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CS 2750
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Report: Project 2

This project involved using Unix system calls and functions to change the permissions on one or more files. The first challenge was flexible parsing of command line options. This was accomplished by the use of the C library function `getopt`. Valid options included: `u,g,o,U,G,O`. For each of these options that were present, the program would check each character of `optarg` which corresponded to file permissions. Two variables of type `mode_t` called `addPermissions` and `removePermissions` were created and initialized to 0. If a valid a permission character was present in `optarg`, a bit in in either `addPermissions` or `removePermissions` would be set to 1. The specific bit to be set depended on which option and which permission character (`r`, `w`, `x`). `U,G,O` corresponded to `removePermissions` and `u,g,o` to `addPermissions`.

The function `getopt` also made it easy to check remaining command line arguments which in the case of this program meant files. The function `stat` was used to check if a file existed, and if so stored information in structure variable `'fileStat'`. This variable was used to retrieve original permissions of a file. Using bitwise operators with the original permissions, `addPermissions`, and `removePermissions` allowed me to compute the final mode that a file should be in. This, along with the file name was passed to a system call to `chmod`.

```
sentient@Wilderness: ~/dev/C/Project-2
sentient@Wilderness:~/dev/C/Project-2$ pwd
/home/sentient/dev/C/Project-2
sentient@Wilderness:~/dev/C/Project-2$ ls
Makefile  Makefile~  obj  README  README~  README,v  src
sentient@Wilderness:~/dev/C/Project-2$ make
gcc -c -Wall -g src/main.c -o obj/main.o
gcc obj/main.o -o mychmod
sentient@Wilderness:~/dev/C/Project-2$ ls
Makefile  Makefile~  mychmod  obj  README  README~  README,v  src
sentient@Wilderness:~/dev/C/Project-2$ ./mychmod

SYNOPSIS
./mychmod OPTION... PERMISSION... FILE...

DESCRIPTION
Uses unix system calls and functions to change
the permissions on one or more files.

OPTIONS
-u      Add permissions for user.
-g      Add permissions for group.
-o      Add permissions for other.
-U      Remove permissions for user.
-G      Remove permissions for group.
-O      Remove permissions for group.

PERMISSIONS
r      READ
w      WRITE
x      EXECUTE

Exit status: 0
sentient@Wilderness:~/dev/C/Project-2$
```

Initial compilation and running without arguments

```
sentient@Wilderness: ~/dev/C/Project-2
sentient@Wilderness:~/dev/C/Project-2$ ./mychmod -f

***Unknown option '-f'***

SYNOPSIS
./mychmod OPTION... PERMISSION... FILE...

DESCRIPTION
Uses unix system calls and functions to change
the permissions on one or more files.

OPTIONS
-u      Add permissions for user.
-g      Add permissions for group.
-o      Add permissions for other.
-U      Remove permissions for user.
-G      Remove permissions for group.
-O      Remove permissions for group.

PERMISSIONS
r      READ
w      WRITE
x      EXECUTE

Exit status: 1
sentient@Wilderness:~/dev/C/Project-2$
```

Running with invalid option

```
sentient@Wilderness: ~/dev/C/Project-2
sentient@Wilderness:~/dev/C/Project-2$ ./mychmod -u

***Option -u requires an argument***

SYNOPSIS
./mychmod OPTION... PERMISSION... FILE...

DESCRIPTION
Uses unix system calls and functions to change
the permissions on one or more files.

OPTIONS
-u      Add permissions for user.
-g      Add permissions for group.
-o      Add permissions for other.
-U      Remove permissions for user.
-G      Remove permissions for group.
-O      Remove permissions for group.

PERMISSIONS
r      READ
w      WRITE
x      EXECUTE
Exit status: 1
sentient@Wilderness:~/dev/C/Project-2$ ./mychmod -u
```

Running valid option without argument (permissions) following

```
sentient@Wilderness: ~/dev/C/Project-2
sentient@Wilderness:~/dev/C/Project-2$ ./mychmod -urwx
No file specified
Exit Status: 2
sentient@Wilderness:~/dev/C/Project-2$
```

