Experiment [1]: [Linux OS Environment Setup]

Name: Tushita Sharma, Roll No.: 590029121, Date: 2025-09-17

AIM:

- To install and configure different Linux operating system environments on a Windows machine. We will use two distinct technologies: **Windows Subsystem for Linux (WSL)** for a lightweight command-line environment and **Oracle VirtualBox** for a full graphical virtual machine.

Requirements:

- A Windows 10/11 PC.
- Administrator access and **hardware virtualization enabled in the BIOS/UEFI**.
- An internet connection.

Theory:

- This experiment is designed to provide hands-on experience with two primary methods of running Linux on a Windows host.This is ideal for developers and system administrators who require a Linux command-line without the overhead of a full virtual machine.
- **Oracle VirtualBox**, on the other hand, is a traditional Type 2 hypervisor. It creates a complete, virtualized computer system on which a guest operating system (like Ubuntu or Linux Mint) can be installed. This method provides a fully isolated environment, complete with a graphical user interface (GUI).

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Procedure & Observations

Part 1: Installing and Configuring WSL (Ubuntu)

Exercise 1: [Installing WSL on Windows]

- **Task Statement:** Enable the required Windows features and install the Ubuntu Linux distribution using a single command.
- **Explanation:** This demonstrates how the modern wsl --install command simplifies the entire setup process, automating what previously required multiple manual steps.
- **Command(s):**

  wsl --install -d ubuntu

- **Observation:** The command automatically enabled the “Virtual Machine Platform” and “Windows Subsystem for Linux” optional components. It then proceeded to download the Ubuntu distribution. The system requested a reboot to complete the final stage of the installation.

Exercise 2: [Configuring the Ubuntu Distribution]

- **Task Statement:** After the initial installation and reboot, configure the Ubuntu environment by creating a new user account.

- **Explanation:** This step is crucial for security and user management within the Linux environment. The new UNIX username and password created are separate from the Windows user account.

- **Observation:** Upon reboot, a terminal window opened automatically. It prompted for a "New UNIX username" and a password. After entering the credentials, the setup was complete and the command-line interface became available.

Exercise 3: [Verifying WSL Installation]

- **Task Statement:** Confirm that the WSL installation is successful and the Ubuntu distribution is ready for use.

- **Explanation:** This command provides a simple way to list all installed WSL distributions, showing their names, versions, and current state.

- **Command(s):**

  ```
  wsl -l -v
  ```

- **Output:**

  ```
    NAME      STATE     VERSION
  * Ubuntu    Running   2
  ```

- **Observation:** The output confirmed that Ubuntu was correctly installed and was currently in a "Running" state, with version 2 (indicating it is running on the WSL 2 architecture).

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Part 2: Installing VirtualBox and a Linux VM (Linux Mint)

Exercise 4: [Installing Oracle VirtualBox]

- **Task Statement:** Download and install the Oracle VirtualBox hypervisor on the Windows host machine.
- **Procedure:** The VirtualBox installer was downloaded from the official website. Permission to install device software for network interfaces was granted.
- **Observation:** The VirtualBox application was successfully installed on the Windows system, along with the necessary drivers to support virtual machines.

Exercise 5: [Creating a Virtual Machine]

- **Task Statement:** Create a new virtual machine to host the Linux Mint operating system.
- **Procedure:** In the VirtualBox Manager, a new VM was created. The name was set to "Linux Mint", and a downloaded .iso file was selected as the installation medium. Hardware resources were configured with **4096 MB RAM** and **2 CPUs**. A new dynamically allocated virtual hard disk of **25 GB** was created.
- **Observation:** The VM was configured with the specified resources, creating a virtualized hardware environment ready to receive an operating system.

Exercise 6: [Installing Linux Mint]

- **Task Statement:** Install the Linux Mint OS on the virtual machine.

- **Procedure:** The newly created VM was started, which booted directly from the Linux Mint .iso.
- **Observation:** The installation proceeded without issues, partitioning the virtual disk and copying the OS files. The process was identical to a standard installation on a physical computer.

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Result

- The experiment was successfully completed by setting up two distinct Linux environments. **Windows Subsystem for Linux** and a complete **virtual machine** with Linux Mint. This project demonstrated proficiency in using both a compatibility layer and a full hypervisor to meet different virtualization needs.

Experiment [2]: [Linux file systems permissions and essential commands]

Name: Tushita Sharma Roll.: 590029121 Date: 2025-09-19

AIM:

- [To Learn linux file systems permissions and essential commands]

Requirements:

- [Any Linux Distro, any kind of text editor (vs code, vim, notepad, nano, etc)]

Theory:

- [Basic Linux file systems permissions and essential commands]

Procedure & Observations

TASK 1: [Directory Navigation]

Task Statement:

- [Create a directory called test_project in your home directory, then create subdirectories docs, scripts, and data inside it. Navigate to the scripts directory and display your current path.]

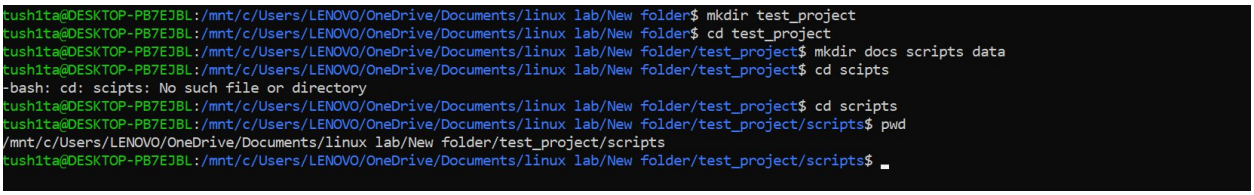
Explanation:

- [Use mkdir to create the wanted directory we can use cd to navigate and use pwd to show current path]

Command(s):

mkdir test_project
cd test_project
mkdir docs, scripts, data
cd scipts
pwd

Output:



TASK 2: [FIle Creation and Content]

Task Statement:

- [Create three files in the docs directory: readme.txt, notes.txt, and todo.txt. Add the text “Project documentation” to readme.txt and “Important notes” to notes.txt. Display the contents of both files.]

Explanation:

- [We can use touch to create empty files and using echo “text” > file.txt to add content to a file and using cat to display file contents]

Command(s):

cd docs
touch readme.txt notes.txt todo.txt
echo "Project documentation" > readme.txt
echo "Important notes" > notes.txt
cat notes.txt
cat readme.txt

Output:

```
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ cd docs
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder/docs$ touch readme.txt notes.txt todo.txt
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder/docs$ echo "Project documentation" > readme.txt
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder/docs$ echo "Important notes" > notes.txt
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder/docs$ cat notes.txt
Important notes
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder/docs$ cat readme.txt
Project documentation
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder/docs$
```

TASK 3: [FIle Operations]

Task Statement:

- [Copy readme.txt to the data directory and rename the copy to project_info.txt. Then move todo.txt from docs to scripts directory.]

