



NATIONAL TEXTILE

UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

Subject

Operating System

SUBMITTED BY:

Fatima Waseem:

23-NTU-CS1155

SECTION SE: 5th (A)

SUBMITTED TO:

Sir Nasir

Operating Systems – COC 3071L

SE 5th A – Fall 2025

Lab 2: Linux Basics and Introduction

Part 1: Linux Environment Orientation

1.1 Understanding the Linux Environment

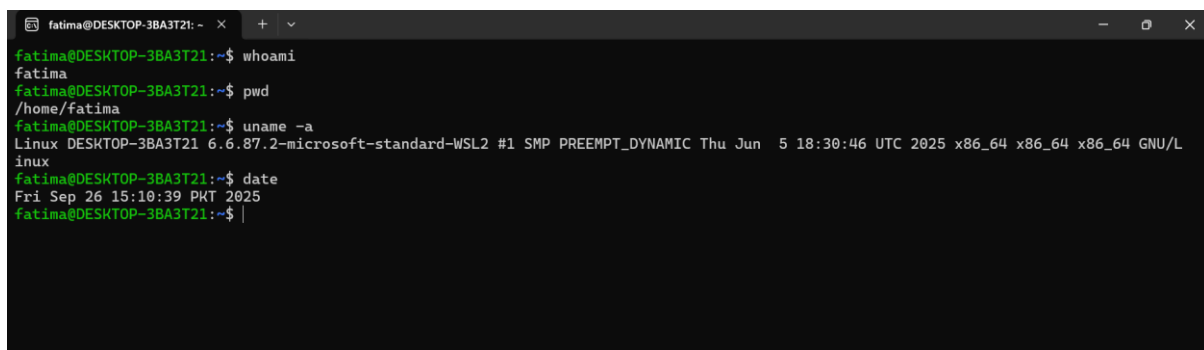
clear

- **Concepts to Cover:**

- What is Linux? Brief history and distributions
- Linux vs Windows: Key differences
- Understanding the shell (bash)
- WSL2 as a Linux environment

- **Hands-on Activity:**

```
# Students open WSL2 terminal and explore
whoami          # Check current user
pwd             # Print working directory
uname -a        # System information
date            # Current date and time
```



```
fatima@DESKTOP-3BA3T21: ~  
fatima@DESKTOP-3BA3T21:~$ whoami  
fatima  
fatima@DESKTOP-3BA3T21:~$ pwd  
/home/fatima  
fatima@DESKTOP-3BA3T21:~$ uname -a  
Linux DESKTOP-3BA3T21 6.6.87.2-microsoft-standard-WSL2 #1 SMP PREEMPT_DYNAMIC Thu Jun  5 18:30:46 UTC 2025 x86_64 x86_64 x86_64 GNU/Linux  
fatima@DESKTOP-3BA3T21:~$ date  
Fri Sep 26 15:10:39 PKT 2025  
fatima@DESKTOP-3BA3T21:~$
```

