



National Textile University

Department of Computer Science

Subject: Operating System

Submitted to: Sir Nasir Mahmood

Submitted by: Maha

Reg. number: 23-NTU-CS-1170

Lab no.: lab3 (class task)

Semester: 5th

Class TASK

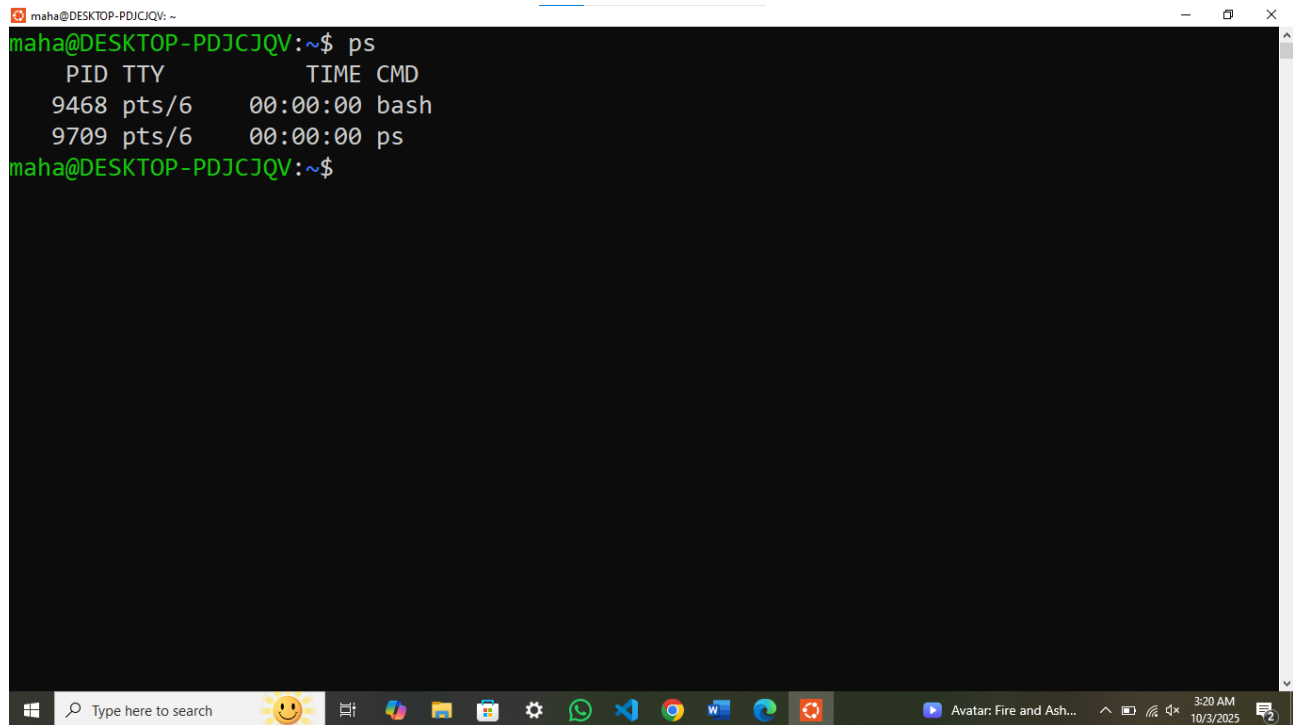
2. Linux Process Commands

2.1 Viewing Processes

`ps` → **Process Status**

- Shows processes in the current terminal session.

`ps`



A terminal window titled 'maha@DESKTOP-PDJCJQV: ~' showing the output of the 'ps' command. The output is as follows:

```
maha@DESKTOP-PDJCJQV:~$ ps
  PID TTY          TIME CMD
  9468 pts/6        00:00:00 bash
  9709 pts/6        00:00:00 ps
maha@DESKTOP-PDJCJQV:~$
```

The terminal window has a Windows taskbar at the bottom with various icons and a system tray showing the time as 3:20 AM on 10/3/2025.

