Experiment 2: Linux File Systems, Permissions, and Essential Commands

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Aim:

- To understand the structure of Linux file systems.
- To learn and practice essential navigation and file management commands.
- To explore file permissions and ownership, and manage them using Linux commands.
- To use user management, system information commands, and editing tools.
- To solve practical exercises and tasks for mastering Linux basics.

Requirements

- A Linux machine (Ubuntu/Debian/Linux Mint or similar).
- User privileges to create, modify, and delete files.
- Access to terminal and text editors like `nano` or `vim`.

Theory

Linux uses a hierarchical file system starting from the root `/`. Essential directories include `/home`, `/etc`, `/usr`, `/var`, `/bin`, and `/tmp`. File permissions are divided among **owner**, **group**, and **others**, with actions `r` (read), `w` (write), and `x` (execute). Navigation commands like `ls`, `pwd`, `cd`, and file operations (`cp`, `mv`, `rm`) form the basis of Linux usage. Editors (`nano`, `vim`) and commands for system info (`uname`, `df`, `top`, `history`) provide insights and control. Practice tasks build practical confidence.

Procedure & Observations

Section 1: File Systems and Permissions

We learned how Linux organizes directories, how to view and change file permissions using `chmod`, `chown`, and `chgrp`.

Section 2: Navigation and File Operations

Commands like `ls`, `pwd`, `cd`, `mkdir`, `rmdir`, `touch`, `cp`, `mv`, `rm` were practiced to manage files and directories.

Section 3: File Viewing and Editing

We used `cat`, `less`, `head`, `tail` to view file contents, and practiced editing with `nano` and `vim`.

Section 4: User Management

Commands `whoami`, `who`, `passwd`, `sudo` were practiced to understand users and privileges.

Section 5: System Information

Commands like `uname`, `df`, `top`, `htop`, `history` were used to gather system and process information.

Section 6: Practice Exercises

Hands-on practice included navigation, file operations, text editing, system exploration, and cleanup.

Practice Exercises

Exercise 1: File System Navigation

```
cd
pwd
mkdir -p projects/linux_practice/{scripts,documents,backup}
cd projects/linux_practice/scripts
touch setup.sh cleanup.sh readme.txt
ls -la
cd ..
ls -la
```

Output:

Exercise 2: File Operations and Permissions

```
cd ~/projects/linux_practice/documents
echo "This is a practice document" > practice.txt
ls -l practice.txt
chmod 644 practice.txt
cp practice.txt ../backup/
cp practice.txt ../backup/practice_backup_$(date +%Y%m%d).txt
ls -la ../backup/
```

Output:

