

Question 3 (2024eb03003):

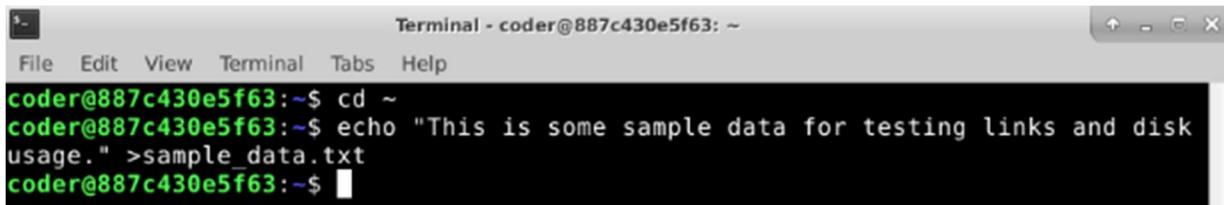
You have been asked to understand how Linux manages files using links and disk usage information. As part of your role, you will perform the following operations within your own user space.

1. File Creation

Create a file named sample_data.txt in your home directory and add some sample text to it.

cd ~ (cd ~ ensures we are in home directory)

echo "This is some sample data for testing links and disk usage." > sample_data.txt (echo "..." > sample_data.txt creates sample_data.txt and writes that sample line into it)



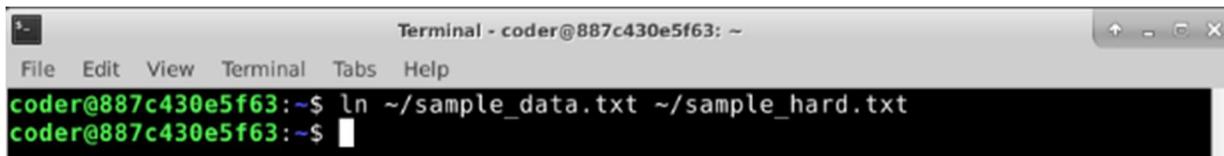
```
Terminal - coder@887c430e5f63: ~
File Edit View Terminal Tabs Help
coder@887c430e5f63:~$ cd ~
coder@887c430e5f63:~$ echo "This is some sample data for testing links and disk usage." >sample_data.txt
coder@887c430e5f63:~$
```

2. Hard Link Creation

Create a hard link to sample_data.txt named sample_hard.txt.

ln ~/sample_data.txt ~/sample_hard.txt

- The first path is the existing file (sample_data.txt).
- The second path is the new hard link name (sample_hard.txt) that points to the same inode and data as the original file.



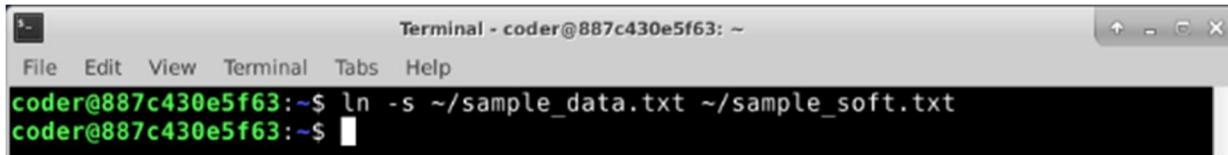
```
Terminal - coder@887c430e5f63: ~
File Edit View Terminal Tabs Help
coder@887c430e5f63:~$ ln ~/sample_data.txt ~/sample_hard.txt
coder@887c430e5f63:~$
```

3. Symbolic Link Creation

Create a symbolic (soft) link to sample_data.txt named sample_soft.txt.

ln -s ~/sample_data.txt ~/sample_soft.txt

- -s tells ln to create a symbolic (soft) link instead of a hard link.
- sample_soft.txt will now point to sample_data.txt, acting like a shortcut to that file.



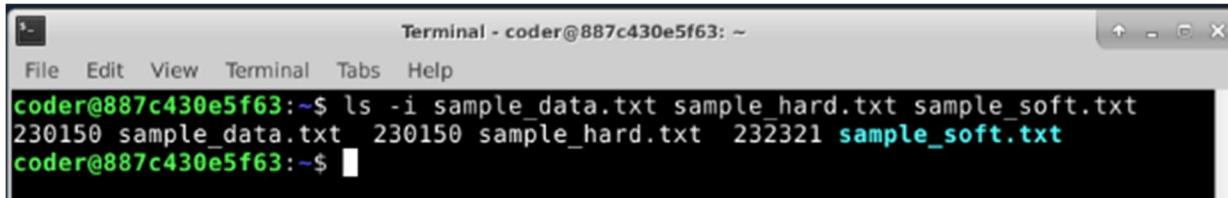
```
Terminal - coder@887c430e5f63: ~
File Edit View Terminal Tabs Help
coder@887c430e5f63:~$ ln -s ~/sample_data.txt ~/sample_soft.txt
coder@887c430e5f63:~$
```