`ps -ef` → **Full list of all processes**

`ps -ef`

- `-e` → show all processes (not just yours).
- `-f` → full format with UID, PPID, etc.

```
maha@DESKTOP-PD1CJQV: ~$ ps -ef
UID          PID     PPID  C  TIME TTY          TIME CMD
root         1       0  0  0:20 ?        00:00:01 sbin/init
root         2       1  0  0:20 ?        00:00:00 /init
root         7       1  0  0:20 ?        00:00:01 plan9 --control-socket 7 --log-level 4 --server-fd 8 --pipe-fd 10 --log-truncate
root        49       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd-journald
root       104       1  0  0:20 ?        00:00:01 /usr/lib/systemd/systemd-udev
systemd+   130       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd-resolved
systemd+   140       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd-timesyncd
root       165       1  0  0:20 ?        00:00:00 /usr/sbin/cron -f -P
message+   166       1  0  0:20 ?        00:00:00 @dbus-daemon --system --address=systemd: --nofork --nopidfile --systemd-activation
root       181       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd-logind
root       187       1  0  0:20 ?        00:00:00 /usr/libexec/WSL-pro-service -vv
root       191       1  0  0:20 hvc0      00:00:00 /sbin/agetty -o -p -- \u --noclear - keep-baud - 115200,38400,9600 vt220
syslog     195       1  0  0:20 ?        00:00:00 /usr/sbin/rsyslogd -n -iNONE
root       209       1  0  0:20 tty1      00:00:00 /sbin/agetty -o -p -- \u --noclear - linux
root       251       1  0  0:20 ?        00:00:00 /usr/bin/python3 /usr/share/unattended-upgrades/unattended-upgrade-shutdown --wait
root       364       2  0  0:20 pts/1    00:00:00 /bin/login -f
maha      412       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd --user
maha      413     412  0  0:20 ?        00:00:00 (sd-pam)
maha      432     364  0  0:20 pts/1    00:00:00 -bash
root     1911       1  0  0:28 ?        00:00:00 /init
root     2976       2  0  0:34 ?        00:00:00 /init
root     2977     2976  0  0:34 ?        00:00:00 /init
maha     2978       2  0  0:34 pts/0     00:00:00 sh -c "$VSCODE_WSL_EXT_LOCATION/scripts/wslServer.sh" e3a5acfb517a443235981655413d566533107e92/node
maha     2979       2  0  0:34 pts/0     00:00:00 sh /mnt/c/Users/hp/.vscode/extensions/ms-vscode-remote.remote-wsl-0.104.3/scripts/
maha     2985       2  0  0:34 pts/0     00:00:00 sh /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/bin/code
maha     2989       2  0  0:34 pts/0     00:00:18 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home/
root     3000       2  0  0:34 ?        00:00:00 /init
root     3001     3000  0  0:34 ?        00:00:01 /init
maha     3002     3001  0  0:34 pts/2     00:00:04 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node -e con
root     3009       2  0  0:34 ?        00:00:00 /init
root     3010     3009  0  0:34 ?        00:00:02 /init
maha     3012     3010  0  0:34 pts/3     00:00:06 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node -e con
maha     3031     2989  0  0:34 pts/0     00:00:01 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home/
maha     3049     2989  6  0:34 pts/0     00:03:12 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node --dns-
root     3113       2  0  0:34 ?        00:00:00 /init
root     3114     3113  0  0:34 ?        00:00:00 /init
root     3110     3114  0  0:34 pts/7     00:00:00 /bin/sh -c cd '/home/maha/1170-OS_LAB-' && /bin/sh
maha     3121     3110  0  0:34 pts/7     00:00:00 /bin/sh
maha     3137     3121  0  0:34 pts/7     00:00:00 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home/
```

ps -ef | grep bash

```
maha@DESKTOP-PD1CJQV: ~$ ps -ef
UID          PID     PPID  C  TIME TTY          TIME CMD
root         1       0  0  0:20 ?        00:00:01 sbin/init
root         2       1  0  0:20 ?        00:00:00 /init
root         7       1  0  0:20 ?        00:00:01 plan9 --control-socket 7 --log-level 4 --server-fd 8 --pipe-fd 10 --log-truncate
root        49       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd-journald
root       104       1  0  0:20 ?        00:00:01 /usr/lib/systemd/systemd-udev
systemd+   130       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd-resolved
systemd+   140       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd-timesyncd
root       165       1  0  0:20 ?        00:00:00 /usr/sbin/cron -f -P
message+   166       1  0  0:20 ?        00:00:00 @dbus-daemon --system --address=systemd: --nofork --nopidfile --systemd-activation
root       181       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd-logind
root       187       1  0  0:20 ?        00:00:00 /usr/libexec/WSL-pro-service -vv
root       191       1  0  0:20 hvc0      00:00:00 /sbin/agetty -o -p -- \u --noclear - keep-baud - 115200,38400,9600 vt220
syslog     195       1  0  0:20 ?        00:00:00 /usr/sbin/rsyslogd -n -iNONE
root       209       1  0  0:20 tty1      00:00:00 /sbin/agetty -o -p -- \u --noclear - linux
root       251       1  0  0:20 ?        00:00:00 /usr/bin/python3 /usr/share/unattended-upgrades/unattended-upgrade-shutdown --wait
root       364       2  0  0:20 pts/1    00:00:00 /bin/login -f
maha      412       1  0  0:20 ?        00:00:00 /usr/lib/systemd/systemd --user
maha      413     412  0  0:20 ?        00:00:00 (sd-pam)
maha      432     364  0  0:20 pts/1    00:00:00 -bash
root     1911       1  0  0:28 ?        00:00:00 /init
root     2976       2  0  0:34 ?        00:00:00 /init
root     2977     2976  0  0:34 ?        00:00:00 /init
maha     2978       2  0  0:34 pts/0     00:00:00 sh -c "$VSCODE_WSL_EXT_LOCATION/scripts/wslServer.sh" e3a5acfb517a443235981655413d566533107e92/node
maha     2979       2  0  0:34 pts/0     00:00:00 sh /mnt/c/Users/hp/.vscode/extensions/ms-vscode-remote.remote-wsl-0.104.3/scripts/
maha     2985       2  0  0:34 pts/0     00:00:00 sh /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/bin/code
maha     2989       2  0  0:34 pts/0     00:00:18 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home/
root     3000       2  0  0:34 ?        00:00:00 /init
root     3001     3000  0  0:34 ?        00:00:01 /init
maha     3002     3001  0  0:34 pts/2     00:00:04 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node -e con
root     3009       2  0  0:34 ?        00:00:00 /init
root     3010     3009  0  0:34 ?        00:00:02 /init
maha     3012     3010  0  0:34 pts/3     00:00:06 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node -e con
maha     3031     2989  0  0:34 pts/0     00:00:01 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home/
maha     3049     2989  6  0:34 pts/0     00:03:12 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node --dns-
root     3113       2  0  0:34 ?        00:00:00 /init
root     3114     3113  0  0:34 ?        00:00:00 /init
root     3110     3114  0  0:34 pts/7     00:00:00 /bin/sh -c cd '/home/maha/1170-OS_LAB-' && /bin/sh
maha     3121     3110  0  0:34 pts/7     00:00:00 /bin/sh
maha     3137     3121  0  0:34 pts/7     00:00:00 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home/
maha     3160     3137  0  0:34 pts/7     00:00:00 /bin/sh
maha     3331     3049  0  0:35 pts/0     00:00:15 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptools
ols
maha     3834     2989  0  0:39 pts/0     00:00:14 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home/
maha     3852     3834  0  0:39 pts/4     00:00:00 /bin/bash --init-file /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/out/vs/workbench/contrib/terminal/common/shellIntegration-bash.sh
maha     3869     2977  0  0:39 pts/0     00:00:00 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptools
ols-srv 3331 {F9218344-7E27-41B8-9C7-6FB047A3E80E}
maha     6094     2977  0  0:55 pts/0     00:00:01 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptools
ols-srv 3331 {A60981E8-3A74-434F-A515-D4DC6A5B5410}
maha     7116     2977  0  0:01 pts/0     00:00:00 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptools
ols-srv 3331 {74D05DF6-3648-471C-B8AF-31A309F888FF}
maha     7768     2977  0  0:05 pts/0     00:00:00 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptools
ols-srv 3331 {B742F872-2E64-4EBF-AFB4-1413361B7249}
maha     9468     9466  0  0:18 pts/6     00:00:00 -bash
maha    10338     9468  99  0:25 pts/6     00:00:00 ps -ef
maha    10339     9468  0  0:25 pts/6     00:00:00 grep --color=auto maha
maha@DESKTOP-PD1CJQV: ~$
```

