



# National Textile University

*Department of Computer Science*

Subject:

**Operating System**

Submitted To:

**Sir Nasir Mehmood**

Submitted By:

**Hafsa Tayyab**

Registration No:

**23-NTU-CS-1163**

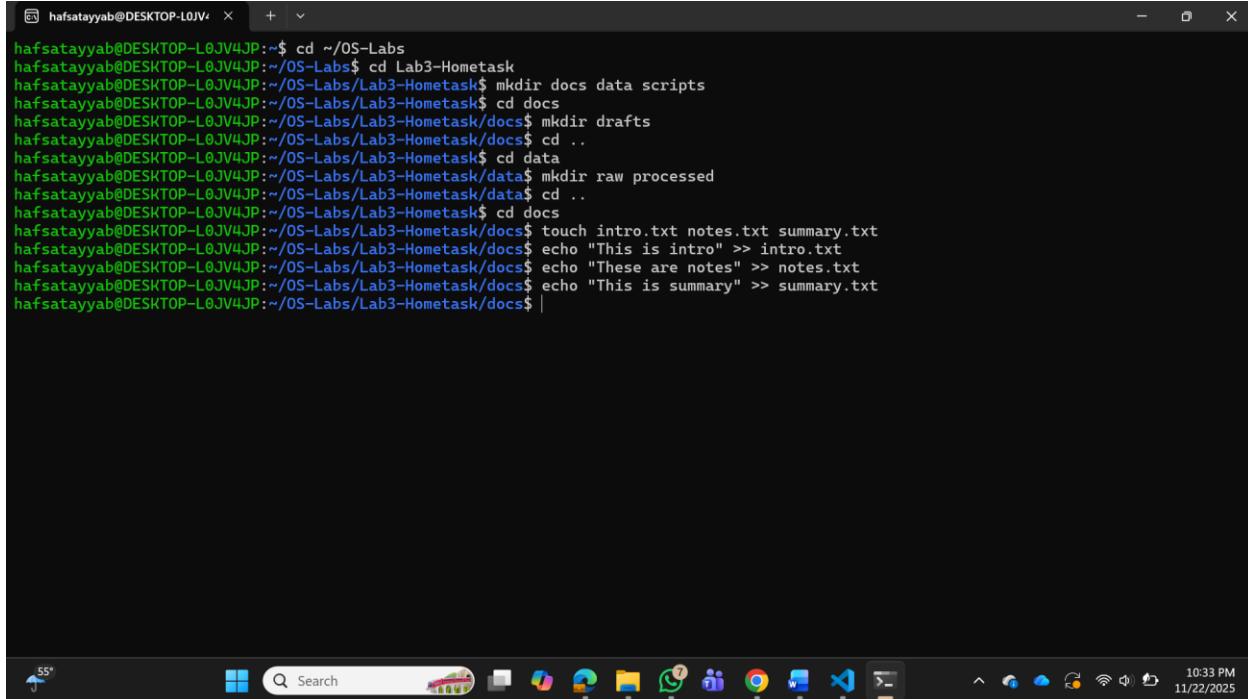
Lab No:

**3 – Home Task**

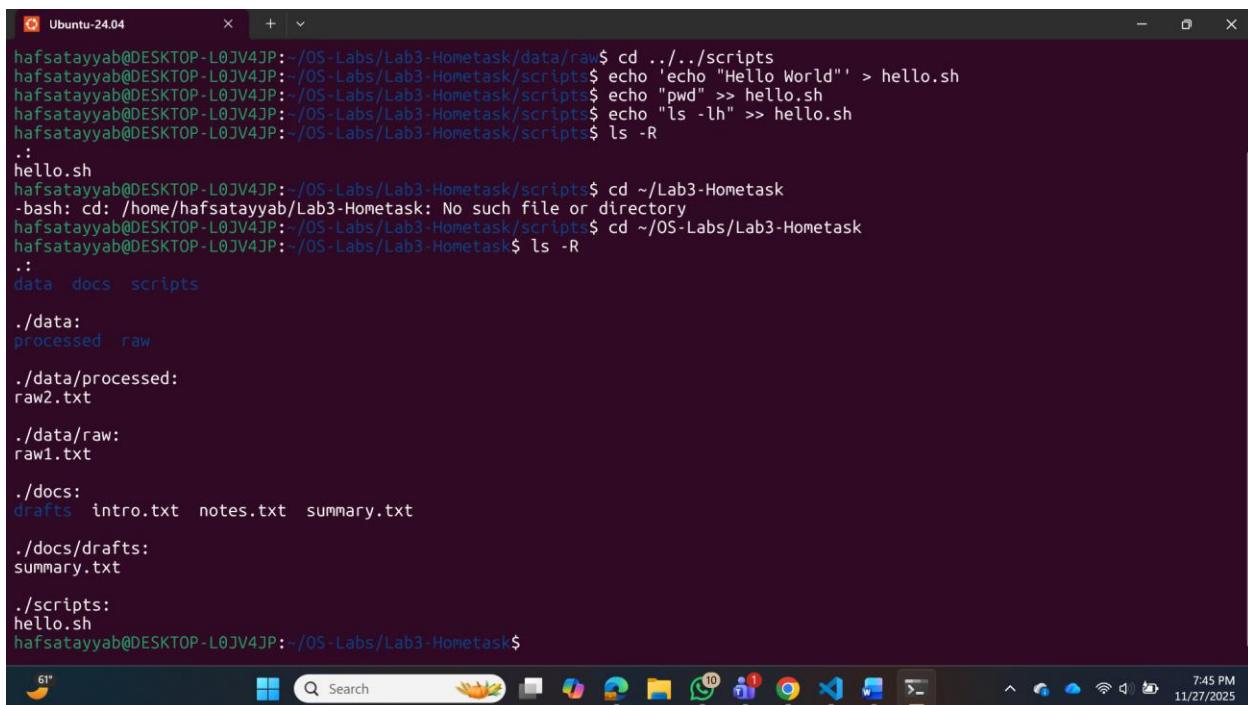
Semester:

**5<sup>th</sup>**

## Part 1: File and Directory Operations



```
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs$ cd ~/OS-Labs
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs$ cd Lab3-Hometask
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ mkdir docs data scripts
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ cd docs
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ mkdir drafts
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ cd ..
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ cd data
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/data$ mkdir raw processed
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/data$ cd ..
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ cd docs
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ touch intro.txt notes.txt summary.txt
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ echo "This is intro" >> intro.txt
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ echo "These are notes" >> notes.txt
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ echo "This is summary" >> summary.txt
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ |
```



```
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/data/raw$ cd ../../scripts
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/scripts$ echo 'echo "Hello World"' > hello.sh
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/scripts$ echo "pwd" >> hello.sh
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/scripts$ echo "ls -lh" >> hello.sh
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/scripts$ ls -R
.:
hello.sh
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/scripts$ cd ~/Lab3-Hometask
-bash: cd: /home/hafsatayyab/Lab3-Hometask: No such file or directory
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/scripts$ cd ~/OS-Labs/Lab3-Hometask
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ ls -R
.:
data docs scripts

./data:
processed raw

./data/processed:
raw2.txt

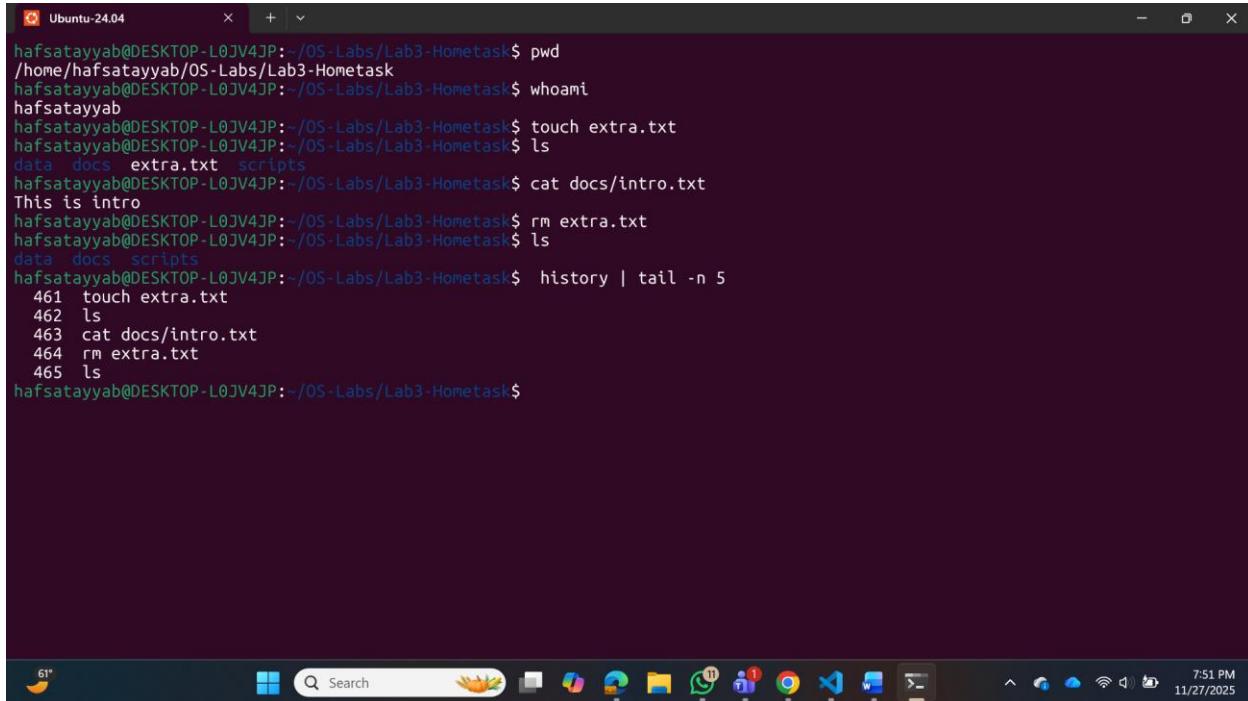
./data/raw:
raw1.txt

./docs:
drafts intro.txt notes.txt summary.txt

./docs/drafts:
summary.txt

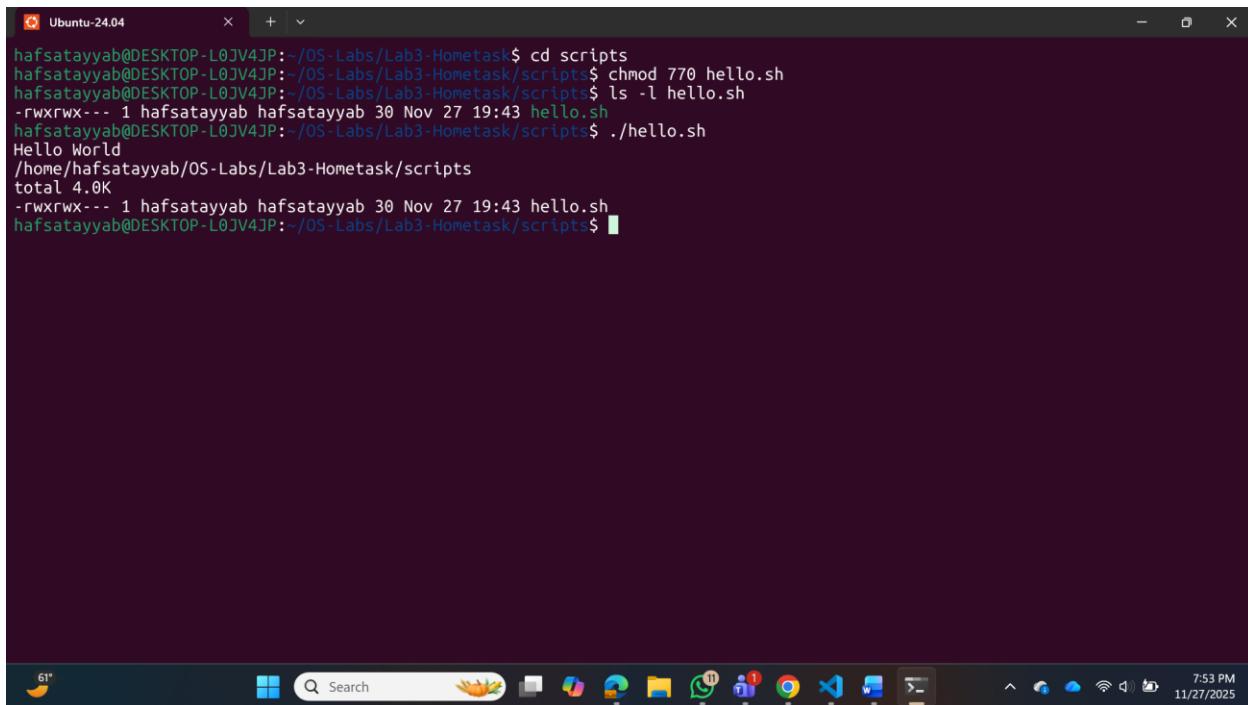
./scripts:
hello.sh
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$
```

