

### Question 3 (2024eb03003):

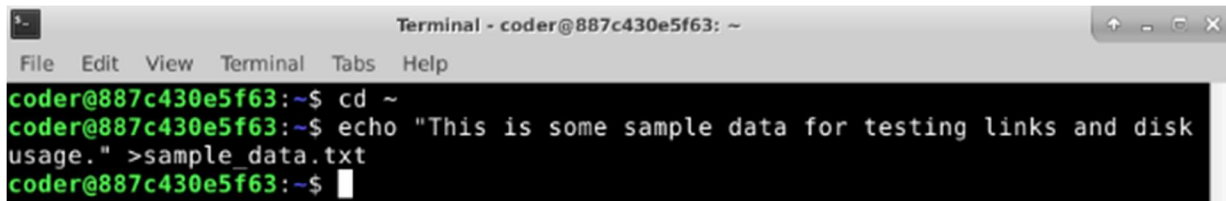
You have been asked to understand how Linux manages files using links and disk usage information. As part of your role, you will perform the following operations within your own user space.

#### 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)

A terminal window titled "Terminal - coder@887c430e5f63: ~" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The terminal shows the following commands and output:

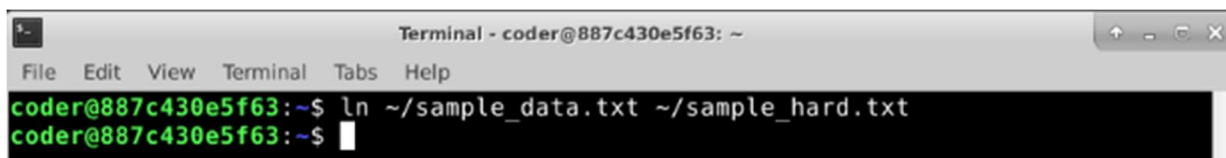
```
coder@887c430e5f63:~$ cd ~
coder@887c430e5f63:~$ echo "This is some sample data for testing links and disk usage." > sample_data.txt
coder@887c430e5f63:~$
```

#### 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.

A terminal window titled "Terminal - coder@887c430e5f63: ~" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The terminal shows the following command and output:

```
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 -li 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 -li 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

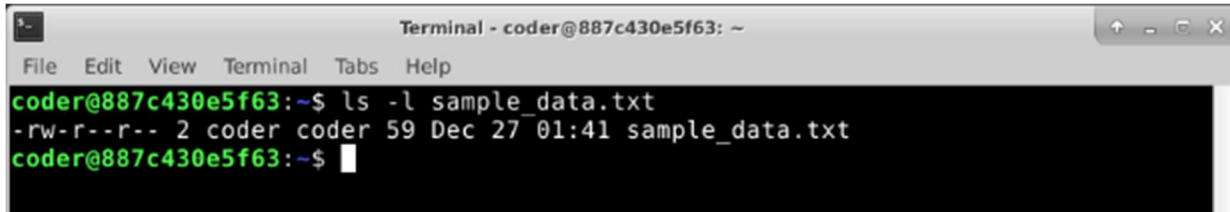
Display detailed file information (permissions, ownership, size, timestamps) of `sample_data.txt`.

**`ls -li 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



```

Terminal - coder@887c430e5f63: ~
File Edit View Terminal Tabs Help
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.



```

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

```

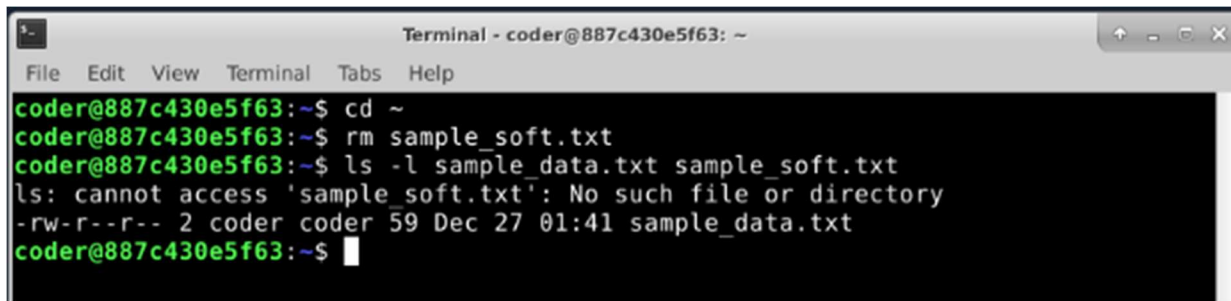
## 9. Link Deletion Test

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 terminal window titled "Terminal - coder@887c430e5f63: ~" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The terminal shows a sequence of commands: "cd ~", "rm sample\_soft.txt", and "ls -l sample\_data.txt sample\_soft.txt". The output of the last command shows "ls: cannot access 'sample\_soft.txt': No such file or directory" and a file listing for "sample\_data.txt" with permissions "-rw-r--r--", owner "2 coder", group "coder", size "59", date "Dec 27 01:41", and filename "sample\_data.txt".

```
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.

```
Terminal - coder@887c430e5f63: ~
File Edit View Terminal Tabs Help
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/volumes/HlFdWxuc/files 8.0E 102T  8.0E   1% /home/coder/coursera
devtmpfs                                 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 /`

```
Terminal - coder@887c430e5f63: ~
File Edit View Terminal Tabs Help
coder@887c430e5f63:~$ df -h /
Filesystem                                Size
e 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`.

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