



National Textile University

Department of Computer Science

Subject:

Operating System

Submitted To:

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3

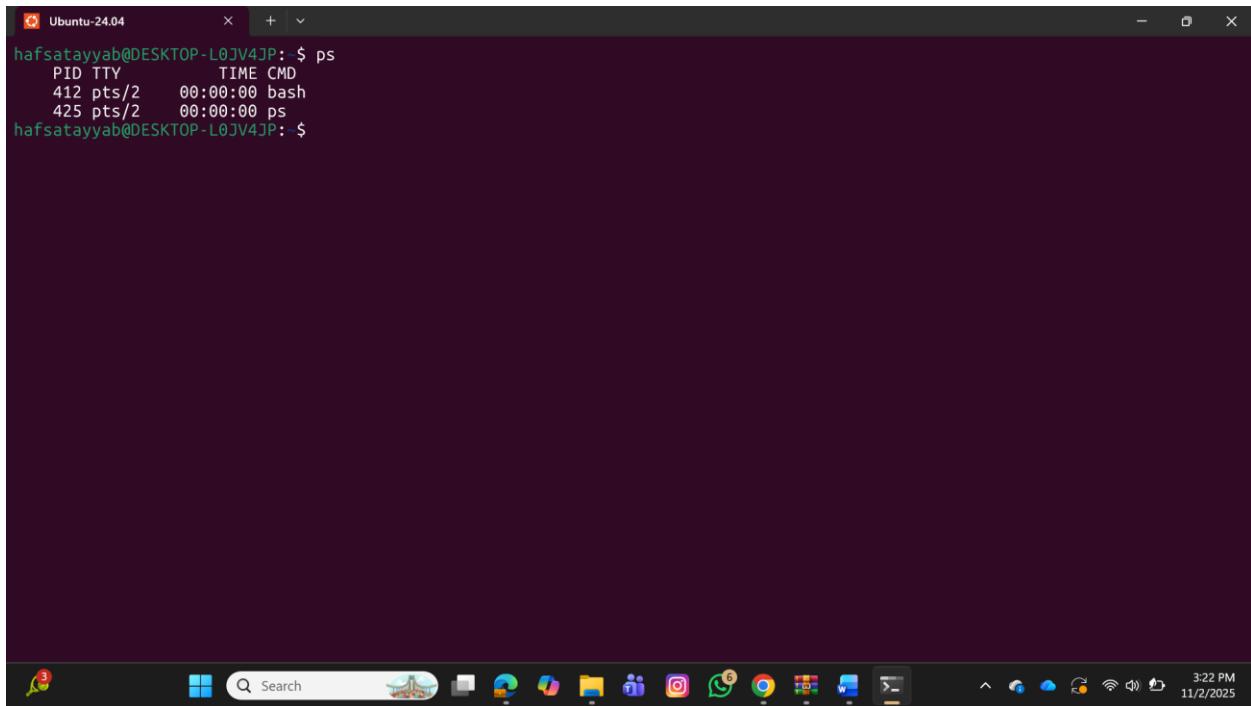
Semester:

5th

2. Linux Process Commands

2.1 Viewing Processes

ps → Process Status



A screenshot of a terminal window titled "Ubuntu-24.04". The window contains the following text:

```
hafsatayyab@DESKTOP-L0JV4JP: $ ps
 PID TTY      TIME CMD
 412 pts/2    00:00:00 bash
 425 pts/2    00:00:00 ps
hafsatayyab@DESKTOP-L0JV4JP: $
```

The terminal is running on a Windows desktop environment, as evidenced by the taskbar at the bottom which includes icons for File Explorer, Edge, and various other Windows applications.

