National Textile University

Department of Computer Science

Subject: Operating System

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Lab no.: lab2

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Semester:5th

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
```

Command: man ls

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

       -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

Manual page ls(1) line 1/268 16% (press h for help or q to quit)

Command: ls –help

```
                             with --sort=time, sort by WORD (newest first)

      --time-style=TIME_STYLE
                             time/date format with -l; see TIME_STYLE below
   -t                        sort by time, newest first; see --time
   -T, --tabsize=COLS        assume tab stops at each COLS instead of 8
   -u                        with -lt: sort by, and show, access time;
                             with -l: show access time and sort by name;
                             otherwise: sort by access time, newest first

   -U                        do not sort; list entries in directory order
   -v                        natural sort of (version) numbers within text
   -w, --width=COLS          set output width to COLS.  0 means no limit
   -x                        list entries by lines instead of by columns
   -X                        sort alphabetically by entry extension
   -Z, --context             print any security context of each file
      --zero                 end each output line with NUL, not newline
   -1                        list one file per line
      --help       display this help and exit
      --version    output version information and exit

The SIZE argument is an integer and optional unit (example: 10K is 10*1024).
Units are K,M,G,T,P,E,Z,Y,R,Q (powers of 1024) or KB,MB,... (powers of 1000).
Binary prefixes can be used, too: KiB=K, MiB=M, and so on.

The TIME_STYLE argument can be full-iso, long-iso, iso, locale, or +FORMAT.
FORMAT is interpreted like in date(1).  If FORMAT is FORMAT1<newline>FORMAT2,
then FORMAT1 applies to non-recent files and FORMAT2 to recent files.
TIME_STYLE prefixed with 'posix-' takes effect only outside the POSIX locale.
Also the TIME_STYLE environment variable sets the default style to use.

The WHEN argument defaults to 'always' and can also be 'auto' or 'never'.

Using color to distinguish file types is disabled both by default and
with --color=never.  With --color=auto, ls emits color codes only when
standard output is connected to a terminal.  The LS_COLORS environment
variable can change the settings.  Use the dircolors(1) command to set it.

Exit status:
 0  if OK,
 1  if minor problems (e.g., cannot access subdirectory),
 2  if serious trouble (e.g., cannot access command-line argument).

GNU coreutils online help: <https://www.gnu.org/software/coreutils/>
Report any translation bugs to <https://translationproject.org/team/>
Full documentation <https://www.gnu.org/software/coreutils/ls>
or available locally via: info '(coreutils) ls invocation'
amina@DESKTOP-SEP18NK:~$
```

Command: which ls

Command: type ls