Explanation:

- [- We can use the cp source destination to copy files and using the mv oldname newname to rename files also using the same command mv file directory/ to move files to another directory we can also combine copy and rename: cp file.txt newdir/newname.txt]

Command(s):

cp readme.txt data/project_info.txt

Output:

```
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ cp readme.txt data/project_info.txt
```

TASK 4: [FIle Permissions]

Task Statement:

- [Create a shell script file called backup.sh in the scripts directory. Add the content #!/bin/bash and echo “Backup complete” to it. Make the file executable only for the owner.]

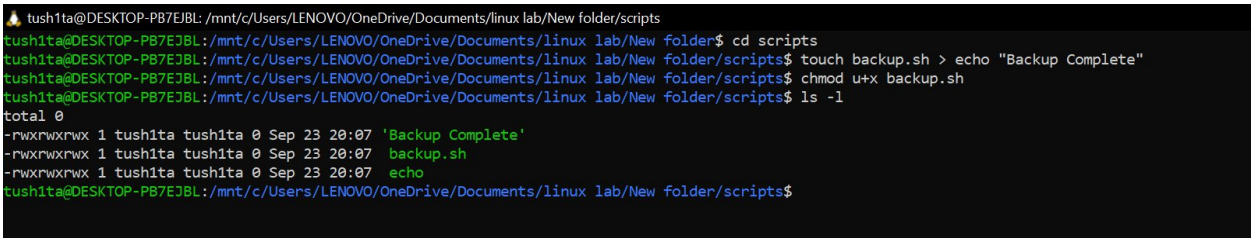
Explanation:

- [Using chmod u+x filename we can make the file executable for user only using ls -l to check for permissions also script files typically need executable permission to run]

Command(s):

cd scripts
touch backup.sh > echo "Backup complete"
chmod u+x backup.sh

Output:



TASK 5: [FIle Viewing]

Task Statement:

- [Create a file called numbers.txt with numbers 1 to 20 (each on a new line). Display only the first 5 lines, then only the last 3 lines, then search for lines containing the number “1”.]

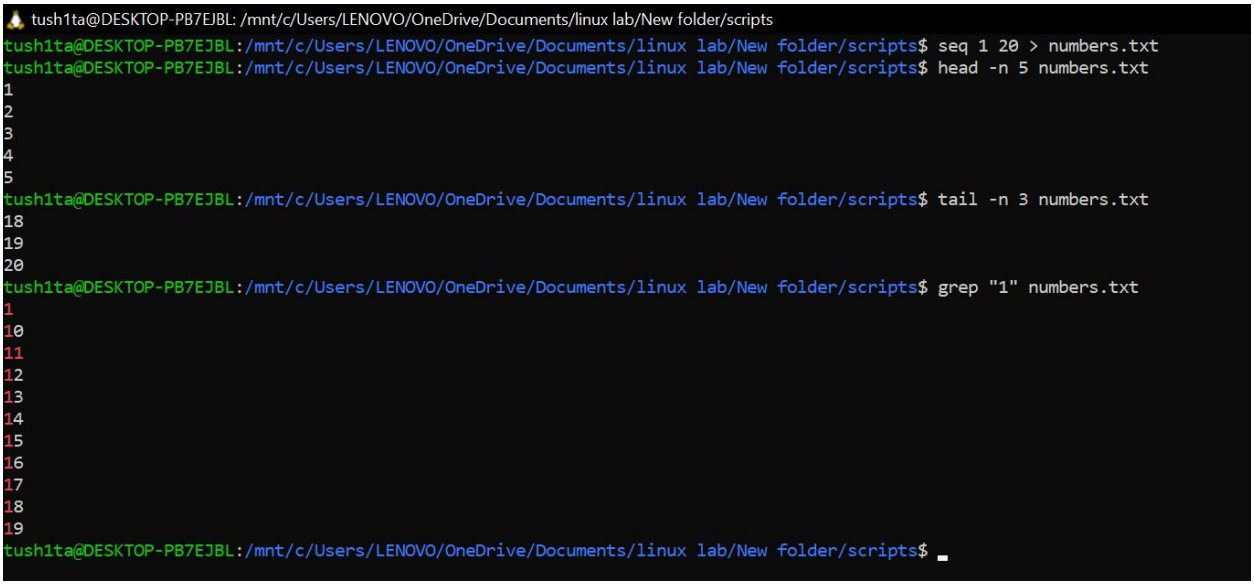
Explanation:

- [I can quickly generate a list of numbers by running seq 1 20 > numbers.txt. To check the first few numbers, I use head -n 5 to see the first 5 lines, and tail -n 3 to see the last 3 lines. If I want to find all numbers containing a “1”, I can use grep “1”. Alternatively, I could create the list manually by using multiple echo commands.]

Command(s):

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

Output:



TASK 6: [Text Editing]

Task Statement:

- [Using nano, create a file called config.txt with the following content:

Database=localhost Port=5432 Username=admin

Save the file and then display its contents.]

Explanation:

- [I open a file in Nano using nano filename.txt and type my content normally. Once I'm done, I press Ctrl+O to save the file and Ctrl+X to exit Nano. After that, I use cat to check the contents and make sure everything was saved correctly.]

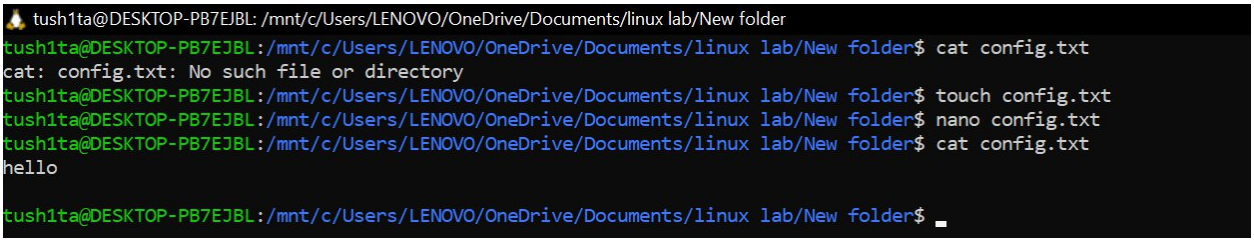
Command(s):

vim config.txt
cat config.txt

Alternatively

nano config.txt
cat config.txt

Output:



TASK 7: [System Information]

Task Statement:

- [Create a file called system_info.txt that contains: your username, current date, your current directory, and disk usage information in human-readable format.]

