

St. Francis Institute of Technology, Mumbai-400 103
Department of Information Technology

A.Y. 2023-2024
Class: SE-ITA/B, Semester: IV
Subject: **UNIX LAB**

Experiment – 4: Study of UNIX file system and Implementation of File and Directory Permissions.

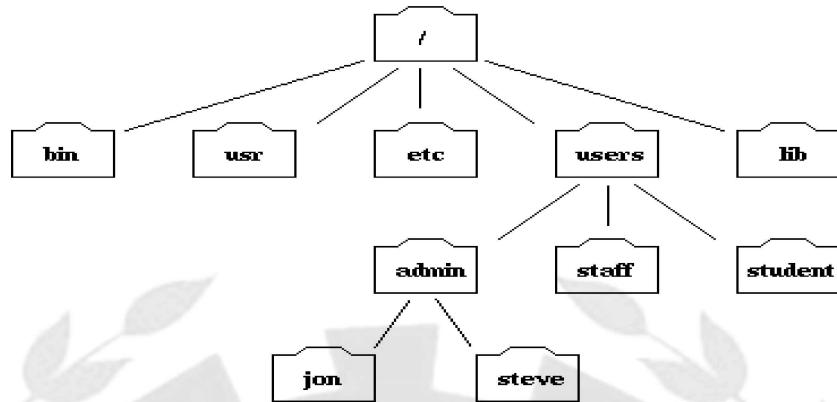
1. **Aim:** To study UNIX file system and Implement File and Directory Permissions.
2. **Objectives:**
 - To understand UNIX file system.
 - To understand and change file and directory permissions.
3. **Outcomes:** After study of this experiment, the student will be able to
 - Understand UNIX file system and file attributes.
 - Apply and change the ownership and file permissions using advance UNIX commands (L402.3).
4. **Prerequisite:** Basic UNIX commands- ls, cd, pwd.
5. **Requirements:** Personal Computer, Ubuntu OS, LibreOffice.
6. **Pre-Experiment Exercise:**

Brief Theory:

UNIX Hierarchical File System structure

All the stored information on a UNIX computer is kept in a filesystem. A file system is a logical collection of files on a partition or disk. Everything in UNIX is considered to be a file, including physical devices such as DVD-ROMs, USB devices, and floppy drives.

UNIX uses a **hierarchical** file system structure, much like an upside-down tree, with root (/) at the base of the file system and all other directories spreading from there. Each file or directory is uniquely identified by its name, the directory in which it resides, and a unique identifier, typically called an inode. There are no dependencies between one filesystem and another. Figure below shows a part of UNIX file system.



Part of the filesystem tree

To describe a specific file or directory in the filesystem hierarchy, you must specify a "path." The path to a location can be defined as an **absolute path**, starting from the root anchor point, or as a **relative path**, starting from the current location. When specifying a path, you simply trace a route through the filesystem tree, listing the sequence of directories you pass through as you go from one point to another. Each directory listed in the sequence is separated by a slash.

Types of files in UNIX

A file is a collection of related information. In UNIX, the files are categorized into:

- **Ordinary (Regular) file**

This is the most common file type. It can be a text file or a binary file. This file cannot contain other files.

- **Directory**

A directory contains no data, but keeps some details of the files and subdirectories that it contains.

- **Special Device file**

This type of files in UNIX allows access to various devices known to your system. Literally, almost every device has a special file associated with it. It can be a character device file or a block device file.

- **Named pipe (FIFO)**

This file is used for simpler inter process communication. A UNIX pipe provides a one-way flow of data. One of the processes uses this pipe for output of data, while another process uses the very same named pipe file for input.

- **Symbolic link**

A UNIX socket (or Inter-process communication socket) is a special file which allows for advanced inter-process communication. A UNIX Socket is used in a client-server application framework.

- **Socket**

A socket file is used to pass information between applications for communication purpose.

7. Laboratory Exercise

A. Procedure

Explain the following commands in UNIX with syntax and example:

File, whereis, which, tar, stat, chmod, chown, chgrp, wc, split, cmp, diff, comm, find, gzip, gunzip .

B. Result/Observation/Program code

8. Post-Experiments Exercise

A. Extended Theory:

1. Explain absolute and relative file path with example.
2. Explain the file access modes in UNIX.

B. Questions:

1. What are the default permissions assigned to files and directories in UNIX?
2. Explain umask command in UNIX with an example.
3. Which of these commands will work? Explain with reasons:
 - a. mkdir a/b/c
 - b. mkdir a/a/b

C. Conclusion:

1. Write what was performed in the experiment.
2. Mention few applications of what was studied.
3. Write the significance of the topic studied in the experiment.