```
amina@DESKTOP-SEP18NK: ~    ×      +    ∨

amina@DESKTOP-SEP18NK:~$ which Is
amina@DESKTOP-SEP18NK:~$ which ls
/usr/bin/ls
amina@DESKTOP-SEP18NK:~$ type ls
ls is aliased to `ls --color=auto'
amina@DESKTOP-SEP18NK:~$ |
```

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
```
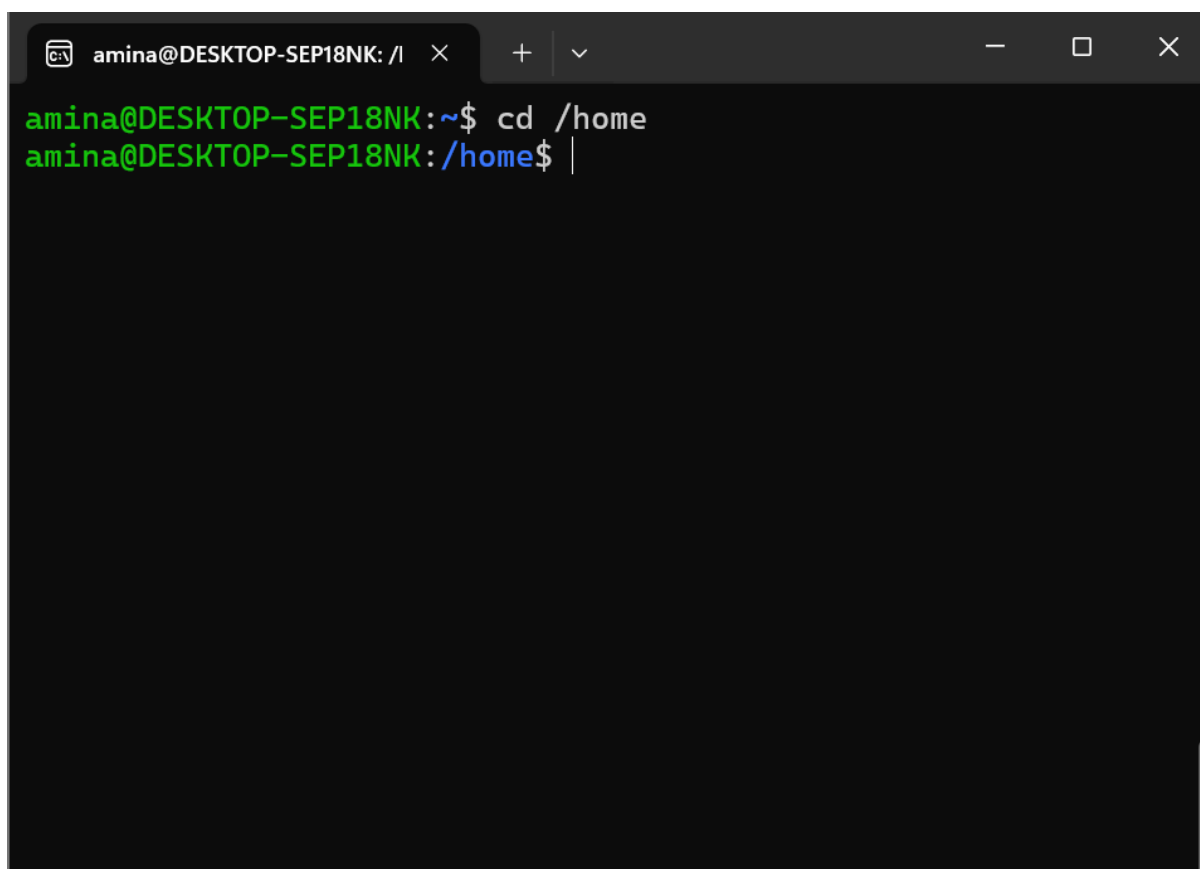
Command: ls /

```
amina@DESKTOP-SEP18NK:~$ ls /
bin                  lib64         sbin.usr-is-merged
bin.usr-is-merged    lost+found    snap
boot                 media         srv
dev                  mnt           sys
etc                  opt           tmp
home                 proc          usr
init                 root          var
lib                  run
lib.usr-is-merged    sbin
amina@DESKTOP-SEP18NK:~$
```

2.


```
amina@DESKTOP-SEP18NK:~$ ls -la
total 92
drwxr-x--- 10 amina amina  4096 Sep 26 15:14 .
drwxr-xr-x  3 root  root   4096 Sep 18 14:46 ..
-rw-------  1 amina amina  2339 Sep 26 08:58 .bash_history
-rw-r--r--  1 amina amina   220 Sep 18 14:46 .bash_logout
-rw-r--r--  1 amina amina  3771 Sep 18 14:46 .bashrc
drwx------  3 amina amina  4096 Sep 18 23:10 .cache
drwxr-xr-x  3 amina amina  4096 Sep 18 23:10 .dotnet
-rw-r--r--  1 amina amina    59 Sep 22 15:14 .gitconfig
-rw-------  1 amina amina    20 Sep 26 15:14 .lesshst
drwxr-xr-x  3 amina amina  4096 Sep 25 11:43 .local
-rw-rw-r--  1 amina amina     0 Sep 26 08:46 .motd_shown
-rw-r--r--  1 amina amina   807 Sep 18 14:46 .profile
drwx------  2 amina amina  4096 Sep 19 16:06 .ssh
-rw-r--r--  1 amina amina     0 Sep 18 14:48 .sudo_as_admin_
successful
-rw-------  1 amina amina  1005 Sep 26 14:45 .viminfo
drwxr-xr-x  5 amina amina  4096 Sep 18 23:10 .vscode-server
drwxr-xr-x  3 amina amina  4096 Sep 26 08:54 HomeTaskOs
drwxr-xr-x  4 amina amina  4096 Sep 19 15:30 Lab1WSL
drwxr-xr-x  4 amina amina  4096 Sep 23 20:13 Lab1WSL-1
-rw-r--r--  1 amina amina     0 Sep 26 14:30 file.txt
-rw-r--r--  1 amina amina    81 Sep 25 11:45 hello.c
-rwxr-xr-x  1 amina amina 15960 Sep 25 11:48 hello.out
-rw-r--r--  1 amina amina   296 Sep 26 14:45 hello.txt
amina@DESKTOP-SEP18NK:~$
```

