UCS1304 Unix and Shell Programming
AY: 2021-22

Name: Krithika Swaminathan
Roll No.: 205001057

Assignment 2 – File Systems

Exercise 1:

Commands: cd [destination path] //path can be absolute or relative
mkdir [new directory] //can also be [path/directory]
ls [directory] //can also be [path/directory]

1. Launch the terminal. - A terminal window was opened.

2. Create three directories named letters, reports and assignment under your home directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ mkdir letters reports assignment

(3 new directories – *letters*, *reports* and *assignment* – were created in the home directory[1].)
Description: The mkdir command is used to create a new directory in the working directory. As shown in the above command, multiple directories can also be created at once using a single mkdir command.

3. Move to directory letters.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cd letters

(The working directory was changed from the home directory to *letters*.)
Description: The cd command is used to change the working directory to the directory specified in the argument.

4. Create two directories named friendly and formal under the letters directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/letters$ mkdir friendly formal

(2 new directories – *friendly* and *formal* – were created in the *letters* directory.)
Description: The mkdir command is used to create a new directory in the working directory. As shown in the above command, multiple directories can also be created at once using a single mkdir command.

5. Move to directory reports using only one command (directly from letters).
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/letters$ cd ../reports

(The working directory was changed from *letters* to *reports* without entering the common parent directory.)
Description: The cd command is used to change the working directory to the directory specified in the argument. Here, the file path uses .. to represent the parent directory of the working direcory.

6. Create three directories called personal, business, and school under the directory reports (use only one command).
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/reports$ mkdir personal business school

[1] For this assignment, *~/kriths* has been considered as the home directory to avoid issues that might arise from having multiple users on the same system.

(3 new directories – *personal*, *business* and *school* – were created in the *reports* directory.)
Description: The mkdir command is used to create a new directory in the working directory. As shown in the above command, multiple directories can also be created at once using a single mkdir command.

7. Create a directory called UNIX under the assignment directory. The directories in this step should be created without moving from the reports directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/reports$ mkdir ../assignment/UNIX

(A new directory called *UNIX* was created in the *assignment* directory without moving to it.)
Description: The mkdir command is used to create a new directory in the directory specified by the path given as the argument to the command. The absolute or relative path can be used to specify the location, eliminating the need to change directories.

8. Move to your home directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~$ cd ~/kriths

(The working directory was changed from *reports* to the home directory.)
Description: The cd command is used to change the working directory to the directory specified in the argument. Here, the file path uses ~ to represent the home directory of the user.

9. Recursively list all of the directories you created.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ ls -R

```
.:
assignment  asst2.odt  lab24.9.odt  letters  reports

./assignment:
UNIX

./assignment/UNIX:

./letters:
formal  friendly

./letters/formal:

./letters/friendly:

./reports:
business  personal  school

./reports/business:

./reports/personal:

./reports/school:
```

(The contents of the home directory are listed recursively.)
Description: The ls command lists the contents of the given directory. The command has various options associated with it. The -R option lists all the subdirectories of the speified directory recursively.

10. Quit the terminal.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ exit

(The terminal window is closed.)
Description: The exit command can be used to quit the terminal.

Exercise 2:

Commands: cd [destination path] //path can be absolute or relative
ls [directory] //can also be [path]
pwd
cat> [new file] //can also be [file path]
cat [file] //can also be [file path]
cp [source path] [destination path]
ln [filename] [hard-link name]
ln -s [filename] [soft-link name]

1. Launch the terminal. - A terminal window was opened.

2. Recursively list the directories under your home directory (the ones created in Exercise 1).
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ ls -R
.:
assignment asst2.odt lab24.9.odt letters reports usp_asst2_057.odt

./assignment:
UNIX

./assignment/UNIX:

./letters:
formal friendly

./letters/formal:

./letters/friendly:

./reports:
business personal school

./reports/business:

./reports/personal:

./reports/school:

(The contents of the home directory are listed recursively.)
Description: The ls command lists the contents of the given directory. The command has various options associated with it. The -R option lists all the subdirectories of the speified directory recursively.

3. Move to the UNIX directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cd assignment/UNIX

(The working directory was changed from the home directory to *UNIX* in a single step.)
Description: The cd command is used to change the working directory to the directory specified in the argument. Here, the file path given by the command's argument specifies the required subdirectory.

4. Check your current directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ pwd
/home/sel-20/kriths/assignment/UNIX

(The absoulte file path of the current working directory is printed on the screen.)
Description: The pwd command is used to display the absolute file path of the current working directory.