- `ps -ef | grep "maha"`

```
maha@DESKTOP-PDJCJQV: ~
.pipe(process.stdout); process.stdin.pipe(client); }); client.on('close', function (hadError) { console.error(hadError ? 'Remote close
with error' : 'Remote close'); process.exit(hadError ? 1 : 0); }); client.on('error', function (err) { process.stderr.write(err && (e
rr_stack || err.message) || String(err)); });
maha 3031 2989 0 02:34 pts/0 00:00:01 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home
maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/out/bootstrap-fork --type=fileWatcher
maha 3049 2989 6 02:34 pts/0 00:03:22 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node --dns-
result-order=ipv4first /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/out/bootstrap-fork --type=extensionHost
--transformURIs --useHostProxy=true
maha 3119 3114 0 02:34 pts/7 00:00:00 /bin/sh -c cd '/home/maha/1170-OS_LAB-' && /bin/sh
maha 3121 3119 0 02:34 pts/7 00:00:00 /bin/sh
maha 3137 3121 0 02:34 pts/7 00:00:00 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home
maha/.vscode-remote-containers/dist/vscode-remote-containers-server-0.427.0.js
maha 3160 3137 0 02:34 pts/7 00:00:00 /bin/sh
maha 3331 3049 0 02:35 pts/0 00:00:15 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptool
ols
maha 3834 2989 0 02:39 pts/0 00:00:14 /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/node /home
maha/.vscode-server/bin/e3a5acfb517a443235981655413d566533107e92/out/bootstrap-fork --type=ptyHost --logsPath /home/maha/.vscode-serve
r/data/logs/20251003T023444
maha 3852 3834 0 02:39 pts/4 00:00:00 /bin/bash --init-file /home/maha/.vscode-server/bin/e3a5acfb517a443235981655413d56
6533107e92/out/vs/workbench/contrib/terminal/common/scripts/shellIntegration-bash.sh
maha 3869 2977 0 02:39 pts/0 00:00:00 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptool
ols-srv 3331 {F9218344-7E27-41B8-9CC7-6FB047A3E80E}
maha 6094 2977 0 02:55 pts/0 00:00:01 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptool
ols-srv 3331 {A609B1E8-3A74-434F-A515-D4DC6A5B5410}
maha 7116 2977 0 03:01 pts/0 00:00:00 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptool
ols-srv 3331 {74D05DF6-3648-471C-B8AF-31A3D9F888FF}
maha 7768 2977 0 03:05 pts/0 00:00:00 /home/maha/.vscode-server/extensions/ms-vscode.cpptools-1.27.7-linux-x64/bin/cpptool
ols-srv 3331 {0742F872-2E64-4EBF-AFB4-141336187249}
maha 9468 9466 0 03:18 pts/6 00:00:00 -bash
maha 10496 9468 0 03:27 pts/6 00:00:00 ps -ef
maha 10497 9468 0 03:27 pts/6 00:00:00 grep --color=auto maha
maha@DESKTOP-PDJCJQV:~$
```

