variable named **COB_COPY_DIR** and set its value to **C:\OpenCOBOL\Copy**.

[14] On a Windows XP computer, start **Control Panel**, double-click **System**, select the **Advanced** tab and click the **Environment Variables** button.

On a Windows Vista or Windows 7 system, start **Control Panel**, double-click **System** (if using Classic View) or click **System and Maintenance** (if Using Control Panel Home view) then **Advanced System Settings.** From the **System Properties** window, click the **Advanced** tab and then press the **Environment Variables** button.

Believe it or not, that's it! You're done.

There is an additional environment variable change you might want to make in the future as you become more familiar with OpenCOBOL – the establishment of the **COB_LIBRARY_PATH** variable.

This variable (as well as the others discussed above) are documented in the **OpenCOBOL Programmers Guide** (look them up in the index).

Sharing Your OpenCOBOL Folder With Others

Sharing the OpenCOBOL environment you have created with others is pretty simple…simply follow these steps:

1. Give the complete OpenCOBOL folder and its contents to whomever you wish to share with. Have them copy it to the root of their "C:" drive (therefore becoming their C:\OpenCOBOL folder).
2. Have them perform the same ENVIRONMENT variable changes as were documented in the "Using Your OpenCOBOL Folder" section.

The GNU General Public License

```
                    GNU GENERAL PUBLIC LICENSE
                       Version 3, 29 June 2007

 Copyright (C) 2007 Free Software Foundation, Inc. <http://fsf.org/>
 Everyone is permitted to copy and distribute verbatim copies
 of this license document, but changing it is not allowed.

                            Preamble

  The GNU General Public License is a free, copyleft license for
software and other kinds of works.

  The licenses for most software and other practical works are designed
to take away your freedom to share and change the works.  By contrast,
the GNU General Public License is intended to guarantee your freedom to
share and change all versions of a program--to make sure it remains free
software for all its users.  We, the Free Software Foundation, use the
GNU General Public License for most of our software; it applies also to
any other work released this way by its authors.  You can apply it to
your programs, too.

  When we speak of free software, we are referring to freedom, not
price.  Our General Public Licenses are designed to make sure that you
have the freedom to distribute copies of free software (and charge for
them if you wish), that you receive source code or can get it if you
want it, that you can change the software or use pieces of it in new
free programs, and that you know you can do these things.

  To protect your rights, we need to prevent others from denying you
these rights or asking you to surrender the rights.  Therefore, you have
certain responsibilities if you distribute copies of the software, or if
you modify it: responsibilities to respect the freedom of others.

  For example, if you distribute copies of such a program, whether
```

gratis or for a fee, you must pass on to the recipients the same freedoms that you received. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

Developers that use the GNU GPL protect your rights with two steps: (1) assert copyright on the software, and (2) offer you this License giving you legal permission to copy, distribute and/or modify it.

For the developers' and authors' protection, the GPL clearly explains that there is no warranty for this free software. For both users' and authors' sake, the GPL requires that modified versions be marked as changed, so that their problems will not be attributed erroneously to authors of previous versions.

Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS

0. Definitions.

"This License" refers to version 3 of the GNU General Public License.

"Copyright" also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

"The Program" refers to any copyrightable work licensed under this License. Each licensee is addressed as "you". "Licensees" and "recipients" may be individuals or organizations.

To "modify" a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a "modified version" of the earlier work or a work "based on" the earlier work.

A "covered work" means either the unmodified Program or a work based on the Program.

To "propagate" a work means to do anything with it that, without permission, would make you directly or secondarily liable for infringement under applicable copyright law, except executing it on a computer or modifying a private copy. Propagation includes copying, distribution (with or without modification), making available to the public, and in some countries other activities as well.

To "convey" a work means any kind of propagation that enables other parties to make or receive copies. Mere interaction with a user through a computer network, with no transfer of a copy, is not conveying.