3.

```
amina@DESKTOP-SEP18NK:~$ cd /home
amina@DESKTOP-SEP18NK:/home$
```

4.


```
amina@DESKTOP-SEP18NK:~$ cd /home
amina@DESKTOP-SEP18NK:/home$ cd ~
amina@DESKTOP-SEP18NK:~$
```

5.

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
```

```
amina@DESKTOP-SEP18NK:~$ pwd
/home/amina
amina@DESKTOP-SEP18NK:~$ ls
HomeTaskOs  Lab1WSL-1  hello.c     hello.txt
Lab1WSL     file.txt   hello.out
amina@DESKTOP-SEP18NK:~$ ls -i
 1604 HomeTaskOs   51794 file.txt    53855 hello.txt
51905 Lab1WSL      51759 hello.c
52118 Lab1WSL-1    51801 hello.out
amina@DESKTOP-SEP18NK:~$ ls -la
total 92
drwxr-x--- 10 amina amina  4096 Sep 26 15:14 .
drwxr-xr-x  3 root  root   4096 Sep 18 14:46 ..
-rw-------  1 amina amina  2856 Sep 26 15:21 .bash_history
-rw-r--r--  1 amina amina   220 Sep 18 14:46 .bash_logout
-rw-r--r--  1 amina amina  3771 Sep 18 14:46 .bashrc
drwx------  3 amina amina  4096 Sep 18 23:10 .cache
drwxr-xr-x  3 amina amina  4096 Sep 18 23:10 .dotnet
-rw-r--r--  1 amina amina    59 Sep 22 15:14 .gitconfig
-rw-------  1 amina amina    20 Sep 26 15:14 .lesshst
drwxr-xr-x  3 amina amina  4096 Sep 25 11:43 .local
-rw-rw-r--  1 amina amina     0 Sep 26 08:46 .motd_shown
-rw-r--r--  1 amina amina   807 Sep 18 14:46 .profile
drwx------  2 amina amina  4096 Sep 19 16:06 .ssh
-rw-r--r--  1 amina amina     0 Sep 18 14:48 .sudo_as_admin_succ
essful
-rw-------  1 amina amina  1005 Sep 26 14:45 .viminfo
drwxr-xr-x  5 amina amina  4096 Sep 18 23:10 .vscode-server
drwxr-xr-x  3 amina amina  4096 Sep 26 08:54 HomeTaskOs
drwxr-xr-x  4 amina amina  4096 Sep 19 15:30 Lab1WSL
drwxr-xr-x  4 amina amina  4096 Sep 23 20:13 Lab1WSL-1
-rw-r--r--  1 amina amina     0 Sep 26 14:30 file.txt
```

