

# [System Programming] Assignment #2

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# Assignment #2 (100 points)

- Due April 18, 2025: 11:59pm
- Platform
  - We will work on Ubuntu 22.10
  - <https://releases.ubuntu.com/kinetic/> (Desktop image)
- If you use MAC, please use Docker Desktop on Mac
  - <https://docs.docker.com/desktop/install/mac-install/>
- If you cannot make this environment, please contact our TA
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# Goal

- Write a program that modifies an ELF file's "rodata" section.
- First, you need to implement a function to check whether the file is really an ELF file or not.
  - If the file is ELF file, you MUST print out **"ELF"**.
- Second, the program must modify the .rodata section as follows.
  - 1. Find a string **"rodata rodata rodata Can you modify this?"**
  - 2. Modify the string to **"I modified it"**  
so that when the elf file execute, it uses the modified string



# Editro

- You will be given source code of a program “editro” that prints basic information of an ELF file and the exact location of the rodata section.
- Given files are editro.c, editro.h, and Makefile.
- Use these files to complete this assignment
- On the following slides, we will provide details (“Mandatory Guidelines”) you must refer.

# Mandatory Guidelines

- The ./assignment2 [binary to be edited] command does the following two.
  - It checks whether the [binary to be edited] file is ELF file through magic number and outputs ONLY the “ELF” string as it is, with case-sensitive. If the binary is not ELF file, It just exits without any output.
  - After confirming that the [binary to be edited] file is ELF file, you must replace the original output string “rodata rodata Can you modify this?” with “I modified it” as it is, with case-sensitive.

# Mandatory Guidelines

- Only C language is allowed. C++, assembly is not allowed.
- The editro.c, editro.h should be changed to assignment2.c, assignment2.h and the built binary name should be assignment2.
  - Do not create additional source files(.c/.h) other than assignment2.c and assignment2.h.
- You are only allowed to modify assignment2.c, assignment2.h and Makefile.
- Makefile needs to be modified to change the binary name and two file names, but linker flag, compiler flag and compiler should not be modified in Makefile.
- Running time and memory overhead are not important in this assignment.

# Example of the assignment #2

- Given files – editor.[c/h], Makefile

```
zeroone@s21lab-04:~/hw/hw1$ tree
├── editro.c
├── editro.h
└── Makefile

0 directories, 3 files
zeroone@s21lab-04:~/hw/hw1$ make
gcc -c -o editro.o editro.c -Wall -g -I.
In file included from editro.c:1:
./editro.h:18:14: error: expected declaration specifiers or '...' before '?' token
   18 | bool is_elf( ?? )
      |              ^
editro.c: In function 'main':
editro.c:23:17: error: expected expression before '?' token
   23 |     if(!is_elf( ?? )) {
      |                 ^
make: *** [Makefile:11: editro.o] Error 1
zeroone@s21lab-04:~/hw/hw1$
```

File names MUST be renamed

You will get some errors when you try to build given files without modification

- What you should do – assignment2.[c/h], Makefile

```
zeroone@s21lab-04:~/hw/hw1$ tree
├── assignment2.c
├── assignment2.h
└── Makefile

0 directories, 3 files
zeroone@s21lab-04:~/hw/hw1$ make
gcc -c -o assignment2.o assignment2.c -Wall -g -I.
gcc -o assignment2 assignment2.o -Wall -g -I.
zeroone@s21lab-04:~/hw/hw1$ ../test
rodاتا rodاتا rodاتا Can you modify this?
zeroone@s21lab-04:~/hw/hw1$ ./assignment2 ../test
ELF
zeroone@s21lab-04:~/hw/hw1$ ../test
I modified it
zeroone@s21lab-04:~/hw/hw1$ tree
.
├── assignment2
├── assignment2.c
├── assignment2.h
├── assignment2.o
└── Makefile

0 directories, 5 files
zeroone@s21lab-04:~/hw/hw1$
```

Binary to be edited

The figure shows how the built program("assignment2") should work

# Submission

- You should submit your code with a code description that explains your code (i.e., comments in the file). In the description, your code must be well commented to explain your algorithm. Make your code .zip file with "StudentID\_YourName.zip" and submit your .zip file on blackboard.

ex)

20195147\_HongjunYang.zip

- assignment2.c // assignment2 code
- assignment2.h // assignment2 header file
- Makefile // Makefile
- report.pdf // assignment2 code description

For the report, please write it briefly.

More specifically, It is enough to copy and paste the important part of your source code and briefly describe it.



# Helpful Sites

- How to determine this file is ELF binary?

```
zeroone@s21ab-04:~/hw/hw1$ xxd -g 1 -l 150 ./test
00000000: 7f 45 4c 46 02 01 01 00 00 00 00 00 00 00 00 00  .ELF.....
```

- [https://en.wikipedia.org/wiki/Executable\\_and\\_Linkable\\_Format](https://en.wikipedia.org/wiki/Executable_and_Linkable_Format)

- How to modify Makfile?

- <https://www.gnu.org/software/make/manual/make.html>
- [https://www.tutorialspoint.com/makefile/makefile\\_example.htm](https://www.tutorialspoint.com/makefile/makefile_example.htm)

- Helpful C functions, or you can use other functions.

- <https://man7.org/linux/man-pages/man2/lseek.2.html>
- <https://man7.org/linux/man-pages/man3/strstr.3.html>
- <https://man7.org/linux/man-pages/man2/write.2.html>