1.2 Getting Help in Linux

- **Commands to demonstrate:**

```
man ls          # Manual pages  
ls --help       # Built-in help  
which ls        # Location of commands  
type ls         # Command type information
```

```
fatima@DESKTOP-3BA3T21: ~  
LS(1) User Commands LS(1)  
NAME  
ls - list directory contents  
SYNOPSIS  
ls [OPTION]... [FILE]...  
DESCRIPTION  
List information about the FILES (the current directory  
by default). Sort entries alphabetically if none of  
-cftuvSUX nor --sort is specified.  
  
Mandatory arguments to long options are mandatory for  
short options too.  
  
-a, --all  
do not ignore entries starting with .  
  
-A, --almost-all  
do not list implied . and ..  
  
--author  
with -l, print the author of each file  
  
-b, --escape  
print C-style escapes for nongraphic characters  
  
--block-size=SIZE  
with -l, scale sizes by SIZE when printing them;  
e.g., '--block-size=M'; see SIZE format below  
Manual page ls(1) line 1/268 10% (press h for help or q to quit)
```

```
fatima@DESKTOP-3BA3T21: ~  
fatima@DESKTOP-3BA3T21:~$ man ls  
Default: fatima@DESKTOP-3BA3T21: ~  
ctrl+alt+l $ ls --help  
[FILE]...  
List information about the FILES (the current directory by default).  
Sort entries alphabetically if none of -cftuvSUX nor --sort is specified.  
  
Mandatory arguments to long options are mandatory for short options too.  
-a, --all do not ignore entries starting with .  
-A, --almost-all do not list implied . and ..  
--author with -l, print the author of each file  
-b, --escape print C-style escapes for nongraphic characters  
--block-size=SIZE with -l, scale sizes by SIZE when printing them;  
e.g., '--block-size=M'; see SIZE format below  
  
-B, --ignore-backups do not list implied entries ending with ~  
-c with -lt: sort by, and show, ctime (time of last  
change of file status information);  
with -l: show ctime and sort by name;  
otherwise: sort by ctime, newest first  
  
-C list entries by columns  
--color[=WHEN] color the output WHEN; more info below  
-d, --directory list directories themselves, not their contents  
-D, --dired generate output designed for Emacs' dired mode  
-f list all entries in directory order  
-F, --classify[=WHEN] append indicator (one of */=>@|) to entries WHEN  
--file-type likewise, except do not append '*'  
--format=WORD across -x, commas -m, horizontal -x, long -l,  
single-column -l, verbose -l, vertical -C  
  
--full-time like -l --time-style=full-iso  
-g like -l, but do not list owner  
--group-directories-first
```

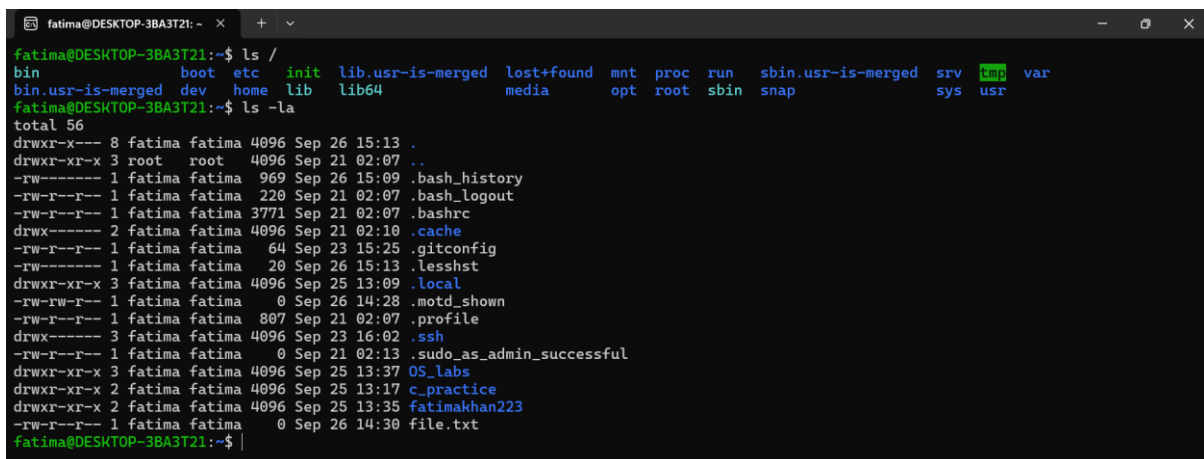
```
fatima@DESKTOP-3BA3T21: ~  
fatima@DESKTOP-3BA3T21:~$ which ls  
/usr/bin/ls  
fatima@DESKTOP-3BA3T21:~$ type ls  
ls is aliased to `ls --color=auto'  
fatima@DESKTOP-3BA3T21:~$
```