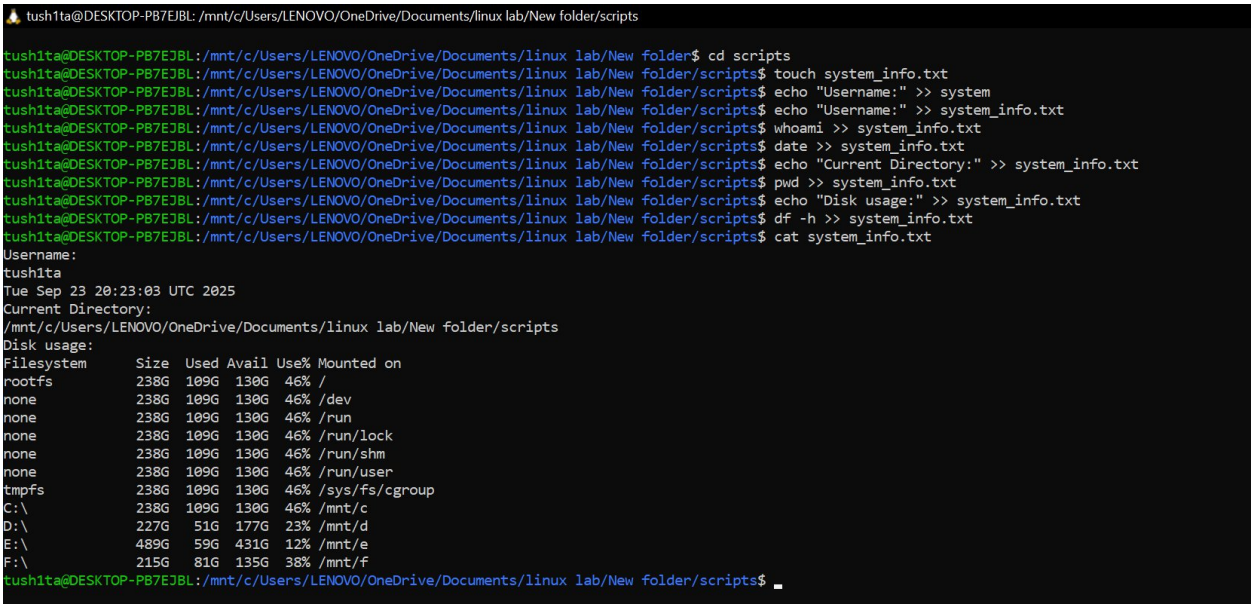
Explanation:

- [I can use whoami to check my username, date to see the current date, and pwd to know my current directory. To check disk usage, I use df -h. I can save the output of any command to a file by using redirection like command >> filename.txt. If I want to add labels, I use echo like this: echo “Username:” >> file.txt.]

Command(s):

```
cd scripts
touch system_info.txt
echo "Username:" >> system_info.txt
whoami >> system_info.txt
echo "Date:" >> system_info.txt
date >> system_info.txt
echo "Current Directory:" >> system_info.txt
pwd >> system_info.txt
echo "Disk Usage:" >> system_info.txt
df -h >> system_info.txt
```

Output:



TASK 8: [File Organisation]

Task Statement:

- [In your test_project directory, create a backup folder. Copy all .txt files from all subdirectories into this backup folder. Then list all files in the backup folder with detailed information.]

Explanation:

- [I can use find . -name "*.txt" to locate all .txt files. Alternatively, I can navigate to each directory and copy files manually. To copy multiple files at once, I use cp file1.txt file2.txt destination/. If I want detailed information about the files, I use ls -la. The wildcard* .txt helps me match all files that end with .txt.]

Command(s):

cp test_project/data/project_info.txt test_project/docs/notes.txt test_project/docs/readme.txt test_project/docs/todo.txt test_project/scripts/config.txt test_project/scripts/numbers.txt test_project/scripts/system_info.txt test_project/scripts/todo.txt backup/

Output:

```
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ cp readme.txt todo.txt scripts/
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ ls -la
total 400
drwxrwxrwx 1 tush1ta tush1ta   4096 Sep 23 20:28  .
drwxrwxrwx 1 tush1ta tush1ta   4096 Sep 23 14:19  ..
-rwxrwxrwx 1 tush1ta tush1ta  46074 Sep 23 13:31  4output1.jpg
-rwxrwxrwx 1 tush1ta tush1ta  47205 Sep 23 14:08  4output2.png
-rwxrwxrwx 1 tush1ta tush1ta  31670 Sep 23 14:18  4output3.jpeg
-rwxrwxrwx 1 tush1ta tush1ta    154 Sep 23 19:11 '590029121_Exp[4]Scriptlog'
-rwxrwxrwx 1 tush1ta tush1ta 180060 Sep 23 19:16 '590029121_Exp[4]Scriptlog.md'
-rwxrwxrwx 1 tush1ta tush1ta    311 Sep 23 19:36 '590029121_Exp[5]'
-rwxrwxrwx 1 tush1ta tush1ta  97061 Sep 23 19:44 '590029121_Exp[5]Scriptlog'
-rwxrwxrwx 1 tush1ta tush1ta      7 Sep 23 20:20  config.txt
drwxrwxrwx 1 tush1ta tush1ta   4096 Sep 23 19:58  data
drwxrwxrwx 1 tush1ta tush1ta   4096 Sep 23 19:53  docs
-rwxrwxrwx 1 tush1ta tush1ta     22 Sep 23 19:58  readme.txt
drwxrwxrwx 1 tush1ta tush1ta   4096 Sep 23 20:29  scripts
drwxrwxrwx 1 tush1ta tush1ta   4096 Sep 23 19:45  test_project
-rwxrwxrwx 1 tush1ta tush1ta      0 Sep 23 20:28  todo.txt
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$
```

TASK 9: [Process and History]

Task Statement:

- [Display your command history and count how many commands you've executed. Then show the top 10 most recent commands.]

Explanation:

- [I can use history to see all the commands I've typed. To count the total number of commands, I use history | wc -l. If I want to view just the last 10 commands, I can use history 10 or history | tail -10. The wc -l command simply counts the number of lines in the output.]

Command(s):

history 10

Output:

```
tush1ta@DESKTOP-PB7EJBL: /mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ history 10
  186  cp test_project/data/project_info.txt
  187  -name"*txt"
  188  ls
  189  touch todo.txt
  190  ls
  191  cp readme.txt todo.txt scripts/
  192  ls -la
  193  history 10
  194  clear
  195  history 10
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$
```

TASK 10: [Comprehensive Cleanup]

Task Statement:

- [Set the permissions of your backup.sh script to be readable, writable, and executable by owner, readable and executable by group, and readable by others. Then create a summary file that lists the total number of files and directories in your entire test_project.]

Explanation:

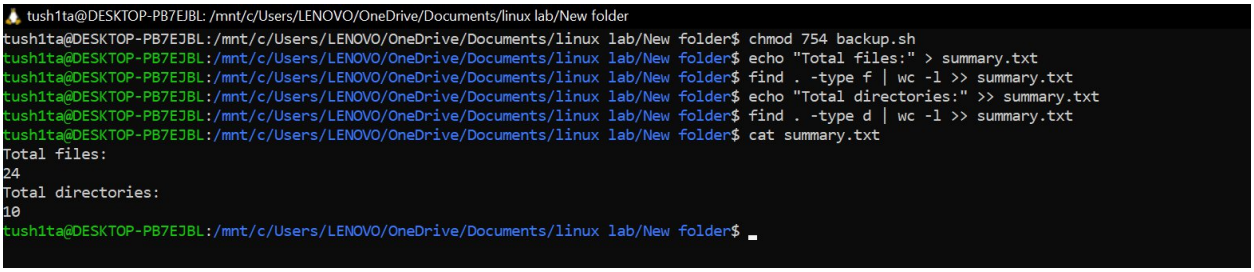
- [I can set permissions for backup.sh using chmod 754 backup.sh to give rwxr-xr– permissions. Alternatively, I can use chmod u=rwx,g=rx,o=r backup.sh. To count all files, I use find . -type f | wc -l, and to count directories, I use find . -type d | wc -l. If I want to see the full directory structure recursively, I use ls -R. I can also combine multiple commands with && or save the outputs to a summary file for later reference.]