4. Inode Verification

Display the inode numbers of sample_data.txt, sample_hard.txt, and sample_soft.txt.

```
cd ~
```

ls -i sample_data.txt sample_hard.txt sample_soft.txt (This command prints the inode number as the first field, followed by each filename, so we will see the inode for all three entries on one line each)



```
Terminal - coder@887c430e5f63: ~
File Edit View Terminal Tabs Help
coder@887c430e5f63:~$ ls -i sample_data.txt sample_hard.txt sample_soft.txt
230150 sample_data.txt 230150 sample_hard.txt 232321 sample_soft.txt
coder@887c430e5f63:~$
```

5. Inode Analysis

Identify which files share the same inode number and briefly explain the reason.

sample_data.txt and **sample_hard.txt** will share the same inode number; **sample_soft.txt** will have a different inode.

- A hard link (here **sample_hard.txt**) is just another directory entry pointing to the *same inode* as the original file (**sample_data.txt**), so both names reference identical metadata and data blocks.
- A symbolic link (**sample_soft.txt**) is its own separate inode that simply stores a pathname to the target, so it necessarily has a different inode number.

6. File Metadata Inspection

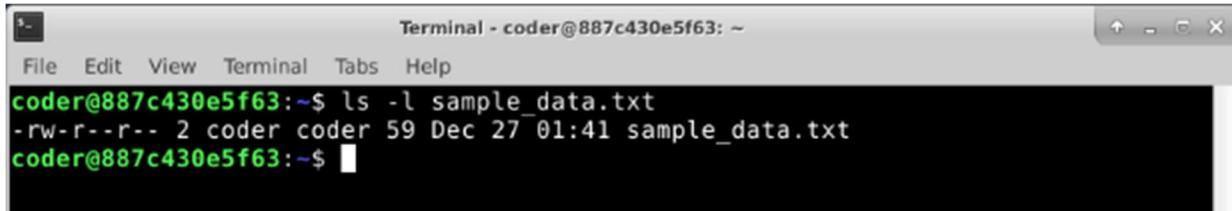
Display detailed file information (permissions, ownership, size, timestamps) of sample_data.txt.

```
ls -l sample_data.txt
```

This shows:

- File type and permissions (e.g., -rw-r--r--)
- Number of links
- Owner username and group

- File size in bytes
- Last modification timestamp
- The filename sample_data.txt



A screenshot of a terminal window titled "Terminal - coder@887c430e5f63: ~". The window has a standard OS X-style title bar with icons for close, minimize, and maximize. The menu bar includes "File", "Edit", "View", "Terminal", "Tabs", and "Help". The main terminal area shows the command "ls -l sample_data.txt" being run. The output is:
coder@887c430e5f63:~\$ ls -l sample_data.txt
-rw-r--r-- 2 coder coder 59 Dec 27 01:41 sample_data.txt
coder@887c430e5f63:~\$

7. Disk Usage Check

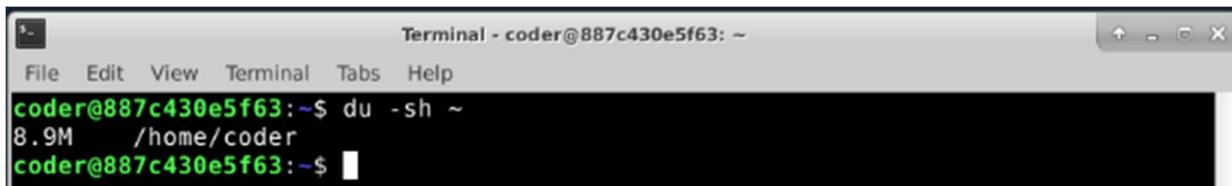
Display the disk usage of your home directory in a human-readable format.

8. File Size Overview

Display the size of each file present in your home directory in a human-readable format.

du -sh ~

- du reports disk usage for files and directories.
- -s shows only the summary total for the given path.
- -h prints the size in a human-readable form like KB, MB, or GB.



