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**A Lab Report**  
**on**  
**“Operating System Lab-I”**

**[Code No.: COMP 307]**

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## **Questions**

### **Q1: What is Linux?**

Linux is an open-source operating system based on the Unix architecture. It manages hardware resources, executes commands, and provides a secure multi-tasking environment. It powers servers, desktops, embedded devices, and even supercomputers. Some of the most popular Linux distributions are ArchLinux, Ubuntu, RedHat, etc.

### **Q2: The Linux Hierarchical File System**

Linux uses a hierarchical file structure that begins at the root directory /. Everything in Linux is a file or a directory, and all paths originate from /. Common directories include:

- /home – User home directories
- /bin – Essential command binaries
- /etc – Configuration files
- /usr – User utilities and applications
- /var – Logs, caches, temporary data

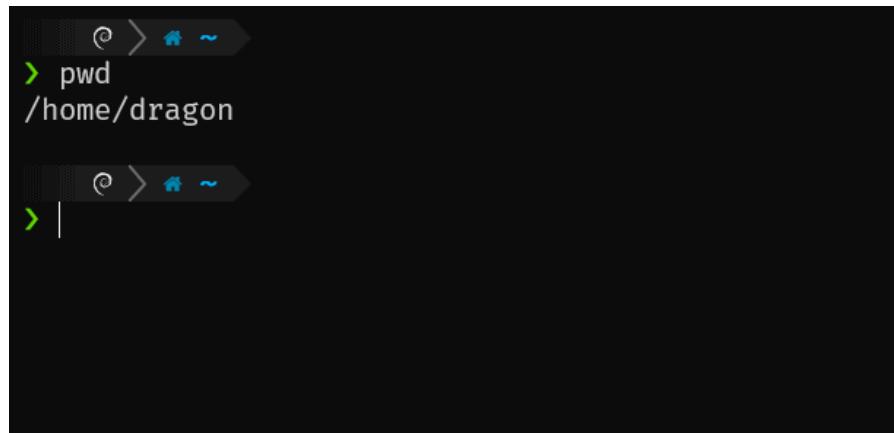
### **Q3: Importance of Linux commands in Operating Systems**

Linux commands are critical because they provide a direct and powerful interface to the operating system. They allow users and administrators to navigate the file system, manage files and directories, monitor system performance, and automate tasks through scripting. Unlike graphical interfaces, command-line commands are faster, use fewer resources, and provide more precise control. Mastering these commands enhances efficiency, troubleshooting capabilities, and overall understanding of how the OS operates, making it indispensable for system administrators, developers, and power users.

## Linux Commands

### 1. **pwd**

The `pwd` command prints your current working directory. It tells you exactly where you are located inside the Linux file system. This is extremely useful when navigating through multiple folders, working in scripts, or verifying paths before executing commands that affect files. Since Linux uses a hierarchical file structure starting at the root `/`, `pwd` helps ensure you never get lost.



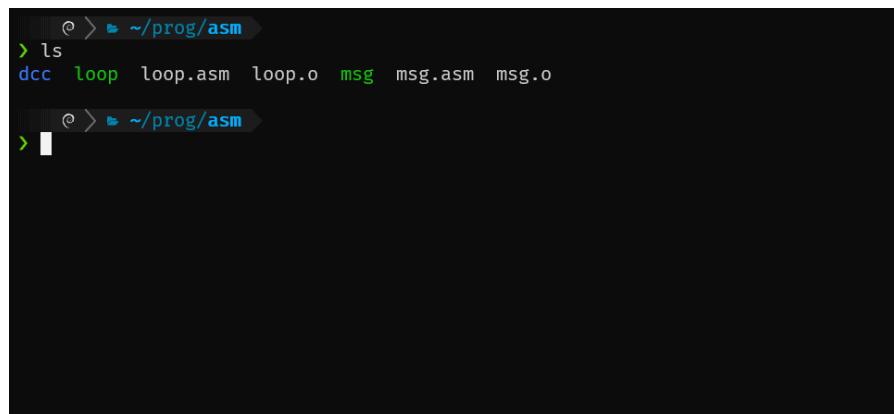
```
① > ~
> pwd
/home/dragon

① > |
```

A screenshot of a terminal window. The prompt shows the user is in their home directory (~). They type 'pwd' and press enter, which outputs the absolute path '/home/dragon'. The terminal then goes back to the previous line, indicated by a vertical cursor bar '|', and remains there.