ps -ef → Full list of all processes

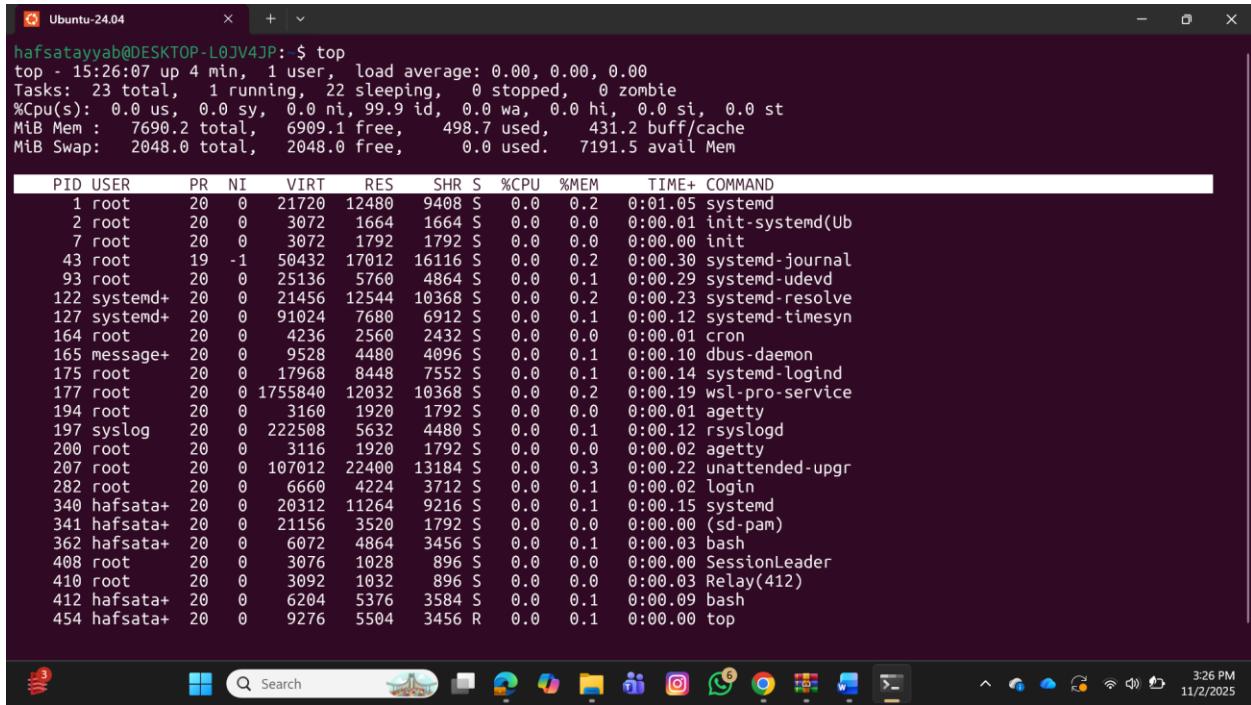
```
Ubuntu-24.04 x + 
hafsatayyab@DESKTOP-L0JV4JP: $ ps -ef
UID      PID  PPID  C STIME TTY          TIME CMD
root      1      0  0 15:21 ?        00:00:01 /sbin/init
root      2      1  0 15:21 ?        00:00:00 /init
root      7      2  0 15:21 ?        00:00:00 plan9 --control-socket 7 --log-level 4 --server-fd 8 --pipe-fd 10 --log-
root     43      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-journald
root     93      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-udevd
systemd+ 122      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-resolved
systemd+ 127      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-timesyncd
root    164      1  0 15:21 ?        00:00:00 /usr/sbin/cron -f -P
message+ 165      1  0 15:21 ?        00:00:00 @dbus-daemon --system --address=systemd: --nofork --nopidfile --systemd-
root    175      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-logind
root    177      1  0 15:21 ?        00:00:00 /usr/libexec/wsl-pro-service -vv
root    194      1  0 15:21 hvc0     00:00:00 /sbin/agetty -o -p -- \u --noclear --keep-baud - 115200,38400,9600 vt220
syslog   197      1  0 15:21 ?        00:00:00 /usr/sbin/rsyslogd -n -iNONE
root    200      1  0 15:21 tty1     00:00:00 /sbin/agetty -o -p -- \u --noclear - linux
root    207      1  0 15:21 ?        00:00:00 /usr/bin/python3 /usr/share/unattended-upgrades/unattended-upgrade-shutd
root    282      2  0 15:21 pts/1     00:00:00 /bin/login -f
hfsata+ 340      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd --user
hfsata+ 341      340  0 15:21 ?        00:00:00 (sd-pam)
hfsata+ 362      282  0 15:21 pts/1     00:00:00 -bash
root    408      2  0 15:22 ?        00:00:00 /init
root    410      408  0 15:22 ?        00:00:00 /init
hfsata+ 412      410  0 15:22 pts/2     00:00:00 -bash
hfsata+ 440      412  0 15:23 pts/2     00:00:00 ps -ef
hafsatayyab@DESKTOP-L0JV4JP: $
```