D. References:

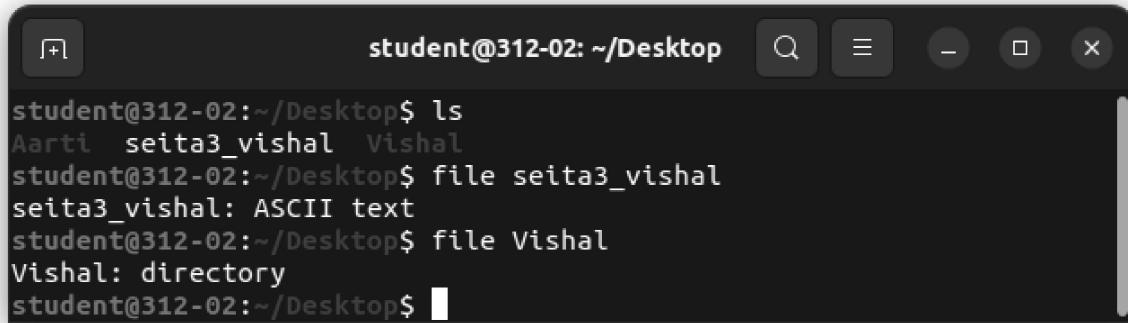
1. Yashwant Kanetkar, UNIX Shell Programming, BPB Publications.
 2. Sumitabha Das, UNIX Concepts and Applications, 3rd Ed., Tata McGraw Hill.
 3. <https://www.geeksforgeeks.org/unix-file-system/>
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Command 1 : file

Description: Displays the file type and other information about the specified file.

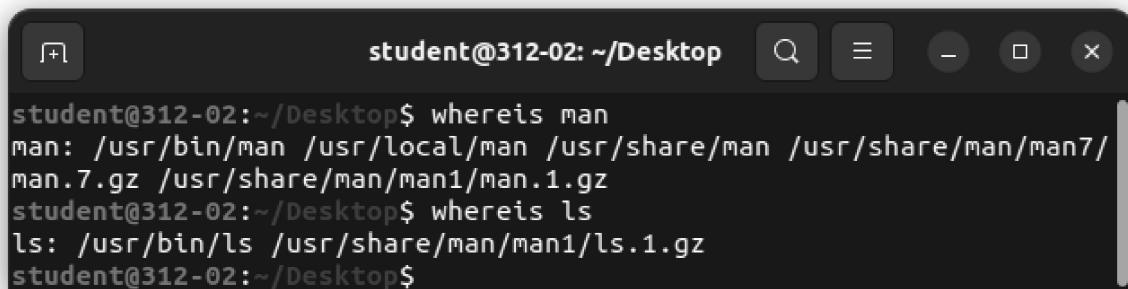


A screenshot of a terminal window titled "student@312-02: ~/Desktop". The window has standard OS X-style controls at the top. The terminal output shows the user running the "ls" command to list files, then using the "file" command to analyze them. The "file" command correctly identifies "seita3_vishal" as an ASCII text file and "Vishal" as a directory.

```
student@312-02:~/Desktop$ ls
Aarti  seita3_vishal  Vishal
student@312-02:~/Desktop$ file seita3_vishal
seita3_vishal: ASCII text
student@312-02:~/Desktop$ file Vishal
Vishal: directory
student@312-02:~/Desktop$
```

Command 2 : whereis

Description: Displays the binary, source, and manual page locations of a specified command.



A screenshot of a terminal window titled "student@312-02: ~/Desktop". The window has standard OS X-style controls at the top. The terminal output shows the user running the "whereis" command twice. First, it finds the "man" command in several locations including /usr/bin/man, /usr/local/man, /usr/share/man, and /usr/share/man/man7/. Then, it finds the "ls" command in /usr/bin/ls and /usr/share/man/man1/ls.1.gz.

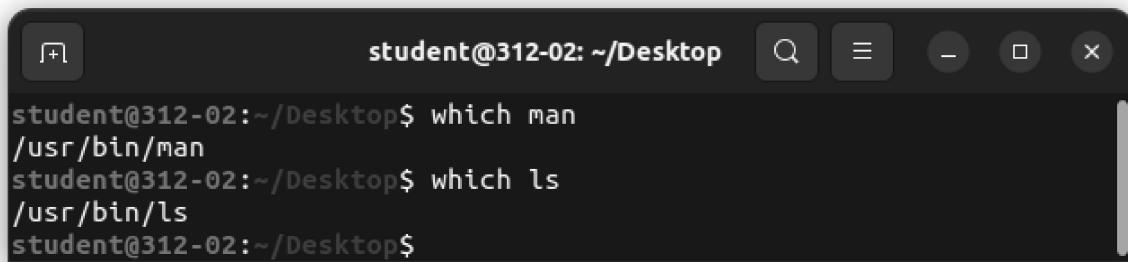
```
student@312-02:~/Desktop$ whereis man
man: /usr/bin/man /usr/local/man /usr/share/man /usr/share/man/man7/
man.7.gz /usr/share/man/man1/man.1.gz
student@312-02:~/Desktop$ whereis ls
ls: /usr/bin/ls /usr/share/man/man1/ls.1.gz
student@312-02:~/Desktop$
```

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Command 3 : which

Description: Returns the path of the executable associated with a specified command.