5&6. Create a file named hw4 that contains short answers to at least five review questions in this chapter. Save the file (it should be saved under the UNIX directory).
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ cat>hw4
Command to list contents of directory: ls
Command to create new directory: mkdir
Command to change directory: cd
Command to delete non-empty directory: rm -r
Command to create a soft link: ln -s

(A file *hw4* is created and content is entered into the file.)
Description: The cat> command creates a new file in the specified directory and simultaneously opens the file for entering content into it. Upon exiting the file, it is automatically saved in the given directory.

7. Move to your home directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ cd ~/kriths

(The working directory was changed from *UNIX* to the home directory.)
Description: The cd command is used to change the working directory to the directory specified in the argument. Here, the file path uses ~ to represent the home directory of the user.

8. Print the content of hw4 from your home directory.

Name: Krithika Swaminathan
Roll No.: 205001057

sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cat assignment/UNIX/hw4
Command to list contents of directory: ls
Command to create new directory: mkdir
Command to change directory: cd
Command to delete non-empty directory: rm -r
Command to create a soft link: ln -s

(The content of the file *hw4* is displayed without changing the current directory.)
Description: The cat command displays the contents of the file specified in the argument.

9&10. Make a copy of hw4 and call it hw4.bk. Store it under the same directory where hw4 is stored.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cp ~/kriths/assignment/UNIX/hw4 ~/kriths/assignment/UNIX/hw4.bk

(The content of *hw4* is copied into a new file called *hw4.bk* in the same directory.)
Description: The cp command is used to copy the required files from the specified source to the destination.

11. From your home directory, check to see if both files (hw4 and hw4.bk) exist.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ ls assignment/UNIX
hw4.bk hw4

(The contents of the *UNIX* directory is displayed to check the existence of the files *hw4* and *hw4.bk*.)
Description: The ls command with no arguments lists the contents of the working directory. The ls command with a file path as the argument lists the contents of the directory specifies by the file path.

12. Move to the UNIX directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cd assignment/UNIX

(The working directory was changed from the home directory to *UNIX* in a single step.)
Description: The cd command is used to change the working directory to the directory specified in the argument. Here, the file path given by the command's argument specifies the required subdirectory.

13. Check your current working directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ pwd
/home/sel-20/kriths/assignment/UNIX

(The absoulte file path of the current working directory is printed on the screen.)
Description: The pwd command is used to display the absolute file path of the current working directory.

14. Make a hard link to the hw4 file. The link should be under the UNIX subdirectory and be called hw4HL.

sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ ln hw4 hw4HL

(A hard link *hw4HL* is created to the file *hw4*.)
Description: The ln command can be used to create a hard link to a given file.

15. Make a soft link to hw4 called hw4SL and store it under the UNIX directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ ln -s hw4 hw4SL

(A soft link *hw4SL* is created to the file *hw4*.)
Description: The ln -s command can be used to create a soft link to a given file.

16. Check the inode of hw4, hw4.bk, hw4HL, and hw4SL. Are all the same? Are all different? Explain how you determined the answer.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ ls -li
total 12
396397 -rw-rw-r-- 1 sel-20 sel-20 25 Oct 1 13:45 hw4.bk
396396 -rw-rw-r-- 2 sel-20 sel-20 25 Oct 1 13:40 hw4HL
396398 lrwxrwxrwx 1 sel-20 sel-20 7 Oct 1 13:47 hw4SL -> hw4
396396 -rw-rw-r-- 2 sel-20 sel-20 25 Oct 1 13:40 hw4

(The inode numbers of the given files are displayed.)
-The number diplayed at the beginning of every line here is the inode number.
-All the inode numbers are not the same. A new inode number is generated for every new file. It is observed that the hard link has the same inode number as the original file while the soft link has a different inode number.
Description: The ls command lists the contents of the given directory. The command has various options associated with it. The -i option is used to print the files along with their inode numbers and the -l option is used to print the files in long format.

17. Use ls command to find the file types of hw4, hw4.bk, hw4HL and hw4SL. Explain your observation.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ ls -l
total 12
-rw-rw-r-- 1 sel-20 sel-20 25 Oct 1 13:45 hw4.bk
-rw-rw-r-- 2 sel-20 sel-20 25 Oct 1 13:40 hw4HL
lrwxrwxrwx 1 sel-20 sel-20 7 Oct 1 13:47 hw4SL -> hw4
-rw-rw-r-- 2 sel-20 sel-20 25 Oct 1 13:40 hw4

(The details of the given files are displayed in long format. It is seen that *hw4SL* is of file type link.)
-The first part (rwx...) of every line denotes the file permissions. The first bit of the file permissions denotes the type of the file.
- A (-) represents a default text file. A (d) represents a directory. An (l) represents a link.
Description: The ls command lists the contents of the given directory. The command has various options associated with it. The -l option is used to print the files in long format.