Command(s):

chmod 754 backup.sh

echo "Total files:" > summary.txt
find . -type f | wc -l >> summary.txt
echo "Total directories:" >> summary.txt
find . -type d | wc -l >> summary.txt

Output:



Experiment 3: Linux File Manipulation and System Manipulation I

Name: Tushita Sharma Roll No.: 590029121 Date: 2025-09-23

Aim:

- To practice Linux file manipulation commands like touch, cp, mv, rm, cat, less, head, tail.
- To explore file permissions and ownership with ls -l, chmod, chown, and chgrp.
- To search and filter files using find and grep.
- To understand archiving and compression with tar, gzip, and gunzip.
- To create and manage links (ln) for both hard and symbolic links.

Requirements

- A Linux machine with bash shell (Ubuntu/Fedora/other).
- User privileges to create, modify, and delete files and directories.
- Access to system utilities like tar, gzip, grep, and find.

Theory

Linux file management involves creating, copying, moving, removing, and viewing files. File permissions and ownership ensure secure access control. Searching and filtering tools like grep and find help locate information efficiently. Archiving with tar and compression with gzip reduce storage usage and simplify file transfer. Links (ln) allow multiple references to the same file data (hard links) or path references (symbolic links).

Procedure & Observations

Exercise 1: Creating and Managing Files

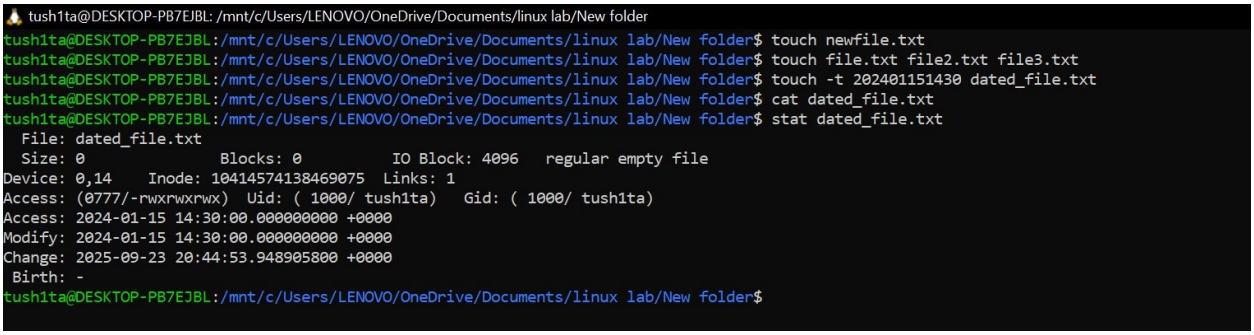
Task Statement:

Create files and manage timestamps using touch.

Command(s):

```
touch newfile.txt
touch file1.txt file2.txt file3.txt
touch -t 202401151430 dated_file.txt
```

Output:



Exercise 2: Copying, Moving, and Deleting Files

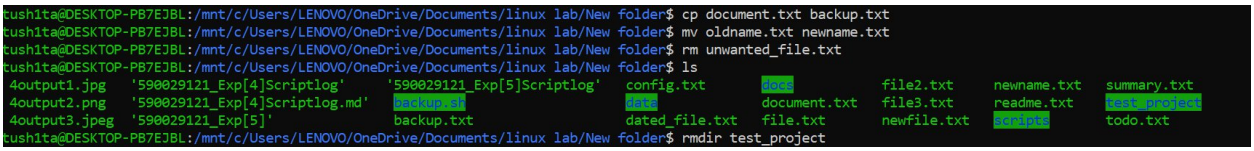
Task Statement:

Use cp, mv, and rm to copy, rename, move, and delete files and directories.

Command(s):

cp document.txt backup_document.txt
mv oldname.txt newname.txt
rm unwanted_file.txt
rm -r old_directory/

Output:



Exercise 3: Viewing File Contents

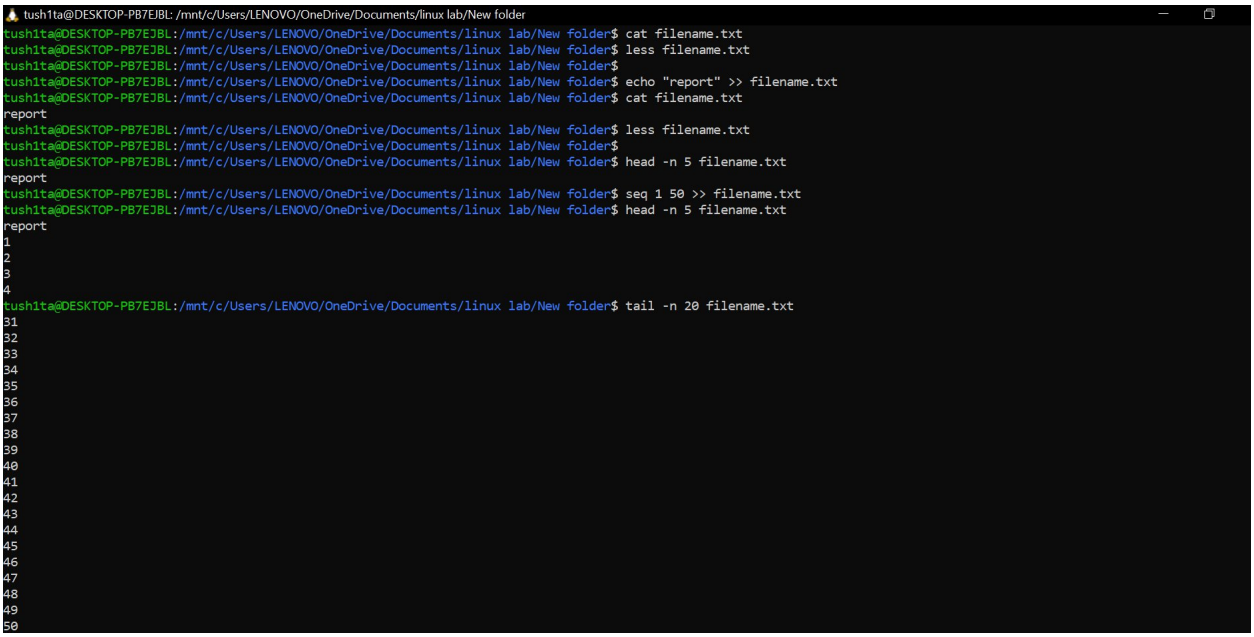
Task Statement:

Display file contents using cat, less, head, and tail.

Command(s):

cat filename.txt
less /var/log/syslog
head -n 5 filename.txt
tail -n 20 filename.txt
tail -f /var/log/syslog

Output:



Exercise 4: File Permissions and Ownership

Task Statement:

Explore file permissions and ownership with ls -l, chmod, chown, and chgrp.