Part 2: File System Navigation

2.1 Understanding Linux Directory Structure

- **Concepts to Cover:**
 - Root directory (/)
 - Important directories: /home, /usr, /etc, /var, /tmp
 - Absolute vs relative paths
 - Hidden files and directories
- **Demonstration:**

```
ls /           # Root directory contents
ls -la        # Long listing with hidden files
cd /home      # Change directory
cd ~          # Home directory shortcut
cd -          # Previous directory
```



```
fatima@DESKTOP-3BA3T21: ~$ ls /
bin      boot  etc   init  lib.usr-is-merged  lost+found  mnt  proc  run  sbin.usr-is-merged  srv  tmp  var
bin.usr-is-merged  dev   home  lib   lib64              media      opt  root  sbin  snap                sys  usr

fatima@DESKTOP-3BA3T21: ~$ ls -la
total 56
drwxr-xr-x 8 fatima fatima 4096 Sep 26 15:13 .
drwxr-xr-x 3 root  root   4096 Sep 21 02:07 ..
-rw-r--r-- 1 fatima fatima 969 Sep 26 15:09 .bash_history
-rw-r--r-- 1 fatima fatima 220 Sep 21 02:07 .bash_logout
-rw-r--r-- 1 fatima fatima 3771 Sep 21 02:07 .bashrc
drwxr-xr-x 2 fatima fatima 4096 Sep 21 02:10 .cache
-rw-r--r-- 1 fatima fatima 64 Sep 23 15:25 .gitconfig
-rw-r--r-- 1 fatima fatima 20 Sep 26 15:13 .lessht
drwxr-xr-x 3 fatima fatima 4096 Sep 25 13:09 .local
-rw-rw-r-- 1 fatima fatima 0 Sep 26 14:28 .motd_shown
-rw-r--r-- 1 fatima fatima 807 Sep 21 02:07 .profile
drwxr-xr-x 3 fatima fatima 4096 Sep 23 16:02 .ssh
-rw-r--r-- 1 fatima fatima 0 Sep 21 02:13 .sudo_as_admin_successful
drwxr-xr-x 3 fatima fatima 4096 Sep 25 13:37 OS_labs
drwxr-xr-x 2 fatima fatima 4096 Sep 25 13:17 c_practice
drwxr-xr-x 2 fatima fatima 4096 Sep 25 13:35 fatimakhan223
-rw-r--r-- 1 fatima fatima 0 Sep 26 14:30 file.txt
fatima@DESKTOP-3BA3T21: ~$
```

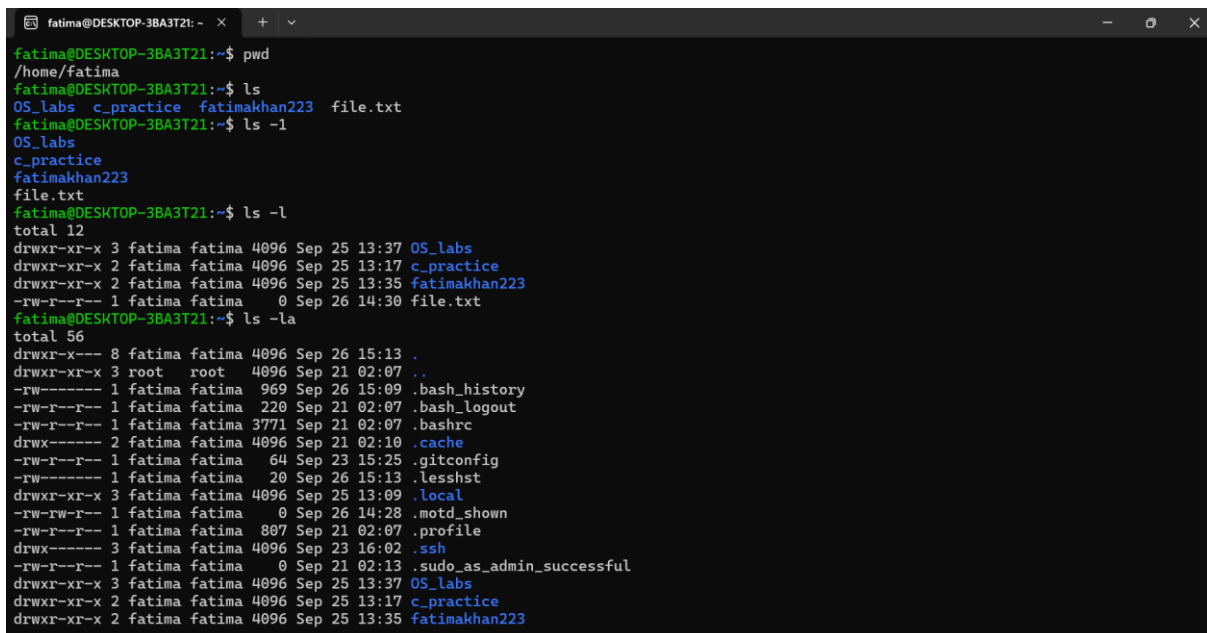


```
fatima@DESKTOP-3BA3T21: ~$ cd /home
fatima@DESKTOP-3BA3T21:/home$ cd ~
fatima@DESKTOP-3BA3T21:~$ cd -
/home
fatima@DESKTOP-3BA3T21:/home$
```

