Operating Systems 0512.4402

Homework 5: Reading the xv6 filesystem in Linux

xv6 includes a filesystem similar to that used in early Unix. The filesystem image is available in the QEMU disk image file fs.img, and when we run "make qemu-nox" we can run simple user space commands which manipulate the filesystem such as cd, ls, and mkdir. For example, typing ls in the root directory from within the xv6 shell shows an output similar to:

```
.              1 1 512
..             1 1 512
README         2 2 2286
cat            2 3 15516
echo           2 4 14396
forktest       2 5 8840
grep           2 6 18360
helloworld     2 7 17288
hellostack     2 8 14388
init           2 9 15020
kill           2 10 14480
ln             2 11 14380
ls             2 12 16948
mkdir          2 13 14508
rm             2 14 14488
sh             2 15 28544
stressfs       2 16 15412
usertests      2 17 62916
wc             2 18 15944
zombie         2 19 14064
console        3 20 0
tmpdir         1 21 32
```

Where the first column is the file or directory name, the second column is the type (1 for directory, 2 for file, 3 for special device file), the third column is the inode number, and the last column is the size.

The goal of this exercise is to write a user-space application, which will run under Linux (not under xv6), and be able to understand the xv6 filesystem internal data structures (superblock, inodes, directory entries, etc), to the point where we can:

1. Display in Linux a listing of the xv6 root directory similar to the ls output from within xv6 above.
2. Be able to exract a file from within the root directory in the xv6 filesytem image, and write it as a normal file in Linux.

The command syntax is one of the following two lines:

```
hw5 fs.img ls
hw5 fs.img cp xv6file linuxfile
```

- fs.img is the xv6 filesystem image file.
- If the second argument is `ls`, the root directory listing should be displayed, in the same 4 column format shown above, as if we were running ls from within xv6.
- If the second argument is `cp`, then we need to extract the contents of the file named xv6file from within the root directory of xv6, and write it to a file under linux named linuxfile.
- xv6file will not contain any path to another directory, it will just be a file name. If it does not exist in the root directory of the xv6 filesystem, an error: "File %s does not exist in the root directory" should be displayed, where %s is the file name.
- fs.img and linuxfile are names of files in Linux, and can contain path elements.

The xv6 filesystem is partially documented in chapter 6 of the xv6 book. For any missing details, read the xv6 source code :)

Submission guidelines

- The solution should be submitted in moodle in a gzipped tar file called hw5_id1_id2.tgz, where id1 and id2 are the "tehudat zehut" of the two students (or hw5_id.tgz if submitting alone).
- The tgz file should contain a subdirectory hw5_id1_id2, and in the subdirectory there should be a Makefile, as well as the .c and .h source files. Running "make" should build the code into an executable called "hw5". Running "make clean" should clean up the executables and object files.
- Make sure to have comments in your source code.
- Submit an external documentation pdf in a file called hw5_id1_id2.pdf, describing your solution.