```
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amina@DESKTOP-SEP18NK:~$ ls -lh
total 36K
drwxr-xr-x 3 amina amina 4.0K Sep 26 08:54 HomeTaskOs
drwxr-xr-x 4 amina amina 4.0K Sep 19 15:30 Lab1WSL
drwxr-xr-x 4 amina amina 4.0K Sep 23 20:13 Lab1WSL-1
-rw-r--r-- 1 amina amina    0 Sep 26 14:30 file.txt
-rw-r--r-- 1 amina amina   81 Sep 25 11:45 hello.c
-rwxr-xr-x 1 amina amina  16K Sep 25 11:48 hello.out
-rw-r--r-- 1 amina amina  296 Sep 26 14:45 hello.txt
amina@DESKTOP-SEP18NK:~$  cd
amina@DESKTOP-SEP18NK:~$ cd --
amina@DESKTOP-SEP18NK:~$ cd ~
amina@DESKTOP-SEP18NK:~$ cd /
amina@DESKTOP-SEP18NK:/$ |
```

Part 3: File and Directory Operations

**3.1 Creating and Managing Files/Directories

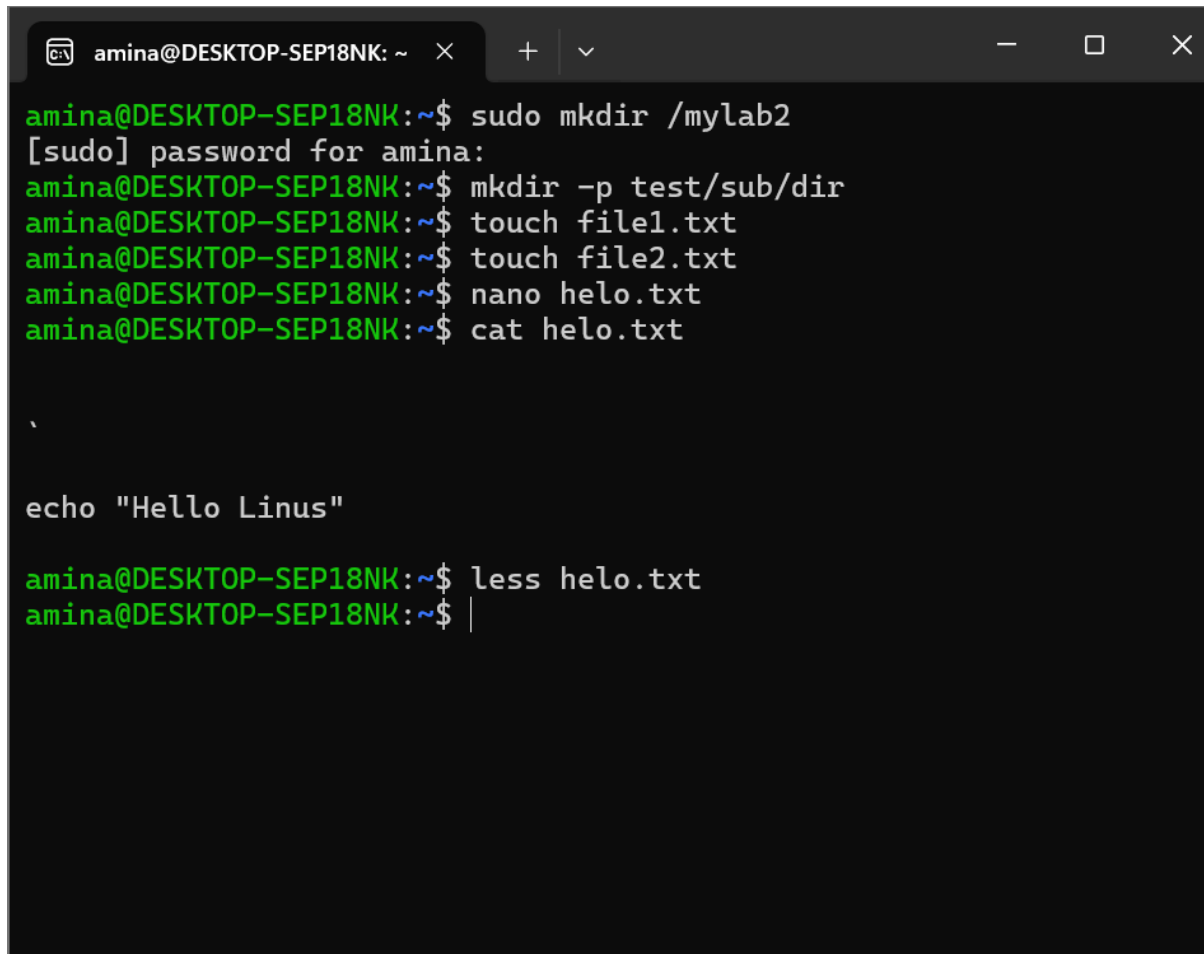- **Commands to demonstrate:**