A screenshot of a terminal window titled "Terminal - coder@887c430e5f63: ~". The window has a standard OS X-style title bar with icons for close, minimize, and maximize. The menu bar includes "File", "Edit", "View", "Terminal", "Tabs", and "Help". The main terminal area shows the command "du -sh ~" being run. The output is:
coder@887c430e5f63:~\$ du -sh ~
8.9M /home/coder
coder@887c430e5f63:~\$

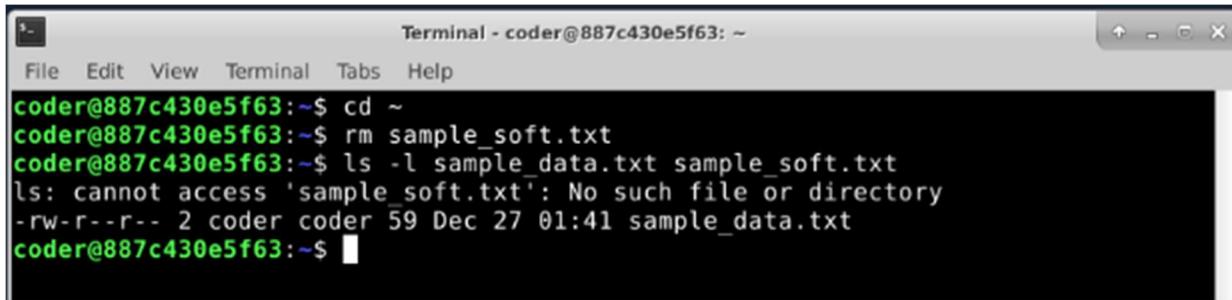
9. Link Deletion Test

Delete the symbolic link sample_soft.txt and verify that the original file sample_data.txt is unaffected.

cd ~

rm sample_soft.txt (This command removes only the symbolic link)

ls -l sample_data.txt sample_soft.txt {This command will still show sample_data.txt present, while sample_soft.txt should now be missing (or give “No such file or directory” if listed alone), confirming the original file is unaffected}



A screenshot of a terminal window titled "Terminal - coder@887c430e5f63: ~". The window has a standard OS X-style title bar with icons for close, minimize, and maximize. The menu bar includes "File", "Edit", "View", "Terminal", "Tabs", and "Help". The main terminal area shows the following command-line session:

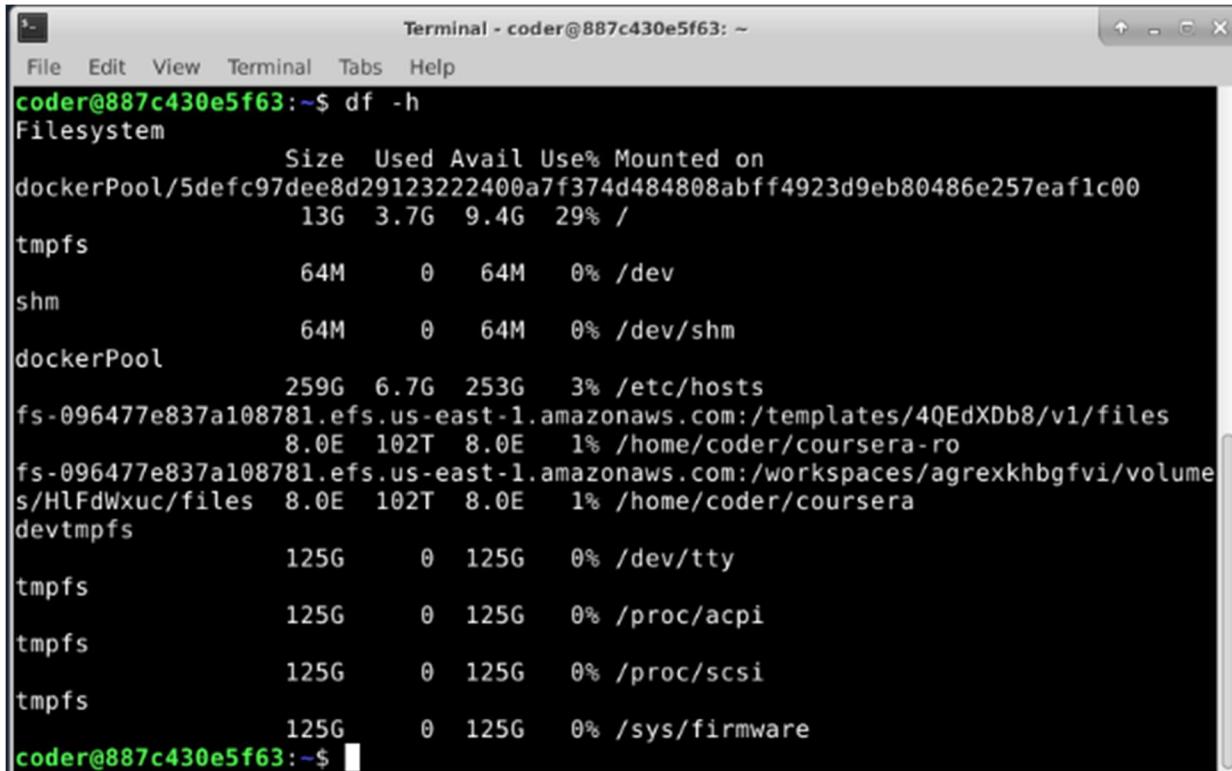
```
coder@887c430e5f63:~$ cd ~
coder@887c430e5f63:~$ rm sample_soft.txt
coder@887c430e5f63:~$ ls -l sample_data.txt sample_soft.txt
ls: cannot access 'sample_soft.txt': No such file or directory
-rw-r--r-- 2 coder coder 59 Dec 27 01:41 sample_data.txt
coder@887c430e5f63:~$
```

