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Course	Operating System
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Submission Date	26/09/2025
Lab No.	2

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
```

1.2 Getting Help in Linux

- ♦ **Commands to demonstrate:**

```
man ls          # Manual pages

ls --help       # Built-in help

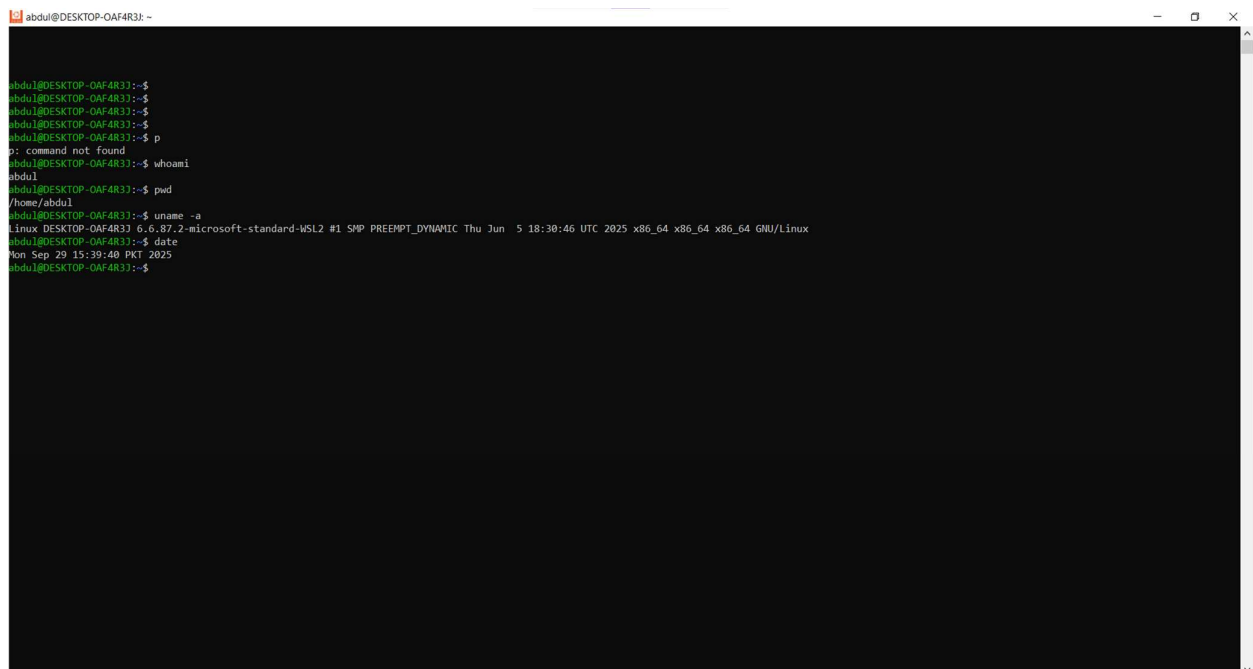
which ls        # Location of commands

type ls
```

Remarks

Copies the file hello.txt to backup.txt.

Used for creating a backup of a file.

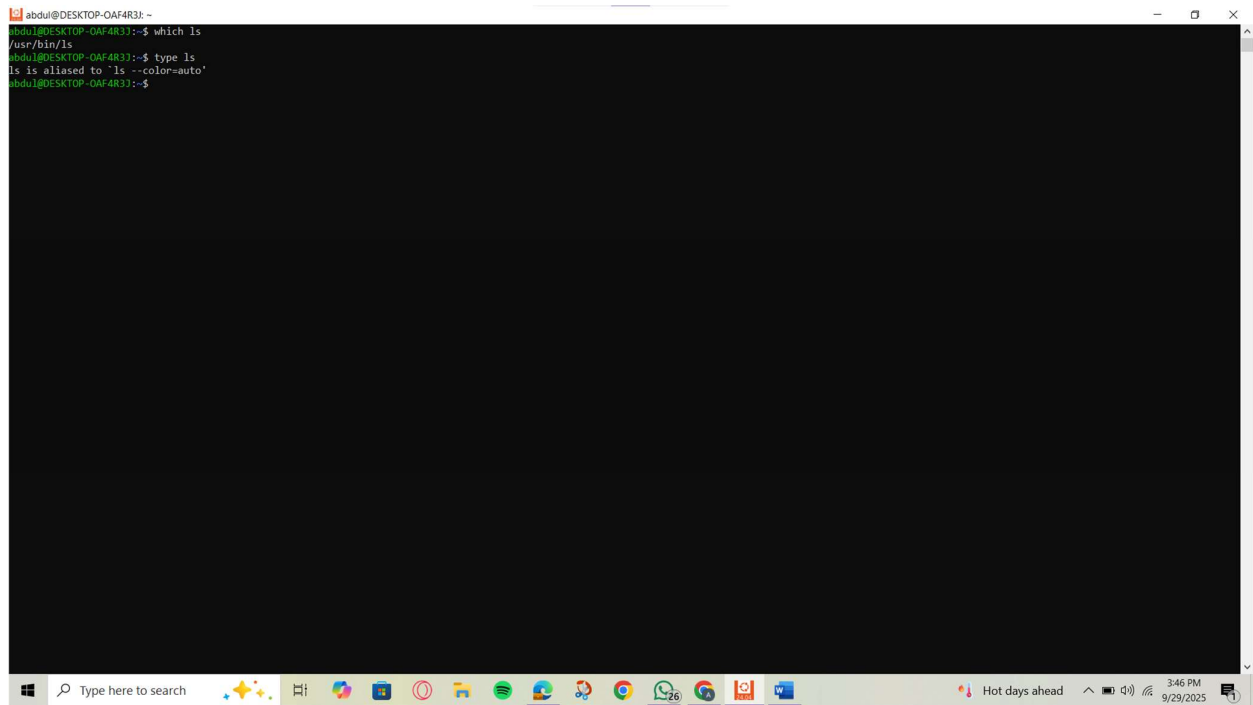


```
abdu1@DESKTOP-OAF4R33: ~
abdu1@DESKTOP-OAF4R33:~$
abdu1@DESKTOP-OAF4R33:~$
abdu1@DESKTOP-OAF4R33:~$
abdu1@DESKTOP-OAF4R33:~$ p
p: command not found
abdu1@DESKTOP-OAF4R33:~$ whoami
abdu1
abdu1@DESKTOP-OAF4R33:~$ pwd
/home/abdu1
abdu1@DESKTOP-OAF4R33:~$ uname -a
Linux DESKTOP-OAF4R33 6.6.87.2-microsoft-standard-WSL2 #1 SMP PREEMPT_DYNAMIC Thu Jun  5 18:30:46 UTC 2025 x86_64 x86_64 GNU/Linux
abdu1@DESKTOP-OAF4R33:~$ date
Mon Sep 29 15:39:40 PKT 2025
abdu1@DESKTOP-OAF4R33:~$
```

```
abdu@DESKTOP-OAF4R3: ~
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
-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
Manual page ls(1) line 1 (press h for help or q to quit)
```

```
abdu@DESKTOP-OAF4R3: ~
    birth time: birth, creation;
    with -l, WORD determines which time to show;
    with --sort=time, sort by WORD (newest first)
--time-style=TIME_STYLE
    time/date format with -l; see TIME_STYLE below
-t, --time
    sort by time, newest first; see --time
-T, --tabsize=COLS
    assume tab stops at each COLS instead of 8
-u, --sort=time
    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
-l
    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,B,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'
abdu@DESKTOP-OAF4R3:~$
```

```
abdu1@DESKTOP-QAF4R31: ~  
abdu1@DESKTOP-QAF4R31:~$ which ls  
/usr/bin/ls  
abdu1@DESKTOP-QAF4R31:~$ type ls  
ls is aliased to 'ls --color=auto'  
abdu1@DESKTOP-QAF4R31:~$
```



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
```

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 #
.             # Home directory
```

Remarks

Copies the whole directory mylab2 into mylab2_backup.

The -r option allows copying folders with their contents.