ps | grep bash This finds all processes related to the bash shell

```
Ubuntu-24.04 x + 
hafsatayyab@DESKTOP-L0JV4JP: $ ps -ef
UID      PID  PPID  C STIME TTY          TIME CMD
root      1      0  0 15:21 ?        00:00:01 /sbin/init
root      2      1  0 15:21 ?        00:00:00 /init
root      7      2  0 15:21 ?        00:00:00 plan9 --control-socket 7 --log-level 4 --server-fd 8 --pipe-fd 10 --log-
root     43      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-journald
root     93      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-udevd
systemd+ 122      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-resolved
systemd+ 127      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-timesyncd
root    164      1  0 15:21 ?        00:00:00 /usr/sbin/cron -f -P
message+ 165      1  0 15:21 ?        00:00:00 @dbus-daemon --system --address=systemd: --nofork --nopidfile --systemd-
root    175      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd-logind
root    177      1  0 15:21 ?        00:00:00 /usr/libexec/wsl-pro-service -vv
root    194      1  0 15:21 hvc0     00:00:00 /sbin/agetty -o -p -- \u --noclear --keep-baud - 115200,38400,9600 vt220
syslog   197      1  0 15:21 ?        00:00:00 /usr/sbin/rsyslogd -n -iNONE
root    200      1  0 15:21 tty1     00:00:00 /sbin/agetty -o -p -- \u --noclear - linux
root    207      1  0 15:21 ?        00:00:00 /usr/bin/python3 /usr/share/unattended-upgrades/unattended-upgrade-shutd
root    282      2  0 15:21 pts/1     00:00:00 /bin/login -f
hfsata+ 340      1  0 15:21 ?        00:00:00 /usr/lib/systemd/systemd --user
hfsata+ 341      340  0 15:21 ?        00:00:00 (sd-pam)
hfsata+ 362      282  0 15:21 pts/1     00:00:00 -bash
root    408      2  0 15:22 ?        00:00:00 /init
root    410      408  0 15:22 ?        00:00:00 /init
hfsata+ 412      410  0 15:22 pts/2     00:00:00 -bash
hfsata+ 440      412  0 15:23 pts/2     00:00:00 ps -ef
hafsatayyab@DESKTOP-L0JV4JP: $ ps -ef |grep bash
hfsata+ 362      282  0 15:21 pts/1     00:00:00 -bash
hfsata+ 412      410  0 15:22 pts/2     00:00:00 -bash
hfsata+ 446      412  0 15:24 pts/2     00:00:00 grep --color=auto bash
hafsatayyab@DESKTOP-L0JV4JP: $
```

2.2 Monitoring Processes Interactively

top → Dynamic process viewer



Ubuntu-24.04 × + | v

hafsatayab@DESKTOP-L0JV4JP: \$ top

top - 15:26:07 up 4 min, 1 user, load average: 0.00, 0.00, 0.00

Tasks: 23 total, 1 running, 22 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, 6909.1 free, 498.7 used, 431.2 buff/cache