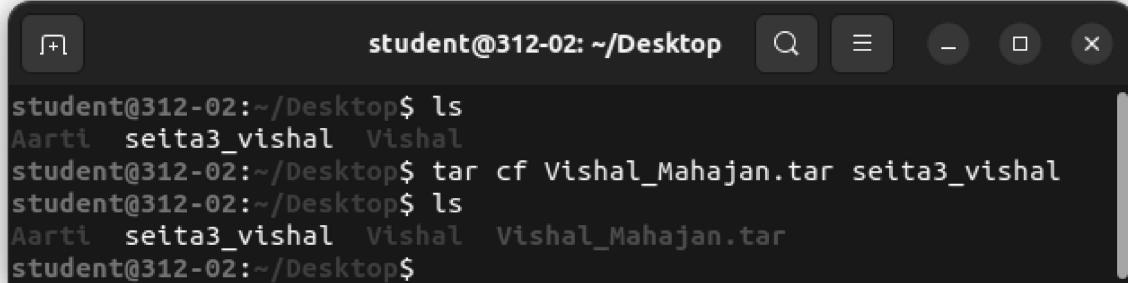


```
student@312-02: ~/Desktop$ which man
/usr/bin/man
student@312-02: ~/Desktop$ which ls
/usr/bin/ls
student@312-02: ~/Desktop$
```

A terminal window titled "student@312-02: ~/Desktop". The window has standard Linux-style window controls (minimize, maximize, close) at the top right. The terminal prompt is "student@312-02: ~/Desktop\$". The user enters the command "which man" followed by "which ls". The output shows the paths to the executables for both commands.

Command 4 : tar cf

Description: Creates a tar archive named <zip name> containing the specified <file>.

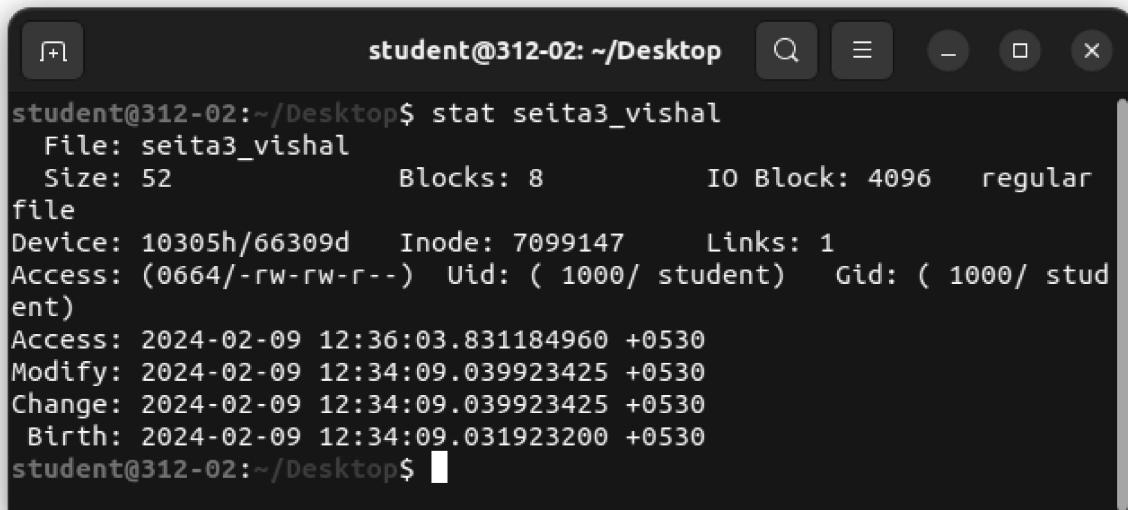


```
student@312-02: ~/Desktop$ ls
Aarti seita3_vishal Vishal
student@312-02: ~/Desktop$ tar cf Vishal_Mahajan.tar seita3_vishal
student@312-02: ~/Desktop$ ls
Aarti seita3_vishal Vishal Vishal_Mahajan.tar
student@312-02: ~/Desktop$
```

A terminal window titled "student@312-02: ~/Desktop". The window has standard Linux-style window controls (minimize, maximize, close) at the top right. The terminal prompt is "student@312-02: ~/Desktop\$". The user lists files in the current directory, then creates a tar archive named "Vishal_Mahajan.tar" containing the file "seita3_vishal". Finally, the user lists the files again to show the archive has been created.

Command 5 : stat

Description: Displays detailed information about the specified file, including access and modification times.



```
student@312-02: ~/Desktop$ stat seita3_vishal
  File: seita3_vishal
  Size: 52          Blocks: 8          IO Block: 4096   regular
file
Device: 10305h/66309d  Inode: 7099147      Links: 1
Access: (0664/-rw-rw-r--)  Uid: ( 1000/ student)  Gid: ( 1000/ student)
Access: 2024-02-09 12:36:03.831184960 +0530
Modify: 2024-02-09 12:34:09.039923425 +0530
Change: 2024-02-09 12:34:09.039923425 +0530
 Birth: 2024-02-09 12:34:09.031923200 +0530
student@312-02: ~/Desktop$
```