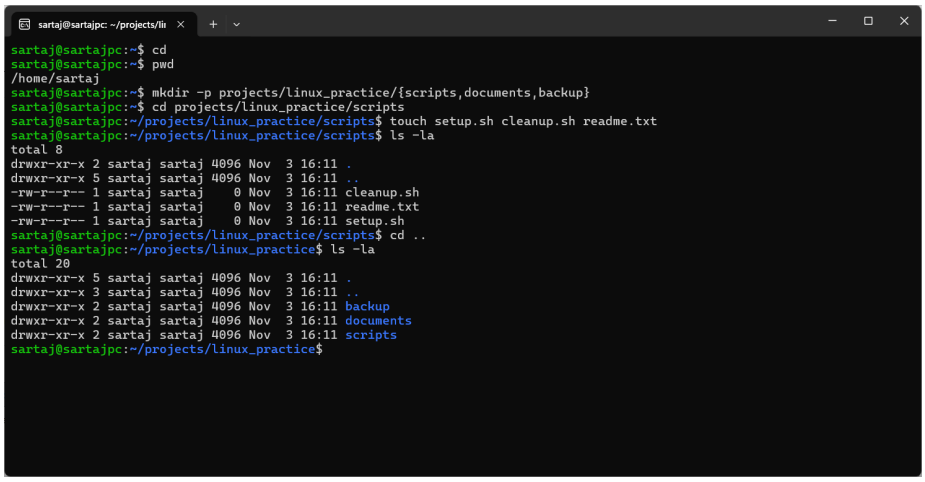


Figure 1: exp2_ex1

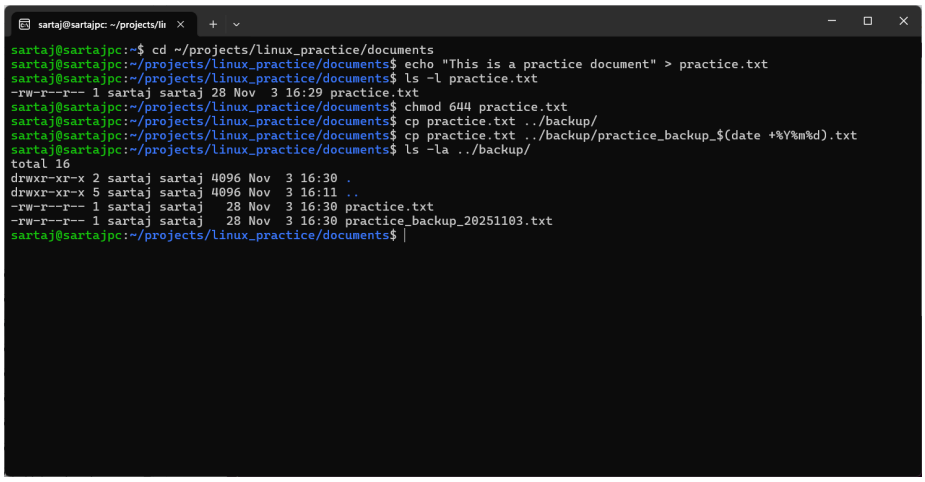
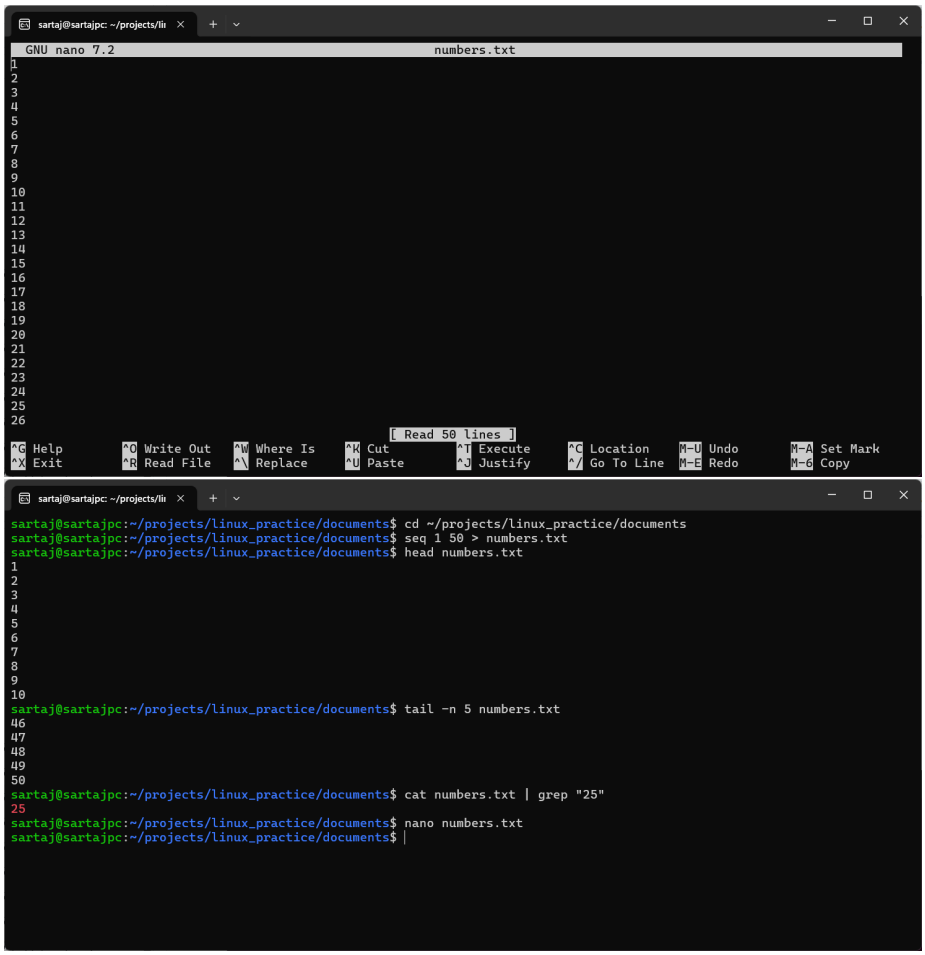