MiB Swap: 2048.0 total, 2048.0 free, 0.0 used. 7191.5 avail Mem

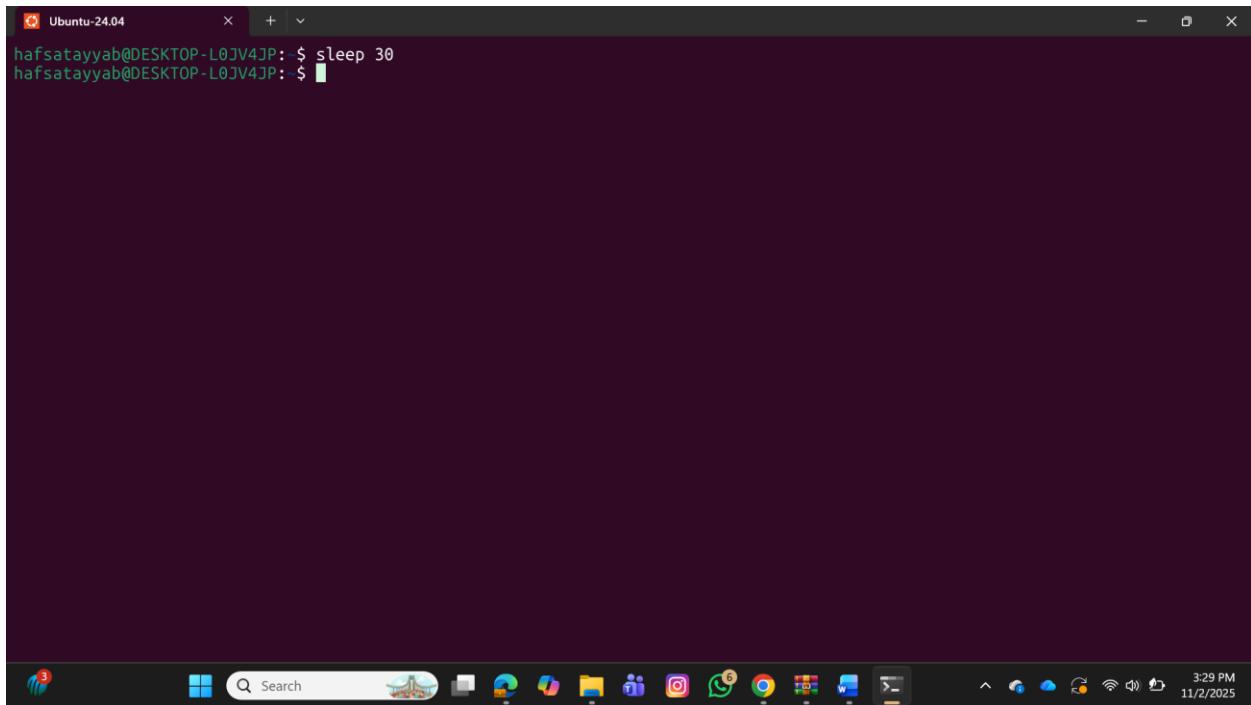
| PID | USER | PR | NI | VIRT | RES | SHR | S | %CPU | %MEM | TIME+ | COMMAND |
|-----|------------|----|----|---------|-------|-------|---|------|------|---------|------------------|
| 1 | root | 20 | 0 | 21720 | 12480 | 9408 | S | 0.0 | 0.2 | 0:01.05 | systemd |
| 2 | root | 20 | 0 | 3072 | 1664 | 1664 | S | 0.0 | 0.0 | 0:00.01 | init-systemd(Ub) |
| 7 | root | 20 | 0 | 3072 | 1792 | 1792 | S | 0.0 | 0.0 | 0:00.00 | init |
| 43 | root | 19 | -1 | 50432 | 17012 | 16116 | S | 0.0 | 0.2 | 0:00.30 | systemd-journal |
| 93 | root | 20 | 0 | 25136 | 5760 | 4864 | S | 0.0 | 0.1 | 0:00.29 | systemd-udevd |
| 122 | systemd+ | 20 | 0 | 21456 | 12544 | 10368 | S | 0.0 | 0.2 | 0:00.23 | systemd-resolve |
| 127 | systemd+ | 20 | 0 | 91024 | 7680 | 6912 | S | 0.0 | 0.1 | 0:00.12 | systemd-timesyn |
| 164 | root | 20 | 0 | 4236 | 2560 | 2432 | S | 0.0 | 0.0 | 0:00.01 | cron |
| 165 | message+ | 20 | 0 | 9528 | 4480 | 4096 | S | 0.0 | 0.1 | 0:00.10 | dbus-daemon |
| 175 | root | 20 | 0 | 17968 | 8448 | 7552 | S | 0.0 | 0.1 | 0:00.14 | systemd-logind |
| 177 | root | 20 | 0 | 1755840 | 12032 | 10368 | S | 0.0 | 0.2 | 0:00.19 | wsl-pro-service |
| 194 | root | 20 | 0 | 3160 | 1920 | 1792 | S | 0.0 | 0.0 | 0:00.01 | agetty |
| 197 | syslog | 20 | 0 | 222508 | 5632 | 4480 | S | 0.0 | 0.1 | 0:00.12 | rsyslogd |
| 200 | root | 20 | 0 | 3116 | 1920 | 1792 | S | 0.0 | 0.0 | 0:00.02 | agetty |
| 207 | root | 20 | 0 | 107012 | 22400 | 13184 | S | 0.0 | 0.3 | 0:00.22 | unattended-upgr |
| 282 | root | 20 | 0 | 6660 | 4224 | 3712 | S | 0.0 | 0.1 | 0:00.02 | login |
| 340 | hafsatayab | 20 | 0 | 20312 | 11264 | 9216 | S | 0.0 | 0.1 | 0:00.15 | systemd |
| 341 | hafsatayab | 20 | 0 | 21156 | 3520 | 1792 | S | 0.0 | 0.0 | 0:00.00 | (sd-pam) |
| 362 | hafsatayab | 20 | 0 | 6072 | 4864 | 3456 | S | 0.0 | 0.1 | 0:00.03 | bash |
| 408 | root | 20 | 0 | 3076 | 1028 | 896 | S | 0.0 | 0.0 | 0:00.00 | SessionLeader |
| 410 | root | 20 | 0 | 3092 | 1032 | 896 | S | 0.0 | 0.0 | 0:00.03 | Relay(412) |
| 412 | hafsatayab | 20 | 0 | 6204 | 5376 | 3584 | S | 0.0 | 0.1 | 0:00.09 | bash |
| 454 | hafsatayab | 20 | 0 | 9276 | 5504 | 3456 | R | 0.0 | 0.1 | 0:00.00 | top |

3 5 Search 11/2/2025 3:26 PM

2.3 Foreground and Background Jobs

Foreground: A process that takes control of the terminal until it finishes.