Command(s):

ls -l
chmod 755 script.sh
chmod u+x script.sh
sudo chown newuser:newgroup file.txt
chgrp developers project.txt

Output:

Exercise 5: File Searching with find

Task Statement:

Search files by name, type, size, and permissions using find.

Command(s):

find -name "*.txt"
find -size -5k
find -perm 777

Output:

```
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ find -name file1
./docs/file1
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ find -size -5k
.
./docs
./docs/file1
./file.txt
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ find -perm 777
.
./docs
./docs/file1
./file.txt
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$
```

Exercise 6: Pattern Searching with grep

Task Statement:

Search for patterns in files using grep.

Command(s):

grep "error" /var/log/syslog
grep -i "Error" logfile.txt
grep -r "function" ~/code/
grep -n "TODO" *.txt

Output:

```
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ grep -w "cat" file.txt
 cat dog cat
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ grep 'error' file.txt
error error error error
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ grep -w "cat" file.txt
 cat dog cat
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ grep -n "error" file.txt
1:error error error error
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ grep -c "cat" file.txt
1
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ grep -c "error" file.txt
1
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$
```

Exercise 7: Archiving and Compression

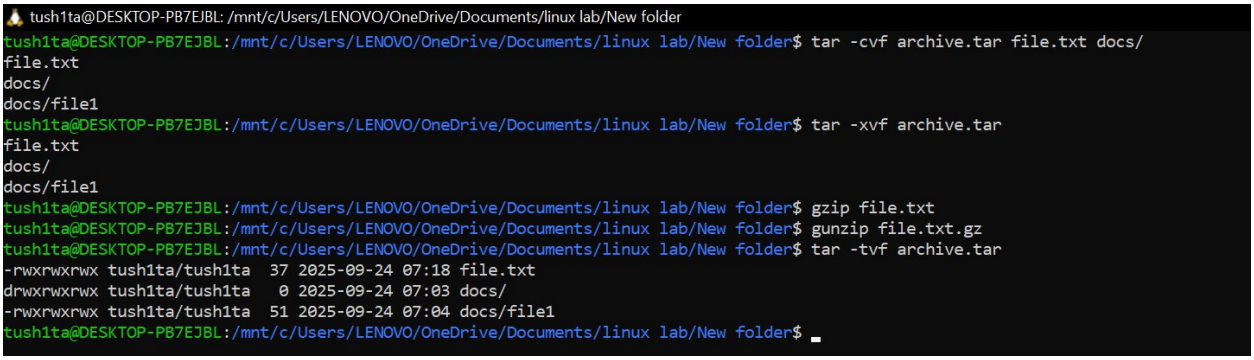
Task Statement:

Create and extract archives using tar, compress and decompress with gzip/gunzip.

Command(s):

tar -czf backup.tar.gz /home/user/documents
tar -xzf backup.tar.gz -C /restore/
gzip largefile.txt
gunzip largefile.txt.gz

Output:



Exercise 8: Creating Links

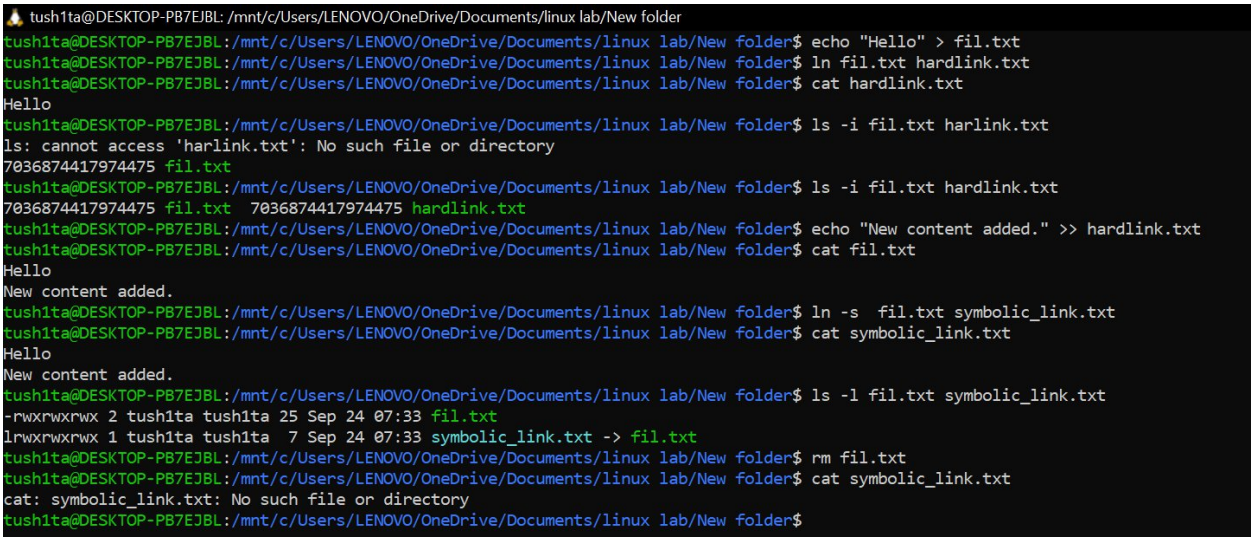
Task Statement:

Create and test hard and symbolic links using ln.

Command(s):

echo "Hello" > original.txt
ln original.txt hardlink.txt
ln -s original.txt symlink.txt
ls -li original.txt hardlink.txt symlink.txt

Output:



Result

- Successfully created, copied, moved, and deleted files.
- Practiced viewing file contents and monitoring logs.
- Explored file permissions and ownership management.
- Used find and grep to locate and filter data.

- Created archives and compressed files.
- Demonstrated both hard and symbolic links.

Challenges Faced & Learning Outcomes

- Challenge 1: Managing files and directories effectively without accidentally overwriting or deleting important data.
- Challenge 2: Remembering numeric vs symbolic permissions in chmod. Fixed through repeated practice.

Learning:

- Gained hands-on experience with essential Linux file manipulation commands (cp, mv, rm, cat, touch, nano/vim, etc.).
- Gained practical skills with file manipulation and permission commands.
- Learned how to efficiently search files and patterns in Linux.
- Understood how to archive and compress files for better storage management.
- Understood differences between hard and symbolic links.

Conclusion

This experiment helped me understand and apply basic Linux file and system manipulation commands. I learned to manage files, directories, and permissions effectively, improving my confidence in using the Linux environment.

Experiment [4]: [Bash Scripting]

Name: Tushita Sharma, Roll No.: 590029121, Date: 2025-09-20

AIM:

- [To Learn Basics of Bash Scripting.]

Requirements:

- [Any Linux Distro, any kind of text editor (vs code, vim, notepad, nano, etc)]

Theory:

- [Learning the basics of bash scripting.]