2.2 Monitoring Processes Interactively

`top` → Dynamic process viewer

`top`

```
maha@DESKTOP-PDJCJQV: ~  
top - 03:29:16 up 1:08, 1 user, load average: 0.05, 0.06, 0.07  
Tasks: 51 total, 1 running, 50 sleeping, 0 stopped, 0 zombie  
%Cpu(s): 1.0 us, 1.7 sy, 0.0 ni, 97.0 id, 0.0 wa, 0.0 hi, 0.3 si, 0.0 st  
MiB Mem : 3865.2 total, 1814.8 free, 1466.0 used, 724.6 buff/cache  
MiB Swap: 1024.0 total, 1024.0 free, 0.0 used, 2399.3 avail Mem  
  
  PID USER      PR  NI  VIRT  RES  SHR  S  %CPU  %MEM    TIME+  COMMAND  
 3049 maha      20   0   52.7g 853596 55680 S   5.0   21.6   3:26.85 node  
2989 maha      20   0   11.3g 106120 52096 S   0.3    2.7   0:19.02 node  
3002 maha      20   0 1019116 60552 43136 S   0.3    1.5   0:04.21 node  
3012 maha      20   0 1013104 55680 43136 S   0.3    1.4   0:06.50 node  
9466 root       20   0   3096   1032   896 S   0.3    0.0   0:00.24 Relay(9468)  
    1 root       20   0  21856  12228  9156 S   0.0    0.3   0:01.94 systemd  
    2 root       20   0   3072   1792  1792 S   0.0    0.0   0:00.10 init-systemd(Ub  
    7 root       20   0   3120   1900  1792 S   0.0    0.0   0:01.88 init  
   49 root      19  -1   66752  16964  16068 S   0.0    0.4   0:00.87 systemd-journal  
  104 root       20   0   25140   6016   4864 S   0.0    0.2   0:01.46 systemd-udev  
  130 systemd+   20   0   21456  12672  10496 S   0.0    0.3   0:00.23 systemd-resolve  
  140 systemd+   20   0   91024   7424   6656 S   0.0    0.2   0:00.27 systemd-timesyn  
  165 root       20   0   4236   2432   2304 S   0.0    0.1   0:00.07 cron  
  166 message+   20   0   9624   4864   4352 S   0.0    0.1   0:00.33 dbus-daemon  
  181 root       20   0   17964   8192   7296 S   0.0    0.2   0:00.32 systemd-logind  
  187 root       20   0 1755840 12928  10496 S   0.0    0.3   0:00.66 wsl-pro-service  
  191 root       20   0   3160   1920  1792 S   0.0    0.0   0:00.03agetty  
  195 syslog    20   0  222508  5376   4352 S   0.0    0.1   0:00.35 rsyslogd  
  209 root       20   0   3116   1792  1664 S   0.0    0.0   0:00.02agetty  
  251 root       20   0  107012  22144  13056 S   0.0    0.6   0:00.28 unattended-upgr  
  364 root       20   0   6820   3968   3456 S   0.0    0.1   0:00.02 login  
  412 maha      20   0   20308  11264   9216 S   0.0    0.3   0:00.23 systemd  
  413 maha      20   0   21144   3512   1792 S   0.0    0.1   0:00.00 (sd-pam)  
  432 maha      20   0   6072   4864   3328 S   0.0    0.1   0:00.05 bash  
 1911 root       20   0   3088   1164   1024 S   0.0    0.0   0:00.00 Relay(1913)
```

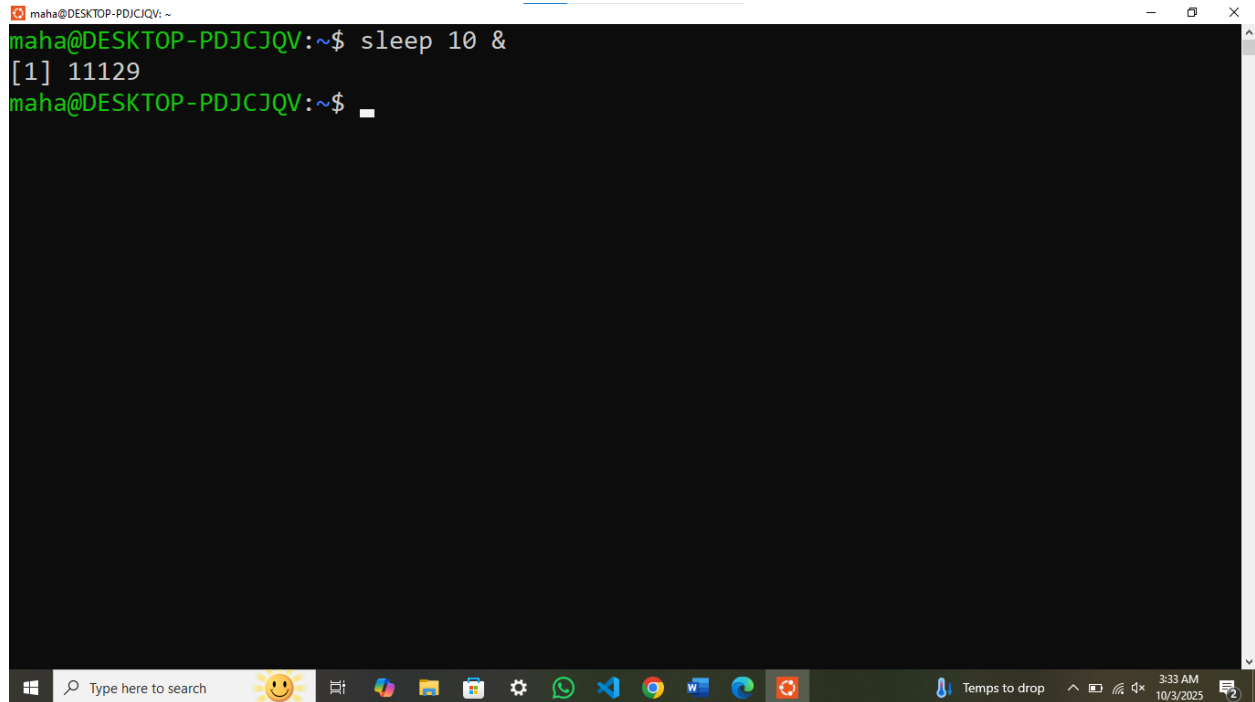
- **Foreground:** A process that takes control of the terminal until it finishes.

sleep 30

```
maha@DESKTOP-PDJCJQV: ~  
maha@DESKTOP-PDJCJQV:~$ sleep 30
```

- **Background:** Add `&` to run without blocking.

```
sleep 30 &
```

A screenshot of a Windows terminal window titled 'maha@DESKTOP-PDJCJQV: ~'. The terminal has a black background with green text. The user enters the command 'sleep 10 &'. The prompt changes to '[1] 11129', indicating the command has been executed in the background. The prompt then returns to 'maha@DESKTOP-PDJCJQV: ~\$'. The Windows taskbar is visible at the bottom, showing various application icons and the system clock at 3:33 AM on 10/3/2025.

```
maha@DESKTOP-PDJCJQV: ~$ sleep 10 &
[1] 11129
maha@DESKTOP-PDJCJQV: ~$
```