`sleep 30`

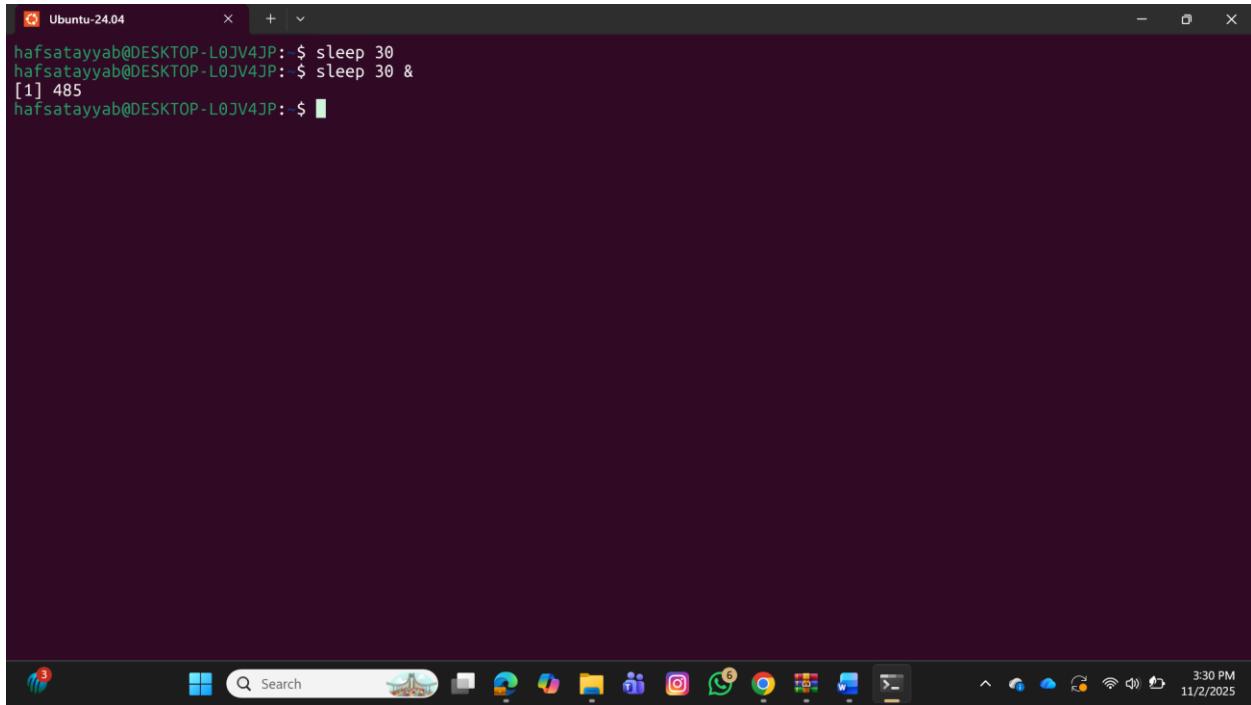


A screenshot of a terminal window titled "Ubuntu-24.04". The window contains the command `sleep 30` and its output. The terminal is dark-themed. Below the terminal is a Windows taskbar with various icons and a system tray showing the date and time (3:29 PM, 11/2/2025).

```
Ubuntu-24.04
hfsatayyab@DESKTOP-L0JV4JP: $ sleep 30
hfsatayyab@DESKTOP-L0JV4JP: $ █
```