An interactive user interface displays "Appropriate Legal Notices" to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source.

The Corresponding Source for a work in source code form is that same work.

2. Basic Permissions.

All rights granted under this License are granted for the term of copyright on the Program, and are irrevocable provided the stated conditions are met. This License explicitly affirms your unlimited permission to run the unmodified Program. The output from running a covered work is covered by this License only if the output, given its

content, constitutes a covered work. This License acknowledges your rights of fair use or other equivalent, as provided by copyright law.

You may make, run and propagate covered works that you do not convey, without conditions so long as your license otherwise remains in force. You may convey covered works to others for the sole purpose of having them make modifications exclusively for you, or provide you with facilities for running those works, provided that you comply with the terms of this License in conveying all material for which you do not control copyright. Those thus making or running the covered works for you must do so exclusively on your behalf, under your direction and control, on terms that prohibit them from making any copies of your copyrighted material outside their relationship with you.

Conveying under any other circumstances is permitted solely under the conditions stated below. Sublicensing is not allowed; section 10 makes it unnecessary.

3. Protecting Users' Legal Rights From Anti-Circumvention Law.

No covered work shall be deemed part of an effective technological measure under any applicable law fulfilling obligations under article 11 of the WIPO copyright treaty adopted on 20 December 1996, or similar laws prohibiting or restricting circumvention of such measures.

When you convey a covered work, you waive any legal power to forbid circumvention of technological measures to the extent such circumvention is effected by exercising rights under this License with respect to the covered work, and you disclaim any intention to limit operation or modification of the work as a means of enforcing, against the work's users, your or third parties' legal rights to forbid circumvention of technological measures.

4. Conveying Verbatim Copies.

You may convey verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice; keep intact all notices stating that this License and any non-permissive terms added in accord with section 7 apply to the code; keep intact all notices of the absence of any warranty; and give all recipients a copy of this License along with the Program.

You may charge any price or no price for each copy that you convey, and you may offer support or warranty protection for a fee.

5. Conveying Modified Source Versions.

You may convey a work based on the Program, or the modifications to produce it from the Program, in the form of source code under the terms of section 4, provided that you also meet all of these conditions:

a) The work must carry prominent notices stating that you modified it, and giving a relevant date.

b) The work must carry prominent notices stating that it is released under this License and any conditions added under section 7. This requirement modifies the requirement in section 4 to "keep intact all notices".

c) You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This

License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.

d) If the work has interactive user interfaces, each must display Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.

A compilation of a covered work with other separate and independent works, which are not by their nature extensions of the covered work, and which are not combined with it such as to form a larger program, in or on a volume of a storage or distribution medium, is called an "aggregate" if the compilation and its resulting copyright are not used to limit the access or legal rights of the compilation's users beyond what the individual works permit. Inclusion of a covered work in an aggregate does not cause this License to apply to the other parts of the aggregate.

6. Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

a) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.

b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.

c) Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.

d) Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

A "User Product" is either (1) a "consumer product", which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage. For a particular product received by a particular user, "normally used" refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.

"Installation Information" for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object code is in no case prevented or interfered with solely because modification has been made.

If you convey an object code work under this section in, or with, or specifically for use in, a User Product, and the conveying occurs as part of a transaction in which the right of possession and use of the User Product is transferred to the recipient in perpetuity or for a fixed term (regardless of how the transaction is characterized), the Corresponding Source conveyed under this section must be accompanied by the Installation Information. But this requirement does not apply if neither you nor any third party retains the ability to install modified object code on the User Product (for example, the work has been installed in ROM).

The requirement to provide Installation Information does not include a requirement to continue to provide support service, warranty, or updates for a work that has been modified or installed by the recipient, or for the User Product in which it has been modified or installed. Access to a network may be denied when the modification itself materially and adversely affects the operation of the network or violates the rules and protocols for communication across the network.