- **Check background jobs:**

```
jobs
```

```
maha@DESKTOP-PDJCJQV: ~  
maha@DESKTOP-PDJCJQV:~$ sleep 15 &  
[1] 11301  
maha@DESKTOP-PDJCJQV:~$ jobs  
[1]+  Running                  sleep 15 &  
maha@DESKTOP-PDJCJQV:~$
```

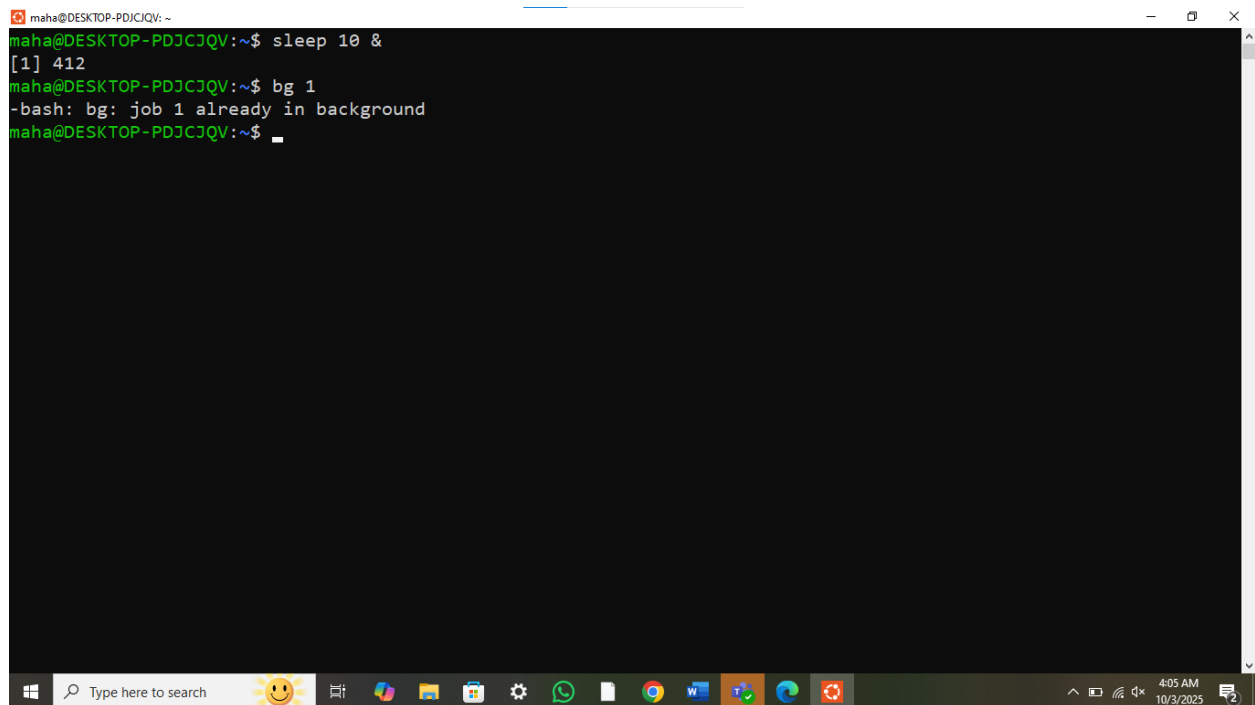
- **Bring a job to foreground:**

```
fg %1
```

```
maha@DESKTOP-PDJCJQV: ~  
maha@DESKTOP-PDJCJQV:~$ sleep 15 &  
[1] 11357  
maha@DESKTOP-PDJCJQV:~$ fg 1  
-bash: fg: job has terminated  
[1]+  Done                    sleep 15  
maha@DESKTOP-PDJCJQV:~$ sleep 15 &  
[1] 11430  
maha@DESKTOP-PDJCJQV:~$ fg 1  
sleep 15  
maha@DESKTOP-PDJCJQV:~$
```

- **Resume suspended job in background:**

```
bg %1
```



```
maha@DESKTOP-PDJCJQV: ~  
maha@DESKTOP-PDJCJQV:~$ sleep 10 &  
[1] 412  
maha@DESKTOP-PDJCJQV:~$ bg 1  
-bash: bg: job 1 already in background  
maha@DESKTOP-PDJCJQV:~$
```

- **Get PID of a process by name:**

```
pidof sleep
```



```
maha@DESKTOP-PDJCJQV: ~  
maha@DESKTOP-PDJCJQV:~$ sleep 20 &  
[1] 11505  
maha@DESKTOP-PDJCJQV:~$ pidof sleep  
11505  
maha@DESKTOP-PDJCJQV:~$
```