## Part 2: Practice with Basic Linux Commands



```
Ubuntu-24.04 x + v
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ pwd
/home/hafsatayyab/OS-Labs/Lab3-Hometask
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ whoami
hafsatayyab
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ touch extra.txt
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ ls
data docs extra.txt scripts
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ cat docs/intro.txt
This is intro
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ rm extra.txt
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ ls
data docs scripts
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ history | tail -n 5
461 touch extra.txt
462 ls
463 cat docs/intro.txt
464 rm extra.txt
465 ls
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$
```

## Part 3: File Permissions and Ownership

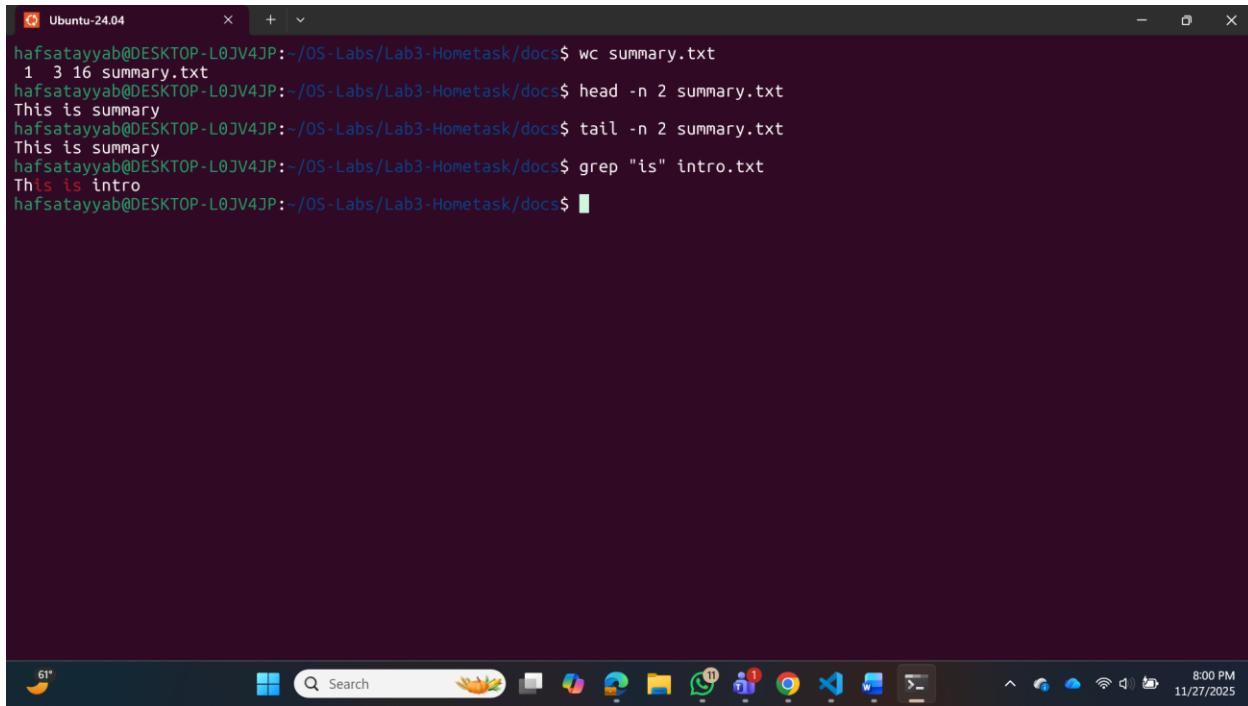


```
Ubuntu-24.04 x + v
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask$ cd scripts
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask/scripts$ chmod 770 hello.sh
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask/scripts$ ls -l hello.sh
-rw-rwx--- 1 hafsatayyab hafsatayyab 30 Nov 27 19:43 hello.sh
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask/scripts$ ./hello.sh
Hello World
/home/hafsatayyab/OS-Labs/Lab3-Hometask/scripts
total 4.0K
-rwxrwx--- 1 hafsatayyab hafsatayyab 30 Nov 27 19:43 hello.sh
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask/scripts$
```

```
hafsatayyab@DESKTOP-L0JV4JP: ~ /OS-Labs/Lab3-Hometask/docs
hafsatayyab@DESKTOP-L0JV4JP: ~/OS-Labs/Lab3-Hometask/docs$ chmod 664 intro.txt
hafsatayyab@DESKTOP-L0JV4JP: ~/OS-Labs/Lab3-Hometask/docs$ ls -l intro.txt
-rw-rw-r-- 1 hafsatayyab hafsatayyab 14 Nov 22 22:22 intro.txt
hafsatayyab@DESKTOP-L0JV4JP: ~/OS-Labs/Lab3-Hometask/docs$ chmod o-rwx notes.txt
hafsatayyab@DESKTOP-L0JV4JP: ~/OS-Labs/Lab3-Hometask/docs$ ls -l
total 16
drwxr-xr-x 2 hafsatayyab hafsatayyab 4096 Nov 27 19:34 drafts
-rw-rw-r-- 1 hafsatayyab hafsatayyab 14 Nov 22 22:22 intro.txt
-rw-r----- 1 hafsatayyab hafsatayyab 16 Nov 22 22:22 notes.txt
-rw-r--r-- 1 hafsatayyab hafsatayyab 16 Nov 22 22:22 summary.txt
hafsatayyab@DESKTOP-L0JV4JP: ~/OS-Labs/Lab3-Hometask/docs$
```