### 2. **ls**

The `ls` command lists all files and directories in your current location. It gives a quick overview of the contents of a folder and is one of the most frequently used commands. By default, it shows only visible items (non-hidden files).



```
① > ~/prog/asm
> ls
dcc  loop  loop.asm  loop.o  msg  msg.asm  msg.o

① > |
```

A screenshot of a terminal window. The prompt shows the user is in the 'prog/asm' directory (~/prog/asm). They type 'ls' and press enter, which lists several files: 'dcc', 'loop', 'loop.asm', 'loop.o', 'msg', 'msg.asm', and 'msg.o'. The terminal then goes back to the previous line, indicated by a vertical cursor bar '|', and remains there.

### 3. **ls -a**

This version of `ls` displays all files, including hidden ones. Hidden files in Linux start with a dot (.), such as `.bashrc` or `.config`. These files usually store configurations and preferences.

```
④ > ~/prog/asm
> ls -a
. .. dcc loop loop.asm loop.o msg msg.asm msg.o
④ > ~/prog/asm
> █
```

#### 4. **ls -l**

The -l option displays a long, detailed listing. It includes file permissions, owner, group, size, and last modification time. This format is essential for understanding access rights and managing file security.

```
④ > ~/prog/asm
> ls -l
total 44
drwxr-xr-x 4 dragon dragon 4096 Jul  7 15:14 dcc
-rw xr-xr-x 1 dragon dragon 8928 Mar 30 2025 loop
-rw-r--r-- 1 dragon dragon  388 Mar 30 2025 loop.asm
-rw-r--r-- 1 dragon dragon  944 Mar 30 2025 loop.o
-rwxr-xr-x 1 dragon dragon 8864 Mar 28 2025 msg
-rw-r--r-- 1 dragon dragon  189 Mar 28 2025 msg.asm
-rw-r--r-- 1 dragon dragon   864 Mar 28 2025 msg.o
④ > ~/prog/asm
> █
```

#### 5. **cd**

The cd command lets you move between directories. It is used to navigate the Linux filesystem. You can move into subdirectories, return to the parent directory using `cd ..`, or jump to a specific absolute path.

```
○ > ~/prog/asm
> cd dcc
○ > ~/prog/asm/dcc > on ⚡ master
> █
```

## 6. **mkdir**

`mkdir` creates a new directory. It is commonly used to organize files by grouping them into folders. You can also create multiple folders at once, or even nested folders using `mkdir -p`.

```
○ > ~/Lab
> mkdir new
○ > ~/Lab
> ls
new
○ > ~/Lab
> █
```

## 7. **rmdir**

This command removes an empty directory. It cannot delete directories that contain files. It is useful for cleaning up folder structures or removing temporary empty folders. To remove the folder there must be a folder that is created.

```
④ > ✎ ~/lab
> rmdir new/
④ > ✎ ~/lab
> ll
total 16K
drwxr-xr-x  2 dragon dragon 4.0K Dec  9 21:07 .
drwx—— 74 dragon dragon 12K Dec  9 21:07 ..
④ > ✎
```

## 8. rm

The rm command deletes files permanently (no recycle bin). It should be used carefully because deleted files are not easily recoverable. You can also remove multiple files at once.

```
④ > ✎ ~/lab
> ls
five.txt four.txt one.txt three.txt two.txt
④ > ✎ ~/lab
> rm one.txt two.txt three.txt four.txt five.txt
④ > ✎ ~/lab
> ls
④ > ✎
```

## 9. rm -r **folder\_name**

The -r option stands for recursive deletion. It removes a directory and everything inside it — files, subfolders, and all. This is powerful and potentially dangerous, so double-check the directory before executing.

```
④ > ✎ ~/lab
> ls
hello
④ > ✎ ~/lab
> rm -r hello/
④ > ✎ ~/lab
> ls
④ > ✎
```

## 10. **touch**

touch is used to create an empty file or update the timestamp of an existing file. It is commonly used in scripting or when preparing placeholder files.

```
④ > ~/lab
> touch hello.txt

④ > ~/lab
> ls
hello.txt

④ > ~/lab
>
```

## 11. **cat**

The cat command reads and displays the content of a file directly in the terminal. It is also used to combine files or create files using output redirection.

```
④ > ~/lab
> cat hello.txt
Hello
This is the Lab Work for OS.

④ > ~/lab
>
```

## 12. **nano, vi, jed**

These are terminal-based text editors. nano is beginner-friendly, vi (or vim) is a powerful editor popular among developers, and jed provides a lightweight interface. They allow editing, writing, and saving files directly from the terminal.