Procedure & Observations

Exercise 1: [Hello World Script]

Task Statement:

- [Basic Usage of Shell Scripts]

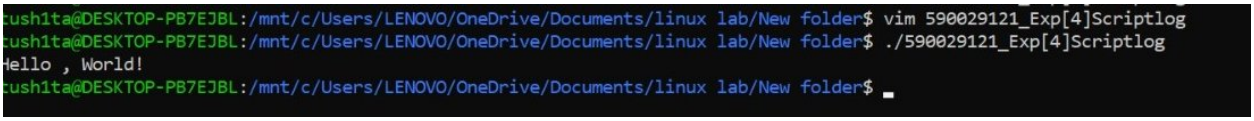
Explanation:

- [Writing Begginer level Shell Scripts]

Command(s):

```
#!/bin/bash
echo "Hello, World!"
```

Output:



Exercise 2: [Personalized Greeting Script]

Task Statement:

- [Basic Shell Script to callout user defined function.]

Explanation:

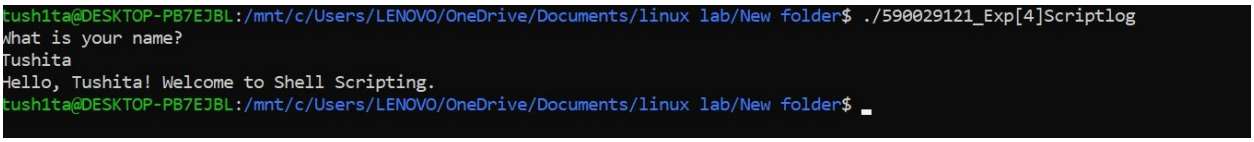
- [This Shell script will take input from user and store it in a variable and then call the variable which will output the stored value.]

Command(s):

```
#!/bin/bash
echo "What is your name?"
```

```
read name
echo "Hello, $name! Welcome to Shell Scripting."
```

Output:



Exercise 3: [Arithmetic Operations in Shell Scripting]

Task Statement:

- [Using Basic Arithmetic Operations in Shell Scripts]

Command(s):

```
#!/bin/bash
echo "Enter first number: "
read num1
echo "Enter second number: "
read num2

echo "Addition: $((num1 + num2))"
echo "Subtraction: $((num1 - num2))"
echo "Multiplication: $((num1 * num2))"
echo "Division: $((num1 / num2))"
```

Output:

Exercise 4:

- [Voting Eligibility]

Task Statement:

- [Using Conditionals in Shell script]

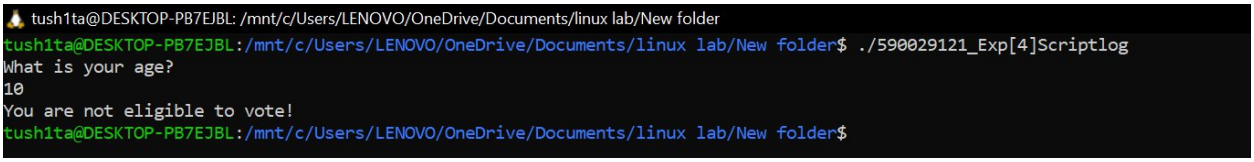
Command(s):

```
#!/bin/bash
echo "What is your age?"
read age
if [ $age -ge 18 ]; then
```

```
    echo "You are eligible to vote!"

else
    echo "You are not eligible to vote!"
```

Output:



Result

- The Exercises were successfully completed for Basic Shell Scripting.

Experiment [5]: [Shell Programming]

Name: Tushita Sharma ,Roll.: 590029121 ,Date: 2025-09-20

AIM:

- [To Learn Basic Conditional Statements in Bash Scripting]

Requirements:

- [Any Linux Distro, any kind of text editor (vs code, vim, notepad, nano, etc)]

Theory:

- [Basic usage of conditions and arrays in bash scripting.]

Procedure & Observations

Exercise 1: [Prime Number Check]

Task Statement:

- [To check if the number given by the user is a prime number or not.]

Explanation:

- [using if else loop wap to check if the number is a prime number or not.]

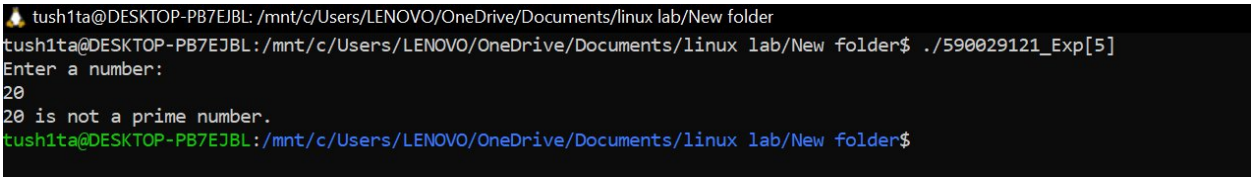
Command(s):

```
#!/bin/bash
echo "Enter a number: "
read num
flag=0

for ((i=2; i<=num/2; i++))
do
   if [ $((num % i)) -eq 0 ]
   then
      flag=1
      break
   fi
done

if [ $flag -eq 0 ]
then
   echo "$num is a prime number."
else
   echo "$num is not a prime number."
fi
```

Output:



Exercise 2: [Sum of Digits]

Task Statement:

- [Take input from user and give the sum of two digits.]

Explanation:

- [This script will take input from user and will give the following output.]

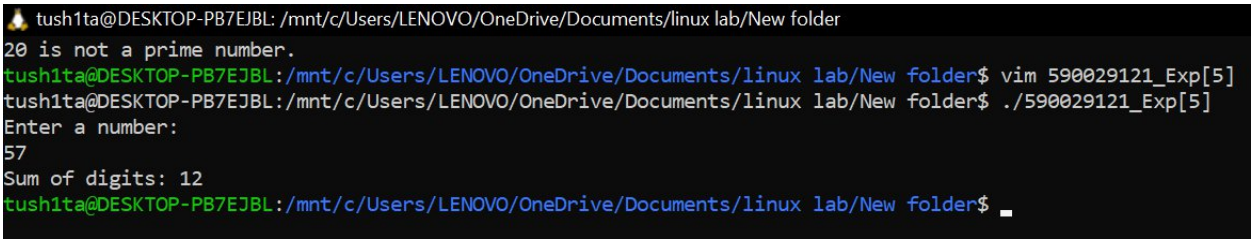
Command(s):

```
#!/bin/bash
echo "Enter a number: "
read num
sum=0

while [ $num -gt 0 ]
do
   digit=$((num % 10))
   sum=$((sum + digit))
   num=$((num / 10))
done

echo "Sum of digits: $sum"
```

Output:



Exercise 3: [Armstrong Numbers]

Task Statement:

- [Take input user and give the sum of Armstrong number of n digits is a number equal to the sum of its digits raised to the power n. Example: $153 = 1^3 + 5^3 + 3^3$]

Explanation:

- [This script will tell if the number entered by the user is an armstrong number or not.]