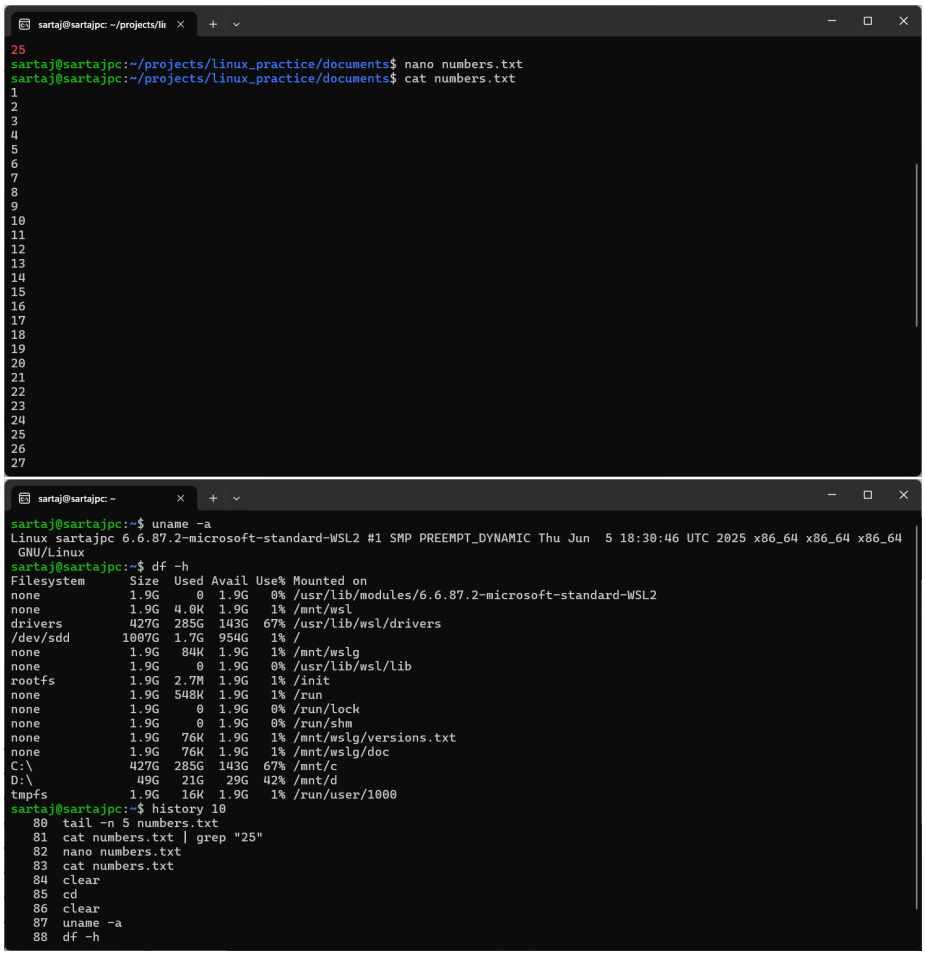
Figure 2: exp2_ex2

Exercise 3: Text Editing and Viewing

```
cd ~/projects/linux_practice/documents
seq 1 50 > numbers.txt
head numbers.txt
tail -n 5 numbers.txt
cat numbers.txt | grep "25"
nano numbers.txt
cat numbers.txt
```

Output:

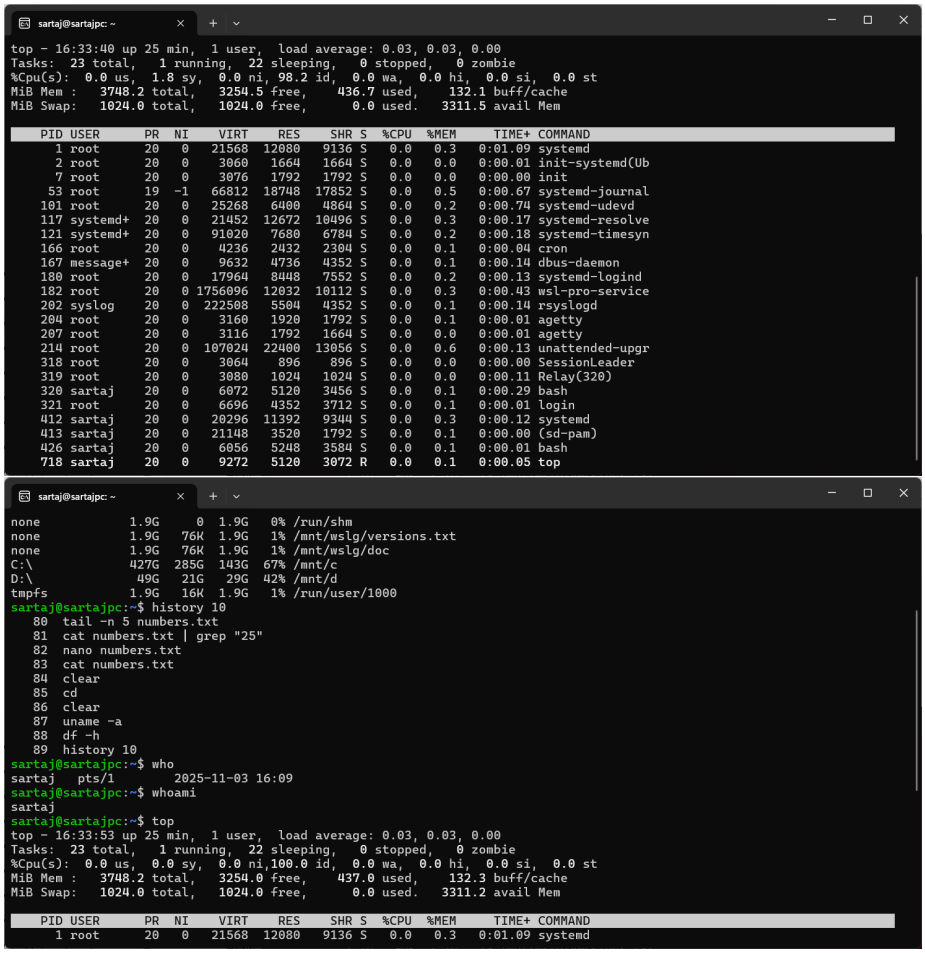




Exercise 4: System Exploration

```
uname -a
df -h
history 10
who
whoami
top
```

Output:



Exercise 5: Cleanup

```
cd ~/projects/linux_practice
rm -i documents/numbers.txt
rmdir backup
rm -r backup
ls -la
history | tail -20
```

Output:

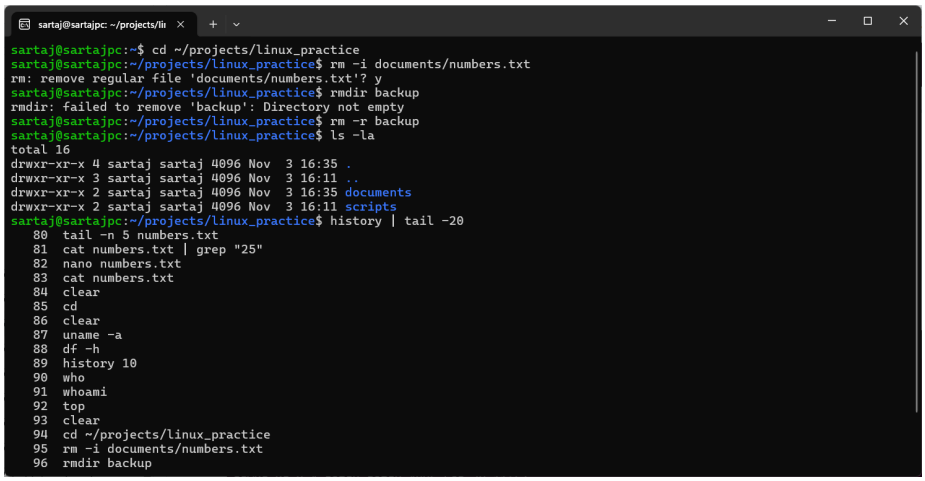


Figure 3: ex2_ex5

Question Bank / Lab Exam Tasks

Task 1: Directory Navigation

```
mkdir -p ~/test_project/{docs,scripts,data}
cd ~/test_project/scripts
pwd
```

Output:

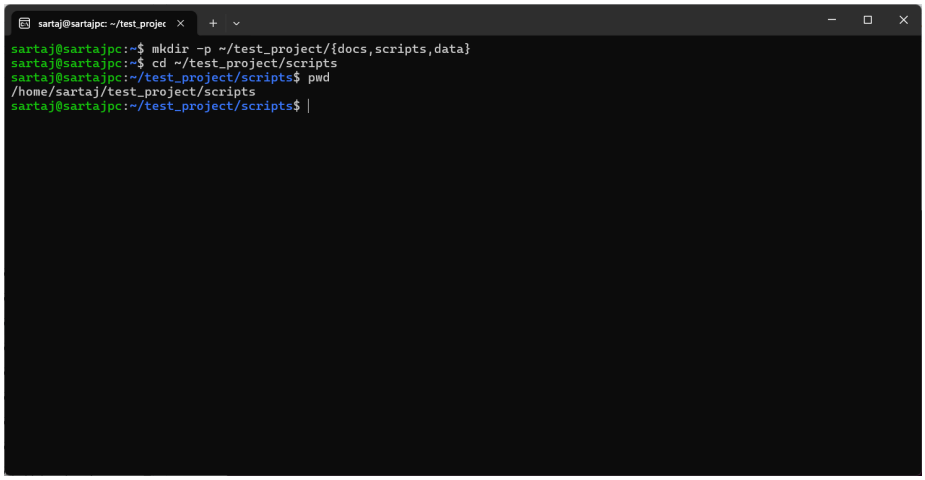


Figure 4: exp2_t1

Task 2: File Creation and Content

```
cd ~/test_project/docs
touch readme.txt notes.txt todo.txt
echo "Project documentation" > readme.txt
echo "Important notes" > notes.txt
cat readme.txt
cat notes.txt
```

Output:

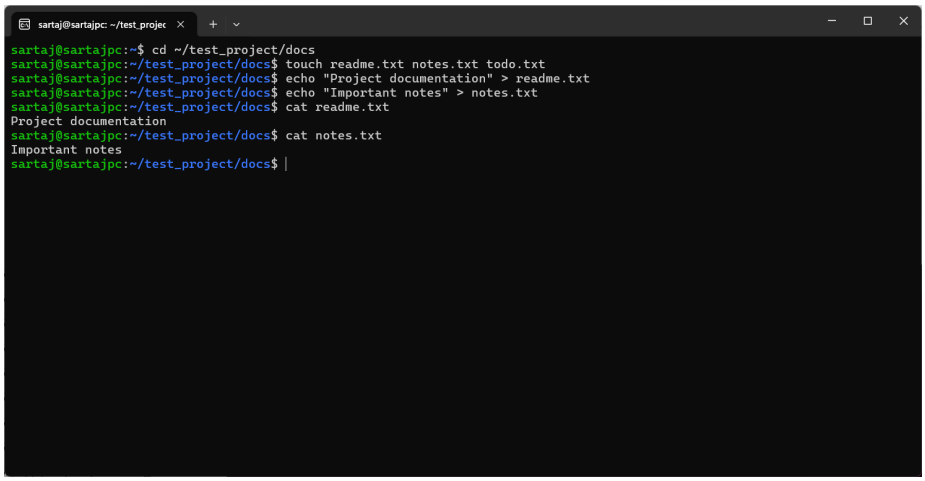


Figure 5: exp2_t2

Task 3: File Operations

```
cp readme.txt ../data/project_info.txt
mv todo.txt ../scripts/
```

Output:

Task 4: File Permissions

```
cd ~/test_project/scripts
echo "#\!/bin/bash" > backup.sh
echo "echo Backup complete" >> backup.sh
```

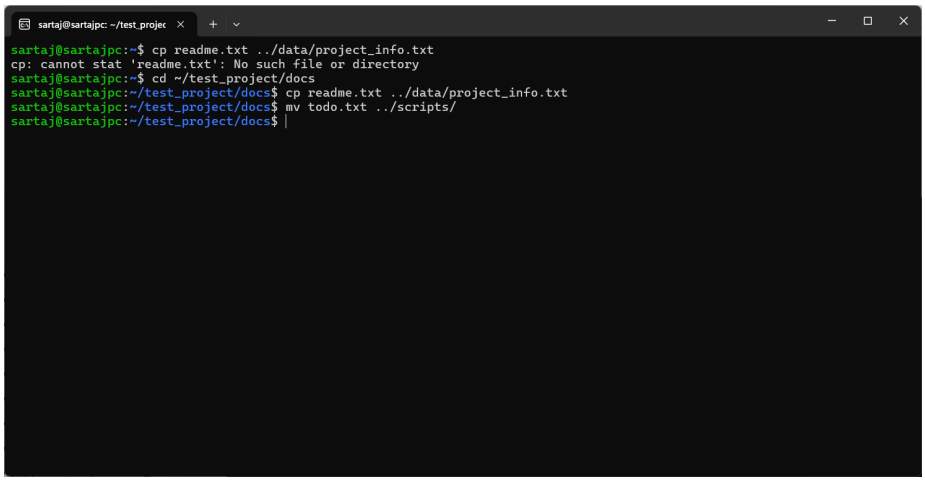


Figure 6: exp2_t3

```
chmod u+x backup.sh
ls -l backup.sh
```

Output:

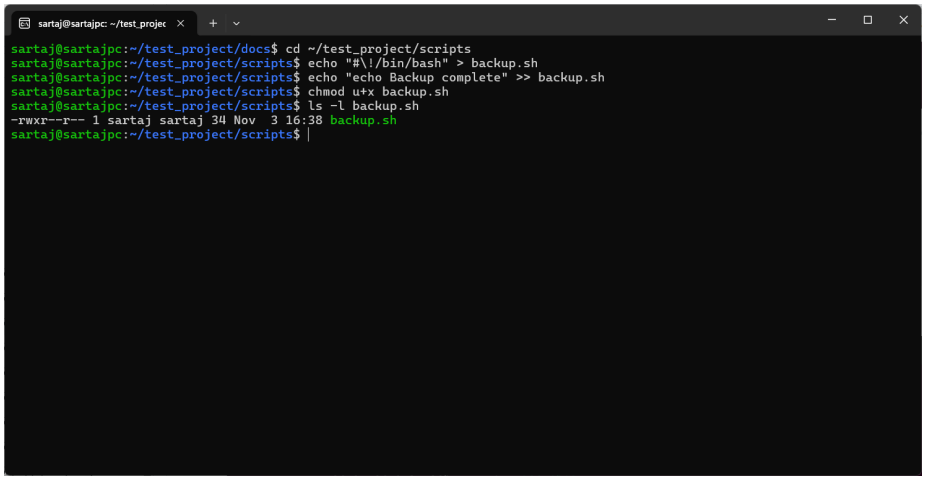


Figure 7: exp2_t4

Task 5: File Viewing

```
seq 1 20 > numbers.txt
head -n 5 numbers.txt
tail -n 3 numbers.txt
grep "1" numbers.txt
```

Output:

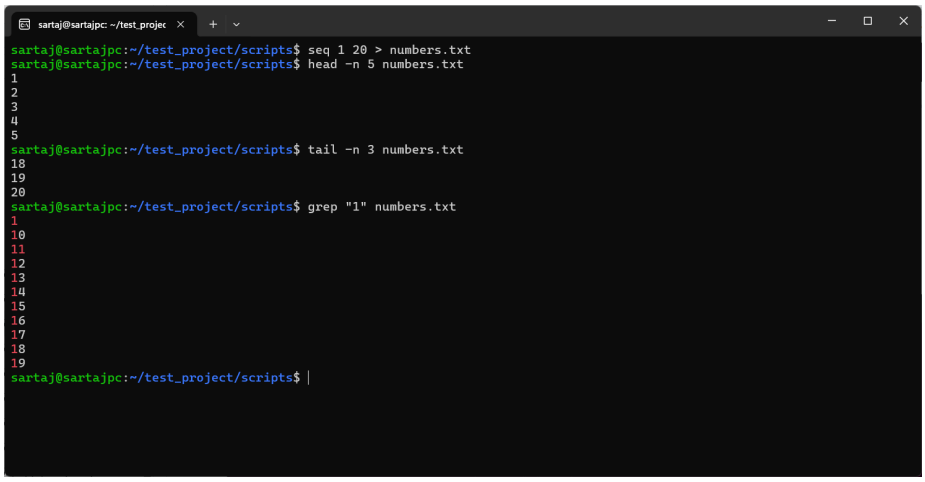


Figure 8: exp2_t5

Task 6: Text Editing

```
nano config.txt
cat config.txt
```

Output:

Task 7: System Information

```
echo "Username: $(whoami)" > system_info.txt
echo "Date: $(date)" >> system_info.txt
echo "Directory: $(pwd)" >> system_info.txt
df -h >> system_info.txt
cat system_info.txt
```