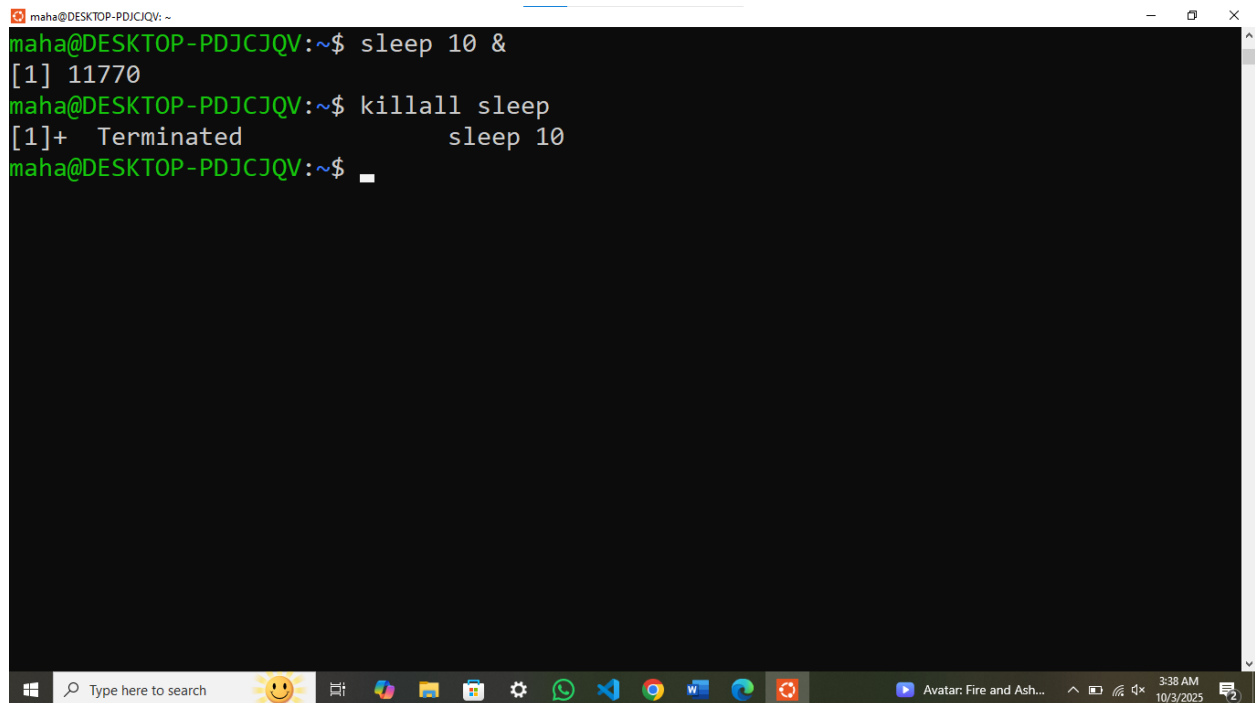
- **Kill by PID:**

```
kill -9 3421
```

```
maha@DESKTOP-PDJCJQV: ~  
maha@DESKTOP-PDJCJQV:~$ sleep 10 &  
[1] 12242  
maha@DESKTOP-PDJCJQV:~$ kill 12242  
maha@DESKTOP-PDJCJQV:~$
```

Kill all processes by name:

```
killall sleep
```



```
maha@DESKTOP-PDJCJQV: ~$ sleep 10 &
[1] 11770
maha@DESKTOP-PDJCJQV: ~$ killall sleep
[1]+  Terminated                  sleep 10
maha@DESKTOP-PDJCJQV: ~$
```

1. Run an infinite process:

```
yes > /dev/null &
```

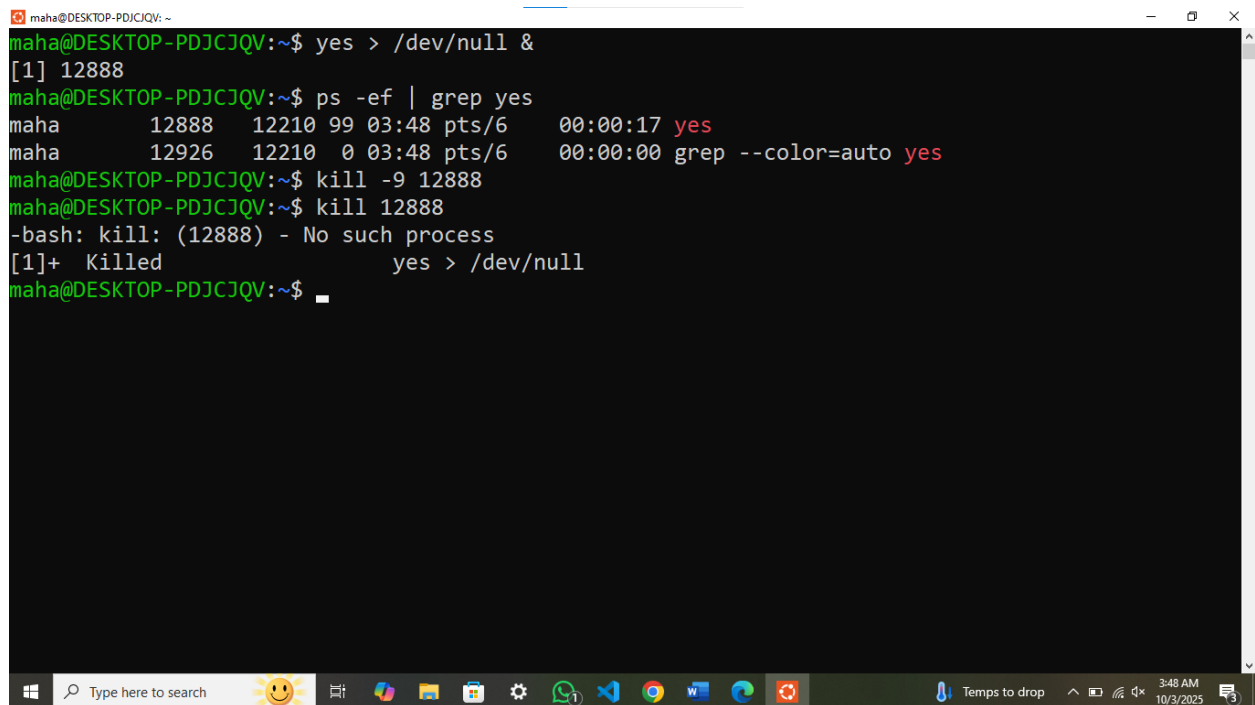
```
maha@DESKTOP-PDJCJQV: ~  
maha@DESKTOP-PDJCJQV:~$ yes > /dev/null &  
[1] 11875  
maha@DESKTOP-PDJCJQV:~$
```