Corresponding Source conveyed, and Installation Information provided, in accord with this section must be in a format that is publicly documented (and with an implementation available to the public in source code form), and must require no special password or key for unpacking, reading or copying.

7. Additional Terms.

"Additional permissions" are terms that supplement the terms of this License by making exceptions from one or more of its conditions. Additional permissions that are applicable to the entire Program shall be treated as though they were included in this License, to the extent that they are valid under applicable law. If additional permissions

apply only to part of the Program, that part may be used separately under those permissions, but the entire Program remains governed by this License without regard to the additional permissions.

When you convey a copy of a covered work, you may at your option remove any additional permissions from that copy, or from any part of it. (Additional permissions may be written to require their own removal in certain cases when you modify the work.) You may place additional permissions on material, added by you to a covered work, for which you have or can give appropriate copyright permission.

Notwithstanding any other provision of this License, for material you add to a covered work, you may (if authorized by the copyright holders of that material) supplement the terms of this License with terms:

a) Disclaiming warranty or limiting liability differently from the terms of sections 15 and 16 of this License; or

b) Requiring preservation of specified reasonable legal notices or author attributions in that material or in the Appropriate Legal Notices displayed by works containing it; or

c) Prohibiting misrepresentation of the origin of that material, or requiring that modified versions of such material be marked in reasonable ways as different from the original version; or

d) Limiting the use for publicity purposes of names of licensors or authors of the material; or

e) Declining to grant rights under trademark law for use of some trade names, trademarks, or service marks; or

f) Requiring indemnification of licensors and authors of that material by anyone who conveys the material (or modified versions of it) with contractual assumptions of liability to the recipient, for any liability that these contractual assumptions directly impose on those licensors and authors.

All other non-permissive additional terms are considered "further restrictions" within the meaning of section 10. If the Program as you received it, or any part of it, contains a notice stating that it is governed by this License along with a term that is a further restriction, you may remove that term. If a license document contains a further restriction but permits relicensing or conveying under this License, you may add to a covered work material governed by the terms of that license document, provided that the further restriction does not survive such relicensing or conveying.

If you add terms to a covered work in accord with this section, you must place, in the relevant source files, a statement of the additional terms that apply to those files, or a notice indicating where to find the applicable terms.

Additional terms, permissive or non-permissive, may be stated in the form of a separately written license, or stated as exceptions; the above requirements apply either way.

8. Termination.

You may not propagate or modify a covered work except as expressly provided under this License. Any attempt otherwise to propagate or modify it is void, and will automatically terminate your rights under this License (including any patent licenses granted under the third

paragraph of section 11).

However, if you cease all violation of this License, then your license from a particular copyright holder is reinstated (a) provisionally, unless and until the copyright holder explicitly and finally terminates your license, and (b) permanently, if the copyright holder fails to notify you of the violation by some reasonable means prior to 60 days after the cessation.

Moreover, your license from a particular copyright holder is reinstated permanently if the copyright holder notifies you of the violation by some reasonable means, this is the first time you have received notice of violation of this License (for any work) from that copyright holder, and you cure the violation prior to 30 days after your receipt of the notice.

Termination of your rights under this section does not terminate the licenses of parties who have received copies or rights from you under this License. If your rights have been terminated and not permanently reinstated, you do not qualify to receive new licenses for the same material under section 10.

9. Acceptance Not Required for Having Copies.

You are not required to accept this License in order to receive or run a copy of the Program. Ancillary propagation of a covered work occurring solely as a consequence of using peer-to-peer transmission to receive a copy likewise does not require acceptance. However, nothing other than this License grants you permission to propagate or modify any covered work. These actions infringe copyright if you do not accept this License. Therefore, by modifying or propagating a covered work, you indicate your acceptance of this License to do so.

10. Automatic Licensing of Downstream Recipients.

Each time you convey a covered work, the recipient automatically receives a license from the original licensors, to run, modify and propagate that work, subject to this License. You are not responsible for enforcing compliance by third parties with this License.