## Part 4: Reading & Searching Files Inside docs/ :

1. Count the number of lines, words, and characters in
2. Show only the first 2 lines of summary.txt using head -n 2
3. Show the last line of summary.txt using tail -n 1 .
4. Search for a keyword (of your choice) in intro.txt grep .



```
Ubuntu-24.04      + 
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ wc summary.txt
 1 3 16 summary.txt
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ head -n 2 summary.txt
This is summary
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ tail -n 2 summary.txt
This is summary
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ grep "is" intro.txt
This is intro
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$
```

## Part 5: Linux Process Commands

### 1. Exploring Processes

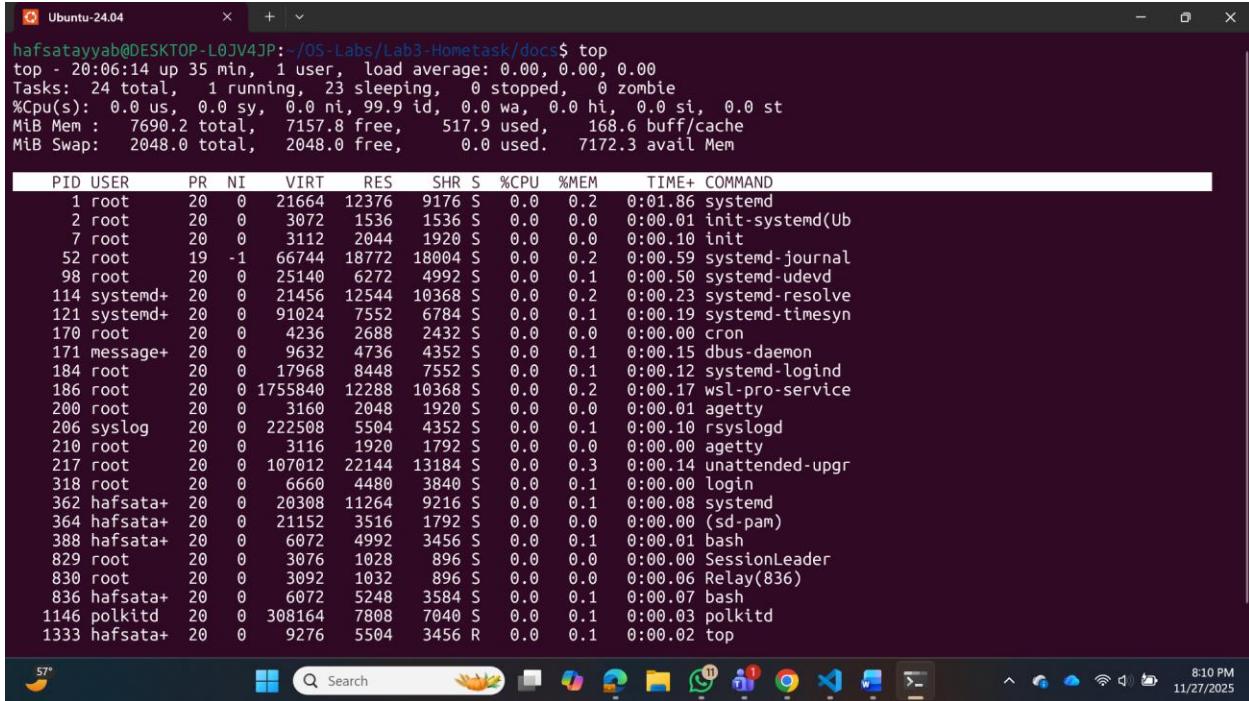
Sr #	PID	PPID	Command
1	1	0	/sbin/init
2	2	1	/init
3	401	325	-bash

```

Ubuntu-24.04 x + v
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask/docs$ ps -ef
UID      PID  PPID  C STIME TTY          TIME CMD
root      1      0  0 19:30 ?        00:00:01 /sbin/init
root      2      1  0 19:30 ?        00:00:00 /init
root      7      2  0 19:30 ?        00:00:00 plan9 --control-socket 7 --log-level 4 --server-fd 8 --pipe-fd 10 --log-
root     52      1  0 19:30 ?        00:00:00 /usr/lib/systemd/systemd-journald
root     98      1  0 19:30 ?        00:00:00 /usr/lib/systemd/systemd-udevd
systemd+ 114      1  0 19:30 ?        00:00:00 /usr/lib/systemd/systemd-resolved
systemd+ 121      1  0 19:30 ?        00:00:00 /usr/lib/systemd/systemd-timesyncd
root    170      1  0 19:30 ?        00:00:00 /usr/sbin/cron -f -P
message+ 171      1  0 19:30 ?        00:00:00 @dbus-daemon --system --address=/systemd: --nofork --nopidfile --systemd-
root    184      1  0 19:30 ?        00:00:00 /usr/lib/systemd/systemd-logind
root    186      1  0 19:30 ?        00:00:00 /usr/libexec/wsl-pro-service -vv
root    200      1  0 19:30 hvc0      00:00:00 /sbin/agetty -o -p -- \u --noclear --keep-baud - 115200,38400,9600 vt220
syslog   206      1  0 19:30 ?        00:00:00 /usr/sbin/rsyslogd -n -iNONE
root    210      1  0 19:30 ttyn1      00:00:00 /sbin/agetty -o -p -- \u --noclear - linux
root    217      1  0 19:30 ?        00:00:00 /usr/bin/python3 /usr/share/unattended-upgrades/unattended-upgrade-shutd
root    318      2  0 19:30 pts/1      00:00:00 /bin/login -f
hfsata+ 362      1  0 19:30 ?        00:00:00 /usr/lib/systemd/systemd --user
hfsata+ 364    362  0 19:30 ?        00:00:00 (sd-pam)
hfsata+ 388    318  0 19:30 pts/1      00:00:00 -bash
root    829      2  0 19:55 ?        00:00:00 /init
root    830    829  0 19:55 ?        00:00:00 /init
hfsata+ 836    830  0 19:55 pts/0      00:00:00 -bash
root   1141      1  0 19:57 ?        00:00:00 /usr/libexec/packagekitd
polkitd 1146      1  0 19:57 ?        00:00:00 /usr/lib/polkit-1/polkitd --no-debug
hfsata+ 1318   836  0 20:01 pts/0      00:00:00 ps -ef
hafsatayyab@DESKTOP-L0JV4JP:/OS-Labs/Lab3-Hometask/docs$
```

