



National Textile University

Department of Computer Science

Subject:

Operating System

Submitted to:

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Submitted by:

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Reg number:

23-NTU-CS-FL-1158

Lab number:

3rd

Semester:

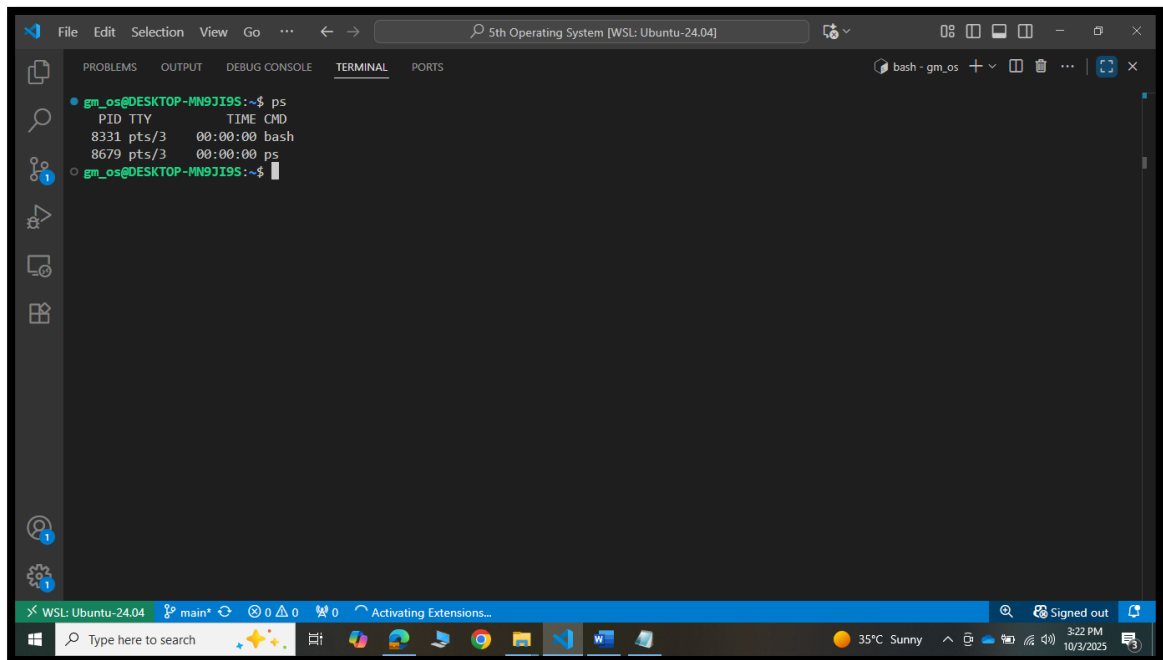
5th

Repository Link: <https://github.com/GhulamMohyuddin28/Operating-System-1158>

Linux Process Commands

2.1 Viewing Processes

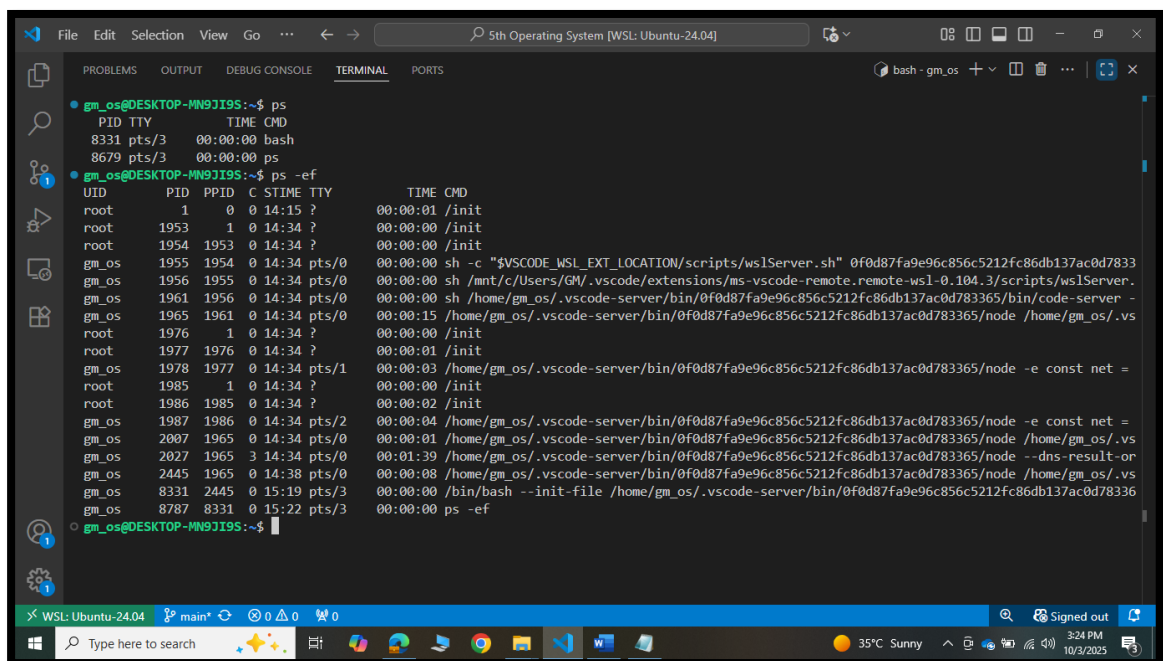
PS Command



The screenshot shows a terminal window with the following output for the 'ps' command:

```
gm_os@DESKTOP-MN9JI9S:~$ ps
  PID TTY          TIME CMD
 8331 pts/3    00:00:00 bash
 8679 pts/3    00:00:00 ps
gm_os@DESKTOP-MN9JI9S:~$
```