An "entity transaction" is a transaction transferring control of an organization, or substantially all assets of one, or subdividing an organization, or merging organizations. If propagation of a covered work results from an entity transaction, each party to that transaction who receives a copy of the work also receives whatever licenses to the work the party's predecessor in interest had or could give under the previous paragraph, plus a right to possession of the Corresponding Source of the work from the predecessor in interest, if the predecessor has it or can get it with reasonable efforts.

You may not impose any further restrictions on the exercise of the rights granted or affirmed under this License. For example, you may not impose a license fee, royalty, or other charge for exercise of rights granted under this License, and you may not initiate litigation (including a cross-claim or counterclaim in a lawsuit) alleging that any patent claim is infringed by making, using, selling, offering for sale, or importing the Program or any portion of it.

11. Patents.

A "contributor" is a copyright holder who authorizes use under this License of the Program or a work on which the Program is based. The work thus licensed is called the contributor's "contributor version".

A contributor's "essential patent claims" are all patent claims owned or controlled by the contributor, whether already acquired or hereafter acquired, that would be infringed by some manner, permitted by this License, of making, using, or selling its contributor version, but do not include claims that would be infringed only as a consequence of further modification of the contributor version. For purposes of this definition, "control" includes the right to grant patent sublicenses in a manner consistent with the requirements of this License.

Each contributor grants you a non-exclusive, worldwide, royalty-free patent license under the contributor's essential patent claims, to make, use, sell, offer for sale, import and otherwise run, modify and propagate the contents of its contributor version.

In the following three paragraphs, a "patent license" is any express agreement or commitment, however denominated, not to enforce a patent (such as an express permission to practice a patent or covenant not to sue for patent infringement). To "grant" such a patent license to a party means to make such an agreement or commitment not to enforce a patent against the party.

If you convey a covered work, knowingly relying on a patent license, and the Corresponding Source of the work is not available for anyone to copy, free of charge and under the terms of this License, through a publicly available network server or other readily accessible means, then you must either (1) cause the Corresponding Source to be so available, or (2) arrange to deprive yourself of the benefit of the patent license for this particular work, or (3) arrange, in a manner consistent with the requirements of this License, to extend the patent license to downstream recipients. "Knowingly relying" means you have actual knowledge that, but for the patent license, your conveying the covered work in a country, or your recipient's use of the covered work in a country, would infringe one or more identifiable patents in that country that you have reason to believe are valid.

If, pursuant to or in connection with a single transaction or arrangement, you convey, or propagate by procuring conveyance of, a covered work, and grant a patent license to some of the parties receiving the covered work authorizing them to use, propagate, modify or convey a specific copy of the covered work, then the patent license you grant is automatically extended to all recipients of the covered work and works based on it.

A patent license is "discriminatory" if it does not include within the scope of its coverage, prohibits the exercise of, or is conditioned on the non-exercise of one or more of the rights that are specifically granted under this License. You may not convey a covered work if you are a party to an arrangement with a third party that is in the business of distributing software, under which you make payment to the third party based on the extent of your activity of conveying the work, and under which the third party grants, to any of the parties who would receive the covered work from you, a discriminatory patent license (a) in connection with copies of the covered work conveyed by you (or copies made from those copies), or (b) primarily for and in connection with specific products or compilations that contain the covered work, unless you entered into that arrangement, or that patent license was granted, prior to 28 March 2007.

Nothing in this License shall be construed as excluding or limiting any implied license or other defenses to infringement that may otherwise be available to you under applicable patent law.

12. No Surrender of Others' Freedom.

If conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot convey a covered work so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not convey it at all. For example, if you agree to terms that obligate you to collect a royalty for further conveying from those to whom you convey the Program, the only way you could satisfy both those terms and this License would be to refrain entirely from conveying the Program.