Running with valid option and permissions, but no file specified

```
sentient@Wilderness: ~/dev/C/Project-2
sentient@Wilderness:~/dev/C/Project-2$ ls
Makefile Makefile~ mychmod obj README README~ README,v src
sentient@Wilderness:~/dev/C/Project-2$ cat > hello.txt
Hello World!sentient@Wilderness:~/dev/C/Project-2$ ls -l
total 52
-rw-rw-r-- 1 sentient sentient 12 Mar 14 20:09 hello.txt
-rw----- 1 sentient sentient 312 Mar 14 20:01 Makefile
-rw----- 1 sentient sentient 355 Mar 14 19:58 Makefile~
-rwxrwxr-x 1 sentient sentient 17344 Mar 14 20:09 mychmod
drwx----- 2 sentient sentient 4096 Mar 14 20:09 obj
-rw----- 1 sentient sentient 1518 Mar 14 19:59 README
-rw----- 1 sentient sentient 1380 Mar 14 19:57 README~
-r----- 1 sentient sentient 1575 Mar 14 19:59 README,v
drwx----- 3 sentient sentient 4096 Mar 14 20:08 src
sentient@Wilderness:~/dev/C/Project-2$ ./mychmod -Gwx -Owx hello.txt
Exit status: 0
sentient@Wilderness:~/dev/C/Project-2$ ls -l
total 52
-rw-rw-r-- 1 sentient sentient 12 Mar 14 20:09 hello.txt
-rw----- 1 sentient sentient 312 Mar 14 20:01 Makefile
-rw----- 1 sentient sentient 355 Mar 14 19:58 Makefile~
-rwxrwxr-x 1 sentient sentient 17344 Mar 14 20:09 mychmod
drwx----- 2 sentient sentient 4096 Mar 14 20:09 obj
-rw----- 1 sentient sentient 1518 Mar 14 19:59 README
-rw----- 1 sentient sentient 1380 Mar 14 19:57 README~
-r----- 1 sentient sentient 1575 Mar 14 19:59 README,v
drwx----- 3 sentient sentient 4096 Mar 14 20:08 src
sentient@Wilderness:~/dev/C/Project-2$
```

Proper running with single file; ls -l to show results

```
sentient@Wilderness: ~/dev/C/Project-2
sentient@Wilderness:~/dev/C/Project-2$ cat > otherFile.txt
This is yet another test...sentient@Wilderness:~/dev/C/Project-2$ ls -l
total 56
-rw-rw-r-- 1 sentient sentient 12 Mar 14 20:09 hello.txt
-rw----- 1 sentient sentient 312 Mar 14 20:01 Makefile
-rw----- 1 sentient sentient 355 Mar 14 19:58 Makefile~
-rwxrwxr-x 1 sentient sentient 17344 Mar 14 20:09 mychmod
drwx----- 2 sentient sentient 4096 Mar 14 20:09 obj
-rw-rw-r-- 1 sentient sentient 27 Mar 14 20:11 otherFile.txt
-rw----- 1 sentient sentient 1518 Mar 14 19:59 README
-rw----- 1 sentient sentient 1380 Mar 14 19:57 README~
-r----- 1 sentient sentient 1575 Mar 14 19:59 README,v
drwx----- 3 sentient sentient 4096 Mar 14 20:08 src
sentient@Wilderness:~/dev/C/Project-2$ ./mychmod -gw -ox -gx -gw hello.txt otherFile.txt
Exit status: 0
sentient@Wilderness:~/dev/C/Project-2$ ls -l
total 56
-rw-rwxr-x 1 sentient sentient 12 Mar 14 20:09 hello.txt
-rw----- 1 sentient sentient 312 Mar 14 20:01 Makefile
-rw----- 1 sentient sentient 355 Mar 14 19:58 Makefile~
-rwxrwxr-x 1 sentient sentient 17344 Mar 14 20:09 mychmod
drwx----- 2 sentient sentient 4096 Mar 14 20:09 obj
-rw-rwxr-x 1 sentient sentient 27 Mar 14 20:11 otherFile.txt
-rw----- 1 sentient sentient 1518 Mar 14 19:59 README
-rw----- 1 sentient sentient 1380 Mar 14 19:57 README~
-r----- 1 sentient sentient 1575 Mar 14 19:59 README,v
drwx----- 3 sentient sentient 4096 Mar 14 20:08 src
sentient@Wilderness:~/dev/C/Project-2$
```

Running with options split up and multiple files specified

Conclusion

This was a fun program to create as it involved experimenting with parsing command line options and using system calls. I especially found command line parsing useful, and I will incorporate into my future programs. I learned a lot about various libraries, and a greater understanding of how more complex C programs are created.