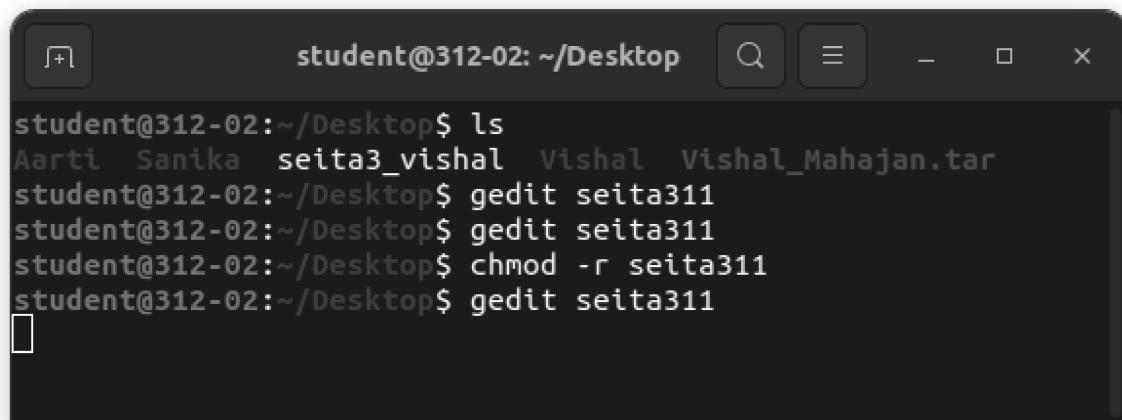
A terminal window titled "student@312-02: ~/Desktop". The window has standard Linux-style window controls (minimize, maximize, close) at the top right. The terminal prompt is "student@312-02: ~/Desktop\$". The user runs the "stat" command on the file "seita3_vishal", displaying its detailed file statistics.

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Class: SE IT A 3

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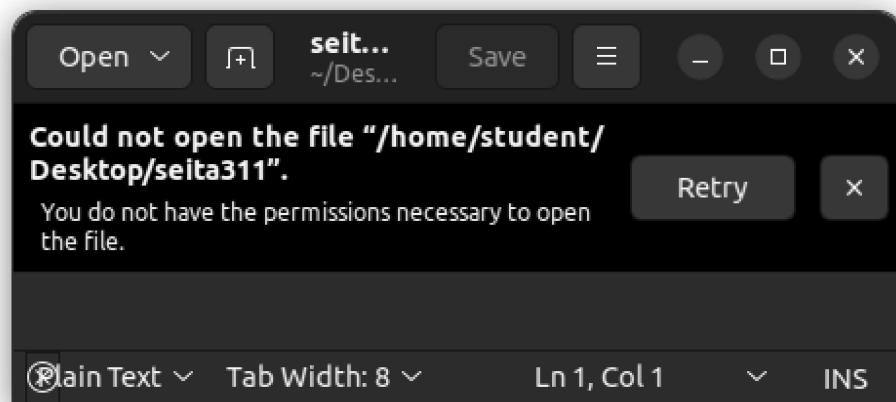
Command 6 : chmod -r

Description: Recursively remove read permissions from the specified file.



A terminal window titled "student@312-02: ~/Desktop". The session shows the following commands:

```
student@312-02:~/Desktop$ ls
Aarti Sanika seita3_vishal Vishal Vishal_Mahajan.tar
student@312-02:~/Desktop$ gedit seita311
student@312-02:~/Desktop$ gedit seita311
student@312-02:~/Desktop$ chmod -r seita311
student@312-02:~/Desktop$ gedit seita311
```

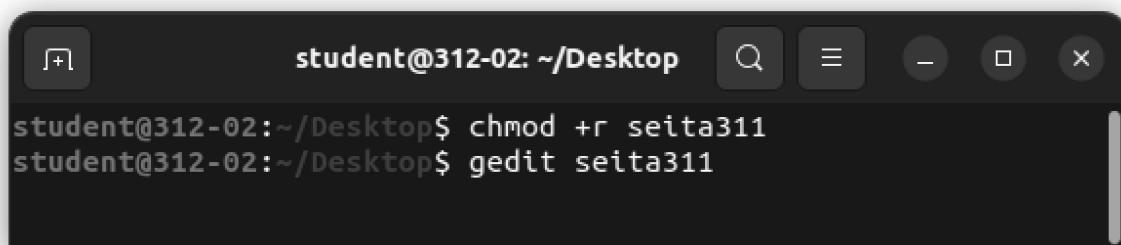


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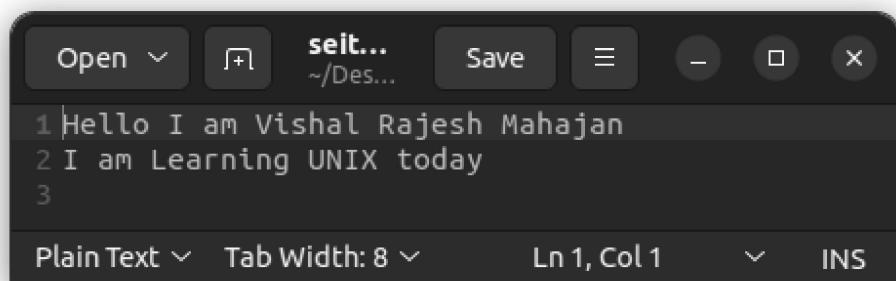
Command :7 chmod +r

Description: Adds read permissions to the specified file.