13. Use with the GNU Affero General Public License.

Notwithstanding any other provision of this License, you have permission to link or combine any covered work with a work licensed under version 3 of the GNU Affero General Public License into a single combined work, and to convey the resulting work. The terms of this License will continue to apply to the part which is the covered work, but the special requirements of the GNU Affero General Public License, section 13, concerning interaction through a network will apply to the combination as such.

14. Revised Versions of this License.

The Free Software Foundation may publish revised and/or new versions of the GNU General Public 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.

Each version is given a distinguishing version number. If the Program specifies that a certain numbered version of the GNU General Public License "or any later version" applies to it, you have the option of following the terms and conditions either of that numbered version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of the GNU General Public License, you may choose any version ever published by the Free Software Foundation.

If the Program specifies that a proxy can decide which future versions of the GNU General Public License can be used, that proxy's public statement of acceptance of a version permanently authorizes you to choose that version for the Program.

Later license versions may give you additional or different permissions. However, no additional obligations are imposed on any author or copyright holder as a result of your choosing to follow a later version.

15. Disclaimer of Warranty.

THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16. Limitation of Liability.

IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MODIFIES AND/OR CONVEYS THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

17. Interpretation of Sections 15 and 16.

If the disclaimer of warranty and limitation of liability provided above cannot be given local legal effect according to their terms, reviewing courts shall apply local law that most closely approximates an absolute waiver of all civil liability in connection with the Program, unless a warranty or assumption of liability accompanies a copy of the Program in return for a fee.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively state the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
    <one line to give the program's name and a brief idea of what it does.>
    Copyright (C) <year>  <name of author>

    This program is free software: you can redistribute it and/or modify
    it under the terms of the GNU General Public License as published by
    the Free Software Foundation, either version 3 of the License, or
    (at your option) any later version.

    This program is distributed in the hope that it will be useful,
    but WITHOUT ANY WARRANTY; without even the implied warranty of
    MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
    GNU General Public License for more details.

    You should have received a copy of the GNU General Public License
    along with this program.  If not, see <http://www.gnu.org/licenses/>.
```

Also add information on how to contact you by electronic and paper mail.

If the program does terminal interaction, make it output a short notice like this when it starts in an interactive mode:

```
    <program>  Copyright (C) <year>  <name of author>
    This program comes with ABSOLUTELY NO WARRANTY; for details type `show
w'.
    This is free software, and you are welcome to redistribute it
    under certain conditions; type `show c' for details.
```

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, your program's commands might be different; for a GUI interface, you would use an "about box".

You should also get your employer (if you work as a programmer) or school, if any, to sign a "copyright disclaimer" for the program, if necessary. For more information on this, and how to apply and follow the GNU GPL, see <http://www.gnu.org/licenses/>.

The GNU General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License instead of this License. But first, please read <http://www.gnu.org/philosophy/why-not-lgp

The GNU Lesser General Public License

GNU LESSER GENERAL PUBLIC LICENSE
Version 3, 29 June 2007

Copyright (C) 2007 Free Software Foundation, Inc. <http://fsf.org/>
Everyone is permitted to copy and distribute verbatim copies
of this license document, but changing it is not allowed.

This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.

0. Additional Definitions.

As used herein, "this License" refers to version 3 of the GNU Lesser General Public License, and the "GNU GPL" refers to version 3 of the GNU General Public License.

"The Library" refers to a covered work governed by this License, other than an Application or a Combined Work as defined below.

An "Application" is any work that makes use of an interface provided by the Library, but which is not otherwise based on the Library. Defining a subclass of a class defined by the Library is deemed a mode of using an interface provided by the Library.

A "Combined Work" is a work produced by combining or linking an Application with the Library. The particular version of the Library with which the Combined Work was made is also called the "Linked Version".

The "Minimal Corresponding Source" for a Combined Work means the Corresponding Source for the Combined Work, excluding any source code for portions of the Combined Work that, considered in isolation, are based on the Application, and not on the Linked Version.

The "Corresponding Application Code" for a Combined Work means the object code and/or source code for the Application, including any data and utility programs needed for reproducing the Combined Work from the Application, but excluding the System Libraries of the Combined Work.

1. Exception to Section 3 of the GNU GPL.

You may convey a covered work under sections 3 and 4 of this License without being bound by section 3 of the GNU GPL.

2. Conveying Modified Versions.

If you modify a copy of the Library, and, in your modifications, a facility refers to a function or data to be supplied by an Application that uses the facility (other than as an argument passed when the facility is invoked), then you may convey a copy of the modified version:

a) under this License, provided that you make a good faith effort to ensure that, in the event an Application does not supply the function or data, the facility still operates, and performs whatever part of its purpose remains meaningful, or

b) under the GNU GPL, with none of the additional permissions of this License applicable to that copy.

3. Object Code Incorporating Material from Library Header Files.

The object code form of an Application may incorporate material from a header file that is part of the Library. You may convey such object code under terms of your choice, provided that, if the incorporated material is not limited to numerical parameters, data structure layouts and accessors, or small macros, inline functions and templates (ten or fewer lines in length), you do both of the following:

a) Give prominent notice with each copy of the object code that the Library is used in it and that the Library and its use are covered by this License.

b) Accompany the object code with a copy of the GNU GPL and this license document.

4. Combined Works.

You may convey a Combined Work under terms of your choice that, taken together, effectively do not restrict modification of the portions of the Library contained in the Combined Work and reverse engineering for debugging such modifications, if you also do each of the following:

a) Give prominent notice with each copy of the Combined Work that the Library is used in it and that the Library and its use are covered by this License.

b) Accompany the Combined Work with a copy of the GNU GPL and this license document.

c) For a Combined Work that displays copyright notices during execution, include the copyright notice for the Library among these notices, as well as a reference directing the user to the copies of the GNU GPL and this license document.

d) Do one of the following:

0) Convey the Minimal Corresponding Source under the terms of this License, and the Corresponding Application Code in a form suitable for, and under terms that permit, the user to recombine or relink the Application with a modified version of the Linked Version to produce a modified Combined Work, in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.

1) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (a) uses at run time a copy of the Library already present on the user's computer

```
        system, and (b) will operate properly with a modified version
        of the Library that is interface-compatible with the Linked
        Version.

    e) Provide Installation Information, but only if you would otherwise
    be required to provide such information under section 6 of the
    GNU GPL, and only to the extent that such information is
    necessary to install and execute a modified version of the
    Combined Work produced by recombining or relinking the
    Application with a modified version of the Linked Version. (If
    you use option 4d0, the Installation Information must accompany
    the Minimal Corresponding Source and Corresponding Application
    Code. If you use option 4d1, you must provide the Installation
    Information in the manner specified by section 6 of the GNU GPL
    for conveying Corresponding Source.)

  5. Combined Libraries.

  You may place library facilities that are a work based on the
Library side by side in a single library together with other library
facilities that are not Applications and are not covered by this
License, and convey such a combined library under terms of your
choice, if you do both of the following:

    a) Accompany the combined library with a copy of the same work based
    on the Library, uncombined with any other library facilities,
    conveyed under the terms of this License.

    b) Give prominent notice with the combined library that part of it
    is a work based on the Library, and explaining where to find the
    accompanying uncombined form of the same work.

  6. Revised Versions of the GNU Lesser General Public License.

  The Free Software Foundation may publish revised and/or new versions
of the GNU Lesser General Public 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.

  Each version is given a distinguishing version number. If the
Library as you received it specifies that a certain numbered version
of the GNU Lesser General Public License "or any later version"
applies to it, you have the option of following the terms and
conditions either of that published version or of any later version
published by the Free Software Foundation. If the Library as you
received it does not specify a version number of the GNU Lesser
General Public License, you may choose any version of the GNU Lesser
General Public License ever published by the Free Software Foundation.

