

Computer Science Fundamentals and Career Pathways

Assignment Number 02: Basics of Linux and Open-Source Tools

Made By-

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Section A

Step 1- Installation

Option B — Install Ubuntu (WSL 2) on Windows 10/11 Prerequisites: Windows 10 or Windows 11. PowerShell (Admin) access.

Steps (PowerShell/Command Prompt as Administrator) 1.

#Enable WSL and Virtual Machine Platform features:

wsl --install

(This installs WSL and will install a default Linux distribution (usually Ubuntu)).

#If you already have WSL but not WSL2 enabled,

run: **wsl --update wsl --set-default-version 2**

#Install Ubuntu from Microsoft Store: **search "Ubuntu"** and click Install (e.g., Ubuntu 22.04 LTS).

#Launch Ubuntu from Start Menu → set username and password. Screenshots to capture: - PowerShell command running

wsl --install (show success message) .

wsl--install

```
Windows PowerShell
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Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

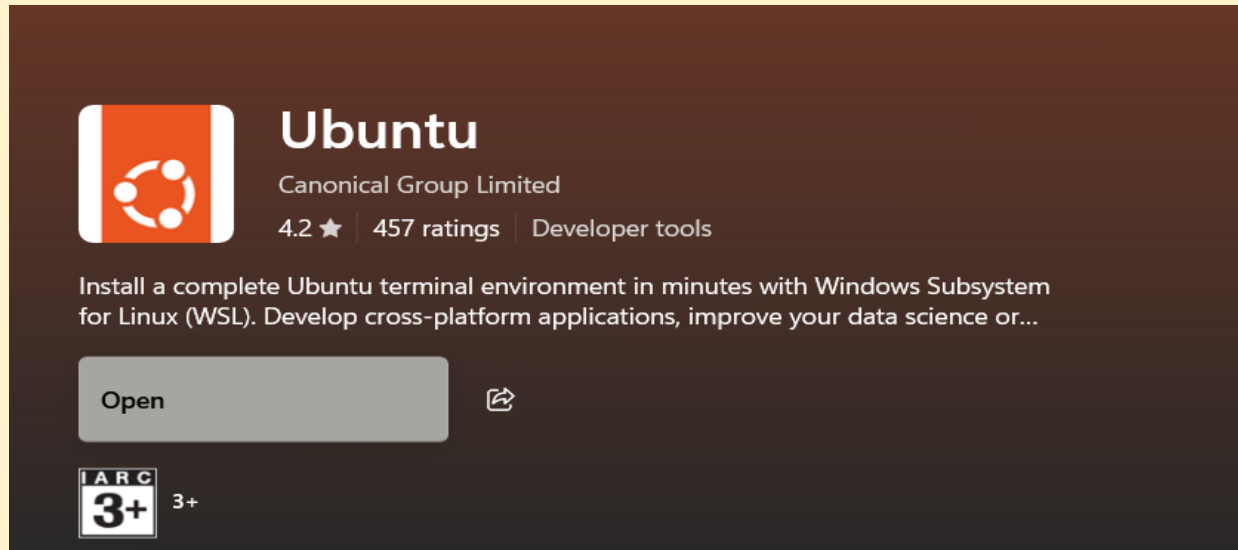
PS C:\WINDOWS\system32> wsl --install
Installing: Virtual Machine Platform
Virtual Machine Platform has been installed.
Installing: Windows Subsystem for Linux
Windows Subsystem for Linux has been installed.
Downloading: WSL Kernel
Installing: WSL Kernel
WSL Kernel has been installed.
Downloading: GUI App Support
[===== 21.0%
```

wsl--update

```
Windows PowerShell
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PS C:\Users\BHAVYA> wsl --update
Checking for updates.
The most recent version of Windows Subsystem for Linux is already installed.
PS C:\Users\BHAVYA>
```



Hardware Configuration:

WSL example - Host OS:

Windows 11 - WSL version: WSL 2 -
Ubuntu distro: Ubuntu 22.04 LTS -
Memory/ disk: WSL uses host
resources

Step 2 — Shell command implementations and documentation

A) File Navigation

1) pwd

Syntax: pwd

Description: Print working directory — shows current directory path.