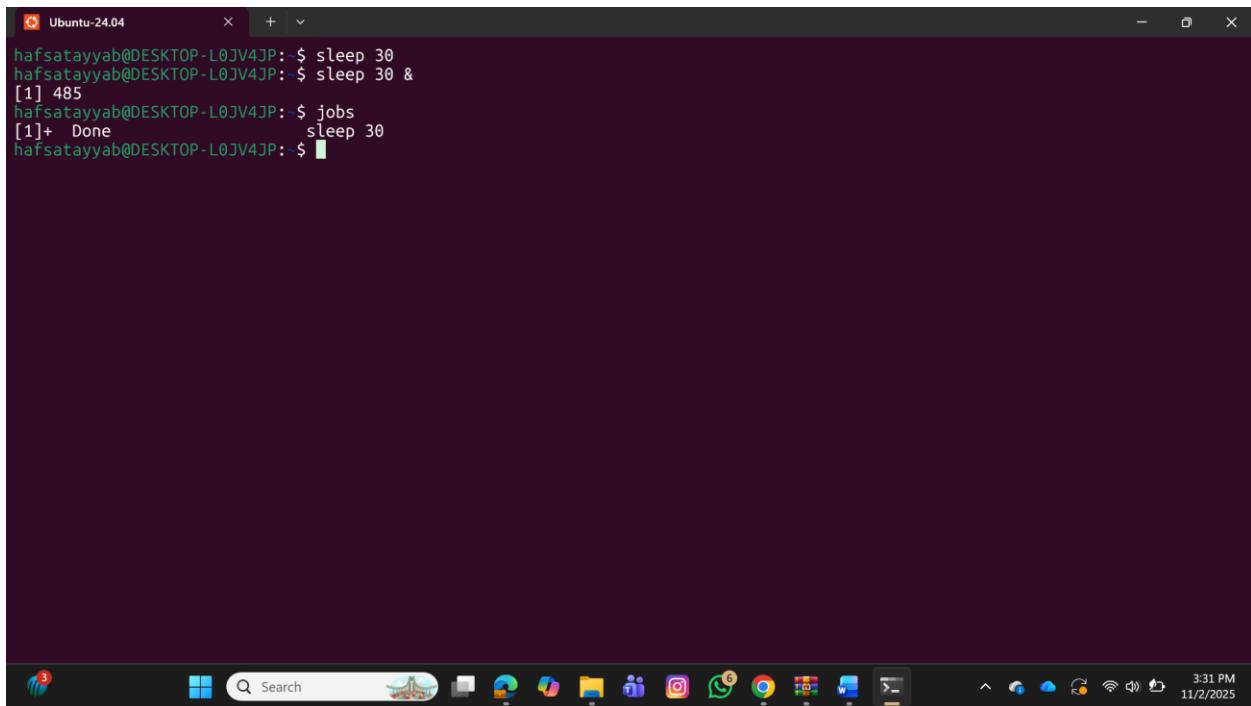
Background: Add & to run without blocking.

sleep 30 &



```
Ubuntu-24.04      + | v
hafsatayyab@DESKTOP-L0JV4JP: $ sleep 30
hafsatayyab@DESKTOP-L0JV4JP: $ sleep 30 &
[1] 485
hafsatayyab@DESKTOP-L0JV4JP: $
```

Check background jobs: jobs



```
Ubuntu-24.04      + | v
hafsatayyab@DESKTOP-L0JV4JP: $ sleep 30
hafsatayyab@DESKTOP-L0JV4JP: $ sleep 30 &
[1] 485
hafsatayyab@DESKTOP-L0JV4JP: $ jobs
[1]+  Done                  sleep 30
hafsatayyab@DESKTOP-L0JV4JP: $
```

Bring a job to foreground: fg %1

A screenshot of a Linux terminal window titled "Ubuntu-24.04". The terminal shows the following session:

```
hafsatayyab@DESKTOP-L0JV4JP: $ sleep 30 &
[1] 514
hafsatayyab@DESKTOP-L0JV4JP: $ fg %1
sleep 30
```

The terminal is running on a desktop environment with a dark theme. The taskbar at the bottom shows various application icons, and the system tray indicates the date and time as 11/2/2025 at 3:33 PM.

Suspend a job: Press Ctrl + Z while it runs.

A screenshot of a Linux terminal window titled "Ubuntu-24.04". The terminal shows the following session:

```
hafsatayyab@DESKTOP-L0JV4JP: $ sleep 30 &
[1] 514
hafsatayyab@DESKTOP-L0JV4JP: $ fg %1
sleep 30
^Z
[1]+  Stopped                  sleep 30
hafsatayyab@DESKTOP-L0JV4JP: $
```

The terminal is running on a desktop environment with a dark theme. The taskbar at the bottom shows various application icons, and the system tray indicates the date and time as 11/2/2025 at 3:34 PM.

Resume suspended job in background: bg %1

```
Ubuntu-24.04 x + v

hafsatayyab@DESKTOP-L0JV4JP: $ sleep 30 &
[1] 514
hafsatayyab@DESKTOP-L0JV4JP: $ fg %1
sleep 30
^Z
[1]+  Stopped                  sleep 30
hafsatayyab@DESKTOP-L0JV4JP: $ bg %1
[1]+ sleep 30 &
hafsatayyab@DESKTOP-L0JV4JP: $
```