Command(s):

```
#!/bin/bash
echo "Enter a number: "
read num
temp=$num
n=${#num}   # number of digits
sum=0

while [ $temp -gt 0 ]
do
   digit=$((temp % 10))
   sum=$((sum + digit**n))
   temp=$((temp / 10))
done

if [ $sum -eq $num ]
then
   echo "$num is an Armstrong number."
else
   echo "$num is not an Armstrong number."
fi
```

Output:

```
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$ ./590029121_Exp[5]
Enter a number:
98
98 is not an armstrong number.
tush1ta@DESKTOP-PB7EJBL:/mnt/c/Users/LENOVO/OneDrive/Documents/linux lab/New folder$
```

Result:

- The Exercises were successfully completed for Basic Shell Scripting.

Experiment 6: Shell Loops

Name: Tushita Sharma Roll No.: 590029121 Date: 2025-09-23

Aim:

- To understand and implement shell loops (for, while, until) in Bash.
- To practice loop control constructs (break, continue) and loop-based file processing.

Requirements

- A Linux system with bash shell.
- A text editor (nano, vim) and permission to create and execute shell scripts.

Theory

Loops allow repeated execution of commands until a condition is met. Common loop constructs in Bash include for (iterate over items), while (repeat while condition true), and until (repeat until condition becomes true). Loop control statements like break and continue change the flow inside loops. Loops are essential for automating repetitive tasks such as processing multiple files, generating sequences, and collecting user input.

Procedure & Observations

Exercise 1: Simple for loop

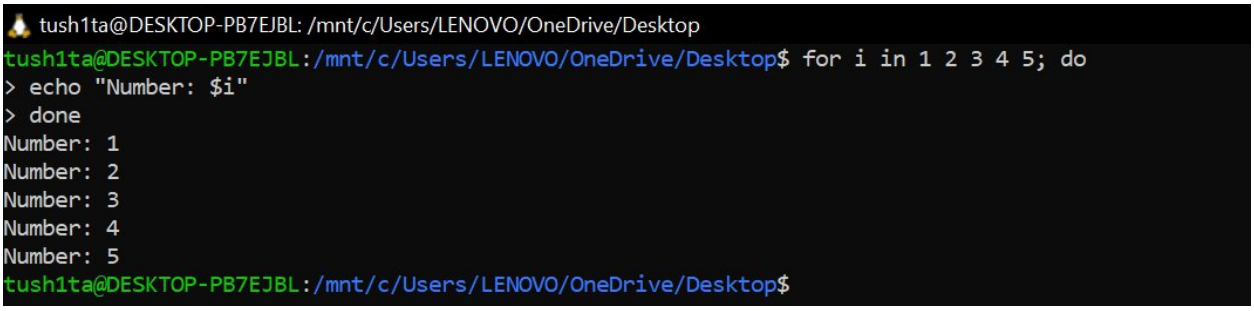
Task Statement:

Write a for loop that prints numbers 1 to 5.

Command(s):

```
for i in 1 2 3 4 5; do
  echo "Number: $i"
done
```

Output:



Exercise 2: for loop over files

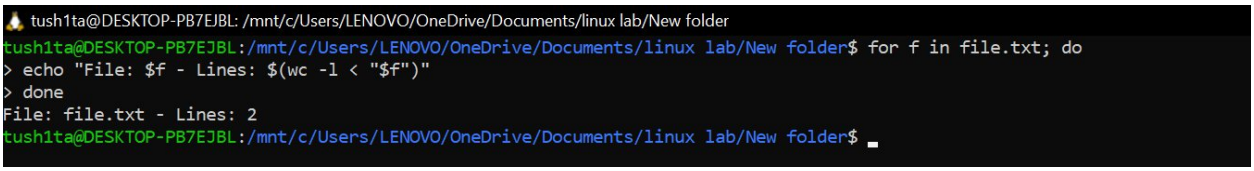
Task Statement:

Process all .txt files in a directory and count lines in each.

Command(s):

```
for f in *.txt; do
  echo "File: $f - Lines: $(wc -l < "$f")"
done
```

Output:



Exercise 3: C-style for loop

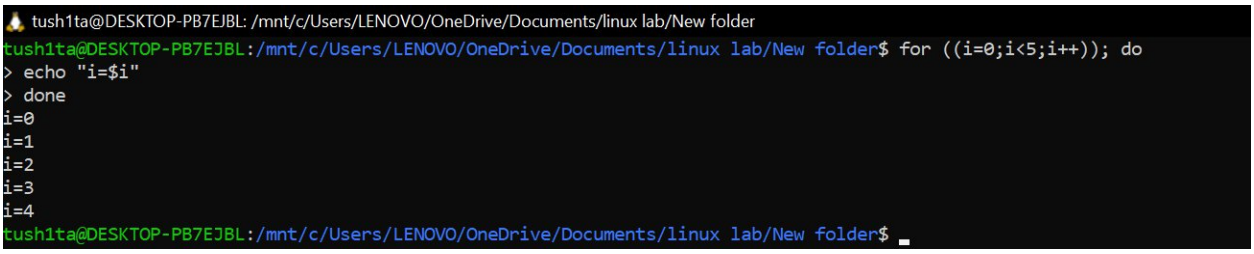
Task Statement:

Use arithmetic C-style loop for numeric iteration.

Command(s):

```
for ((i=0;i<5;i++)); do
  echo "i=$i"
done
```

Output:



Exercise 4: while loop and reading input

Task Statement:

Write a while loop that reads lines from a file or from user input.

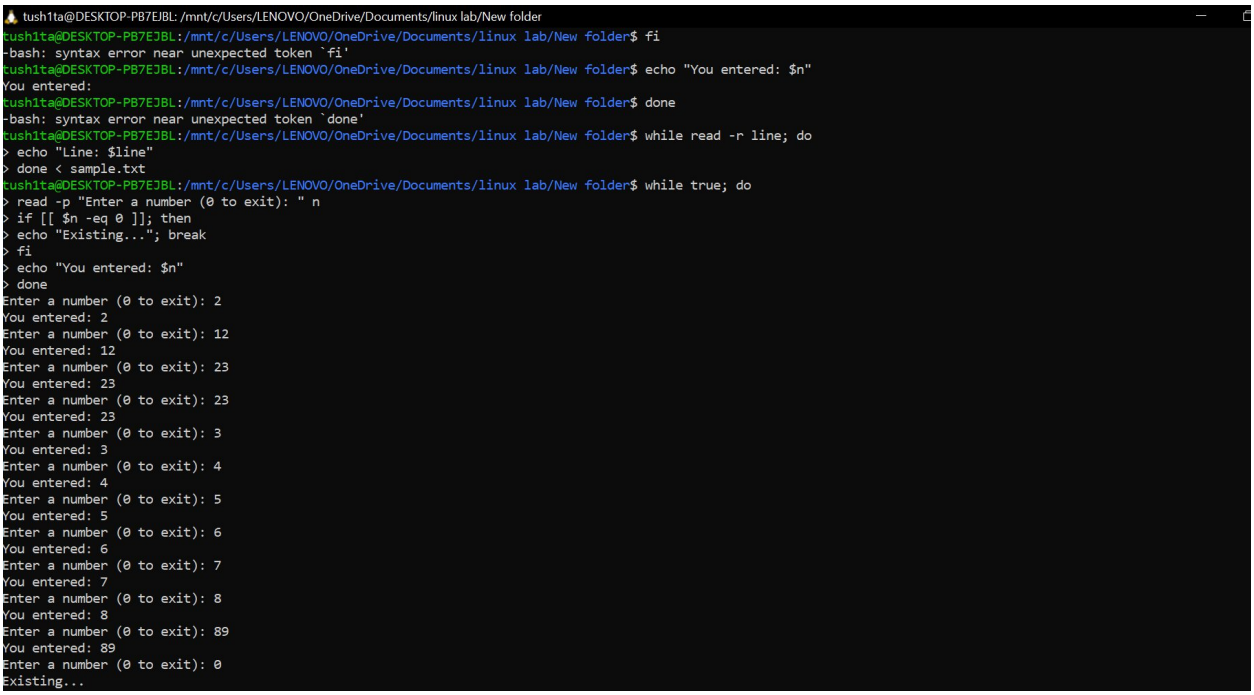
Command(s):

```
# Read from file
while read -r line; do
```

```
  echo "Line: $line"
done < sample.txt

# Read from user with exit condition
while true; do
  read -p "Enter a number (0 to exit): " n
  if [[ $n -eq 0 ]]; then
    echo "Exiting..."; break
  fi
  echo "You entered: $n"
done
```