When/Why: Use to confirm your current directory before running file operations.

```
ubuntu@linuxopsys:~$ pwd
/home/ubuntu
ubuntu@linuxopsys:~$ cd projects/mydir1/
ubuntu@linuxopsys:~/projects/mydir1$ pwd
/home/ubuntu/projects/mydir1
ubuntu@linuxopsys:~/projects/mydir1$
```

2) ls

Syntax: ls

Description: List directory contents.

When/Why: Quick view of files; use(-l for long format, -a to include hidden files).

```
[ved@localhost ~]$ ls -l
total 556
-rw-rw-r-- 1 ved ved 515845 Feb  5 13:00 commands.png
drwxr-xr-x. 2 ved ved 4096 Dec 24 12:06 Desktop
drwxr-xr-x. 6 ved ved 4096 Feb  5 12:56 Documents
drwxr-xr-x. 3 ved ved 4096 Dec 21 10:44 Downloads
drwx----- 7 ved ved 4096 Oct  1 09:26 Mail
drwxr-xr-x. 2 ved ved 4096 Sep 22 19:25 Music
drwxr-xr-x. 2 ved ved 4096 Nov  7 13:38 Pictures
drwxr-xr-x. 2 ved ved 4096 Sep 22 19:25 Public
drwxr-xr-x. 2 ved ved 4096 Sep 22 19:25 Templates
drwxrwxr-x 2 ved ved 4096 Feb  5 12:58 test
-rw-rw-r-- 1 ved ved 4830 Dec 24 12:00 Untitled1.abw.saved
drwxr-xr-x. 2 ved ved 4096 Sep 22 19:25 Videos
drwxr-xr-x 5 root root 4096 Dec 11 13:35 wordpress
[ved@localhost ~]$
```

3) Cd

Syntax: `cd [directory]`

Description: Change directory.

When/Why: Navigate filesystem to the folder where you want to operate.

```
user@machine:~$ cd /tmp
user@machine:/tmp$ cd ..
user@machine:/$ cd -
/tmp
user@machine:/tmp$ cd
```

4) tree

Syntax: `tree [options] [directory]`

Description: Display directory tree (hierarchical).

When/Why: Visualize directory structure — useful for documentation and debugging. (If tree is missing: `sudo apt update && sudo apt install tree`.)

```
sana@sana-HP-ProBook-4530s:~$ tree -d
.
├── Desktop
├── Documents
├── Downloads
├── TouchpadIndicator-nester
│   ├── icons
│   └── locale
│       ├── de
│       │   └── LC_MESSAGES
│       ├── es
│       │   └── LC_MESSAGES
│       ├── fr
│       │   └── LC_MESSAGES
│       ├── it
│       │   └── LC_MESSAGES
│       └── pt_BR
```

B) File and Directory Management

1) mkdir

Syntax: `mkdir [options] directory_name`

Description: Create a directory.

When/Why: Create directories to organize files.

```
hlnanshu@ansh:~/htf-daily/dir$ ls
hlnanshu@ansh:~/htf-daily/dir$ mkdir -p dir1/dir2/dir3
hlnanshu@ansh:~/htf-daily/dir$ ls -R
.:
dir1
./dir1:
dir2
```

2) touch

Syntax: touch filename

Description: Create an empty file or update timestamp.

When/Why: Quickly create placeholder files.

3) cp

Syntax: cp [options] source destination

Description: Copy files or directories (-r for recursive).

When/Why: Duplicate files or folder trees.

```
~/practice$ cp -f a.txt b.txt
~/practice$ cat b.txt
```

4) mv

Syntax: mv [options] source destination

Description: Move or rename files/directories.

When/Why: Organize or rename items.

```
~$ ls
file2
~$ mv file1 newFile
~$ ls
newFile
~$
```

5) rm

Syntax: rm [options] file

Description: Remove files. Use (-r to remove directories recursively and -f to force).