```
abdu@DESKTOP-OAF4R33:~$ ls /
bin  bin.usr-is-merged  boot  dev  etc  home  init  lib  lib.usr-is-merged  lib64  lost+found  media  mnt  opt  proc  root  run  shin  shin.usr-is-merged  snap  srv  sys  usr  var
abdu@DESKTOP-OAF4R33:~$ ls -la
total 52
drwxr-xr-x 7 abdul abdul 4096 Sep 29 15:44 .
drwxr-xr-x 3 root  root  4096 Sep 19 06:03 ..
-rw-r--r-- 1 abdul abdul 921 Sep 24 23:28 .bash_history
-rw-r--r-- 1 abdul abdul 220 Sep 19 06:03 .bash_logout
-rw-r--r-- 1 abdul abdul 3771 Sep 19 06:03 .bashrc
drwxr-xr-x 3 abdul abdul 4096 Sep 19 10:30 .cache
drwxr-xr-x 3 abdul abdul 4096 Sep 19 10:30 .dotnet
drwxr-xr-x 7 abdul abdul 4096 Sep 19 15:03 .git
-rw-r--r-- 1 abdul abdul 68 Sep 24 10:38 .gitconfig
-rw-r--r-- 1 abdul abdul 20 Sep 29 15:44 .lessht
-rw-r--r-- 1 abdul abdul 0 Sep 29 15:39 .motd_shown
-rw-r--r-- 1 abdul abdul 807 Sep 19 06:03 .profile
drwxr-xr-x 2 abdul abdul 4096 Sep 24 11:02 .ssh
-rw-r--r-- 1 abdul abdul 0 Sep 19 06:05 .sudo_as_admin_successful
drwxr-xr-x 5 abdul abdul 4096 Sep 19 10:30 .vscode-server
abdu@DESKTOP-OAF4R33:~$ cd /home
abdu@DESKTOP-OAF4R33:/home$ cd ~
abdu@DESKTOP-OAF4R33:~$ cd
abdu@DESKTOP-OAF4R33:~$
```

2.2

```
abdu@DESKTOP-OAF4R3:~$ pwd
/home/abdu
abdu@DESKTOP-OAF4R3:~$ ls
total 0
abdu@DESKTOP-OAF4R3:~$ ls -la
total 52
drwxr-x--- 7 abdu abdu 4096 Sep 29 15:44 .
drwxr-xr-x 3 root root 4096 Sep 19 06:03 ..
-rw-r--r-- 1 abdu abdu 921 Sep 24 23:28 .bash_history
-rw-r--r-- 1 abdu abdu 220 Sep 19 06:03 .bash_logout
-rw-r--r-- 1 abdu abdu 3771 Sep 19 06:03 .bashrc
drwxr----- 3 abdu abdu 4096 Sep 19 10:30 .cache
drwxr-xr-x 3 abdu abdu 4096 Sep 19 10:30 .dotnet
drwxr-xr-x 7 abdu abdu 4096 Sep 19 15:03 .git
-rw-r--r-- 1 abdu abdu 68 Sep 24 10:38 .gitconfig
-rw-r----- 1 abdu abdu 20 Sep 29 15:44 .lessht
-rw-rw-r-- 1 abdu abdu 0 Sep 29 15:39 .motd_shown
-rw-r--r-- 1 abdu abdu 807 Sep 19 06:03 .profile
drwxr----- 2 abdu abdu 4096 Sep 24 11:02 .ssh
-rw-r--r-- 1 abdu abdu 0 Sep 19 06:05 sudo_as_admin_successful
drwxr-xr-x 5 abdu abdu 4096 Sep 19 10:30 .vscode-server
abdu@DESKTOP-OAF4R3:~$ ls -lh
total 0
abdu@DESKTOP-OAF4R3:~$ cd
abdu@DESKTOP-OAF4R3:~$ cd ..
abdu@DESKTOP-OAF4R3:~$ cs --
Command 'cs' not found, but can be installed with:
sudo apt install csound
abdu@DESKTOP-OAF4R3:~$ cd ~
abdu@DESKTOP-OAF4R3:~$ cd /
abdu@DESKTOP-OAF4R3:/$
```

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

# Text editors introduction

nano hello.txt        # Simple text editor

# OR
```

- ◆ File viewing commands:

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

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

3.2 Copying, Moving, and Deleting

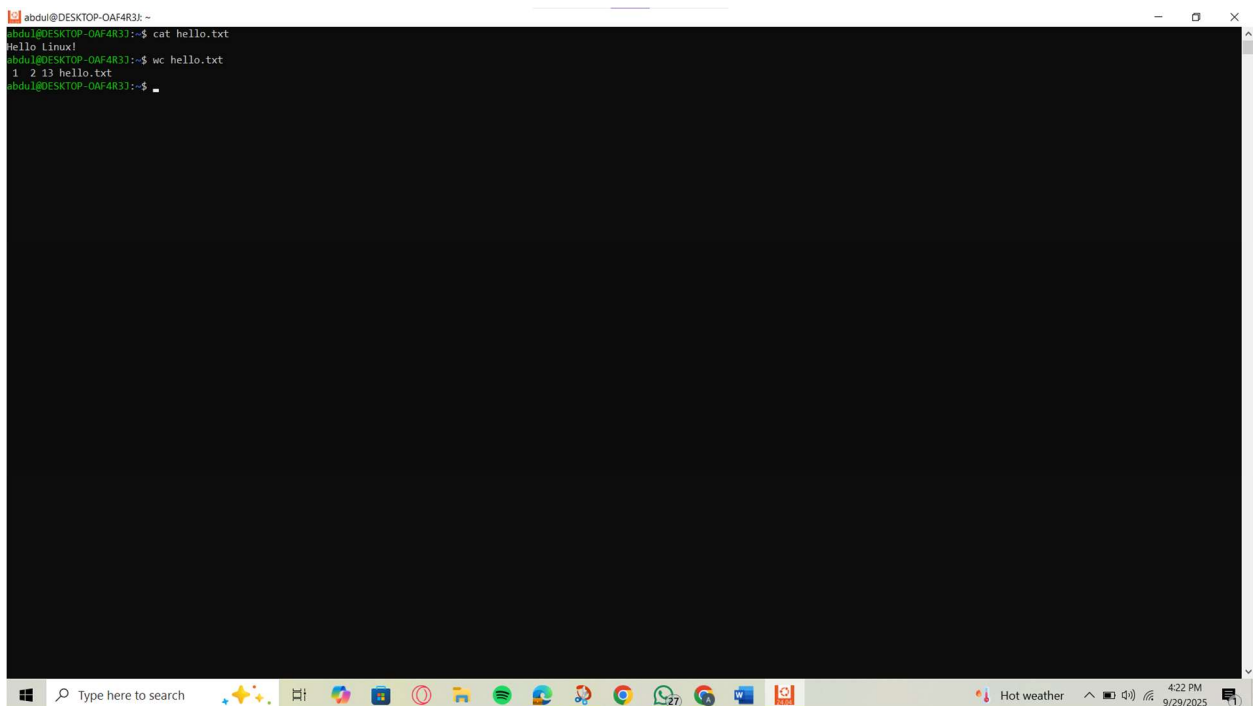
- ◆ **Commands to practice:**

```
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
```

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

Remarks

Renames backup.txt to renamed.txt.
mv can also move files between directories.



The screenshot shows a Windows terminal window with a black background and green text. The terminal title bar reads 'abdui@DESKTOP-OAF4R3: ~'. The command history and output are as follows:

```
abdui@DESKTOP-OAF4R3:~$ cat hello.txt
Hello Linux!
abdui@DESKTOP-OAF4R3:~$ wc hello.txt
 1  2 13 hello.txt
abdui@DESKTOP-OAF4R3:~$
```

The Windows taskbar is visible at the bottom, showing the search bar, task view button, and several application icons. The system tray on the right indicates the time is 4:22 PM on 9/29/2025.

3.2

```
abdu1@DESKTOP-OAF4R3:~  
abdu1@DESKTOP-OAF4R3:~$ cp hello.txt backup.txt  
abdu1@DESKTOP-OAF4R3:~$ cp -r mylab2 mylab2_backup  
abdu1@DESKTOP-OAF4R3:~$ mv backup.txt renamed.txt  
abdu1@DESKTOP-OAF4R3:~$ rm renamed.txt  
abdu1@DESKTOP-OAF4R3:~$ rm -r mylab2_backup  
abdu1@DESKTOP-OAF4R3:~$ ls  
file1.txt file2.txt file3.txt hello.txt hello.txt.save mylab2 test  
abdu1@DESKTOP-OAF4R3:~$ cd home  
-bash: cd: home: No such file or directory  
abdu1@DESKTOP-OAF4R3:~$ rm -r mylab2_backup  
rm: cannot remove 'mylab2_backup': No such file or directory  
abdu1@DESKTOP-OAF4R3:~$
```

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.