Output:



Exercise 5: until loop

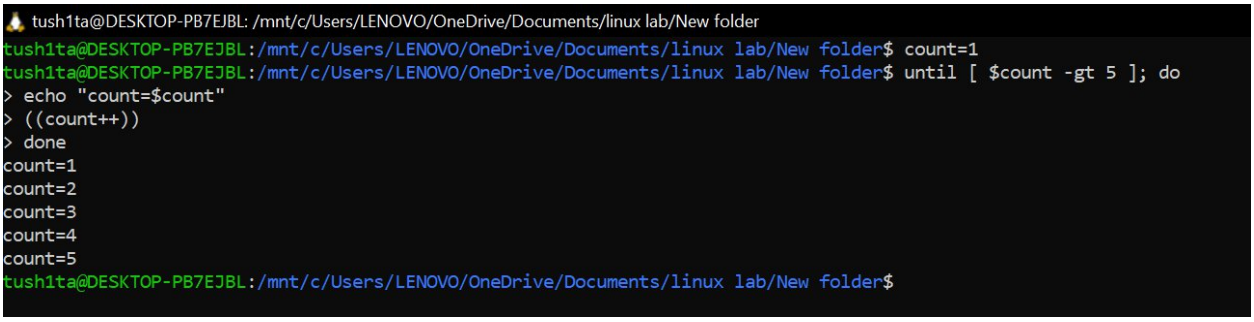
Task Statement:

Use an until loop to run until a condition becomes true.

Command(s):

```
count=1
until [ $count -gt 5 ]; do
  echo "count=$count"
  ((count++))
done
```

Output:



Exercise 6: break and continue

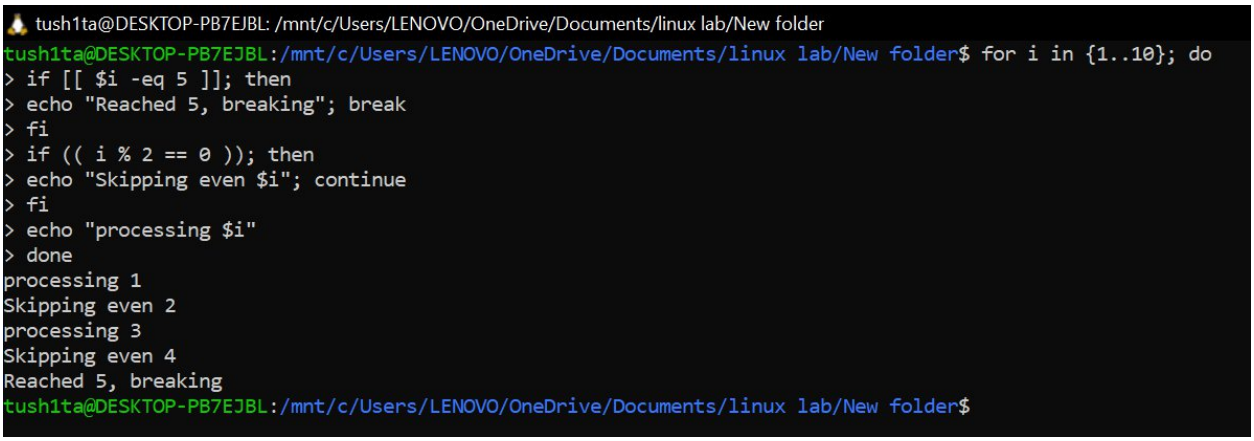
Task Statement:

Demonstrate break and continue inside a loop.

Command(s):

```
for i in {1..10}; do
  if [[ $i -eq 5 ]]; then
    echo "Reached 5, breaking"; break
  fi
  if (( i % 2 == 0 )); then
    echo "Skipping even $i"; continue
  fi
  echo "Processing $i"
done
```

Output:



Exercise 7: Nested loops

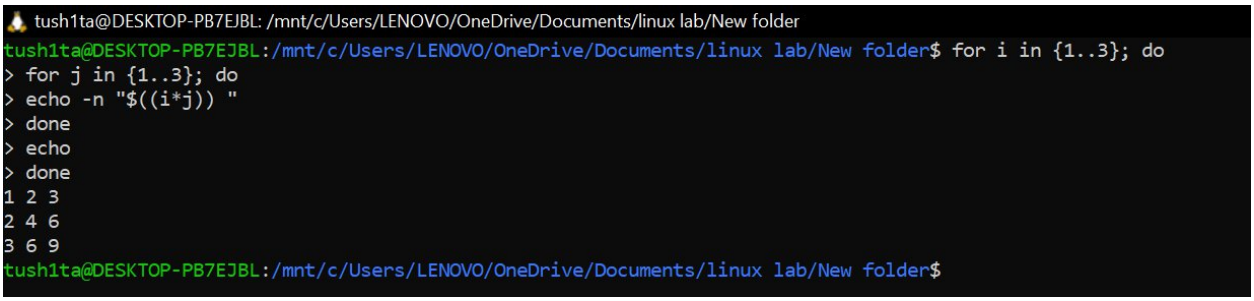
Task Statement:

Create nested loops to generate a multiplication table.

Command(s):

```
for i in {1..3}; do
  for j in {1..3}; do
    echo -n "$((i*j)) "
  done
  echo
done
```

Output:



Result

- Implemented for, while, and until loops and used loop control statements.
- Practiced reading input, processing files, and nested iteration.

Challenges Faced & Learning Outcomes

- Challenge 1: Handling spaces and special characters when iterating filenames — learned to use quotes and read -r.
- Challenge 2: Remembering arithmetic syntax in Bash — used (( )) and expr where needed.

Learning:

- Loops are powerful for automation in shell scripting. Correct quoting and use of control constructs prevent common bugs.

Conclusion

The lab demonstrated practical loop constructs in Bash for automating repetitive tasks and processing data efficiently.