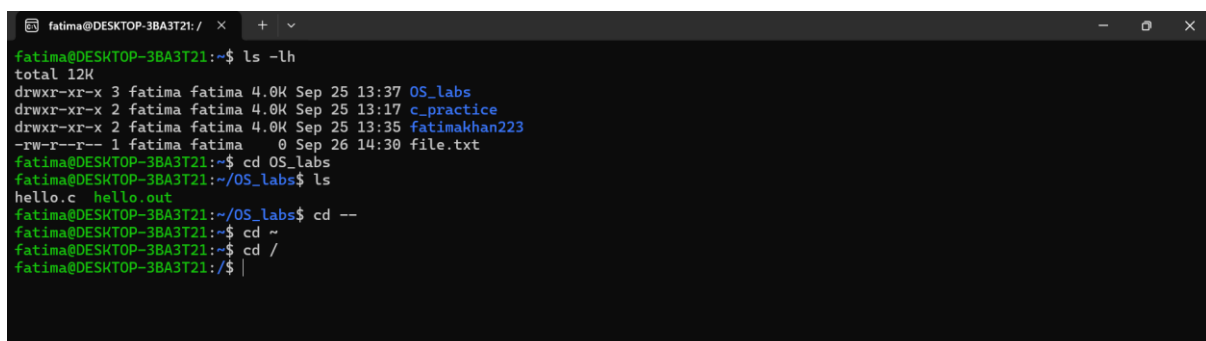
2.2 Basic Navigation Commands (15 minutes)

- Commands to practice:

```
pwd          # Present working directory
ls           # List directory contents
ls -l        # Long format
ls -la       # Include hidden files
ls -lh       # Human readable sizes
cd           # Change directory
cd ..        # Parent directory
cd ~         # Home directory
cd /         # Root directory
```



```
fatima@DESKTOP-3BA3T21:~$ pwd
/home/fatima
fatima@DESKTOP-3BA3T21:~$ ls
OS_labs  c_practice  fatimakhan223  file.txt
fatima@DESKTOP-3BA3T21:~$ ls -l
total 12
-rw-r--r-- 1 fatima fatima 0 Sep 26 14:30 file.txt
fatima@DESKTOP-3BA3T21:~$ ls -lh
total 56
drwxr-xr-x 8 fatima fatima 4096 Sep 26 15:13 .
drwxr-xr-x 3 root root 4096 Sep 21 02:07 ..
-rw-r--r-- 1 fatima fatima 969 Sep 26 15:09 .bash_history
-rw-r--r-- 1 fatima fatima 220 Sep 21 02:07 .bash_logout
-rw-r--r-- 1 fatima fatima 3771 Sep 21 02:07 .bashrc
drwxr-xr-x 2 fatima fatima 4096 Sep 21 02:10 .cache
-rw-r--r-- 1 fatima fatima 64 Sep 23 15:25 .gitconfig
-rw-r--r-- 1 fatima fatima 20 Sep 26 15:13 .lessht
drwxr-xr-x 3 fatima fatima 4096 Sep 25 13:09 .local
-rw-r--r-- 1 fatima fatima 0 Sep 26 14:28 .motd_shown
-rw-r--r-- 1 fatima fatima 807 Sep 21 02:07 .profile
drwxr-xr-x 3 fatima fatima 4096 Sep 23 16:02 .ssh
-rw-r--r-- 1 fatima fatima 0 Sep 21 02:13 .sudo_as_admin_successful
drwxr-xr-x 3 fatima fatima 4096 Sep 25 13:37 OS_labs
drwxr-xr-x 2 fatima fatima 4096 Sep 25 13:17 c_practice
drwxr-xr-x 2 fatima fatima 4096 Sep 25 13:35 fatimakhan223
```



```
fatima@DESKTOP-3BA3T21:~$ ls -lh
total 12K
drwxr-xr-x 3 fatima fatima 4.0K Sep 25 13:37 OS_labs
drwxr-xr-x 2 fatima fatima 4.0K Sep 25 13:17 c_practice
drwxr-xr-x 2 fatima fatima 4.0K Sep 25 13:35 fatimakhan223
-rw-r--r-- 1 fatima fatima 0 Sep 26 14:30 file.txt
fatima@DESKTOP-3BA3T21:~$ cd OS_labs
fatima@DESKTOP-3BA3T21:~/OS_labs$ ls
hello.c  hello.out
fatima@DESKTOP-3BA3T21:~/OS_labs$ cd --
fatima@DESKTOP-3BA3T21:~$ cd ~
fatima@DESKTOP-3BA3T21:~$ cd /
fatima@DESKTOP-3BA3T21:/$
```

