

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

- **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
```

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
```

```
shanza1209@DESKTOP-LIS8TTJ:~$ wgoami
Command 'wgoami' not found, did you mean:
  command 'whoami' from deb coreutils (9.4-3ubuntu6.1)
Try: sudo apt install <deb name>
shanza1209@DESKTOP-LIS8TTJ:~$ whoami
shanza1209
shanza1209@DESKTOP-LIS8TTJ:~$ pwd
/home/shanza1209
shanza1209@DESKTOP-LIS8TTJ:~$ uname -a
Linux DESKTOP-LIS8TTJ 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
shanza1209@DESKTOP-LIS8TTJ:~$ date
Fri Oct 24 15:54:28 PKT 2025
shanza1209@DESKTOP-LIS8TTJ:~$
```

```
shanza1209@DESKTOP-LIS8TTJ:~$ wgoami
Command 'wgoami' not found, did you mean:
  command 'whoami' from deb coreutils (9.4-3ubuntu6.1)
Try: sudo apt install <deb name>
shanza1209@DESKTOP-LIS8TTJ:~$ whoami
shanza1209
shanza1209@DESKTOP-LIS8TTJ:~$ pwd
/home/shanza1209
shanza1209@DESKTOP-LIS8TTJ:~$ uname -a
Linux DESKTOP-LIS8TTJ 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
shanza1209@DESKTOP-LIS8TTJ:~$ date
Fri Oct 24 15:54:28 PKT 2025
shanza1209@DESKTOP-LIS8TTJ:~$ man ls
shanza1209@DESKTOP-LIS8TTJ:~$ ls --help
Usage: ls [OPTION]... [FILE]...
List information about the FILES (the current directory by default).
Sort entries alphabetically if none of -ctuvSUX 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 ..
-l, --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, --sort=TYPE           with -lt: sort by, and show, ctime (time of last
                        change of file status information);
                        with -l: show (time and sort by name);
                        otherwise: sort by ctime, newest first

-C, --sort=TYPE           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, --classify[=WHEN]    list all entries in directory order
                        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 -1, verbose -l, vertical -C

--full-time              like -l --time-style=full-iso
-g, --group-directories-first
                        like -l, but do not list owner
                        group directories before files;
                        can be augmented with a --sort option, but any
                        use of --sort=none (-U) disables grouping

shanza1209@DESKTOP-LIS8TTJ:~$
```

```
shanza1209@DESKTOP-LIS8TT:~$ which ls
/usr/bin/ls
shanza1209@DESKTOP-LIS8TT:~$ type ls
ls is aliased to 'ls --color=auto'
shanza1209@DESKTOP-LIS8TT:~$
```

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
```

```
shanza1209@DESKTOP-LIS8T7: /home
shanza1209@DESKTOP-LIS8T7:~$ which ls
/usr/bin/ls
shanza1209@DESKTOP-LIS8T7:~$ type ls
ls is aliased to 'ls --color=auto'
shanza1209@DESKTOP-LIS8T7:~$ ls /
bin          dev          lib64       mnt          root       /sbin        usr-is-merged  sys         var
bin          home         lib         lost+found  opt         run         snap          usr
shanza1209@DESKTOP-LIS8T7:~$ ls -la
total 68
drwxr-xr-x 11 shanza1209 shanza1209 4096 Oct 24 15:56 .
drwxr-xr-x  3 root        root        4096 Oct 18 22:56 ..
-rw-r--r--  1 shanza1209 shanza1209  33 Oct 18 23:36 .bash_history
-rw-r--r--  1 shanza1209 shanza1209  220 Oct 18 22:56 .bash_logout
-rw-r--r--  1 shanza1209 shanza1209  2771 Oct 18 22:56 .bashrc
drwxr-xr-x  3 shanza1209 shanza1209 4096 Oct 19 13:55 .cache
-rw-r--r--  1 shanza1209 shanza1209  58 Oct 24 15:38 .gitconfig
-rw-r--r--  1 shanza1209 shanza1209  20 Oct 24 15:56 .lessht
-rw-r--r--  1 shanza1209 shanza1209   0 Oct 24 14:20 .motd_show
-rw-r--r--  1 shanza1209 shanza1209  807 Oct 18 22:56 .profile
drwxr-xr-x  2 shanza1209 shanza1209 4096 Oct 24 15:43 .ssh
-rw-r--r--  1 shanza1209 shanza1209   0 Oct 18 22:58 .sudo_as_admin_successful
drwxr-xr-x  3 shanza1209 shanza1209 4096 Oct 19 13:55 .vscode-remote-containers
drwxr-xr-x  5 shanza1209 shanza1209 4096 Oct 19 13:55 .vscode-server
drwxr-xr-x  2 shanza1209 shanza1209 4096 Oct 24 15:12 Lab06
drwxr-xr-x  2 shanza1209 shanza1209 4096 Oct 19 14:27 Lab4_OS
drwxr-xr-x  2 shanza1209 shanza1209 4096 Oct 24 14:18 Lab_07
drwxr-xr-x  6 shanza1209 shanza1209 4096 Oct 24 15:53 Labs_OS
drwxr-xr-x  2 shanza1209 shanza1209 4096 Oct 24 15:47 Wst_Lab1
shanza1209@DESKTOP-LIS8T7:~$ cd /home
shanza1209@DESKTOP-LIS8T7:~$ cd ~
shanza1209@DESKTOP-LIS8T7:~$ cd -
/home
shanza1209@DESKTOP-LIS8T7:~$
```

2.2 Basic Navigation Commands (15 minutes)

- Commands to practice:

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

