Programming in Linux Environment 2017-B
Assignment 4: Compiled projects

Deadline: Thursday, 4/05/2017

This assignment should be submitted as a single *.tar.gz* file. The assignment should be submitted in groups of 3 students. Names and IDs of the students in the group must be written in a separate README file, and also listed in the submission comment in Moodle.

Task 1

The files in this task should reside in part1 subdirectory.

Initialize the following *x86-64* project:

- main.c — main program file
- helper.h, helper.c — auxiliary functions

The helper module should contain a logging function, and a function for solving a quadratic equation $ax^2 + bx + c = 0$. The main program should ask for quadratic equation input a, b, c and print the results using the logging function.

A preprocessor define VERBOSE_LOGGING must be supported that switches between simple and verbose logging.

Write the script build that compiles the project into a prog executable, as follows:

- script receives options --compiler and --linker with compiler and linker options (the latter are passed to linker using -Wl option of the compiler)
- script receives an optional --strip switch, that strips the resulting executable of debugging information, using strip command
- helper module is put into a static libhelper.a library using ar, this library is added to the executable during linking phase
- **only** the required compile, link, archive addition actions are performed — build a dependency graph beforehand, and compare file modification timestamps
- compiler and linker phases are separate (i.e., don't use multi-stage commands like gcc -o prog main.c)

Example:
./build --compiler "-static -march=native -DVERBOSE_LOGGING -Wall" --linker "-O 1 -z combreloc" --strip

Task 2

The files in this task should reside in part2 subdirectory.

Separate the files into subdirectories:

- src — sources and headers
- obj — generated object files
- lib — libraries
- bin — executables

The build script resides at top level.

Add assembly file delta.asm in *NASM* syntax[1] that contains a function for computing the delta part of quadratic equation solution — $b^2 - 4ac$, with a corresponding delta.h header. Use the Linux x86-64 calling convention[2] for working with parameters, and compile with -f elf64 option of nasm. You may find the objconv tool[3] useful for generating the assembly.

Compile helper.c as a dynamic library, and use linker's -rpath option to enable the executable to find libhelper.so under lib (when executed as bin/prog). Remember to provide the same -shared -fpic parameters at both the compiling and the linking stages.

Adjust the build script to perform all of the above, and add the following options:

- --clean — cleans all the generated files
- --deps — shows file dependencies using gcc -MM option.

Good luck!

[1] http://cs.lmu.edu/~ray/notes/nasmtutorial/
[2] https://en.wikipedia.org/wiki/X86_calling_conventions
[3] https://github.com/vertis/objconv