18. Quit the terminal
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths/assignment/UNIX$ exit

(The terminal window is closed.)
Description: The exit command can be used to quit the terminal.

Exercise 3:

Commands: mkdir [new directory] //can also be [path/directory]
ls [directory]
cat [file]
find [search_directory] [search_type] [file] [-exec [command] {}]
cp [source path] [destination path]
rm [option] [file or directory]
ln [filename] [hard-link name]
ln -s [filename] [soft-link name]

1. Launch the terminal. - A terminal window was opened.

2. Create a backup directory in your home directory called backups.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ mkdir backups

(A new directory called *backups* was created in the home directory.)
Description: The mkdir command is used to create a new directory in the working directory.

3. Use the find command to find the pathnames of all of the files (hw4, hw4.bk, hw4HL, hw4SL) that you created in Exercise 2. All of them should be found using only one find command. The command must also copy all of them to the backups directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ find ~/kriths -name hw4* -exec cp {} ~/kriths/backups/ \;

(The find command located the required file within the home directory, i.e., the file path of the required file is returned. The exec part of the command allows another command to be simultaneously executed with find. Here, the file path returned by find is used as the source path for the cp command. Hence, the files whose name begin with *hw4* are copied to the backups folder.)
Description: The find command locates the required file(s) within the given directory and returns the file path(s).

4. Check the number of links and inode number of (hw4, hw4.bk, hw4HL, hw4SL). Make note of the results.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ ls -li assignment/UNIX
total 12
396397 -rw-rw-r-- 1 sel-20 sel-20 25 Oct 1 13:45 hw4.bk
396396 -rw-rw-r-- 2 sel-20 sel-20 25 Oct 1 13:40 hw4HL
396398 lrwxrwxrwx 1 sel-20 sel-20 7 Oct 1 13:47 hw4SL -> hw4
396396 -rw-rw-r-- 2 sel-20 sel-20 25 Oct 1 13:40 hw4

(The number of links and the inode numbers of the given files are displayed.)

-The number diplayed at the beginning for each file represents the inode number of that file.
-The third entry for each file represents the number of links to that file.
-All the inode numbers are not the same. A new inode number is generated for every new file. It is observed that the hard link has the same inode number as the original file while the soft link has a different inode number.
-The soft link file and the bk file have only 1 link each. Whereas, the original file and the hard link file both display that they have 2 links each.
Description: The ls command lists the contents of the given directory. The command has various options associated with it. The -i option is used to print the files along with their inode numbers and the -l option is used to print the files in long format.

5. Delete the original hw4 file without moving from your home directory.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ rm assignment/UNIX/hw4

(The file *hw4* is deleted.)
Description: The rm command is used to delete the required files and directories.

6. Check the existence of hw4, hw4.bk, hw4HL, hw4SL.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ ls -R assignment
assignment:
UNIX

assignment/UNIX:
hw4.bk hw4HL hw4SL

(The files under the assignment directory are listed recursively. It is verified that the file hw4 has been deleted.)
Description: The ls command lists the contents of the given directory. The command has various options associated with it. The -R option lists all the subdirectories of the specified directory recursively.

7. Check the contents of hw4, hw4.bk, hw4HL, hw4SL.

sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cat assignment/UNIX/hw4
cat: assignment/UNIX/hw4: No such file or directory

(The file hw4 no longer exists.)
Description: The cat command displays the contents of the file specified in the argument.

sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cat assignment/UNIX/hw4.bk
Command to list contents of directory: ls
Command to create new directory: mkdir
Command to change directory: cd
Command to delete non-empty directory: rm -r
Command to create a soft link: ln -s

(The file hw4.bk exists and its contents have been verified.)

Description: The cat command displays the contents of the file specified in the argument.

sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cat assignment/UNIX/hw4HL
Command to list contents of directory: ls
Command to create new directory: mkdir
Command to change directory: cd
Command to delete non-empty directory: rm -r
Command to create a soft link: ln -s

(The file *hw4HL* exists and its contents are the same as those of the original file.)
Interpretation: A hard link contains a copy of the contents of the original file. When the original file is deleted, the hard link still contains the contents of the file.

sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cat assignment/UNIX/hw4SL
cat: assignment/UNIX/hw4SL: No such file or directory

(The file *hw4SL* has now become a dangling link.)
Interpretation: A soft link only contains a reference to the original file. It does not contain a copy of the contents of the original file. If the original file is deleted, the soft link becomes a dangling link.