```
shanza1209@DESKTOP-LIS8T7: /
drwxr-xr-x 2 shanza1209 shanza1209 4096 Oct 24 14:18 Lab_07
drwxr-xr-x 6 shanza1209 shanza1209 4096 Oct 24 15:53 Labs_OS
drwxr-xr-x 2 shanza1209 shanza1209 4096 Oct 24 15:47 Wst_Lab1
shanza1209@DESKTOP-LIS8T7:~$ cd /home
shanza1209@DESKTOP-LIS8T7:~$ cd ~
shanza1209@DESKTOP-LIS8T7:~$ cd -
/home
shanza1209@DESKTOP-LIS8T7:~$ pwd
/home
shanza1209@DESKTOP-LIS8T7:~$ ls
shanza1209
shanza1209@DESKTOP-LIS8T7:~$ ls -l
total 4
drwxr-xr-x 11 shanza1209 shanza1209 4096 Oct 24 15:56 shanza1209
shanza1209@DESKTOP-LIS8T7:~$ ls -la
total 12
drwxr-xr-x  3 root        root        4096 Oct 18 22:56 .
drwxr-xr-x 22 root        root        4096 Oct 24 14:19 ..
drwxr-xr-x 11 shanza1209 shanza1209 4096 Oct 24 15:56 shanza1209
shanza1209@DESKTOP-LIS8T7:~$ ls -lh
total 4.0K
drwxr-xr-x 11 shanza1209 shanza1209 4.0K Oct 24 15:56 shanza1209
shanza1209@DESKTOP-LIS8T7:~$ cd
shanza1209@DESKTOP-LIS8T7:~$ cd ..
shanza1209@DESKTOP-LIS8T7:~$ cd ~
shanza1209@DESKTOP-LIS8T7:~$ cd /
shanza1209@DESKTOP-LIS8T7:/$
```

Part 3: File and Directory Operations

**3.1 Creating and Managing Files/Directories

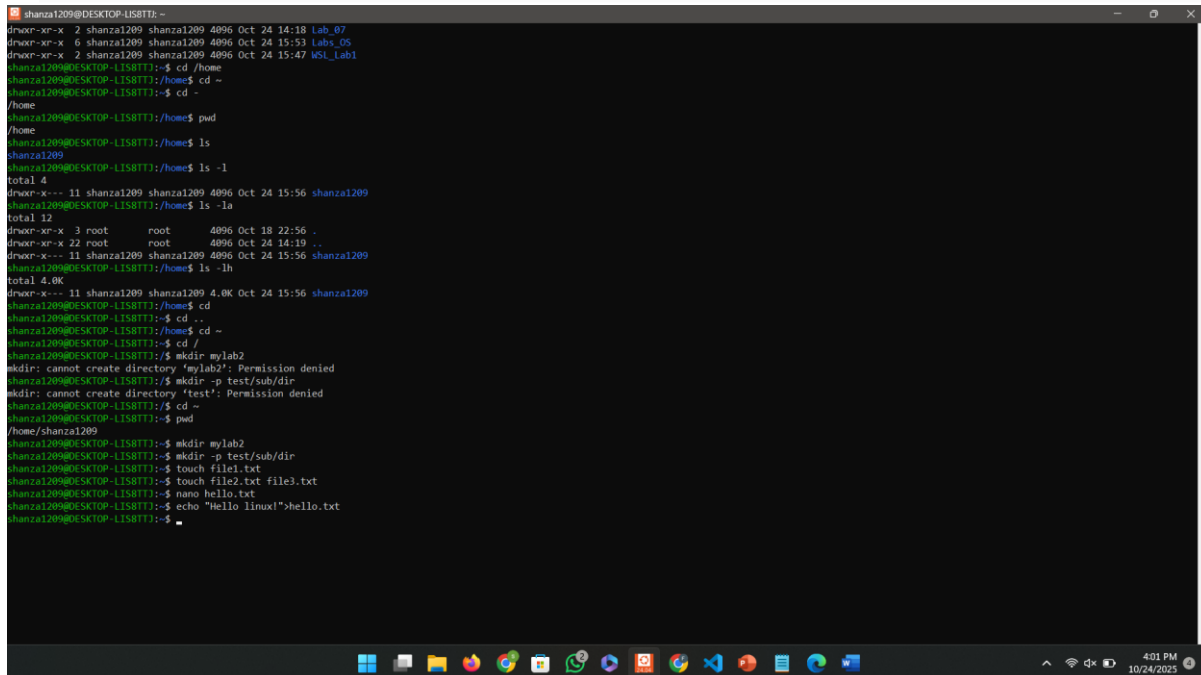
- Commands to demonstrate:

```
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
```



```
shanza1209@DESKTOP-L1S8TT:~$
drwxr-xr-x  2 shanza1209 shanza1209 4096 Oct 24 14:18 Lab_07
drwxr-xr-x  6 shanza1209 shanza1209 4096 Oct 24 15:53 Labs_05
drwxr-xr-x  2 shanza1209 shanza1209 4096 Oct 24 15:47 MSI_Lab1
shanza1209@DESKTOP-L1S8TT:~$ cd /home
shanza1209@DESKTOP-L1S8TT:~$ cd ~
shanza1209@DESKTOP-L1S8TT:~$ pwd
/home
shanza1209@DESKTOP-L1S8TT:~$ ls
shanza1209
shanza1209@DESKTOP-L1S8TT:~$ ls -l
total 4
drwxr-x--- 11 shanza1209 shanza1209 4096 Oct 24 15:56 shanza1209
shanza1209@DESKTOP-L1S8TT:~$ ls -la
total 12
drwxr-xr-x  3 root    root      4096 Oct 18 22:56 .
drwxr-xr-x 22 root    root      4096 Oct 24 14:19 ..
drwxr-x--- 11 shanza1209 shanza1209 4096 Oct 24 15:56 shanza1209
shanza1209@DESKTOP-L1S8TT:~$ ls -lh
total 4.0K
drwxr-x--- 11 shanza1209 shanza1209 4.0K Oct 24 15:56 shanza1209
shanza1209@DESKTOP-L1S8TT:~$ cd
shanza1209@DESKTOP-L1S8TT:~$ cd ~
shanza1209@DESKTOP-L1S8TT:~$ cd /
shanza1209@DESKTOP-L1S8TT:/ $ mkdir mylab2
mkdir: cannot create directory 'mylab2': Permission denied
shanza1209@DESKTOP-L1S8TT:/ $ mkdir -p test/sub/dir
mkdir: cannot create directory 'test': Permission denied
shanza1209@DESKTOP-L1S8TT:/ $ cd ~
shanza1209@DESKTOP-L1S8TT:~$ pwd
/home/shanza1209
shanza1209@DESKTOP-L1S8TT:~$ mkdir mylab2
shanza1209@DESKTOP-L1S8TT:~$ mkdir -p test/sub/dir
shanza1209@DESKTOP-L1S8TT:~$ touch file1.txt
shanza1209@DESKTOP-L1S8TT:~$ touch file2.txt file3.txt
shanza1209@DESKTOP-L1S8TT:~$ nano hello.txt
shanza1209@DESKTOP-L1S8TT:~$ echo "Hello Linux!">hello.txt
shanza1209@DESKTOP-L1S8TT:~$
```

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