### 13. cp

cp copies files from one place to another. You can also copy directories using the -r option. This command is essential for backups, duplication, and organizing files.

```
o > ~ /lab >
> tree
.
└── dest
    └── src
        └── hello.txt
3 directories, 1 file

o > ~ /lab >
> cp src/hello.txt dest/
o > ~ /lab >
> tree
.
└── dest
    └── hello.txt
└── src
    └── hello.txt
3 directories, 2 files

o > ~ /lab >
> |
```

### 14. mv

mv allows you to move or rename files and directories. Renaming is simply a move within the same folder. It's used for reorganizing or updating file names.

```
⑥ > ~/lab
> tree
.
└── dest
    └── src
        └── hello.txt

3 directories, 1 file

⑥ > ~/lab
> mv src/hello.txt dest/
⑥ > ~/lab
> tree
.
└── dest
    └── hello.txt
    └── src

3 directories, 1 file

⑥ > ~/lab
> █
```

## 15. **locate**

This command searches for files by name. It uses a system database, which makes the search extremely fast. It's ideal for finding misplaced files.

```
⑥ > ~/lab
> locate hello.txt
/home/dragon/lab/dest/ hello.txt

⑥ > ~/lab
> █
```

## 16. **echo**

Prints text or variable values to the terminal. It is commonly used in scripts to produce messages, debug values, or write text into files using redirection.

```
⑥ > ~ /lab
> echo "Hello"
Hello

⑥ > ~ /lab
> |
```

## 17. **uname -a**

Shows complete system information, including kernel version, machine architecture, hostname, and operating system. Useful for debugging or checking system specs.

```
⑥ > ~ /lab
> uname -a
Linux dragon 6.6.87.2-microsoft-standard-WSL2 #1 SMP PREEMPT_DYNAMIC Thu Jun 5 18:30:46 UTC 2025 x86_64 GNU/Linux
⑥ > ~ /lab
> |
```

## 18. **df -h**

Displays disk usage in human-readable format (MB/GB). It shows total size, used space, available space, and mounted filesystems. Handy for monitoring storage.

```
⑥ > ~ /lab
> df -h
Filesystem      Size  Used Avail Use% Mounted on
none            3.9G   0    3.9G  0% /usr/lib/modules/6.6.87.2-microsoft-standard-WSL2
none            3.9G  4.0K  3.9G  1% /mnt/wsl
drivers          477G 312G 165G 66% /usr/lib/wsl/drivers
/dev/sdd        1007G 78G 879G 9% /
none            3.9G 200K 3.9G 1% /mnt/wslg
none            3.9G   0    3.9G  0% /usr/lib/wsl/lib
rootfs           3.8G  2.7M 3.8G 1% /init
none            3.8G   0    3.8G  0% /dev
none            3.9G 572K 3.9G 1% /run
none            3.9G   0    3.9G  0% /run/lock
none            3.9G  1.1M 3.9G 1% /run/shm
none            3.9G  80K  3.9G 1% /mnt/wslg/versions.txt
none            3.9G  80K  3.9G 1% /mnt/wslg/doc
C:\             477G 312G 165G 66% /mnt/c
tmpfs           780M  12K 780M 1% /run/user/1000
⑥ > ~ /lab
> |
```

## 19. **ps -u \$USER**

Lists all currently running processes for your user. It displays process IDs, CPU usage, memory usage, and command names. Very useful for identifying unnecessary or stuck processes.

```
c) > ~/lab
> ps -u dragon
   PID TTY      TIME CMD
    762 ?        00:00:00 systemd
    763 ?        00:00:00 (sd-pam)
    793 pts/1   00:00:00 zsh
   1065 ?        00:00:00 dbus-daemon
   1068 ?        00:00:00 at-spi-bus-laun
   1074 ?        00:00:00 dbus-daemon
   1075 ?        00:00:00 gvfsd
   1109 ?        00:00:00 at-spi2-registr
  1341 pts/0   00:00:07 zsh
  1345 pts/0   00:00:00 zsh
  1466 pts/0   00:00:00 zsh
  1467 pts/0   00:00:01 zsh
  1469 pts/0   00:00:04 gitstatusd-linu
  5638 pts/2   00:00:09 zsh
  5645 pts/2   00:00:00 zsh
  5764 pts/2   00:00:00 zsh
  5765 pts/2   00:00:00 zsh
  5767 pts/2   00:00:00 gitstatusd-linu
  5982 pts/2   00:00:00 main
  7839 pts/2   00:00:00 ps

c) > ~/lab
> |
```