Part 3: File and Directory Operations

**3.1 Creating and Managing Files/Directories

- **Commands to demonstrate:**

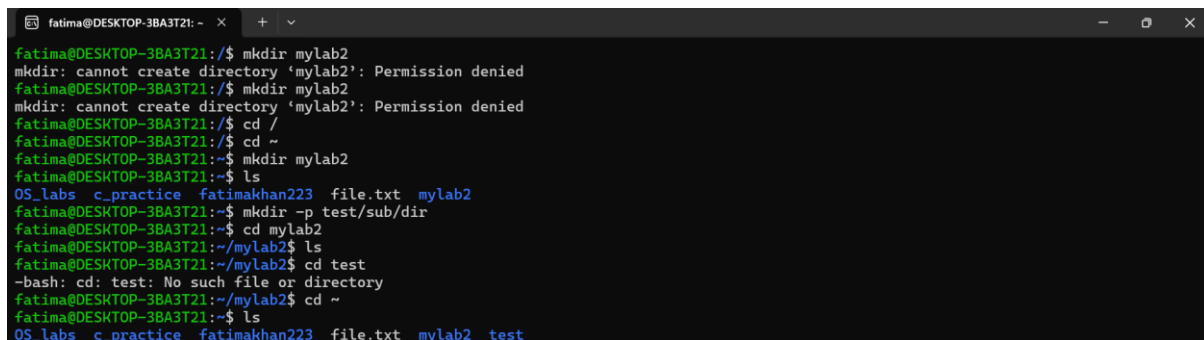
```
mkdir mylab2           # Create directory
mkdir -p test/sub/dir  # Create nested directories
touch file1.txt        # Create empty file
touch file2.txt file3.txt # Multiple files

# Text editors introduction
nano hello.txt          # Simple text editor
# OR
echo "Hello Linux!" > hello.txt # Redirect output to file
```