```
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
```

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```
amina@DESKTOP-SEP18NK:~$ sudo mkdir /mylab2
[sudo] password for amina:
amina@DESKTOP-SEP18NK:~$ mkdir -p test/sub/dir
amina@DESKTOP-SEP18NK:~$ touch file1.txt
amina@DESKTOP-SEP18NK:~$ touch file2.txt
amina@DESKTOP-SEP18NK:~$ nano helo.txt
amina@DESKTOP-SEP18NK:~$ cat helo.txt


`

echo "Hello Linus"

amina@DESKTOP-SEP18NK:~$ less helo.txt
amina@DESKTOP-SEP18NK:~$ |
```

Command: nano helo.txt

```
  GNU nano 7.2                    helo.txt *

`

echo "Hello Linus"
```

```
Save modified buffer?
Y Yes
N No              ^C Cancel
```

Command:

head helo.txt

tail helo.txt

wc helo.txt

```
amina@DESKTOP-SEP18NK:~$ sudo mkdir /mylab2
[sudo] password for amina:
amina@DESKTOP-SEP18NK:~$ mkdir -p test/sub/dir
amina@DESKTOP-SEP18NK:~$ touch file1.txt
amina@DESKTOP-SEP18NK:~$ touch file2.txt
amina@DESKTOP-SEP18NK:~$ nano helo.txt
amina@DESKTOP-SEP18NK:~$ cat helo.txt


`

echo "Hello Linus"

amina@DESKTOP-SEP18NK:~$ less helo.txt
amina@DESKTOP-SEP18NK:~$ head helo.txt


`

echo "Hello Linus"

amina@DESKTOP-SEP18NK:~$ tail helo.txt


`

echo "Hello Linus"

amina@DESKTOP-SEP18NK:~$ wc helo.txt
 6  4 25 helo.txt
amina@DESKTOP-SEP18NK:~$
```

```
amina@DESKTOP-SEP18NK: ~      ×        +      ∨

`

echo "Hello Linus"

~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
(END)
```

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
```

```
amina@DESKTOP-SEP18NK:~/Lab2$ cp helo.txt backup.txt
amina@DESKTOP-SEP18NK:~/Lab2$
```