2.4 Process Identification

Get PID of a process by name: pidof sleep

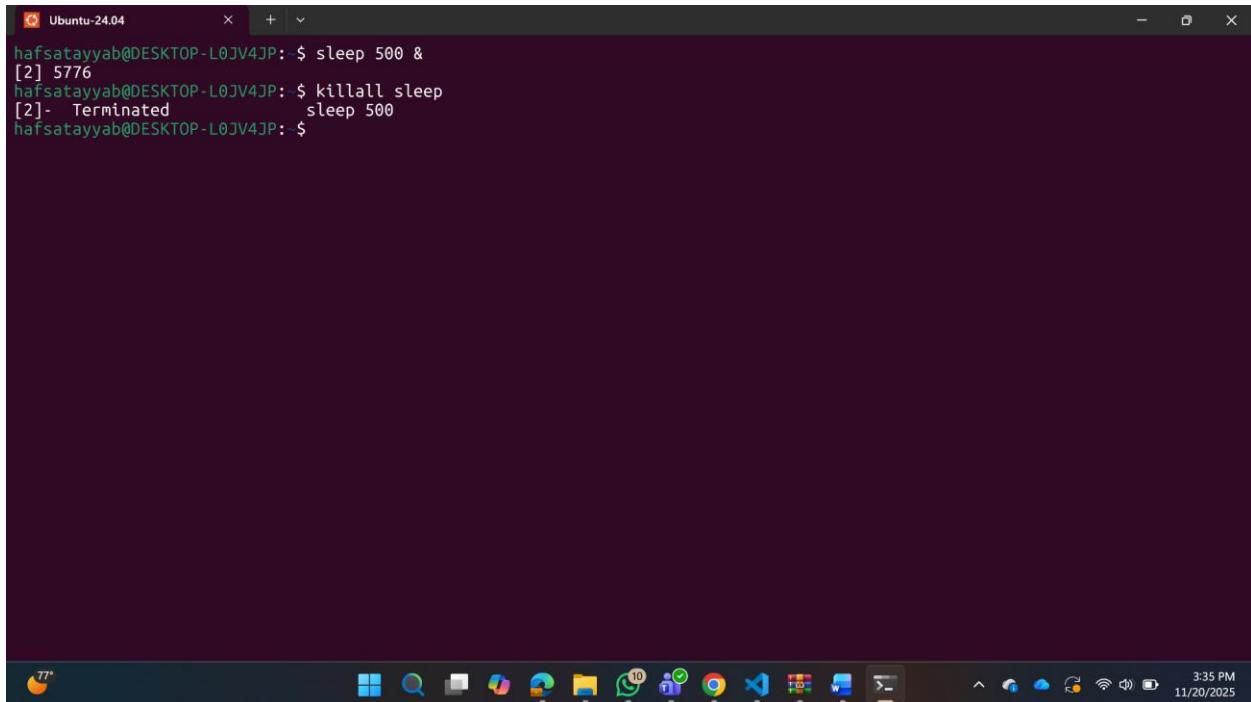
Search using ps and grep : ps-ef | grep firefox

```
Ubuntu-24.04 x + v
hafsatayyab@DESKTOP-L0JV4JP: $ sleep 30 &
[1] 2309
hafsatayyab@DESKTOP-L0JV4JP: $ pidof sleep
2309
hafsatayyab@DESKTOP-L0JV4JP: $ ps -ef | grep firefox
ps -ef: command not found
hafsatayyab@DESKTOP-L0JV4JP: $ ps -ef | grep firefox
hafsatayyab@DESKTOP-L0JV4JP: $ ps -ef | grep --color=auto firefox
[1]+ Done sleep 30
hafsatayyab@DESKTOP-L0JV4JP: $ █
```

2.5 Killing Processes

Kill by PID: kill-9 3421-9 → force kill (SIGKILL).

Kill all processes by name: killall sleep



```
Ubuntu-24.04      + | v
hafsatayyab@DESKTOP-L0JV4JP: $ sleep 500 &
[2] 5776
hafsatayyab@DESKTOP-L0JV4JP: $ killall sleep
[2]- Terminated          sleep 500
hafsatayyab@DESKTOP-L0JV4JP: $
```

Practice Task:

Run an infinite process: yes > /dev/null & (yes prints “y” forever; redirected to /dev/null to hide output).

2. Find it with: ps -ef | grep yes

3. Kill it with: kill-9

3. C Programs on Processes

Program 1: Print PID and PPID

The screenshot shows a Windows desktop environment with the Visual Studio Code (VS Code) application open. The title bar indicates the workspace is "LAB3 [WSL: UBUNTU-24.04]" and the file "task1.c" is currently selected.

The code editor displays the following C code:

```
#include <stdio.h>
#include <unistd.h>
int main() {
    printf("My PID: %d\n", getpid());
    printf("My Parent PID: %d\n", getppid());
    return 0;
}
```

The terminal tab at the bottom shows the command being run and its output:

```
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$ task1.c gcc -o task1
task1.c: command not found
hafsatayyab@ESKTOP-L0JV4JP:~/OS-Labs/Lab3$ gcc task1.c -o task1
hafsatayyab@ESKTOP-L0JV4JP:~/OS-Labs/Lab3$ ./task1
My PID: 29881
My Parent PID: 29587
hafsatayyab@ESKTOP-L0JV4JP:~/OS-Labs/Lab3$
```

The status bar at the bottom shows the system is running on WSL: Ubuntu-24.04, and the date and time are 11/21/2025, 12:38 PM.