```
shanza1209@DESKTOP-LIS8TT2:~  
shanza1209@DESKTOP-LIS8TT2:~/home$ cd  
shanza1209@DESKTOP-LIS8TT2:~$ cd -  
shanza1209@DESKTOP-LIS8TT2:~/home$ cd ~  
shanza1209@DESKTOP-LIS8TT2:~$ cd /  
shanza1209@DESKTOP-LIS8TT2:/$ mkdir mylab2  
mkdir: cannot create directory 'mylab2': Permission denied  
shanza1209@DESKTOP-LIS8TT2:/$ mkdir -p test/sub/dir  
mkdir: cannot create directory 'test': Permission denied  
shanza1209@DESKTOP-LIS8TT2:/$ cd ~  
shanza1209@DESKTOP-LIS8TT2:~$ pwd  
/home/shanza1209  
shanza1209@DESKTOP-LIS8TT2:~$ mkdir mylab2  
shanza1209@DESKTOP-LIS8TT2:~$ mkdir -p test/sub/dir  
shanza1209@DESKTOP-LIS8TT2:~$ touch file1.txt  
shanza1209@DESKTOP-LIS8TT2:~$ touch file2.txt file3.txt  
shanza1209@DESKTOP-LIS8TT2:~$ nano hello.txt  
shanza1209@DESKTOP-LIS8TT2:~$ echo "Hello linux!">hello.txt  
shanza1209@DESKTOP-LIS8TT2:~$ cat hello.txt  
Hello linux!  
shanza1209@DESKTOP-LIS8TT2:~$ less hello.txt  
shanza1209@DESKTOP-LIS8TT2:~$ head hello.txt  
Hello linux!  
shanza1209@DESKTOP-LIS8TT2:~$ tail hello.txt  
Hello linux!  
shanza1209@DESKTOP-LIS8TT2:~$  
shanza1209@DESKTOP-LIS8TT2:~$ wc hello.txt  
1 2 13 hello.txt  
shanza1209@DESKTOP-LIS8TT2:~$
```

3.2 Copying, Moving, and Deleting

- Commands to practice:

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