```
Lab1WSL-1    file1.txt    hello.out    myLan2
amina@DESKTOP-SEP18NK:~$ cp -r Lab2 Lab2_backup
amina@DESKTOP-SEP18NK:~$ mv backup.txt
mv: missing destination file operand after 'backup.txt'
Try 'mv --help' for more information.
amina@DESKTOP-SEP18NK:~$ cd Lab2
amina@DESKTOP-SEP18NK:~/Lab2$ mv backup.txt remaned.txt
amina@DESKTOP-SEP18NK:~/Lab2$ rm rename.txt
rm: cannot remove 'rename.txt': No such file or directory
amina@DESKTOP-SEP18NK:~/Lab2$ ls
helo.txt   remaned.txt
amina@DESKTOP-SEP18NK:~/Lab2$ rm remaned.txt
amina@DESKTOP-SEP18NK:~/Lab2$ cd ..
amina@DESKTOP-SEP18NK:~$ rmdir Lab2_backup.txt
rmdir: failed to remove 'Lab2_backup.txt': No such file or directory
amina@DESKTOP-SEP18NK:~$ rmdir Lab2_backup
rmdir: failed to remove 'Lab2_backup': Directory not empty
amina@DESKTOP-SEP18NK:~$ ls
HomeTaskOs   Lab2_backup   hello.c    myLan2
Lab1WSL      file.txt      hello.out  test
Lab1WSL-1    file1.txt     hello.txt
Lab2         file2.txt     helo.txt
amina@DESKTOP-SEP18NK:~$ rmdir Lab2_backup
rmdir: failed to remove 'Lab2_backup': Directory not empty
amina@DESKTOP-SEP18NK:~$ ls Lab2_backup/
backup.txt  helo.txt
```

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)
```

```
amina@DESKTOP-SEP18NK:~$ sudo chmod 755 helo.txt
amina@DESKTOP-SEP18NK:~$ sudo chmod u+x helo.txt
amina@DESKTOP-SEP18NK:~$ ls
HomeTaskOs  Lab2       file1.txt   hello.out   myLan2
Lab1WSL     OSlabs     file2.txt   hello.txt   test
Lab1WSL-1   file.txt   hello.c     helo.txt
amina@DESKTOP-SEP18NK:~$ ls -l
total 56
drwxr-xr-x 3 amina amina  4096 Sep 26 08:54 HomeTaskOs
drwxr-xr-x 4 amina amina  4096 Sep 19 15:30 Lab1WSL
drwxr-xr-x 4 amina amina  4096 Sep 23 20:13 Lab1WSL-1
drwxr-xr-x 2 amina amina  4096 Sep 26 15:59 Lab2
drwxr-xr-x 4 amina amina  4096 Sep 26 16:13 OSlabs
-rwxr-xr-x 1 amina amina     0 Sep 26 14:30 file.txt
-rw-r--r-- 1 amina amina     0 Sep 26 15:27 file1.txt
-rw-r--r-- 1 amina amina     0 Sep 26 15:28 file2.txt
-rw-r--r-- 1 amina amina    81 Sep 25 11:45 hello.c
-rwxr-xr-x 1 amina amina 15960 Sep 25 11:48 hello.out
-rw-r--r-- 1 amina amina   296 Sep 26 14:45 hello.txt
-rwxr-xr-x 1 amina amina    25 Sep 26 15:29 helo.txt
drwxr-xr-x 2 amina amina  4096 Sep 26 15:40 myLan2
drwxr-xr-x 3 amina amina  4096 Sep 26 15:27 test
amina@DESKTOP-SEP18NK:~$
```

```
amina@DESKTOP-SEP18NK:~$ chown user:group file.txt
chown: invalid user: 'user:group'
amina@DESKTOP-SEP18NK:~$ chown amina:group file.txt
chown: invalid group: 'amina:group'
amina@DESKTOP-SEP18NK:~$ chown amina:amina file.txt
amina@DESKTOP-SEP18NK:~$ ls -l
total 56
drwxr-xr-x 3 amina amina  4096 Sep 26 08:54 HomeTaskOs
drwxr-xr-x 4 amina amina  4096 Sep 19 15:30 Lab1WSL
drwxr-xr-x 4 amina amina  4096 Sep 23 20:13 Lab1WSL-1
drwxr-xr-x 2 amina amina  4096 Sep 26 15:59 Lab2
drwxr-xr-x 4 amina amina  4096 Sep 26 16:13 OSlabs
-rwxr-xr-x 1 amina amina     0 Sep 26 14:30 file.txt
-rw-r--r-- 1 amina amina     0 Sep 26 15:27 file1.txt
-rw-r--r-- 1 amina amina     0 Sep 26 15:28 file2.txt
-rw-r--r-- 1 amina amina    81 Sep 25 11:45 hello.c
-rwxr-xr-x 1 amina amina 15960 Sep 25 11:48 hello.out
-rw-r--r-- 1 amina amina   296 Sep 26 14:45 hello.txt
-rwxr-xr-x 1 amina amina    25 Sep 26 15:29 helo.txt
drwxr-xr-x 2 amina amina  4096 Sep 26 15:40 myLan2
drwxr-xr-x 3 amina amina  4096 Sep 26 15:27 test
amina@DESKTOP-SEP18NK:~$
```

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
```