- All processes are using same amount of CPU**
- Most memory is used by**

PID	User	%Mem	Command
217	root	0.3	Unattended-upgr



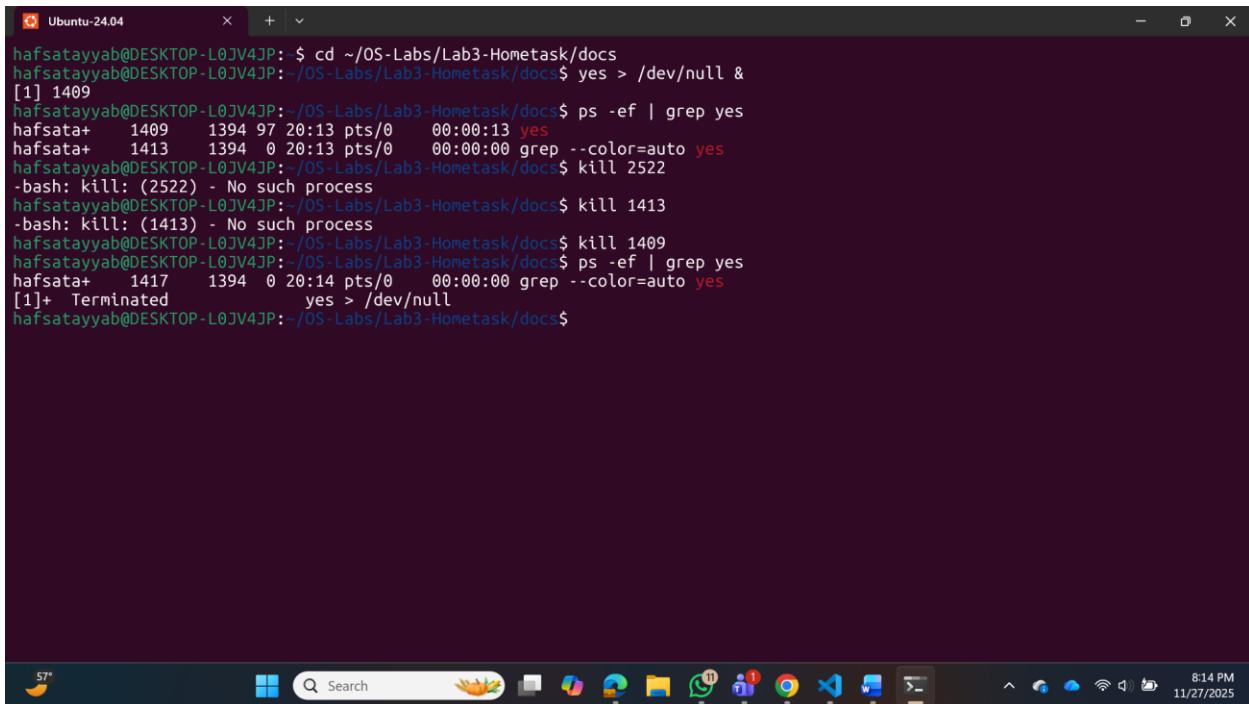
```

hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ top
top - 20:06:14 up 35 min, 1 user, load average: 0.00, 0.00, 0.00
Tasks: 24 total, 1 running, 23 sleeping, 0 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
MiB Mem : 7690.2 total, 7157.8 free, 517.9 used, 168.6 buff/cache
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used. 7172.3 avail Mem

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
 1 root 20 0 21664 12376 9176 S 0.0 0.2 0:01.86 systemd
 2 root 20 0 3072 1536 1536 S 0.0 0.0 0:00.01 init-systemd(Ub
 7 root 20 0 3112 2044 1920 S 0.0 0.0 0:00.10 init
 52 root 19 -1 66744 18772 18004 S 0.0 0.2 0:00.59 systemd-journal
 98 root 20 0 25140 6272 4992 S 0.0 0.1 0:00.50 systemd-udevd
114 systemd+ 20 0 21456 12544 10368 S 0.0 0.2 0:00.23 systemd-resolve
121 systemd+ 20 0 91024 7552 6784 S 0.0 0.1 0:00.19 systemd-timesyn
170 root 20 0 4236 2688 2432 S 0.0 0.0 0:00.00 cron
171 message+ 20 0 9632 4736 4352 S 0.0 0.1 0:00.15 dbus-daemon
184 root 20 0 17968 8448 7552 S 0.0 0.1 0:00.12 systemd-logind
186 root 20 0 1755840 12288 10368 S 0.0 0.2 0:00.17 wsl-pro-service
200 root 20 0 3160 2048 1920 S 0.0 0.0 0:00.01 getty
206 syslog 20 0 222508 5504 4352 S 0.0 0.1 0:00.10 rsyslogd
210 root 20 0 3116 1920 1792 S 0.0 0.0 0:00.00 getty
217 root 20 0 107012 22144 13184 S 0.0 0.3 0:00.14 unattended-upgr
318 root 20 0 6660 4480 3848 S 0.0 0.1 0:00.00 login
362 hfsata+ 20 0 20308 11264 9216 S 0.0 0.1 0:00.08 systemd
364 hfsata+ 20 0 21152 3516 1792 S 0.0 0.0 0:00.00 (sd-pam)
388 hfsata+ 20 0 6072 4992 3456 S 0.0 0.1 0:00.01 bash
829 root 20 0 3076 1028 896 S 0.0 0.0 0:00.00 SessionLeader
830 root 20 0 3092 1032 896 S 0.0 0.0 0:00.06 Relay(836)
836 hfsata+ 20 0 6072 5248 3584 S 0.0 0.1 0:00.07 bash
1146 polkitd 20 0 308164 7808 7040 S 0.0 0.1 0:00.03 polkitd
1333 hfsata+ 20 0 9276 5504 3456 R 0.0 0.1 0:00.02 top