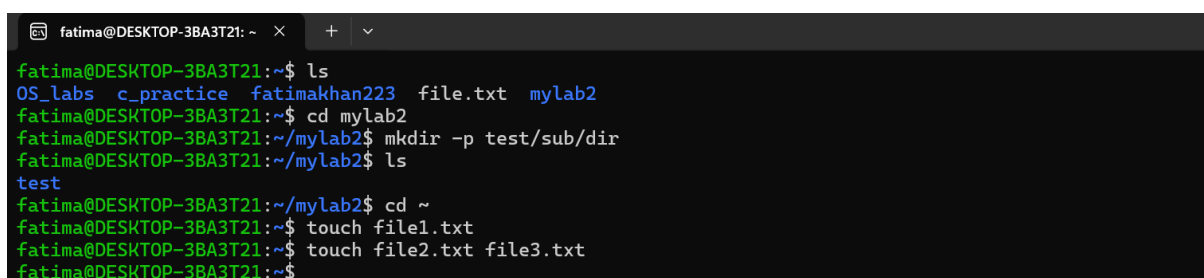
- **File viewing commands:**

```
cat hello.txt          # Display file contents
less hello.txt          # Page through file
head hello.txt          # First 10 lines
```

```
tail hello.txt         # Last 10 lines
wc hello.txt           # Word count
```



```
fatima@DESKTOP-3BA3T21: ~  
fatima@DESKTOP-3BA3T21:/$ mkdir mylab2  
mkdir: cannot create directory 'mylab2': Permission denied  
fatima@DESKTOP-3BA3T21:/$ mkdir mylab2  
mkdir: cannot create directory 'mylab2': Permission denied  
fatima@DESKTOP-3BA3T21:/$ cd /  
fatima@DESKTOP-3BA3T21:/$ cd ~  
fatima@DESKTOP-3BA3T21:~$ mkdir mylab2  
fatima@DESKTOP-3BA3T21:~$ ls  
OS_labs  c_practice  fatimakhan223  file.txt  mylab2  
fatima@DESKTOP-3BA3T21:~$ mkdir -p test/sub/dir  
fatima@DESKTOP-3BA3T21:~$ cd mylab2  
fatima@DESKTOP-3BA3T21:~/mylab2$ ls  
fatima@DESKTOP-3BA3T21:~/mylab2$ cd test  
-bash: cd: test: No such file or directory  
fatima@DESKTOP-3BA3T21:~/mylab2$ cd ~  
fatima@DESKTOP-3BA3T21:~$ ls  
OS_labs  c_practice  fatimakhan223  file.txt  mylab2  test
```



```
fatima@DESKTOP-3BA3T21:~$ ls  
OS_labs  c_practice  fatimakhan223  file.txt  mylab2  
fatima@DESKTOP-3BA3T21:~$ cd mylab2  
fatima@DESKTOP-3BA3T21:~/mylab2$ mkdir -p test/sub/dir  
fatima@DESKTOP-3BA3T21:~/mylab2$ ls  
test  
fatima@DESKTOP-3BA3T21:~/mylab2$ cd ~  
fatima@DESKTOP-3BA3T21:~$ touch file1.txt  
fatima@DESKTOP-3BA3T21:~$ touch file2.txt file3.txt  
fatima@DESKTOP-3BA3T21:~$
```

```
fatima@DESKTOP-3BA3T21: ~  
fatima@DESKTOP-3BA3T21:~$ nano "hello.txt"  
fatima@DESKTOP-3BA3T21:~$ echo "Hello Linux!" > hello.txt  
fatima@DESKTOP-3BA3T21:~$ cat hello.txt  
Hello Linux!  
fatima@DESKTOP-3BA3T21:~$ less hello.txt  
fatima@DESKTOP-3BA3T21:~$ head hello.txt  
Hello Linux!  
fatima@DESKTOP-3BA3T21:~$ |
```

3.2 Copying, Moving, and Deleting

- **Commands to practice:**

<code>cp</code>	<code>hello.txt backup.txt</code>	# Copy file
<code>cp</code>	<code>-r mylab2 mylab2_backup</code>	# Copy directory recursively
<code>mv</code>	<code>backup.txt renamed.txt</code>	# Move/rename file
<code>rm</code>	<code>renamed.txt</code>	# Remove file
<code>rm</code>	<code>-r mylab2_backup</code>	# Remove directory
<code>rmdir</code>	<code>empty_directory</code>	# Remove empty directory

```
fatima@DESKTOP-3BA3T21: ~  
fatima@DESKTOP-3BA3T21:~$ cp hello.txt backup.txt  
fatima@DESKTOP-3BA3T21:~$ cp -r mylab2 mylab2_backup  
fatima@DESKTOP-3BA3T21:~$ mv backup.txt renamed.txt  
fatima@DESKTOP-3BA3T21:~$ rm renamed.txt  
fatima@DESKTOP-3BA3T21:~$ rm -r mylab2_backup  
fatima@DESKTOP-3BA3T21:~$ |
```