10. Disk Utility Demonstration

Demonstrate the usage of du and df commands using various useful options and briefly explain the output.

df -h

- df shows disk space usage per mounted filesystem.
- -h prints sizes in a human-readable form (KB/MB/GB), with columns like:
 - Filesystem: device or mount.
 - Size, Used, Avail: total, used, and available space.
 - Use%: percentage used.
 - Mounted on: mount point path.

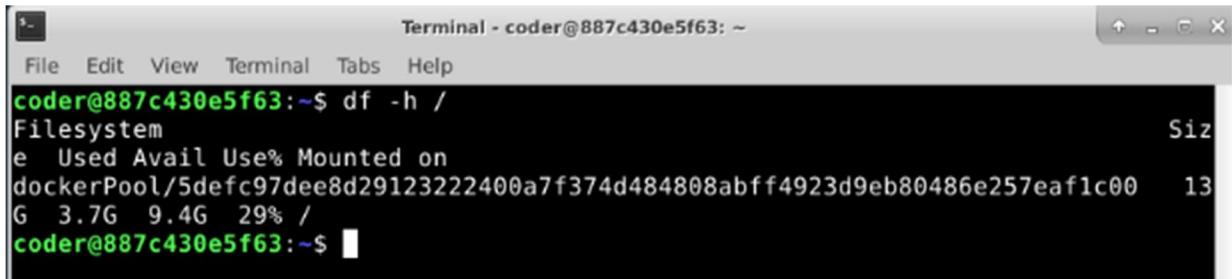


A terminal window titled "Terminal - coder@887c430e5f63: ~". The window shows the output of the command "df -h". The output lists various filesystems with their size, used space, available space, usage percentage, and mount point. The most prominent entry is the root filesystem "dockerPool" which is mounted at "/" with a size of 13G, used 3.7G, and 29% usage.

```
coder@887c430e5f63:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
dockerPool/5defc97dee8d29123222400a7f374d484808abff4923d9eb80486e257eaf1c00  13G   3.7G   9.4G  29% /
tmpfs           64M    0   64M   0% /dev
shm             64M    0   64M   0% /dev/shm
dockerPool      259G  6.7G  253G  3% /etc/hosts
fs-096477e837a108781.efs.us-east-1.amazonaws.com:/templates/4QEdXDb8/v1/files  8.0E  102T  8.0E  1% /home/coder/coursera-ro
fs-096477e837a108781.efs.us-east-1.amazonaws.com:/workspaces/agrexkhbgfvi/volume 8.0E  102T  8.0E  1% /home/coder/coursera
HlFdWxuc/files  125G    0  125G   0% /dev/tty
tmpfs           125G    0  125G   0% /proc/acpi
tmpfs           125G    0  125G   0% /proc/scsi
tmpfs           125G    0  125G   0% /sys/firmware
coder@887c430e5f63:~$
```

To focus just on our root filesystem:

```
df -h /
```



A terminal window titled "Terminal - coder@887c430e5f63: ~". The window shows the output of the command "df -h /". The output is identical to the previous "df -h" command, but it only displays the root filesystem "dockerPool" which is mounted at "/" with a size of 13G, used 3.7G, and 29% usage.

```
coder@887c430e5f63:~$ df -h /
Filesystem      Size  Used Avail Use% Mounted on
dockerPool/5defc97dee8d29123222400a7f374d484808abff4923d9eb80486e257eaf1c00  13G   3.7G   9.4G  29% /
coder@887c430e5f63:~$
```

```
du -sh ~
```

- du reports how much space files/directories consume.
- -s gives only a summary total for the specified path.
- -h again makes the size human-readable.

This command tells us how much disk space our home directory uses, complementing the filesystem overview from df.



A screenshot of a terminal window titled "Terminal - coder@887c430e5f63: ~". The window has a standard OS X-style title bar with icons for minimizing, maximizing, and closing. The menu bar includes "File", "Edit", "View", "Terminal", "Tabs", and "Help". The main terminal area shows the command "du -sh ~" being run, followed by its output "8.9M /home/coder". The prompt "coder@887c430e5f63:~\$ " is visible at the bottom.

```
File Edit View Terminal Tabs Help
coder@887c430e5f63:~$ du -sh ~
8.9M /home/coder
coder@887c430e5f63:~$
```