```

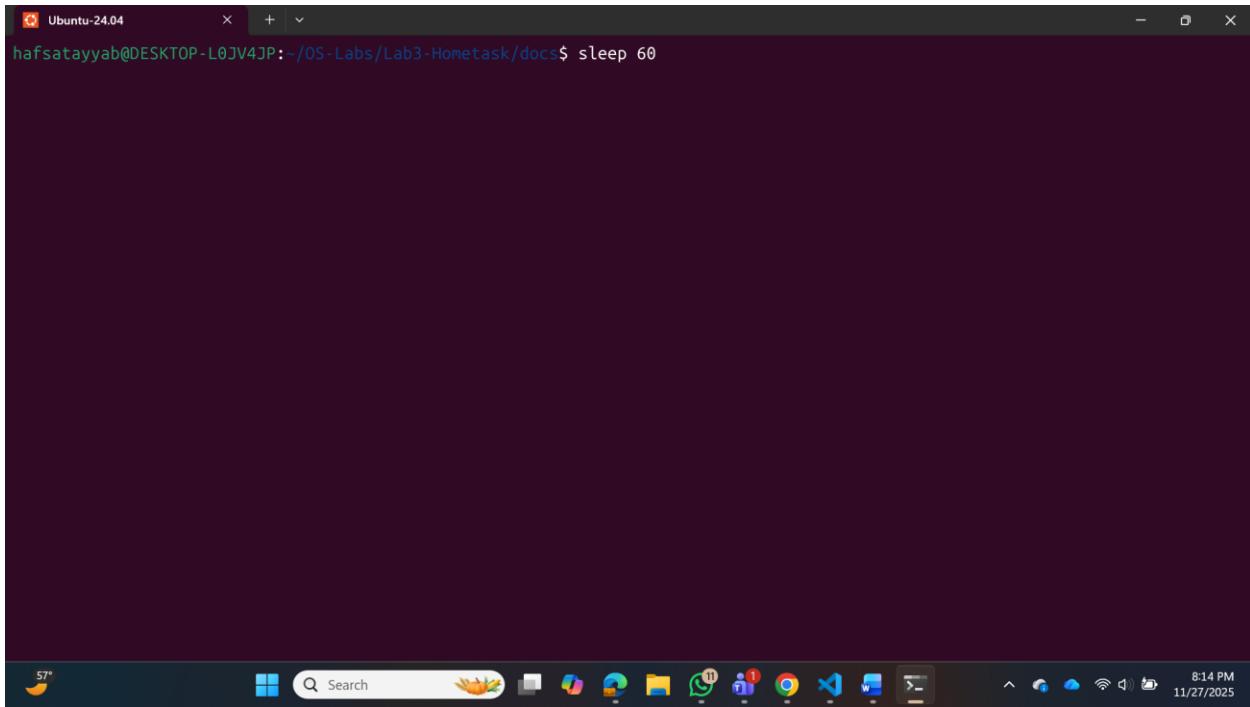
## 2. Practice with Infinite Process



```

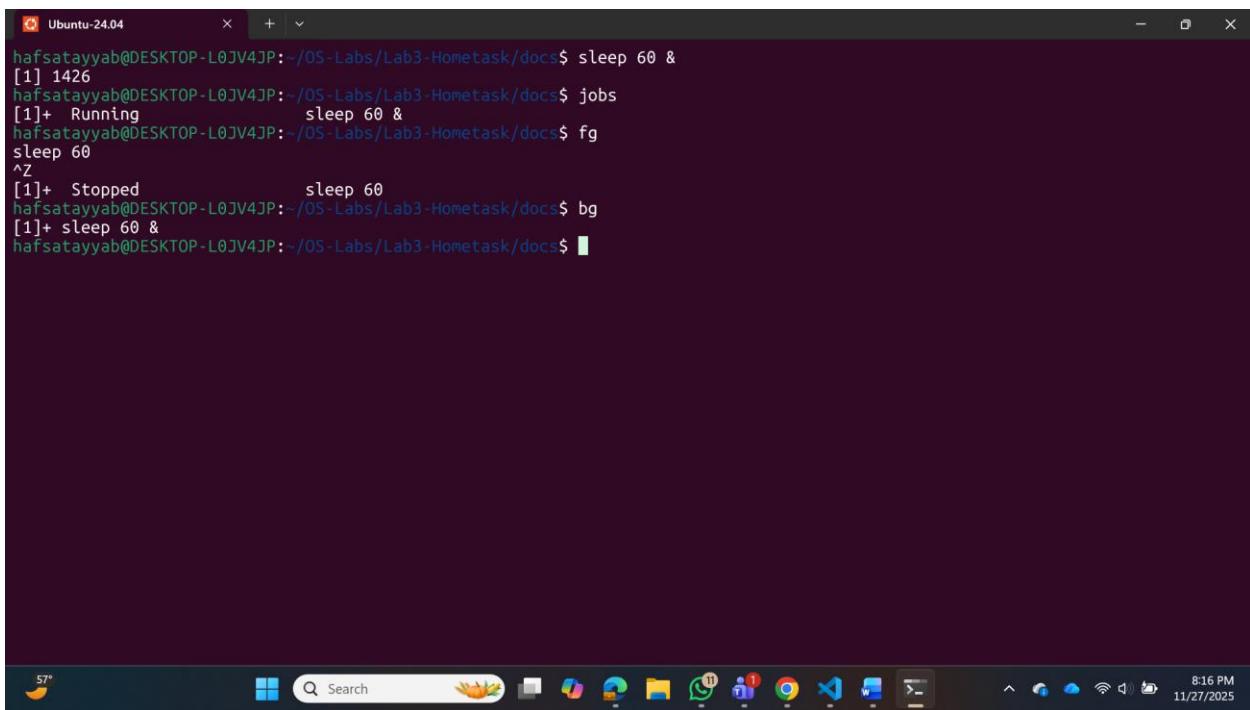
hafsatayyab@DESKTOP-L0JV4JP:~$ cd ~/OS-Labs/Lab3-Hometask/docs
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ yes > /dev/null &
[1] 1409
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ ps -ef | grep yes
hfsata+ 1409 1394 97 20:13 pts/0 00:00:13 yes
hfsata+ 1413 1394 0 20:13 pts/0 00:00:00 grep --color=auto yes
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ kill 2522
-bash: kill: (2522) - No such process
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ kill 1413
-bash: kill: (1413) - No such process
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ kill 1409
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ ps -ef | grep yes
hfsata+ 1417 1394 0 20:14 pts/0 00:00:00 grep --color=auto yes
[1]+ Terminated yes > /dev/null
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$
```

### 3. Foreground & Background Jobs



A screenshot of a Windows desktop environment with a dark theme. A terminal window titled "Ubuntu-24.04" is open, showing the command "sleep 60" being run. The desktop bar at the bottom shows various icons and the date/time "11/27/2025 8:14 PM".

```
Ubuntu-24.04 x + hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ sleep 60
```