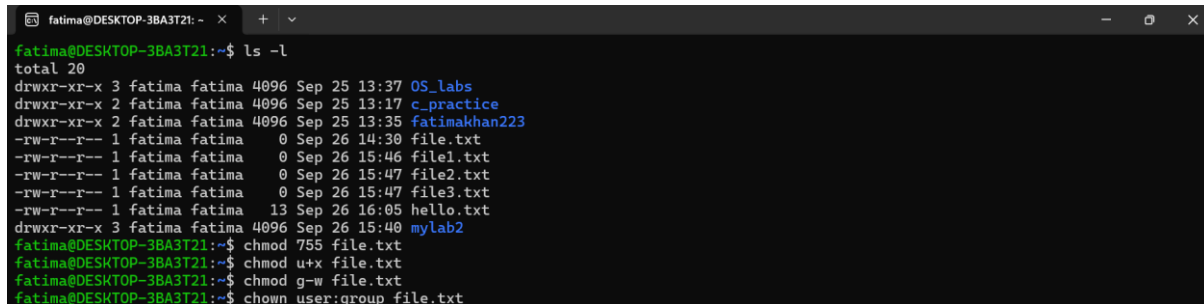
Hands-on Exercise: Students create a directory structure, add files, and practice file operations.

Part 4: File Permissions and Ownership

4.1 Understanding File Permissions

- **Concepts to Cover:**
 - Permission types: read (r), write (w), execute (x)
 - Permission groups: user (u), group (g), others (o)
 - Numeric notation: 755, 644, etc.
- **Commands to demonstrate:**

```
ls -l # View permissions
chmod 755 file.txt # Change permissions (numeric)
chmod u+x file.txt # Add execute permission for user
chmod g-w file.txt # Remove write permission for group
chown user:group file.txt # Change ownership (if applicable)
```

A terminal window titled 'fatima@DESKTOP-3BA3T21: ~' showing the execution of several commands. The first command is 'ls -l', which lists files with their permissions, owner, group, size, and date. The files listed are 'OS_labs', 'c_practice', 'fatimakhan223', 'file.txt', 'file1.txt', 'file2.txt', 'file3.txt', 'hello.txt', and 'mylab2'. The second command is 'chmod 755 file.txt'. The third command is 'chmod u+x file.txt'. The fourth command is 'chmod g-w file.txt'. The fifth command is 'chown user:group file.txt'.

```
fatima@DESKTOP-3BA3T21:~$ ls -l
total 20
drwxr-xr-x 3 fatima fatima 4096 Sep 25 13:37 OS_labs
drwxr-xr-x 2 fatima fatima 4096 Sep 25 13:17 c_practice
drwxr-xr-x 2 fatima fatima 4096 Sep 25 13:35 fatimakhan223
-rw-r--r-- 1 fatima fatima 0 Sep 26 14:30 file.txt
-rw-r--r-- 1 fatima fatima 0 Sep 26 15:46 file1.txt
-rw-r--r-- 1 fatima fatima 0 Sep 26 15:47 file2.txt
-rw-r--r-- 1 fatima fatima 0 Sep 26 15:47 file3.txt
-rw-r--r-- 1 fatima fatima 13 Sep 26 16:05 hello.txt
drwxr-xr-x 3 fatima fatima 4096 Sep 26 15:40 mylab2
fatima@DESKTOP-3BA3T21:~$ chmod 755 file.txt
fatima@DESKTOP-3BA3T21:~$ chmod u+x file.txt
fatima@DESKTOP-3BA3T21:~$ chmod g-w file.txt
fatima@DESKTOP-3BA3T21:~$ chown user:group file.txt
```

Part 5: Text Processing and Utilities

5.1 Essential Text Commands

- **Commands to demonstrate:**

```
grep "pattern" file.txt # Search for patterns
grep -i "pattern" file.txt # Case-insensitive search
grep -n "pattern" file.txt # Show line numbers
```

5.2 Pipes and Redirection

- **Concepts and commands:**

```
ls -l | grep ".txt" # Pipe output
cat file1.txt file2.txt > combined.txt # Redirect output
echo "new line" >> file.txt # Append to file
sort file.txt | uniq # Chain commands
```


Part 6: Introduction to Processes

6.1 Understanding Processes

- **Concepts to Cover:**
 - What is a process?
 - Process ID (PID)
 - Parent-child relationships
 - Process states
- **Commands to demonstrate:**

```
ps                # Show current processes
ps aux           # Detailed process list
ps -ef           # Full format listing
pstree           # Process tree
top              # Real-time process viewer
htop             # Enhanced process viewer (if available)
kill PID         # Terminate process by PID
killall process_name # Kill processes by name
pkill pattern    # Kill processes matching pattern
```