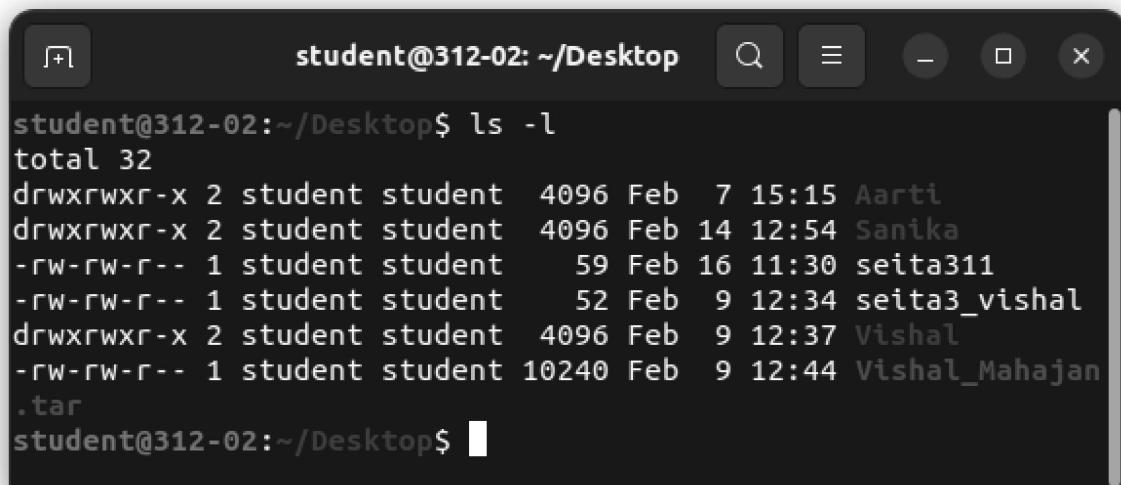
A terminal window titled "student@312-02: ~/Desktop". The command "chmod +r seita311" is entered and executed, followed by "gedit seita311".

```
student@312-02:~/Desktop$ chmod +r seita311
student@312-02:~/Desktop$ gedit seita311
```



Command 8: ls -l

Description: Lists detailed information about files and directories in the current directory.



A terminal window titled "student@312-02: ~/Desktop". The command "ls -l" is entered and executed, displaying a detailed list of files and their metadata.

```
student@312-02:~/Desktop$ ls -l
total 32
drwxrwxr-x 2 student student 4096 Feb  7 15:15 Aarti
drwxrwxr-x 2 student student 4096 Feb 14 12:54 Sanika
-rw-rw-r-- 1 student student    59 Feb 16 11:30 seita311
-rw-rw-r-- 1 student student   52 Feb  9 12:34 seita3_vishal
drwxrwxr-x 2 student student 4096 Feb  9 12:37 Vishal
-rw-rw-r-- 1 student student 10240 Feb  9 12:44 Vishal_Mahajan
.tar
student@312-02:~/Desktop$
```

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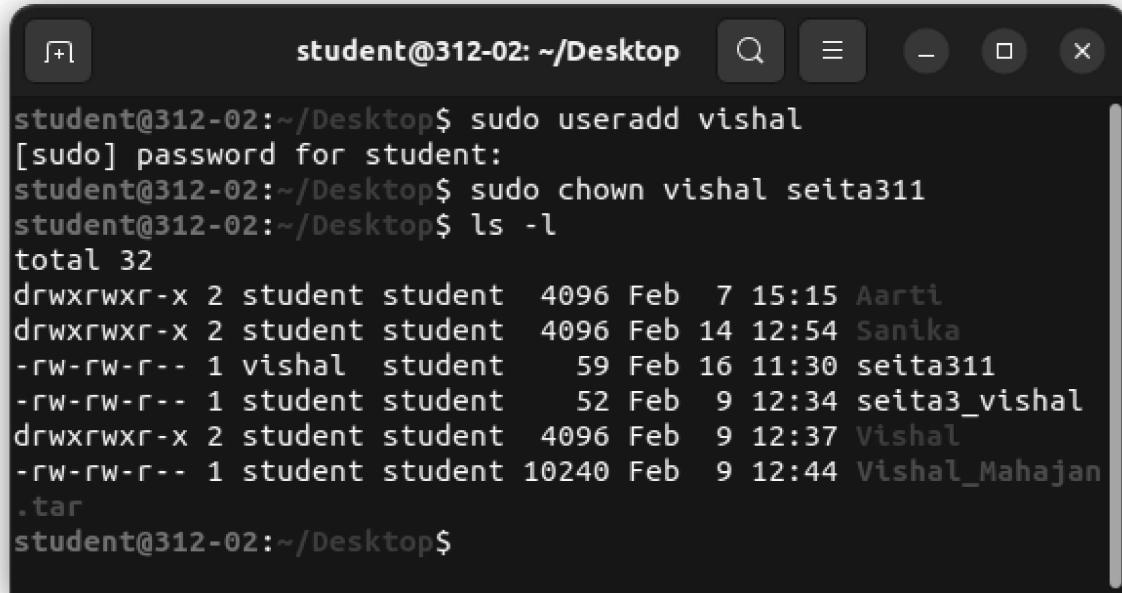
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Command 9 : useradd , chown

Useradd: Adds a new user to the system with the specified username.