A screenshot of the same Ubuntu desktop environment. The terminal window shows the command "sleep 60 &" being run, followed by the output of the "jobs" command which shows a single running job [1]+. The user then runs "fg" to bring the job to the foreground, "sleep 60", and finally "bg" to return it to the background. The desktop bar at the bottom shows the date/time "11/27/2025 8:16 PM".

```
Ubuntu-24.04 x + hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ sleep 60 &
[1] 1426
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ jobs
[1]+  Running                  sleep 60 &
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ fg
sleep 60
^Z
[1]+  Stopped                  sleep 60
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$ bg
[1]+  sleep 60 &
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask/docs$
```

## Part 6: C Programs on Processes

### Program 1 – Exec with top

The screenshot shows the VS Code interface with the terminal tab active. The terminal window displays the output of the `top` command on an Ubuntu 24.04 system. The output shows various processes running, including system daemons like node, systemd, and cron, along with user programs like program1.c. The terminal window also shows the user's command history at the bottom.

```
Tasks: 48 total, 1 running, 47 sleeping, 0 stopped, 0 zombie
MiB Mem : 7690.2 total, 6604.1 free, 954.5 used, 289.7 buff/cache
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used. 6735.7 avail Mem

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
1618 hfsata+ 20 0 32.6g 305772 64000 S 3.7 3.9 0:17.75 node
1459 hfsata+ 20 0 11.3g 122860 52480 S 0.7 1.6 0:04.49 node
1598 hfsata+ 20 0 1022032 62856 42752 S 0.7 0.8 0:01.16 node
2515 hfsata+ 20 0 1141076 71396 47488 S 0.7 0.9 0:01.38 node
1589 hfsata+ 20 0 1022760 63116 42496 S 0.3 0.8 0:00.49 node
1597 root 20 0 3088 1164 1024 S 0.3 0.0 0:00.30 Relay(1598)
1 root 20 0 21664 12376 9176 S 0.0 0.2 0:01.96 systemd
2 root 20 0 3072 1536 1536 S 0.0 0.0 0:00.02 init-systemd(Up)
7 root 20 0 3112 2044 1920 S 0.0 0.0 0:00.10 init
52 root 19 -1 66744 18772 18004 S 0.0 0.2 0:00.71 systemd-journal
98 root 20 0 25148 6272 4992 S 0.0 0.1 0:00.65 systemd-udevd
114 systemd+ 20 0 21456 12544 10368 S 0.0 0.2 0:00.25 systemd-resolve
121 systemd+ 20 0 91024 7552 6784 S 0.0 0.1 0:00.23 systemd-timesync
178 root 20 0 4236 2688 2432 S 0.0 0.0 0:00.01 cron
171 message+ 20 0 9632 4736 4352 S 0.0 0.1 0:00.22 dbus-daemon
184 root 20 0 17968 8448 7552 S 0.0 0.1 0:00.13 systemd-logind
186 root 20 0 1755840 12672 10368 S 0.0 0.2 0:00.21 wsl-pro-service
200 root 20 0 3160 2048 1920 S 0.0 0.0 0:00.01 agetty
206 syslog 20 0 222508 5504 4352 S 0.0 0.1 0:00.13 rsyslogd
210 root 20 0 3116 1920 1792 S 0.0 0.0 0:00.00 agetty
217 root 20 0 197812 22144 13184 S 0.0 0.3 0:00.14 unattended-upgr
318 root 20 0 6660 4488 3840 S 0.0 0.1 0:00.00 login
362 hfsata+ 20 0 20308 11264 9216 S 0.0 0.1 0:00.09 systemd
364 hfsata+ 20 0 21152 3516 1792 S 0.0 0.0 0:00.00 (sd-pam)
388 hfsata+ 20 0 6072 4992 3456 S 0.0 0.1 0:00.01 bash
1146 polkitd 20 0 388164 7808 7804 S 0.0 0.1 0:00.09 polkitd
Child process terminated.
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$
```

The screenshot shows the VS Code interface with the terminal tab active. The terminal window displays the output of the command `ps -ef | grep top`. It shows four entries from the user `hafsatayyab`, each corresponding to a running instance of the `top` command. The terminal window also shows the user's command history at the bottom.

```
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ ps -ef | grep top
hfsata+ 2791 2790 0 20:27 pts/6 00:00:00 top
hfsata+ 3878 3438 0 20:29 pts/7 00:00:00 grep --color=auto top
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ kill 2791
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ ps -ef | grep top
hfsata+ 3982 3438 0 20:29 pts/7 00:00:00 grep --color=auto top
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$
```

## Program 2 – Incomplete Program

The screenshot shows a Microsoft Visual Studio Code (VS Code) interface running in a WSL Ubuntu 24.04 terminal window. The code editor displays a file named `program2.c` with the following content:

```
4
5     int main() {
6         pid_t pid = fork();
7
8         if (pid < 0) {
9             perror("fork failed");
10            return 1;
11        }
12
13        if (pid == 0) {
14            execvp("date", "date", NULL);
15            perror("execvp failed");
16        } else {
17            wait(NULL);
18            printf("Child finished\n");
19        }
20
21    return 0;
22}
```

The terminal below shows the execution of the program:

```
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ gcc program2.c -o program2
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$ ./program2
Thu Nov 27 20:32:04 PKT 2025
Child finished
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3-Hometask$
```

The status bar at the bottom indicates the file is 57% complete.