`ps -ef | grep yes`

```
maha@DESKTOP-PDJCJQV: ~  
maha@DESKTOP-PDJCJQV:~$ sleep 10 &  
[1] 12242  
maha@DESKTOP-PDJCJQV:~$ kill 12242  
maha@DESKTOP-PDJCJQV:~$ ps -ef | grep yes  
maha      12409   12210  0 03:43 pts/6    00:00:00 grep --color=auto yes  
[1]+  Terminated                  sleep 10  
maha@DESKTOP-PDJCJQV:~$
```

3. Kill it with:

```
kill -9 <PID>
```

A terminal window titled 'maha@DESKTOP-PDJCJQV: ~' showing a sequence of commands and their outputs. The user runs 'yes > /dev/null &', which starts a background process with PID 12888. Then, they run 'ps -ef | grep yes', which shows two processes: one for 'yes' (PID 12888) and one for 'grep' (PID 12926). Next, they run 'kill -9 12888', which sends a SIGKILL signal to the 'yes' process. Finally, they run 'kill 12888', which results in an error message: '-bash: kill: (12888) - No such process'. The terminal also shows a '+ Killed' message from the background process.

```
maha@DESKTOP-PDJCJQV:~$ yes > /dev/null &
[1] 12888
maha@DESKTOP-PDJCJQV:~$ ps -ef | grep yes
maha      12888   12210  99  03:48 pts/6    00:00:17 yes
maha      12926   12210   0  03:48 pts/6    00:00:00 grep --color=auto yes
maha@DESKTOP-PDJCJQV:~$ kill -9 12888
maha@DESKTOP-PDJCJQV:~$ kill 12888
-bash: kill: (12888) - No such process
[1]+  Killed                  yes > /dev/null
maha@DESKTOP-PDJCJQV:~$
```

3. C Programs on Processes

Program 1: Print PID and PPID

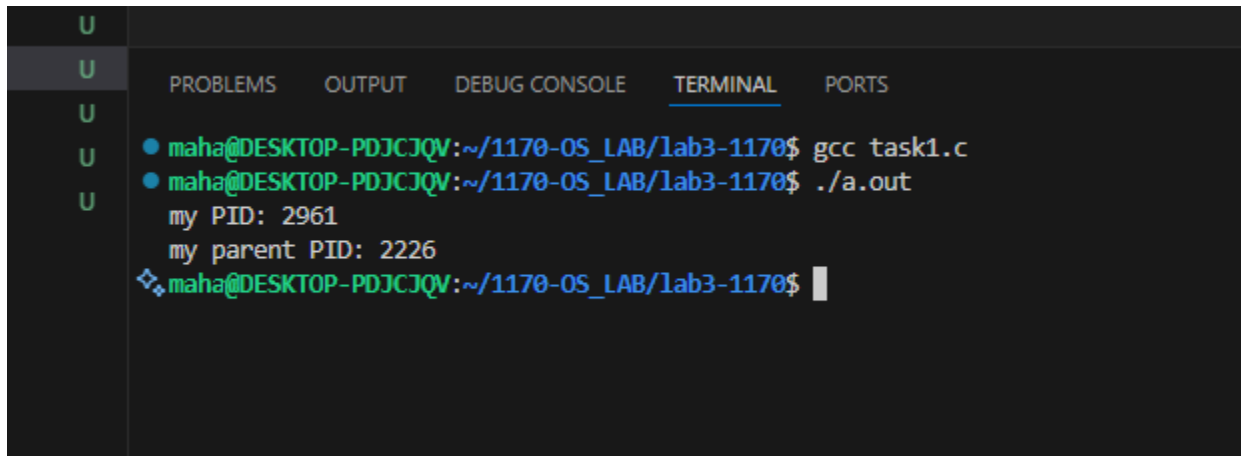
Code:

```
#include <stdio.h>
#include <unistd.h>

int main() {
    printf("my PID: %d\n", getpid());
    printf("my parent PID: %d\n", getppid());
    return 0;
}
```

```
}
```

Terminal:



```
U
U
U
U
U
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
● maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$ gcc task1.c
● maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$ ./a.out
  my PID: 2961
  my parent PID: 2226
❖ maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$
```

Program 2: Fork – Creating Child Process

Code:

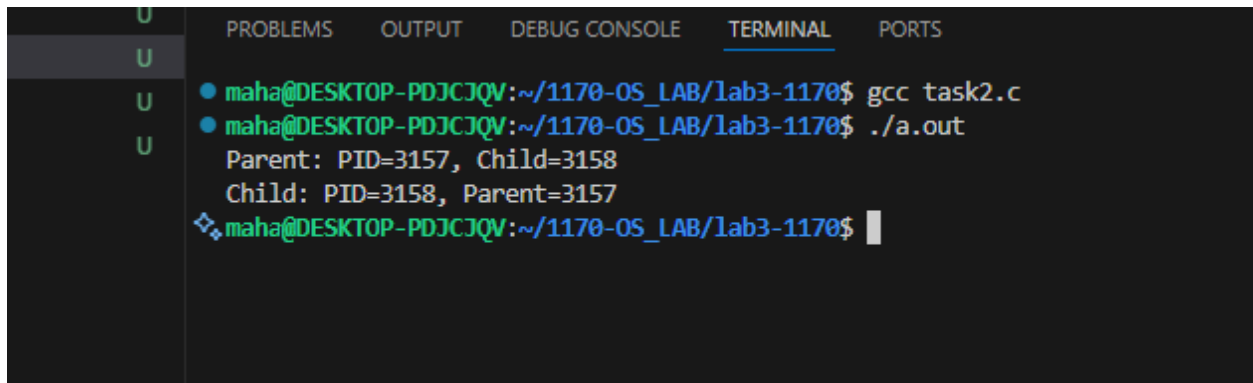
```
#include <stdio.h>
#include <unistd.h>
#include <sys/types.h> // add this header for pid_t

int main() {
    pid_t pid = fork();

    if (pid == 0) {
        // This block runs in the child process
        printf("Child: PID=%d, Parent=%d\n", getpid(), getppid());
    } else {
        // This block runs in the parent process
        printf("Parent: PID=%d, Child=%d\n", getpid(), pid);
    }

    return 0;
}
```