8. Restore hw4 by making a copy of hw4.bk.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cp ~/kriths/assignment/UNIX/hw4.bk ~/kriths/assignment/UNIX/hw4

(The content of *hw4.bk* is copied into a new file called *hw4* in the same directory.)
Description: The cp command is used to copy the required files from the specified source to the destination.

sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ cat assignment/UNIX/hw4
Command to list contents of directory: ls
Command to create new directory: mkdir
Command to change directory: cd
Command to delete non-empty directory: rm -r
Command to create a soft link: ln -s

(It is observed that the contents of hw4 have now been restored.)

9. You may have noticed that your soft link (hw4SL) contains garbage. Delete this file.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ rm assignment/UNIX/hw4SL

(The file *hw4SL* is deleted.)
Description: The rm command is used to delete the required files and directories.

10. Make a soft link to hw4 and save it as hw4SL under the same directory as it was.
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ ln -s hw4 hw4SL

(A soft link *hw4SL* is created to the file *hw4*.)
Description: The ln -s command can be used to create a soft link to a given file.

11. List recursively all of your files and directories to confirm all operations.

```
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ ls -R
.:
assignment  backups  lab24.9.odt  reports
asst2.odt   hw4SL    letters      usp_asst2_057.odt

./assignment:
UNIX

./assignment/UNIX:
hw4.bk  hw4HL  hw4

./backups:
hw4.bk  hw4HL  hw4SL  hw4

./letters:
formal  friendly

./letters/formal:

./letters/friendly:

./reports:
business  personal  school

./reports/business:

./reports/personal:

./reports/school:
```

(The contents of the home directory are listed recursively. All operations performed have been verified.)
Description: The ls command lists the contents of the given directory. The command has various options associated with it. The -R option lists all the subdirectories of the specified directory recursively.

12. Print the number of files created given the date.

```
kri@kri-ubuntu:~$ find ~/workspace -type f -newermt 2021-10-02 ! -newermt 2021-10-03 -exec ls -l {} \;
-rw-rw-r-- 1 kri kri 1652 Oct  2 11:27 /home/kri/workspace/java/Pangram.java
-rw-rw-r-- 1 kri kri 2435 Oct  2 12:13 /home/kri/workspace/java/Search.java
-rw-rw-r-- 1 kri kri 276146 Oct  2 12:49 /home/kri/workspace/java/oopl_ex2_057.odt
-rw-rw-r-- 1 kri kri 2540 Oct  2 12:38 /home/kri/workspace/java/Matrix.java
```

```
-rw-rw-r-- 1 kri kri 1011 Oct  2 11:46 /home/kri/workspace/java/FindLongestWord.java
-rw-rw-r-- 1 kri kri 1410 Oct  2 10:58 /home/kri/workspace/java/CheckPangram.java
-rw-rw-r-- 1 kri kri 30603 Oct  2 19:17 /home/kri/workspace/unix/usp_assignment2.odt
-rw-rw-r-- 1 kri kri 72 Oct  2 19:17 /home/kri/workspace/unix/.~lock.usp_assignment2.odt#
-rw-rw-r-- 1 kri kri 72 Oct  2 13:11 /home/kri/workspace/unix/.~lock.usp_assignment1.odt#
```

```
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ find . -type f -newermt 2021-10-01 ! -newermt 2021-10-02
./.~lock.usp_asst2_057.odt#
./usp_asst2_057.odt
./backups/hw4.bk
./backups/hw4
./backups/hw4HL
./backups/hw4SL
./assignment/UNIX/hw4.bk
./assignment/UNIX/hw4
./assignment/UNIX/hw4HL
```

(The files created today are displayed.)
Description: The find command locates the required file(s) within the given directory and returns the file path(s). The ls -l command lists the total number of files and a list of the files in long format.

13. Print the number of files created given the type.

Based on file permissions:

```
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ find . -perm 777 -exec ls -l {} \;
total 1
lrwxrwxrwx 1 sel-20 sel-20 1 Oct 1 14:42 ./assignment/UNIX/hw4SL -> hw4
```

Using wildcard characters:

```
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ find . -name my* -exec ls -l {} \;
total 8
drwxrwxr-x 4 sel-20 sel-20 4096 Sep 26 14:19 Domain
drwxrwxr-x 2 sel-20 sel-20 4096 Sep 26 14:39 hello
```

(The number of files of required type is printed.)
Description: The find command locates the required file(s) within the given directory and returns the file path(s). The ls -l command lists the total number of files and a list of the files in long format.

14. Quit the terminal.

```
sel-20@sel20-HP-Compaq-Pro-6305-SFF:~/kriths$ exit
```

(The terminal window is closed.)
Description: The exit command can be used to quit the terminal.