## 20. **top**

Displays real-time system activity. It shows active processes, CPU load, memory usage, and system uptime. It's one of the most important performance-monitoring commands.

```
top - 08:45:29 up 1 day, 6:36, 4 users, load average: 0.04, 0.02, 0.00
Tasks: 76 total, 1 running, 56 sleeping, 19 stopped, 0 zombie
CPU(s): 0.0 us, 0.0 sy, 0.0 ni, 99.9 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
Mem Mem: 7792.2 total, 3174.3 free, 1307.5 used, 5518.3 buff/cache
Mem Swap: 2048.0 total, 2048.0 free, 0.0 used, 6444.7 avail Mem

      PID USER PR NI VIRT  RES SHR S %CPU %MEM TIME+ COMMAND
 273 mysql  20  0 234624 396456 36992 S  0.6  5.0 13:23:52 mysqld
 829 root   20  0 557620 111720 43032 S  0.0  0.5 00:00:00 systemd
 1  root   20  0 167620 11720 3776 S  0.0  0.1 0:05.59 systemd
 2 root   20  0 3120 1920 1920 S  0.0  0.0 0:00.16 init-systemd(De
 6 root   20  0 3120 1792 1792 S  0.0  0.0 0:00.00 init
 58 root   20  0 49404 1536 14464 S  0.0  0.2 0:02.79 systemd-journal
 76 root   20  0 24904 5760 4688 S  0.0  0.0 0:00.00 systemd-udevd
173 root   20  0 163760 3672 2712 S  0.0  0.5 0:00.00 dhclient
179 root   20  0 3608 1970 1792 S  0.0  0.0 0:00.65 cron
188 message 20  0 8084 3960 3456 S  0.0  0.0 0:00.65 dbus-daemon
189 root   20  0 475008 20352 18304 S  0.0  0.3 0:00.08 nix-daemon
193 redis   20  0 60780 11392 8576 S  0.0  0.1 3:24.09 redis-server
210 root   20  0 16728 10372 6528 S  0.0  0.0 0:00.76 system-logind
214 root   20  0 39564 11872 8576 S  0.0  0.1 0:00.00 sshd
239 root   20  0 2524 1536 1536 S  0.0  0.0 0:00.00 getty
240 root   20  0 5880 1920 1792 S  0.0  0.0 0:00.00 getty
265 root   20  0 4668 960 640 S  0.0  0.0 0:00.00 in.tftpd
271 root   20  0 6572 1756 3512 S  0.0  0.1 0:05.54 apache2
325 postltd 20  0 238008 3056 2712 S  0.0  0.0 0:00.00 postltd
368 postgres 20  0 216808 29568 27126 S  0.0  0.4 0:04.10 postgres
392 postgres 20  0 216932 8580 6144 S  0.0  0.1 0:00.06 postgres
393 postgres 20  0 216948 7172 4736 S  0.0  0.1 0:01.03 postgres
400 postgres 20  0 216808 10372 7936 S  0.0  0.1 0:01.06 postgres
401 postgres 20  0 218396 8092 6408 S  0.0  0.1 0:00.57 postgres
402 postgres 20  0 216808 10372 7936 S  0.0  0.1 0:01.06 postgres
403 postgres 20  0 216808 10372 7936 S  0.0  0.1 0:01.06 postgres
746 Debian- 20  0 30052 17784 5376 S  0.0  0.2 0:07.97 exim4
752 root   20  0 3136 1164 1024 S  0.0  0.0 0:00.04 Relay(753)
754 root   20  0 5804 3456 3072 S  0.0  0.0 0:00.00 login
762 dragon  20  0 19200 10496 8704 S  0.0  0.1 0:00.20 systemd
763 dragon  20  0 168408 20352 1536 S  0.0  0.1 0:00.00 (sd-pam)
793 root   20  0 3476 3224 2048 S  0.0  0.1 0:00.00 at-spi2-registr
796 root   20  0 6548 3968 3584 S  0.0  0.0 0:00.00 sudo
1065 dragon 20  0 7888 3840 3584 S  0.0  0.0 0:00.02 dbus-daemon
1068 dragon 20  0 311032 7296 6656 S  0.0  0.1 0:00.01 at-spi-bus-laun
1074 dragon 20  0 7784 3840 3584 S  0.0  0.0 0:00.00 dbus-daemon
```

## 21. **chmod**

Modifies file permissions. Permissions control who can read, write, or execute a file. chmod is essential for running scripts, securing files, and managing access rights.

```
○ > ✚ ~/lab/dest
> ls -l
total 0
-rw-r--r-- 1 dragon dragon 0 Dec  9 21:39 hello.txt

○ > ✚ ~/lab/dest
> chmod 755 hello.txt

○ > ✚ ~/lab/dest
> ls -l
total 0
-rwxr-xr-x 1 dragon dragon 0 Dec  9 21:39 hello.txt

○ > ✚ ~/lab/dest
> █
```