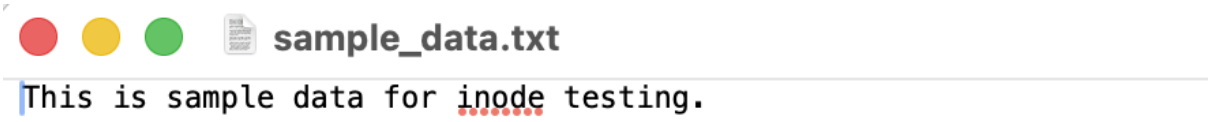
1) File Creation:

```
yashwanthnalla@192 GA-Module(1-4) % echo "This is sample data for inode testing." > ~/sample_data.txt
yashwanthnalla@192 GA-Module(1-4) %
```



This command creates a file named sample_data.txt in the home directory and writes sample text into it.

2) Hard Link Creation:

```
yashwanthnalla@192 GA-Module(1-4) % ln ~/sample_data.txt ~/sample_hard.txt
yashwanthnalla@192 GA-Module(1-4) %
```

I used the 'ln' command without any switches to create a hard link. This creates a new directory entry (sample_hard.txt) that points to the exact same inode (physical data location) as the original file.

3) Symbolic (Soft) Link creation:

```
yashwanthnalla@192 GA-Module(1-4) % ln -s ~/sample_data.txt ~/sample_soft.txt
yashwanthnalla@192 GA-Module(1-4) %
```

I used 'ln' with the '-s' switch to create a symbolic link. Unlike the hard link, this file acts as a pointer or "shortcut" that references the path of the original file rather than the data blocks directly.

4) Inode Verification:

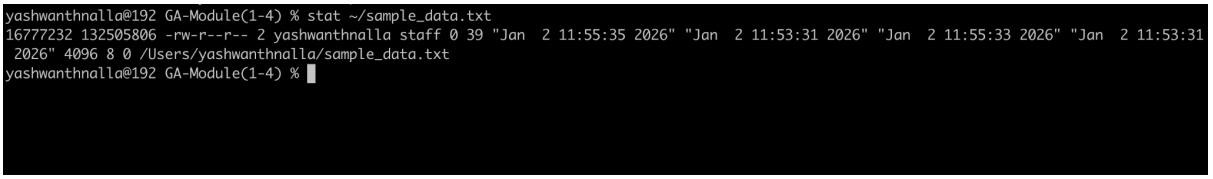
```
yashwanthnalla@192 GA-Module(1-4) % ls -i ~/sample_data.txt ~/sample_hard.txt ~/sample_soft.txt
132505806 /Users/yashwanthnalla/sample_data.txt 132510259 /Users/yashwanthnalla/sample_soft.txt
132505806 /Users/yashwanthnalla/sample_hard.txt
yashwanthnalla@192 GA-Module(1-4) %
```

The '-i' option in the 'ls' command displays the inode number (index node) for each file listed, allowing me to compare the unique identifiers used by the filesystem to manage these files.

5) Inode Analysis:

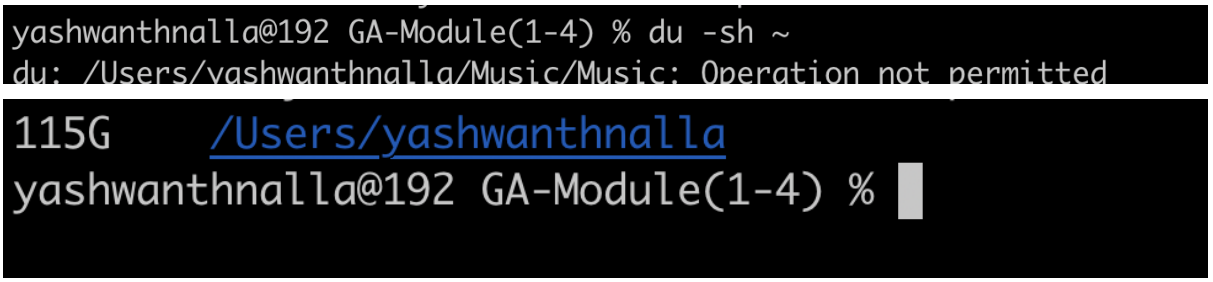
Sample_data.txt and sample_hard.txt share the same inode because hard links reference the same inode.
sample_soft.txt has a different inode because symbolic links store only the file path, not the actual data.

