Libraries

Chapter 8

Introduction

- **Libraries** contain code that is already written that we can use in our programs
  - Commonly contain **functions**, **structures**, **enumerations**, and **constants**
- Usually specific to some task or technology
  - Math library, graphics library, etc.

Using a Library

- To use a library, we first need to include the appropriate header file from the library in our program
  - The header file contains structure, enumeration, and constant definitions as well as function prototypes

- Then we need to link in the library when compiling
- Accomplished with the -l switch (lowercase L) immediately followed by the library name
  - **gcc *program*.c -l*libraryName***
    - Note there's not space between -l and the name

- Compiler has a list of default directories to look for the header and the library
- Headers are commonly kept in
  - **/usr/include**
- Libraries are usually stored in
  - **/usr/lib**

- We can tell to compiler to look in additional directories for headers with the -I switch (capital i)
  - **gcc *program*.c -I/*some/path***
- Similarly, we can tell the compiler to look for libraries in another directory with -L switch
  - **gcc *program*.c -L/*some/path***

Purpose of Libraries

- Why do we use libraries?
  - Convenience / Avoid Redundancy
  - Expertise
  - Hardware / System Independence
    - Figure 8.1 page 262
    - Figure 8.2 page 263

Common Libraries

- Many, many different libraries, some common ones are:
  - C Standard Library
  - curses
  - Xlib
  - OpenGL

C Standard Library

- Been using C Standard Library throughout the course
  - printf(), strlen(), sqrt(), fopen(), etc.
- Actually several libraries grouped together
  - math, strings, files, etc.
- Header files include stdio.h, stdlib.h, math.h, string.h, time.h, etc.

- So common, generally don't need to add the -l switch when compiling
  - Might have to add one for math functions on Linux
- Most compilers automatically add the switch to compiler command

curses

- **curses** is a library for creating text-based user interfaces
  - Name based on the word cursor
- Nowadays, ncurses (new curses) is pretty common
- These types of programs common for installing or configuring Linux or Unix when a GUI is not available

- **curses_demo.c**
  - Includes header
  - Compile command needs to link to the library

Xlib

- Several different layers of libraries used for GUI in Unix and Linux
- **Xlib** is the foundation or basis upon which most of these operate
- Xlib is responsible for basic window creation and management and can do some 2D drawing

- Other libraries for user interfaces in desktop applications or graphics operate on top of Xlib
  - Figure 8.7 page 276
- GTK+ is a library often used for GNU desktop applications and the Gnome desktop environment
- Qt is another library, KDE desktop environment uses it

- **xlib_demo1.c**
  - Creates a simple window
  - Has a Display, Window, and GC variable
    - Structures describing the window and how to draw on it

- **xlib_demo2.c**
  - Draws lines on the window
  - Gets coordinates for lines from the user

OpenGL

- **OpenGL** is a popular open source graphics library
- Often used in 3D games and simulators
- Most GUI libraries have some capabilities for at least basic 2D graphics, but most don't support 3D graphics

- OpenGL itself is for drawing graphics, it doesn't have support for creating windows
- Another library called **GLUT** is usually used alongside to actually create the windows

- **opengl_demo1.c**
  - Draws a simple square and triangle
  - glut~ functions deal with the window and program
  - gl~ functions deal with the actual rendering
  - Uses callback functions to specify rendering functions to periodically call

- **opengl_demo2.c**
  - Draws in 3D now, cube and pyramid
  - Also draws in color
  - And is rotating the shapes