```
shanza1209@DESKTOP-LIS8TT2:~  
shanza1209@DESKTOP-LIS8TT2:~$ cd /  
shanza1209@DESKTOP-LIS8TT2:/$ mkdir mylab2  
mkdir: cannot create directory 'mylab2': Permission denied  
shanza1209@DESKTOP-LIS8TT2:/$ mkdir -p test/sub/dir  
mkdir: cannot create directory 'test': Permission denied  
shanza1209@DESKTOP-LIS8TT2:/$ cd ~  
shanza1209@DESKTOP-LIS8TT2:~$ pwd  
/home/shanza1209  
shanza1209@DESKTOP-LIS8TT2:~$ mkdir mylab2  
shanza1209@DESKTOP-LIS8TT2:~$ mkdir -p test/sub/dir  
shanza1209@DESKTOP-LIS8TT2:~$ touch file1.txt  
shanza1209@DESKTOP-LIS8TT2:~$ touch file2.txt file3.txt  
shanza1209@DESKTOP-LIS8TT2:~$ nano hello.txt  
shanza1209@DESKTOP-LIS8TT2:~$ echo "Hello linux!">hello.txt  
shanza1209@DESKTOP-LIS8TT2:~$ cat hello.txt  
Hello linux!  
shanza1209@DESKTOP-LIS8TT2:~$ less hello.txt  
shanza1209@DESKTOP-LIS8TT2:~$ head hello.txt  
Hello linux!  
shanza1209@DESKTOP-LIS8TT2:~$ tail hello.txt  
Hello linux!  
shanza1209@DESKTOP-LIS8TT2:~$  
shanza1209@DESKTOP-LIS8TT2:~$ wc hello.txt  
1 2 13 hello.txt  
shanza1209@DESKTOP-LIS8TT2:~$ cp hello.txt backup.txt  
shanza1209@DESKTOP-LIS8TT2:~$ cp -r mylab2 mylab2_backup  
shanza1209@DESKTOP-LIS8TT2:~$ mv backup.txt renamed.txt  
shanza1209@DESKTOP-LIS8TT2:~$ rm renamed.txt  
shanza1209@DESKTOP-LIS8TT2:~$ rm -r mylab2_backup  
shanza1209@DESKTOP-LIS8TT2:~$ rmdir empty_directory  
rmdir: failed to remove 'empty_directory': No such file or directory  
shanza1209@DESKTOP-LIS8TT2:~$
```

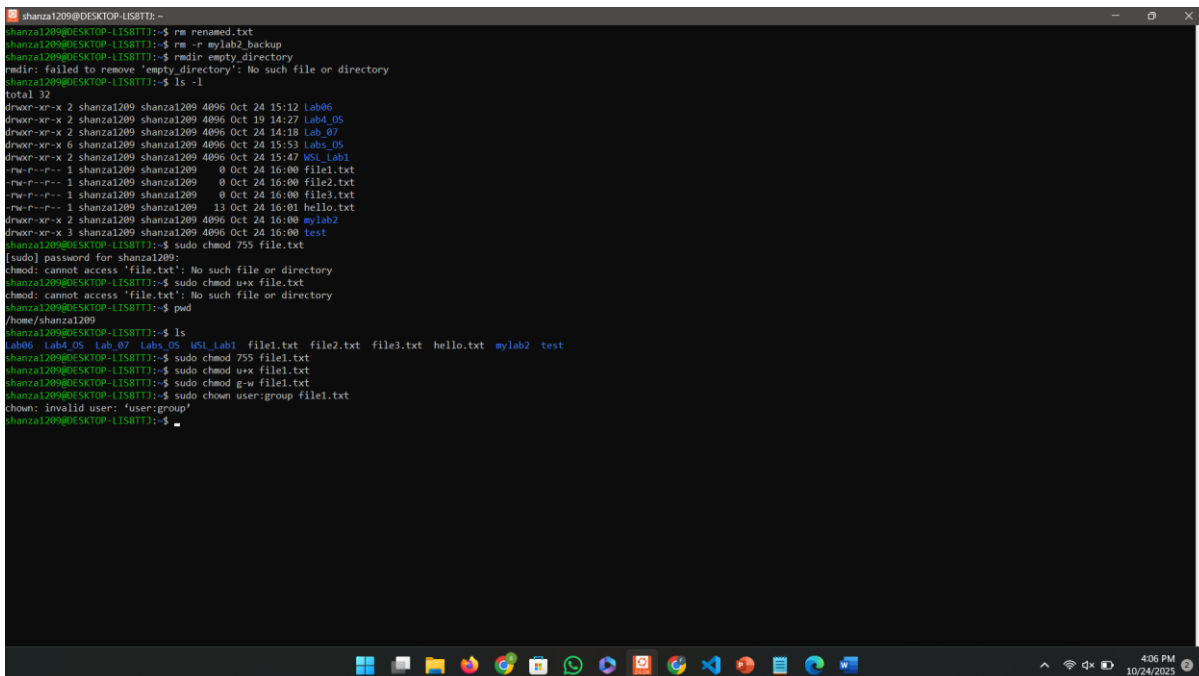
Hands-on Exercise: Students create a directory structure, add files, and practice file operations.

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)
```



```
shanzai209@DESKTOP-LIS8TT2:~$ rm renamed.txt
shanzai209@DESKTOP-LIS8TT2:~$ rm -r mylab2_backup
shanzai209@DESKTOP-LIS8TT2:~$ mkdir empty_directory
mkdir: failed to remove 'empty_directory': No such file or directory
shanzai209@DESKTOP-LIS8TT2:~$ ls -l
total 32
drwxr-xr-x 2 shanzai209 shanzai209 4096 Oct 24 15:12 Lab06
drwxr-xr-x 2 shanzai209 shanzai209 4096 Oct 19 14:27 Lab4_05
drwxr-xr-x 2 shanzai209 shanzai209 4096 Oct 24 14:18 Lab_07
drwxr-xr-x 6 shanzai209 shanzai209 4096 Oct 24 15:53 Labs_05
drwxr-xr-x 2 shanzai209 shanzai209 4096 Oct 24 15:47 WSL_Lab1
-rw-r--r-- 1 shanzai209 shanzai209  0 Oct 24 16:00 file1.txt
-rw-r--r-- 1 shanzai209 shanzai209  0 Oct 24 16:00 file2.txt
-rw-r--r-- 1 shanzai209 shanzai209  0 Oct 24 16:00 file3.txt
-rw-r--r-- 1 shanzai209 shanzai209 13 Oct 24 16:01 hello.txt
drwxr-xr-x 2 shanzai209 shanzai209 4096 Oct 24 16:00 mylab2
drwxr-xr-x 3 shanzai209 shanzai209 4096 Oct 24 16:00 test
shanzai209@DESKTOP-LIS8TT2:~$ sudo chmod 755 file.txt
[sudo] password for shanzai209:
chmod: cannot access 'file.txt': No such file or directory
shanzai209@DESKTOP-LIS8TT2:~$ sudo chmod u+x file.txt
chmod: cannot access 'file.txt': No such file or directory
shanzai209@DESKTOP-LIS8TT2:~$ pwd
/home/shanzai209
shanzai209@DESKTOP-LIS8TT2:~$ ls
Lab06 Lab4_05 Lab_07 Labs_05 WSL_Lab1 file1.txt file2.txt file3.txt hello.txt mylab2 test
shanzai209@DESKTOP-LIS8TT2:~$ sudo chmod 755 file1.txt
shanzai209@DESKTOP-LIS8TT2:~$ sudo chmod u+x file1.txt
shanzai209@DESKTOP-LIS8TT2:~$ sudo chmod g-w file1.txt
shanzai209@DESKTOP-LIS8TT2:~$ sudo chown user:group file1.txt
chown: invalid user: 'user:group'
shanzai209@DESKTOP-LIS8TT2:~$
```

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
```