  If the Library as you received it specifies that a proxy can decide
whether future versions of the GNU Lesser General Public License shall
apply, that proxy's public statement of acceptance of any version is
permanent authorization for you to choose that version for the
Library.
```

Berkeley Database (BDB) License

```
/*
 * Copyright (c) 1990-2006
 *      Oracle Corporation.  All rights reserved.
 *
```

```
 * Redistribution and use in source and binary forms, with or without
 * modification, are permitted provided that the following conditions
 * are met:
 * 1. Redistributions of source code must retain the above copyright
 *    notice, this list of conditions and the following disclaimer.
 * 2. Redistributions in binary form must reproduce the above copyright
 *    notice, this list of conditions and the following disclaimer in the
 *    documentation and/or other materials provided with the distribution.
 * 3. Redistributions in any form must be accompanied by information on
 *    how to obtain complete source code for the DB software and any
 *    accompanying software that uses the DB software.  The source code
 *    must either be included in the distribution or be available for no
 *    more than the cost of distribution plus a nominal fee, and must be
 *    freely redistributable under reasonable conditions.  For an
 *    executable file, complete source code means the source code for all
 *    modules it contains.  It does not include source code for modules or
 *    files that typically accompany the major components of the operating
 *    system on which the executable file runs.
 *
 * THIS SOFTWARE IS PROVIDED BY ORACLE CORPORATION ``AS IS'' AND ANY EXPRESS
 * OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED
 * WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR
 * NON-INFRINGEMENT, ARE DISCLAIMED.  IN NO EVENT SHALL ORACLE CORPORATION
 * BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR
 * CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF
 * SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS
 * INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
 * CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
 * ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF
 * THE POSSIBILITY OF SUCH DAMAGE.
 */
/*
 * Copyright (c) 1990, 1993, 1994, 1995
 *      The Regents of the University of California.  All rights reserved.
 *
 * Redistribution and use in source and binary forms, with or without
 * modification, are permitted provided that the following conditions
 * are met:
 * 1. Redistributions of source code must retain the above copyright
 *    notice, this list of conditions and the following disclaimer.
 * 2. Redistributions in binary form must reproduce the above copyright
 *    notice, this list of conditions and the following disclaimer in the
 *    documentation and/or other materials provided with the distribution.
 * 3. Neither the name of the University nor the names of its contributors
 *    may be used to endorse or promote products derived from this software
 *    without specific prior written permission.
 *
 * THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS ``AS IS'' AND
 * ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE
 * IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE
 * ARE DISCLAIMED.  IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE
 * FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL
 * DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS
 * OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION)
 * HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT
 * LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY
```

```
 * OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF
 * SUCH DAMAGE.
 */
/*
 * Copyright (c) 1995, 1996
 *      The President and Fellows of Harvard University.  All rights reserved.
 *
 * Redistribution and use in source and binary forms, with or without
 * modification, are permitted provided that the following conditions
 * are met:
 * 1. Redistributions of source code must retain the above copyright
 *    notice, this list of conditions and the following disclaimer.
 * 2. Redistributions in binary form must reproduce the above copyright
 *    notice, this list of conditions and the following disclaimer in the
 *    documentation and/or other materials provided with the distribution.
 * 3. Neither the name of the University nor the names of its contributors
 *    may be used to endorse or promote products derived from this software
 *    without specific prior written permission.
 *
 * THIS SOFTWARE IS PROVIDED BY HARVARD AND ITS CONTRIBUTORS ``AS IS'' AND
 * ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE
 * IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE
 * ARE DISCLAIMED.  IN NO EVENT SHALL HARVARD OR ITS CONTRIBUTORS BE LIABLE
 * FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL
 * DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS
 * OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION)
 * HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT
 * LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY
 * OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF
 * SUCH DAMAGE.
 */
```