6) File Metadata Inspection:



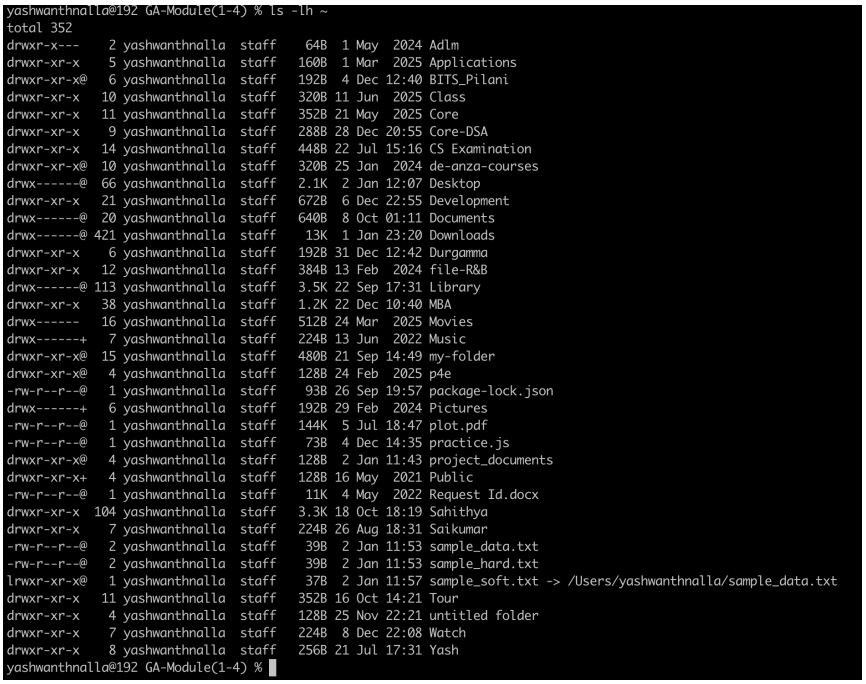
The ‘stat’ command displays detailed metadata such as permissions, ownership, size, and timestamps of the file.

7) Disk Usage Check:



This command shows the total disk usage of the home directory.

8) File Size Overview:



I used ‘ls’ to list files with the ‘-l’ (long format) and ‘-h’ (human-readable) flags. This displays the size of every individual file in the home directory.

9) Link Deletion Test:

```
yashwanthnalla@192 GA-Module(1-4) % rm ~/sample_soft.txt && ls -l ~/sample_data.txt
-rw-r--r--@ 2 yashwanthnalla  staff  39  2 Jan 11:53 /Users/yashwanthnalla/sample_data.txt
yashwanthnalla@192 GA-Module(1-4) %
```

I removed the soft link using rm. Listing the original file afterwards confirms that deleting a soft link only removes the pointer; the actual data and the original file (sample_data.txt) remain completely intact.

10) Disk Utility Demonstration:

```
yashwanthnalla@192 GA-Module(1-4) % df -h && du -sh ~/document
Filesystem        Size    Used   Avail Capacity iused ifree %iused  Mounted on
/dev/disk3s1s1   460Gi    11Gi   208Gi     6%    453k  2.2G    0%   /
devfs            201Ki   201Ki     0Bi   100%     696     0  100%   /dev
/dev/disk3s6     460Gi   2.0Gi   208Gi     1%       2  2.2G    0%   /System/Volumes/VM
/dev/disk3s2     460Gi   7.7Gi   208Gi     4%    1.3k  2.2G    0%   /System/Volumes/Preboot
/dev/disk3s4     460Gi   4.6Mi   208Gi     1%      84  2.2G    0%   /System/Volumes/Update
/dev/disk1s2     500Mi   6.0Mi   482Mi     2%       3  4.9M    0%   /System/Volumes/xarts
/dev/disk1s1     500Mi   5.7Mi   482Mi     2%      30  4.9M    0%   /System/Volumes/iSCPreboot
/dev/disk1s3     500Mi   1.5Mi   482Mi     1%      45  4.9M    0%   /System/Volumes/Hardware
/dev/disk3s5     460Gi   230Gi   208Gi    53%    1.9M  2.2G    0%   /System/Volumes/Data
map auto_home      0Bi     0Bi     0Bi   100%       0     0     -   /System/Volumes/Data/home
  0B    /Users/yashwanthnalla/document
yashwanthnalla@192 GA-Module(1-4) %
```

I chose ~/document as an example created in Q2

‘df -h’ displays the available disk space on the entire filesystem. ‘du -sh’ shows the space consumed by a specific directory tree.