Name: Dayu Liu Career Account ID (email): liu1589@purdue.edu

Homework 5

Due: November 24th (Sunday), 11:59 pm on Blackboard

This homework requires you to think about files and directories in a Unix file system (e.g., Linux). You may need to look up details on the web.

A user with user ID 100 and group ID 200 enters the commands below. For purposes of this homework, we will assume the time when a user starts is 4298400 (decimal), and that each command takes 1 second to enter. Thus, line 2 is executed at time 4298401 and so on.

Line number	Command
1	`mkdir a`
2	`mkdir b`
3	`mkdir c`
4	`touch a/x`
5	`ln a/x b/y`
6	`echo hi there > a/x`
7	`cp a/x c/z`
8	`mv b/y ./g`
9	`echo bye > g`

1. You should already understand a Unix umask. If you do not, look up the meaning. Suppose the user umask is 022. What will the permissions be for directory ./a after line 1? Why?
   The permission for directory ./a is 755 (user: rwx, group: rx, other: rx) because the default permissions value for directory is 777. And 777 - 022 = 755
2. Suppose the inode number for ./a (line 1) is 19375. What will the inode contain after line 1 has been executed?
   It contains metadata such as owner's userID, groupID, file size, number of links, permissions, timestamps.
   It also contains all null pointers since nothing are included yet.
3. Does inode 19375 change after line 2 has been executed? If so, what changes?
   No, i-node for ./a will not changed for creation of ./b

4. Suppose the inode for a/x created in line 4 is 20030. What do the pointers in the inode contain afer line 4?

   Since the file was created as empty by touch command, it has an inode with all null pointers.

5. Do the pointers in inode 20030 change after line 5?

   After line 5, the number of pointers (links) for inode 20030 is 2 because line 5 performs hard link.

6. After line 5, what inode numbers will the directory entries for a/x and b/y contain? Why?

   The inode number for a/x and b/y are the same, which are 20030. Because it's hard link, which means b/y is just a name that references the original inode 20030.

7. Do the pointers in inode 20030 change after line 6?

   Yes, the pointers in inode 20030 will change after line 6 because content is modified.

8. When line 7 is executed, will any value in inode 20030 change? If so what? If not, why not?

   No. Because cp is soft link, which is like a shortcut, the original inode 20030 is not modified.

9. When line 8 is executed, does the "modified" time stamp in the inode corresponding to b/y change? Why or why not?

   No, because there is change regarding the move operation but the content is not modified. Thus the "changed" time stamp is changed, the "modified" time stamp stays the same.

10. After line 9, what are the contents of a/x and c/z? Why?

    a/x has "bye" and c/z has "hi there"

    Because when moving within a filesystem, the inode does not change, only the directory mapping of the inode is changed, the actual data on the hard disk (contents of the file) does not move. So when g is updated to "bye", a/x changes as well. However, because when copying a file, a new file with a new inode is created, c/z created by "cp" will not be updated by line 9 and thus keeps the content of "hi there"