Terminal:



```
maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$ gcc task2.c
maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$ ./a.out
Parent: PID=3157, Child=3158
Child: PID=3158, Parent=3157
maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$
```

Program 3: Execl – Replacing a Process

Code:

```
#include <stdio.h>
#include <unistd.h>
#include <sys/types.h> // required for pid_t

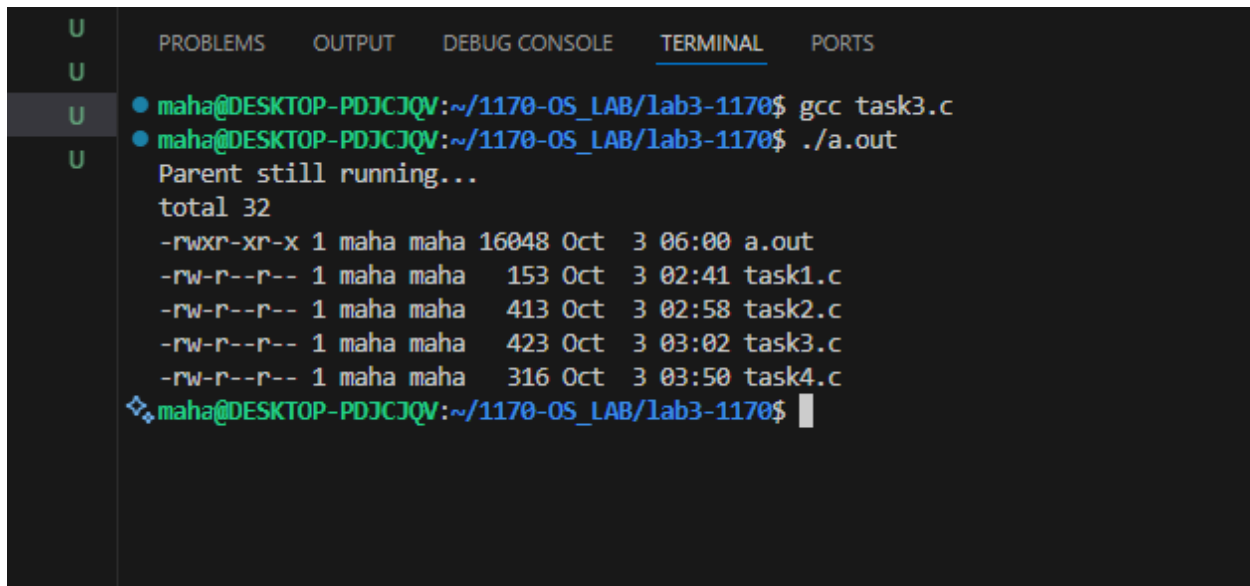
int main() {
    pid_t pid = fork();

    if (pid == 0) {
        // Child process
        execlp("ls", "ls", "-l", NULL);

        // This line only runs if execlp fails
        printf("This will not print if exec succeeds.\n");
    } else {
        // Parent process
        printf("Parent still running...\n");
    }

    return 0;
}
```

Terminal:



```
U
U
U
U
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS
● maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$ gcc task3.c
● maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$ ./a.out
Parent still running...
total 32
-rwxr-xr-x 1 maha maha 16048 Oct  3 06:00 a.out
-rw-r--r-- 1 maha maha  153 Oct  3 02:41 task1.c
-rw-r--r-- 1 maha maha  413 Oct  3 02:58 task2.c
-rw-r--r-- 1 maha maha  423 Oct  3 03:02 task3.c
-rw-r--r-- 1 maha maha  316 Oct  3 03:50 task4.c
❖ maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$
```

Program 4: Wait – Synchronization

Code:

```
#include <stdio.h>
#include <unistd.h>
#include <sys/wait.h>

int main() {
    pid_t pid = fork();
    if (pid == 0) {
        execlp("ls", "ls", "-l", NULL);
        printf("This will not print if exec succeeds.\n");
    } else {
        waitpid(pid, NULL, 0); // Wait for the child process to finish
        printf("Parent still running...\n");
    }
    return 0;
}
```

Terminal:

```
10 waitpid(pid, NULL, 0); // wait for the child process to finish
11 printf("Parent finished\n");

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
● maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$ gcc task4.c
● maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$ ./a.out
total 32
-rwxr-xr-x 1 maha maha 16088 Oct  3 06:01 a.out
-rw-r--r-- 1 maha maha  153 Oct  3 02:41 task1.c
-rw-r--r-- 1 maha maha  413 Oct  3 02:58 task2.c
-rw-r--r-- 1 maha maha  423 Oct  3 03:02 task3.c
-rw-r--r-- 1 maha maha  316 Oct  3 03:50 task4.c
Parent still running...
❖ maha@DESKTOP-PDJCJQV:~/1170-OS_LAB/lab3-1170$
```

.....