When/Why: Delete unnecessary files. Be careful — deletions are permanent.

```
~/GFG $ rm B.txt
~/GFG $ rm A
'A': Is a directory
~/GFG $
```

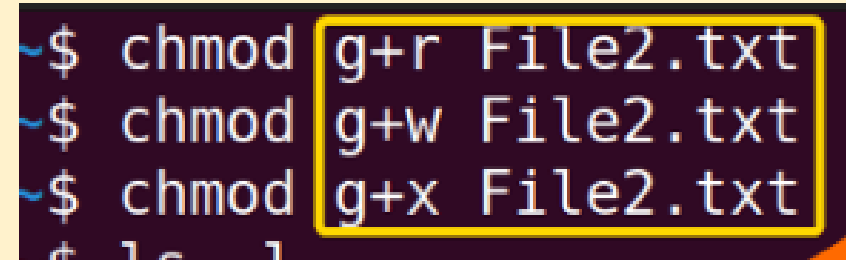
C) Permissions Management

1) chmod

Syntax: `chmod [options]`

Description: Change file mode (permissions)

When/Why: Secure files by restricting write/execute permissions.

A terminal window with a dark background and light blue text. It shows three lines of commands: `$ chmod g+r File2.txt`, `$ chmod g+w File2.txt`, and `$ chmod g+x File2.txt`. The permissions `g+r`, `g+w`, and `g+x` are highlighted with a yellow rectangular box.

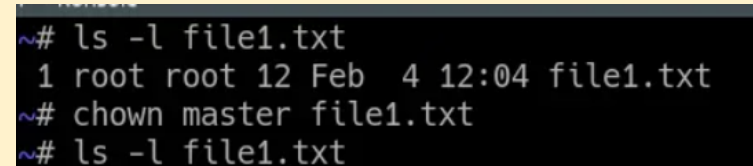
```
~$ chmod g+r File2.txt
~$ chmod g+w File2.txt
~$ chmod g+x File2.txt
```

2) chown

Syntax: `chown [owner][:group] file`

Description: Change file owner and/or group.

When/Why: Set correct ownership for scripts or service files.

A terminal window with a dark background and light blue text. It shows three lines of commands: `# ls -l file1.txt`, `# chown master file1.txt`, and `# ls -l file1.txt`. The output of the first `ls` command shows the file is owned by root:root.

```
~# ls -l file1.txt
1 root root 12 Feb  4 12:04 file1.txt
~# chown master file1.txt
~# ls -l file1.txt
```

D) Process Monitoring

1) **ps**

Syntax: `ps [options]`

Description: Report snapshot of current processes. Common: (`ps aux`).

When/Why: Check running processes, PIDs for troubleshooting.

2) **top**

Syntax: `top`

Description: Interactive process viewer with CPU/memory usage.

When/Why: Monitor system in real-time; kill misbehaving processes.

3) **kill**

Syntax: `kill [signal] PID` or `kill -9 PID`

Description: Send signals to processes (terminate, etc.).

When/Why: Stop misbehaving processes when graceful shutdown fails.

```
~$ kill -l
T      3) SIGQUIT      4) SIGILL
S      8) SIGFPE       9) SIGKILL
R2     13) SIGPIPE     14) SIGALRM
LD     18) SIGCONT     19) SIGSTOP
```


E) Networking Tools

1) Ping

Syntax: ping [options] destination

Description: Send ICMP echo requests to check reachability and latency. When/Why: Basic network connectivity test.

```
[root@localhost ~]# ping www.ipcisco.com
PING www.ipcisco.com (178.128.175.110): 56 data bytes
64 bytes from 178.128.175.110: seq=0 ttl=56 time=376.290 ms
64 bytes from 178.128.175.110: seq=1 ttl=56 time=362.500 ms
64 bytes from 178.128.175.110: seq=2 ttl=56 time=362.860 ms
64 bytes from 178.128.175.110: seq=3 ttl=56 time=362.220 ms
64 bytes from 178.128.175.110: seq=4 ttl=56 time=357.825 ms
64 bytes from 178.128.175.110: seq=5 ttl=56 time=365.660 ms
```

2) Ifconfig / ip

Syntax: ifconfig or ip addr show

Description: Show network interface configuration. (ifconfig may be deprecated in favor of ip .)

When/Why: See assigned IPs and interface states.

3) netstat (or ss)

Syntax: netstat -tuln or ss -tuln

Description: List network sockets and listening ports.