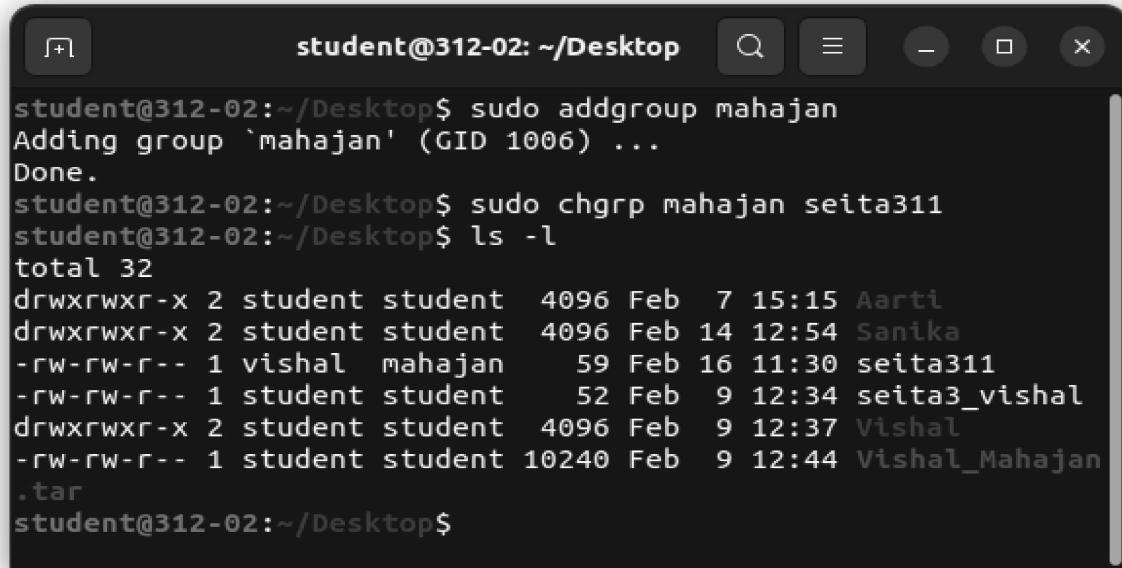
Chown: Changes the owner of the specified file to the specified username



```
student@312-02: ~/Desktop$ sudo useradd vishal
[sudo] password for student:
student@312-02:~/Desktop$ sudo chown vishal seita311
student@312-02:~/Desktop$ ls -l
total 32
drwxrwxr-x 2 student student 4096 Feb  7 15:15 Aarti
drwxrwxr-x 2 student student 4096 Feb 14 12:54 Sanika
-rw-rw-r-- 1 vishal student    59 Feb 16 11:30 seita311
-rw-rw-r-- 1 student student   52 Feb  9 12:34 seita3_vishal
drwxrwxr-x 2 student student 4096 Feb  9 12:37 Vishal
-rw-rw-r-- 1 student student 10240 Feb  9 12:44 Vishal_Mahajan
.tar
student@312-02:~/Desktop$
```

Command 10 : addgroup

addgroup : Adds a new group named b1 to the system.



```
student@312-02:~/Desktop$ sudo addgroup mahajan
Adding group `mahajan' (GID 1006) ...
Done.
student@312-02:~/Desktop$ sudo chgrp mahajan seita311
student@312-02:~/Desktop$ ls -l
total 32
drwxrwxr-x 2 student student 4096 Feb  7 15:15 Aarti
drwxrwxr-x 2 student student 4096 Feb 14 12:54 Sanika
-rw-rw-r-- 1 vishal mahajan    59 Feb 16 11:30 seita311
-rw-rw-r-- 1 student student   52 Feb  9 12:34 seita3_vishal
drwxrwxr-x 2 student student 4096 Feb  9 12:37 Vishal
-rw-rw-r-- 1 student student 10240 Feb  9 12:44 Vishal_Mahajan
.tar
student@312-02:~/Desktop$
```

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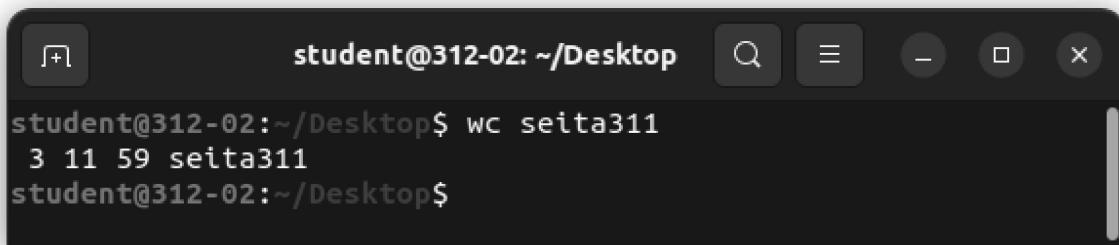
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Command 11 : wc

Wc: Displays the word count, line count, and byte count of the specified file.