Program 2: Fork – Creating Child Process

The screenshot shows the Visual Studio Code interface running in WSL (Ubuntu 24.04). The Explorer sidebar shows files task1, task1.c, task2, task2.c, and task3, with task2.c selected. The main editor pane displays the following C code:

```
1 #include <stdio.h>
2 #include <unistd.h>
3 #include <sys/types.h>
4 int main() {
5     pid_t pid = fork();
6     if (pid == 0) {
7         // This block runs in the child process
8         printf("Child: PID=%d, Parent=%d\n", getpid(), getppid());
9     } else {
10        // This block runs in the parent process
11        printf("Parent: PID=%d, Child=%d\n", getpid(), pid);
12    }
13    return 0;
14 }
```

The terminal below shows the output of running the program:

```
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$ gcc task2.c -o task2
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$ ./task2
Parent: PID=32094, Child=32095
Child: PID=32095, Parent=32094
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$
```

Program 3: Exec – Replacing a Process

The screenshot shows the Visual Studio Code interface running in WSL (Ubuntu 24.04). The Explorer sidebar shows files task1, task1.c, task2, task2.c, and task3, with task3.c selected. The main editor pane displays the following C code:

```
1 #include <stdio.h>
2 #include <unistd.h>
3 #include <sys/types.h>
4 int main() {
5     pid_t pid = fork();
6     if (pid == 0) {
7         execvp("ls", "ls", "-l");
8         printf("This will not print if exec succeeds.\n");
9     } else {
10        printf("Parent still running...\n");
11    }
12    return 0;
13 }
```

The terminal below shows the output of running the program:

```
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$ gcc task3.c -o task3
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$ ./task3
Parent still running...
total 60
-rwxr-xr-x 1 hafsatayyab hafsatayyab 16048 Nov 21 12:48 task1
-rw-r--r-- 1 hafsatayyab hafsatayyab 151 Nov 21 12:34 task1.c
-rwxr-xr-x 1 hafsatayyab hafsatayyab 16088 Nov 21 12:48 task2
-rw-r--r-- 1 hafsatayyab hafsatayyab 370 Nov 21 12:47 task2.c
-rwxr-xr-x 1 hafsatayyab hafsatayyab 16048 Nov 21 12:49 task3
-rw-r--r-- 1 hafsatayyab hafsatayyab 285 Nov 21 12:47 task3.c
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$
```

Program 4: Wait – Synchronization

The screenshot shows a Windows desktop environment with a Visual Studio Code (VS Code) window open. The title bar of the window reads "Lab3 [WSL: Ubuntu-24.04]". The code editor displays a file named "task4.c" with the following content:

```
1 #include <stdio.h>
2 #include <unistd.h>
3 #include <sys/wait.h>
4 int main() {
5     pid_t pid = fork();
6     if (pid == 0) {
7         execvp("ls", {"ls", "-l", NULL});
8         printf("This will not print if exec succeeds.\n");
9     } else {
10        waitpid(pid, NULL, 0); // Wait for the child process to finish
11        printf("Parent still running...\n");
12    }
13    return 0;
14 }
```

The terminal tab at the bottom of the VS Code interface shows the following command-line session:

```
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$ gcc task4.c -o task4
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$ ./task4
total 80
-rwxr-xr-x 1 hafsatayyab hafsatayyab 16048 Nov 21 12:48 task1
-rw-r--r-- 1 hafsatayyab hafsatayyab 151 Nov 21 12:34 task1.c
-rwxr-xr-x 1 hafsatayyab hafsatayyab 16088 Nov 21 12:48 task2
-rw-r--r-- 1 hafsatayyab hafsatayyab 370 Nov 21 12:47 task2.c
-rwxr-xr-x 1 hafsatayyab hafsatayyab 16048 Nov 21 12:49 task3
-rw-r--r-- 1 hafsatayyab hafsatayyab 285 Nov 21 12:47 task3.c
-rwxr-xr-x 1 hafsatayyab hafsatayyab 16088 Nov 21 12:51 task4
-rw-r--r-- 1 hafsatayyab hafsatayyab 351 Nov 21 12:50 task4.c
Parent still running...
hafsatayyab@DESKTOP-L0JV4JP:~/OS-Labs/Lab3$
```

The status bar at the bottom of the screen indicates the current time as "12:51 PM" and the date as "11/21/2025".