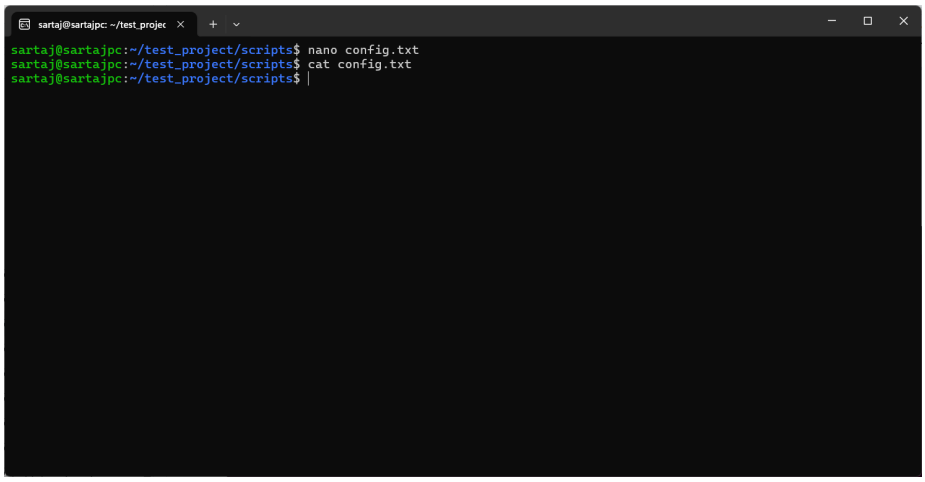


Figure 9: exp2_t6

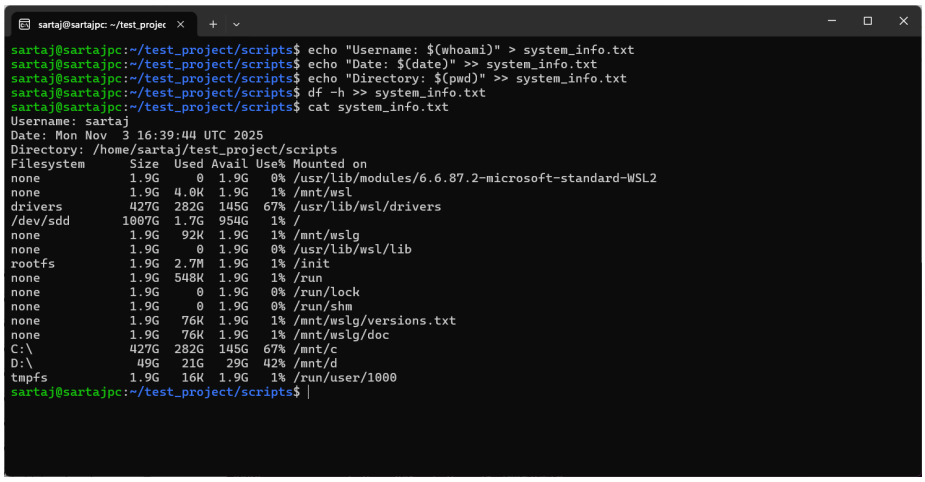


Figure 10: exp2_t7

Output:

Task 8: File Organization

```
mkdir ~/test_project/backup
cp ~/test_project/*/*.txt ~/test_project/backup/
ls -la ~/test_project/backup
```

Output:

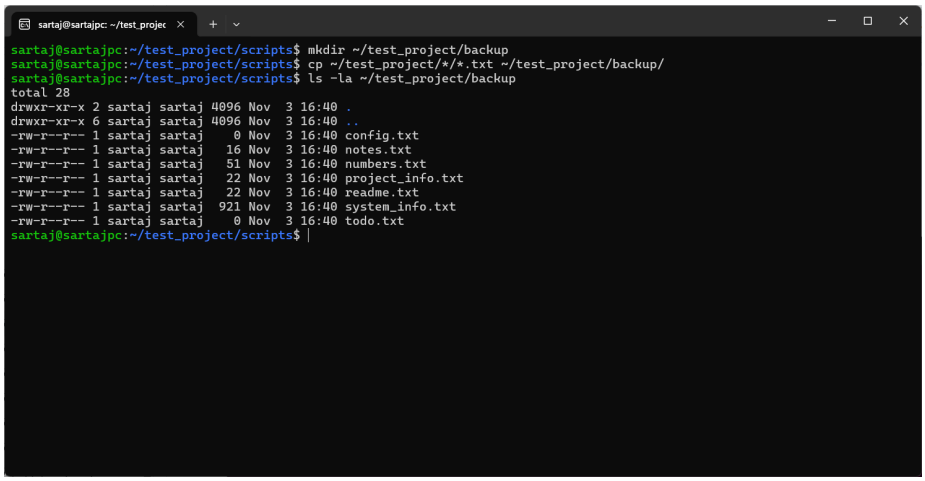


Figure 11: exp2_t8

Task 9: Process and History

```
history | wc -l
history 10
```

Output:

Task 10: Comprehensive Cleanup

```
chmod 754 backup.sh
find ~/test_project -type f | wc -l > summary.txt
find ~/test_project -type d | wc -l >> summary.txt
cat summary.txt
```

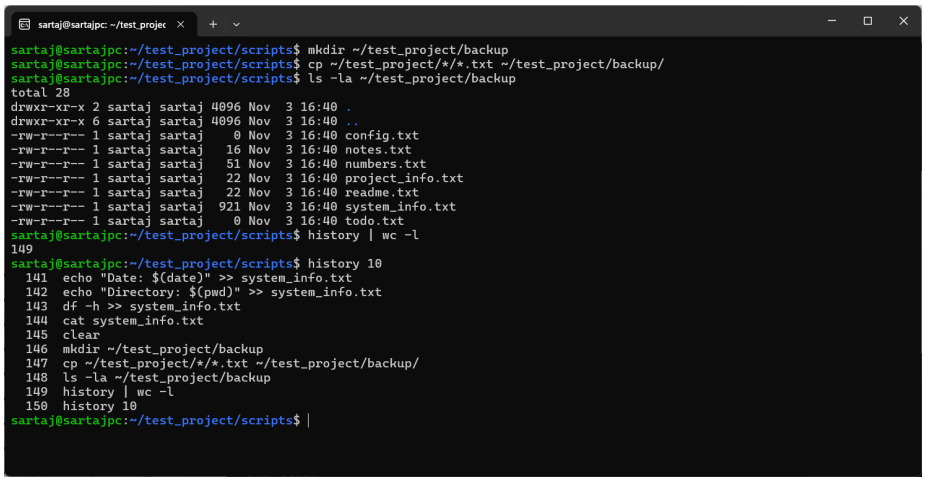


Figure 12: exp2_t9

Output:

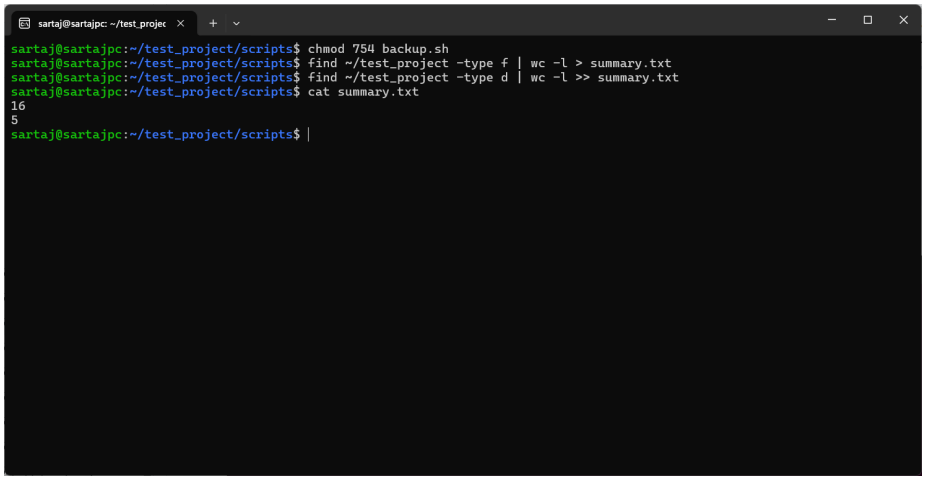


Figure 13: exp2_t10

Result

- Explored Linux file system structure.
- Practiced file operations, editing, and permissions.
- Learned user and system management commands.
- Completed practical exercises and lab exam-style tasks.

Challenges Faced & Learning Outcomes

- Challenge 1: Managing complex directory structures.
- Challenge 2: Remembering symbolic vs numeric permissions.
- Challenge 3: Using `find`, `grep`, and redirection effectively.

Learning:

- Mastered Linux navigation, file handling, and permissions.
- Gained practical knowledge of user/system management.
- Practiced exam-style tasks to solidify learning.

Conclusion

This experiment comprehensively covered **Linux file systems, permissions, commands, editing, user management, and system info**. The tasks ensured thorough practice, making it a complete foundation for Linux proficiency.