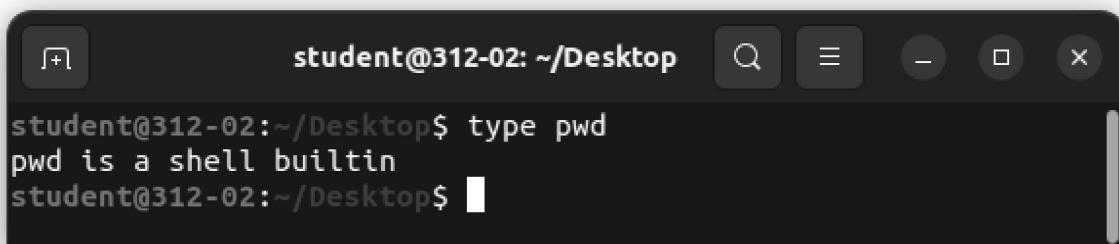


```
student@312-02: ~/Desktop$ wc seita311
3 11 59 seita311
student@312-02: ~/Desktop$
```

A screenshot of a terminal window titled "student@312-02: ~/Desktop". The window has standard OS X-style controls at the top. The terminal content shows the command "wc seita311" being run, which outputs the word count (3), line count (11), and byte count (59) for the file "seita311".

Command 12 : type

Type: Show what type of command is it

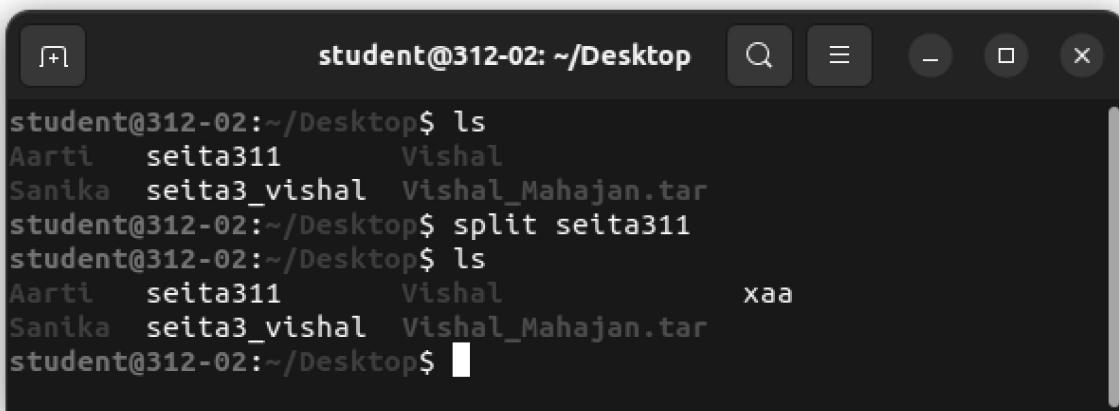


```
student@312-02: ~/Desktop$ type pwd
pwd is a shell builtin
student@312-02: ~/Desktop$
```

A screenshot of a terminal window titled "student@312-02: ~/Desktop". The terminal content shows the command "type pwd" being run, which outputs "pwd is a shell builtin".

Command 13 : split

Splits a file into smaller parts.

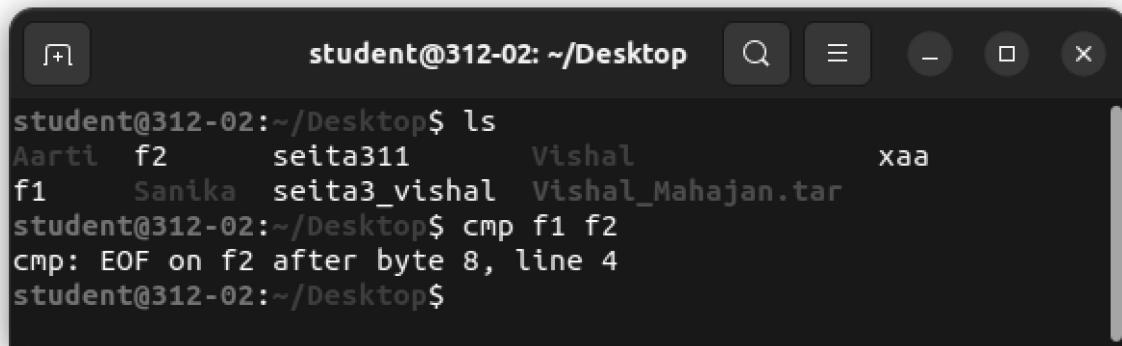


```
student@312-02: ~/Desktop$ ls
Aarti    seita311      Vishal
Sanika   seita3_vishal Vishal_Mahajan.tar
student@312-02: ~/Desktop$ split seita311
student@312-02: ~/Desktop$ ls
Aarti    seita311      Vishal              xaa
Sanika   seita3_vishal Vishal_Mahajan.tar
student@312-02: ~/Desktop$
```

A screenshot of a terminal window titled "student@312-02: ~/Desktop". The terminal content shows the command "split seita311" being run. It also includes the output of "ls" before and after the split command, showing files "seita311", "Vishal", "seita3_vishal", "Vishal_Mahajan.tar", and the newly created file "xaa".

Command 14 : cmp

Compare two files byte-by-byte. It gives a concise description of differences between the two files.