When/Why: Debug network services and port conflicts.

Step 3 — Shell scripts

- Script A — Backup a Directory (backup_dir.sh)

```
#!/bin/bash
# backup_dir.sh
# Purpose: Copy a specified directory to a backup folder with a timestamp.

# Date: 2025-11-09

# Usage: ./backup_dir.sh /path/to/source /path/to/backup_root

SOURCE_DIR="$1"
BACKUP_ROOT="$2"

if [[ -z "$SOURCE_DIR" || -z "$BACKUP_ROOT" ]]; then
    echo "Usage: $0 SOURCE_DIR BACKUP_ROOT"
    exit 1
```

Explanation & usage: - The script accepts two arguments — the source path and a backup root directory. - It creates a timestamped backup directory and uses `cp -a` to preserve permissions and symbolic links.

```
fi

if [[ ! -d "$SOURCE_DIR" ]]; then
    echo "Source directory does not exist: $SOURCE_DIR"
    exit 2
fi

TIMESTAMP=$(date +"%Y%m%d_%H%M%S")
BACKUP_DIR="$BACKUP_ROOT/backup_${basename "$SOURCE_DIR"}_$TIMESTAMP"

mkdir -p "$BACKUP_DIR"

# Copy files recursively while preserving attributes
cp -a "$SOURCE_DIR/" "$BACKUP_DIR/"

if [[ $? -eq 0 ]]; then
    echo "Backup successful: $BACKUP_DIR"
    exit 0
else
    echo "Backup failed"
    exit 3
fi
```

- Script B — CPU/Memory Monitoring (resource_monitor.sh)

```
#!/bin/bash
# resource_monitor.sh
# Purpose: Log CPU and memory usage to a file at regular intervals.

# Date: 2025-11-09

# Usage: ./resource_monitor.sh /path/to/logfile interval_seconds
LOGFILE="$1"
INTERVAL=${2:-60} # default to 60 seconds if not provided
```

```
if [[ -z "$LOGFILE" ]]; then
    echo "Usage: $0 LOGFILE [INTERVAL_SECONDS]"
    exit 1
fi

mkdir -p "$(dirname "$LOGFILE")"

# Header for logfile
echo "timestamp,cpu_percent,mem_total,mem_used,mem_free" >> "$LOGFILE"

while true; do
    TIMESTAMP=$(date +"%Y-%m-%d_%H:%M:%S")
    # cpu usage (percentage) using top in batch mode
    CPU_PERCENT=$(top -b -n1 | grep "%Cpu(s)" | awk '{print 100 - $8}')
    # memory using free
    read -r MEM_TOTAL MEM_USED MEM_FREE <<< $(free -m | awk '/Mem:/ {print $2"
"$3" "$4}')
    echo "$TIMESTAMP,$CPU_PERCENT,$MEM_TOTAL,$MEM_USED,$MEM_FREE" >> "$LOGFILE"
    sleep "$INTERVAL"
done
```

- Script C — Automated Download Task (auto_download.sh)

```
#!/bin/bash
# auto_download.sh
# Purpose: Download a file from the internet using wget or curl and store it in
a predefined directory.

# Date: 2025-11-09

# Usage: ./auto_download.sh URL /path/to/download_dir

URL="$1"
DOWNLOAD_DIR="$2"
```

```
if [[ -z "$URL" || -z "$DOWNLOAD_DIR" ]]; then
    echo "Usage: $0 URL DOWNLOAD_DIR"
    exit 1
fi

mkdir -p "$DOWNLOAD_DIR"
FILENAME=$(basename "$URL")
DEST="$DOWNLOAD_DIR/$FILENAME"

# Prefer wget if available
if command -v wget >/dev/null 2>&1; then
    wget -O "$DEST" "$URL"
elif command -v curl >/dev/null 2>&1; then
    curl -L -o "$DEST" "$URL"
else
    echo "Neither wget nor curl is installed. Install one and retry."
    exit 2
fi

if [[ $? -eq 0 ]]; then
    echo "Downloaded $URL to $DEST"
    exit 0
else
    echo "Download failed"
    exit 3
fi
```

