National Institute of Technology Calicut
Department of Computer Science and Engineering

CS4086E: Systems Programming Lab

Introduction to Make

Practice Questions

1) Write a Makefile to compile a C project with multiple source files.
   You are given the following files in your project: main.c, utils.c, and math.c. Write a Makefile that compiles these files into an executable app. The main.c file should include utils.h and math.h and and utils.c should include math.h.

2) Create a Makefile that compiles a program with object files located in different directories.
   - You have two directories: src/ (for C files) and obj/ (for object files).
   - Write a Makefile that:
     - Compiles all .c files in src/ into .o files in the obj/ directory.
     - Links the object files into an executable program.
     - Assume there are multiple .c files and no subdirectories in src/

3) Write a Makefile that:
   - Compiles all .c files in the src/ directory.
   - Automatically tracks dependencies on header files, so if a header file is changed, the corresponding .o files are recompiled.

     Example Directory structure:

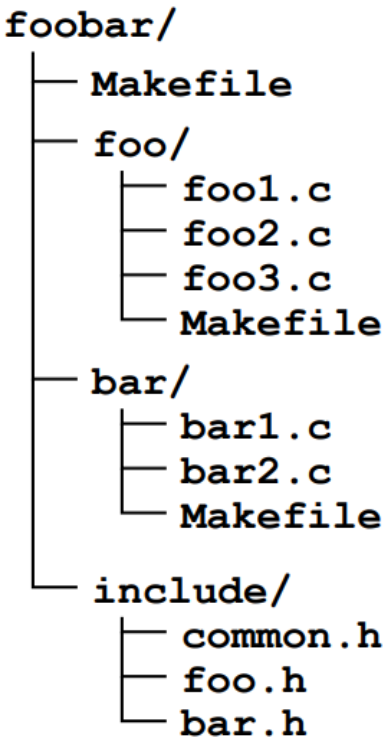
```
Project/
 |--- Makefile
 |--- src/
          |--- main.c
          |--- utils.c
          |--- math.c
 |---  obj/        # Object files will be placed here (main.o, utils.o, etc.)
 |--- deps/        # Dependency files (main.d, utils.d, etc.)
 |--- program   # Executable file
```

4) You have a project with root directory **foobar** (see the below figure) for preparing a shared (that is, dynamic) library libfoobar.so. The source codes are in **two subdirectories**: **foo** contains the foomatic functions, and **bar** contains the bargodic functions. All the required header files reside in the subdirectory include. Both the foomatic and the bargodic functions require the header file common.h. The foomatic functions additionally require the header file foo.h, and the bargodic functions the header file bar.h. A makefile in the foo directory is meant for generating the object files from the foomatic source files, and a makefile in the bar directory is meant for generating the object files from the bargodic source files. No libraries are to be prepared in the foo and the bar directories. A top-level makefile in the foobar directory is meant for recursively invoking the makefiles of the foo and the bar subdirectories and finally combining all the object files into the dynamic library file (in the foobar

directory). The source files use the #include format. There is no need to write install and clean targets.

Write the three makefiles :

1. Makefile in foobar/
2. Makefile in foobar/foo/
3. Makefile in foobar/bar/



Instructions:

1. Date of Submission: on or before 30, Jan.'25
2. Upload the scripts in the Eduserver as a compressed folder containing all the codes named individually.
3. Name of the file: FirstName_RollNo.rar