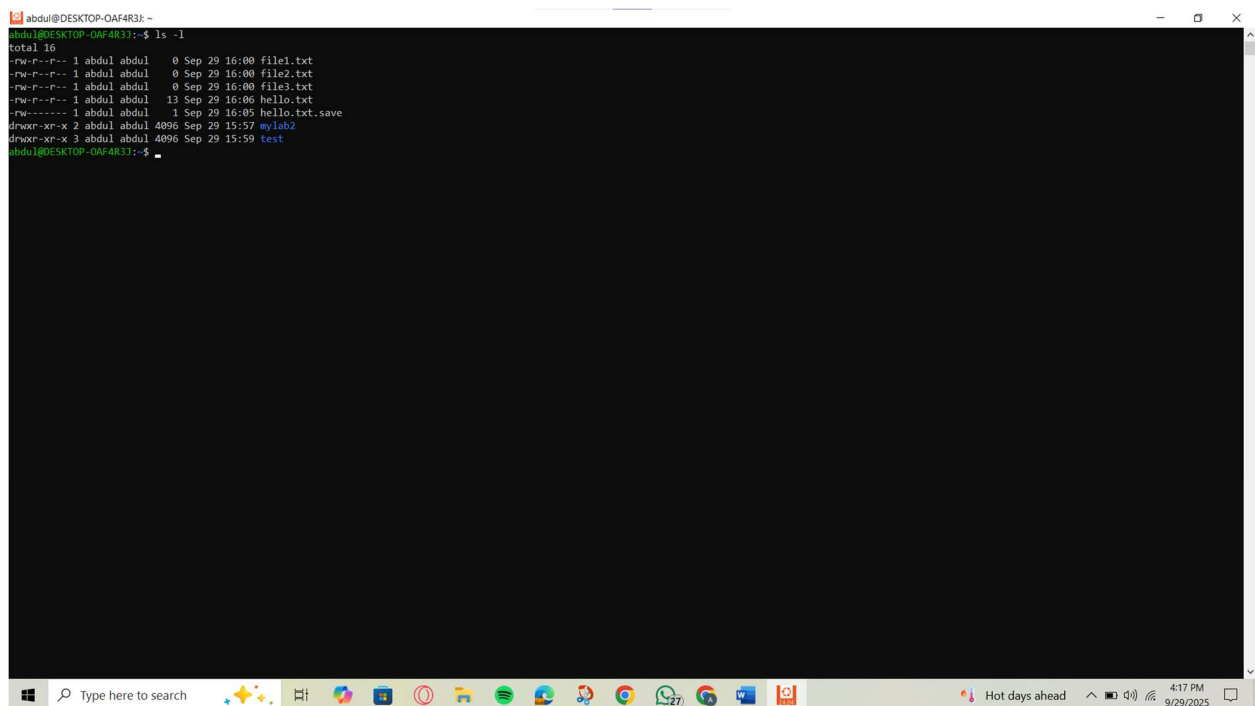
- ◆ **Commands to demonstrate:**

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

Remarks

Deletes the file renamed.txt.

Removes it permanently from the system



```
abdul@DESKTOP-OAF4R31: ~
abdul@DESKTOP-OAF4R31:~$ ls -l
total 16
-rw-r--r-- 1 abdul abdul 0 Sep 29 16:00 file1.txt
-rw-r--r-- 1 abdul abdul 0 Sep 29 16:00 file2.txt
-rw-r--r-- 1 abdul abdul 0 Sep 29 16:00 file3.txt
-rw-r--r-- 1 abdul abdul 13 Sep 29 16:06 hello.txt
-rw-r--r-- 1 abdul abdul 1 Sep 29 16:05 hello.txt.save
drwxr-xr-x 2 abdul abdul 4096 Sep 29 15:57 mylab2
drwxr-xr-x 3 abdul abdul 4096 Sep 29 15:59 test
abdul@DESKTOP-OAF4R31:~$
```