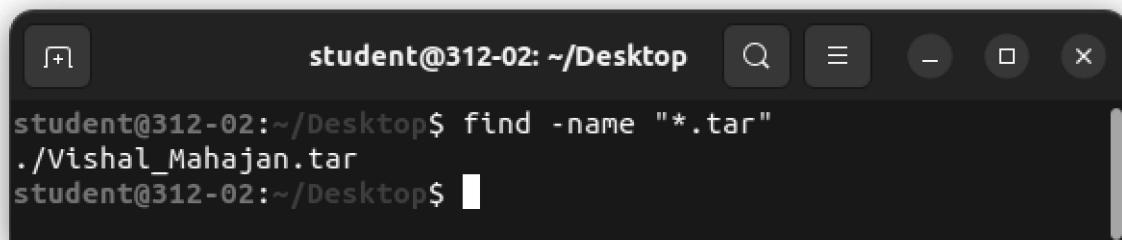


A screenshot of a terminal window titled "student@312-02: ~/Desktop". The window has standard OS X-style controls at the top right. The terminal output shows:

```
student@312-02:~/Desktop$ ls
Aarti  f2      seita311      Vishal          xaa
f1      Sanika  seita3_vishal  Vishal_Mahajan.tar
student@312-02:~/Desktop$ cmp f1 f2
cmp: EOF on f2 after byte 8, line 4
student@312-02:~/Desktop$
```

Command 15: find

Searches for files with a .txt extension in the current directory and its subdirectories.



A screenshot of a terminal window titled "student@312-02: ~/Desktop". The window has standard OS X-style controls at the top right. The terminal output shows:

```
student@312-02:~/Desktop$ find -name "*.tar"
./Vishal_Mahajan.tar
student@312-02:~/Desktop$
```

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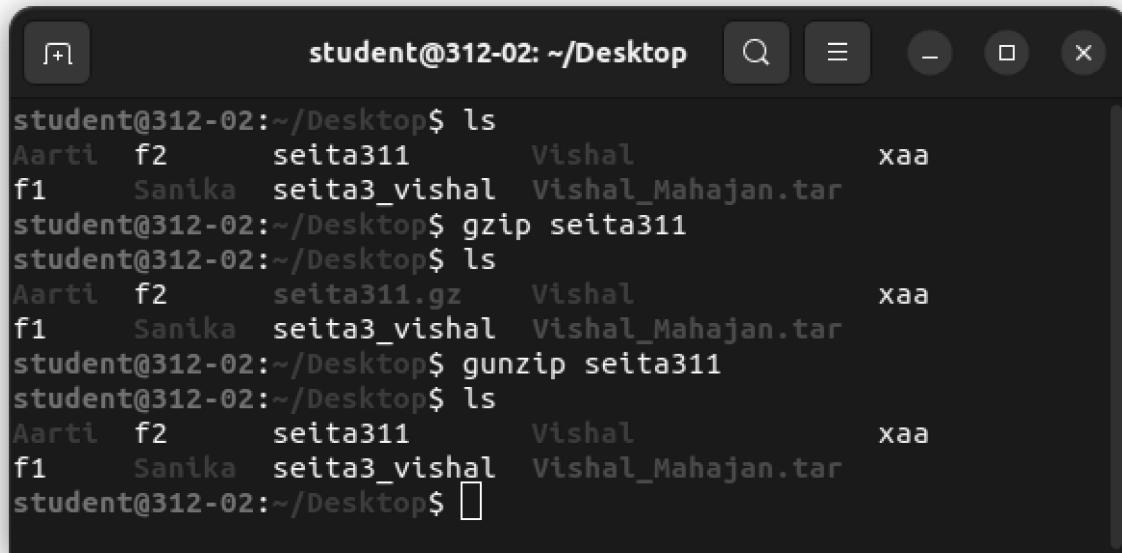
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Command 16 : gzip and gunzip

Compresses the specified file using gzip.

Decompresses the gzip-compressed file1.



The screenshot shows a terminal window titled "student@312-02: ~/Desktop". The terminal displays the following sequence of commands and their results:

```
student@312-02:~/Desktop$ ls
Aarti f2      seita311      Vishal          xaa
f1     Sanika  seita3_vishal  Vishal_Mahajan.tar
student@312-02:~/Desktop$ gzip seita311
student@312-02:~/Desktop$ ls
Aarti f2      seita311.gz    Vishal          xaa
f1     Sanika  seita3_vishal  Vishal_Mahajan.tar
student@312-02:~/Desktop$ gunzip seita311
student@312-02:~/Desktop$ ls
Aarti f2      seita311      Vishal          xaa
f1     Sanika  seita3_vishal  Vishal_Mahajan.tar
student@312-02:~/Desktop$ 
```

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Command 17 : diff comm

Compares the contents of two files and shows the differences.

Compares two sorted files line by line and displays lines unique to each file and common lines.

```
student@312-02: ~/Desktop$ cat > 123.txt
Ajay
kevin
shubham
vishal
^C
student@312-02:~/Desktop$ cat > 456.txt
shubham
vishal
^C
student@312-02:~/Desktop$ diff 123.txt 456.txt
1,2d0
< Ajay
< kevin
student@312-02:~/Desktop$ comm 123.txt 456.txt
Ajay
kevin
      shubham
      vishal
student@312-02:~/Desktop$
```