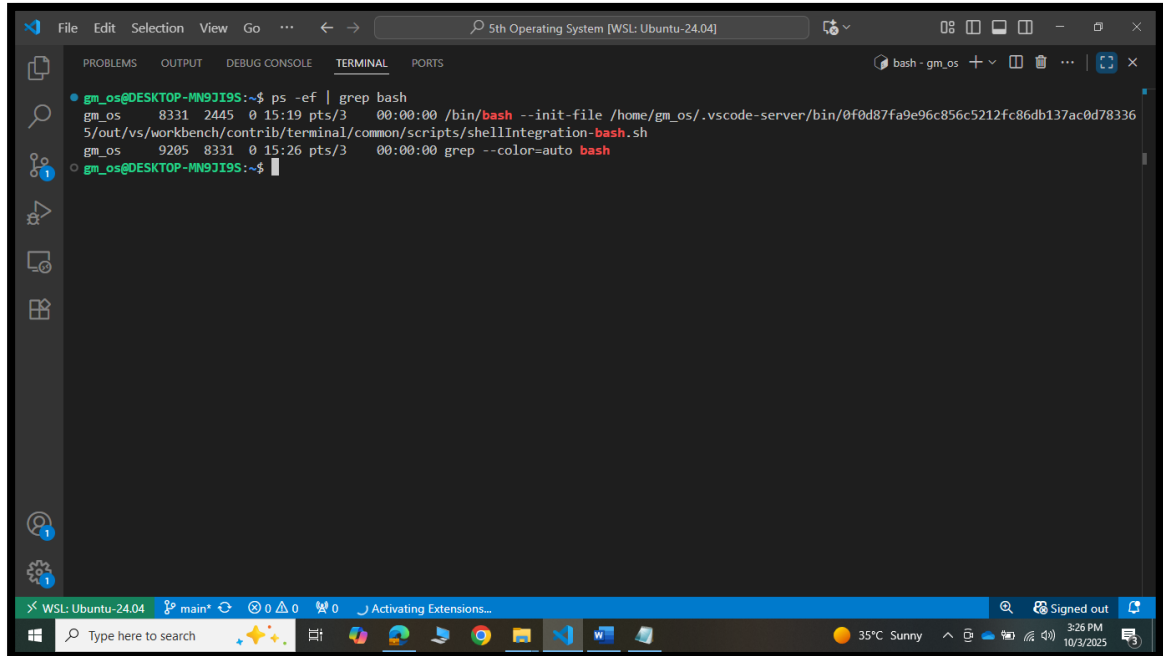
EF Command in PS



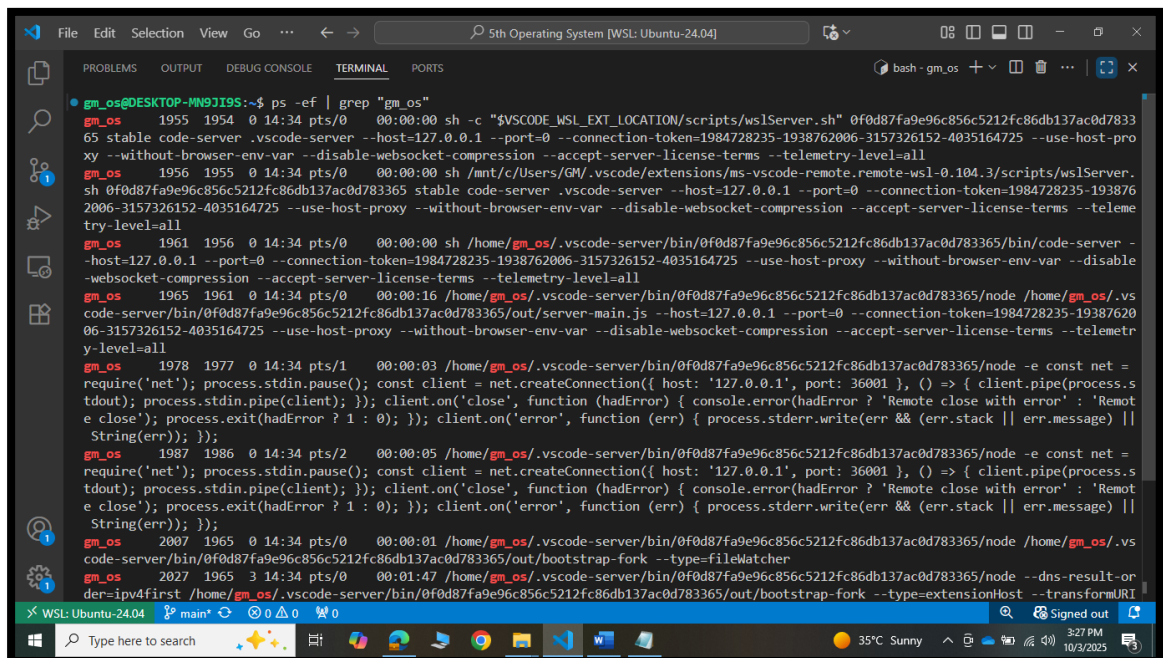
The screenshot shows a terminal window with the following output for the 'ps -ef' command:

```
gm_os@DESKTOP-MN9JI9S:~$ ps -ef
UID          PID    PPID  C STIME TTY          TIME CMD
root           1        0  0  14:15 ?            00:00:01 /init
root       1953        1  0  14:34 ?            00:00:00 /init
root       1954       1953  0  14:34 ?            00:00:00 /init
gm_os       1955       1954  0  14:34 pts/0      00:00:00 sh -c "$VSCODE_WSL_EXT_LOCATION/scripts/wslServer.sh" 0f0d87fa9e96c856c5212fc86db137ac0d7833
gm_os       1956       1955  0  14:34 pts/0      00:00:00 sh /mnt/c/Users/GM/.vscode/extensions/ms-vscode-remote.remote-wsl-0.104.3/scripts/wslServer.
gm_os       1961       1956  0  14:34 pts/0      00:00:00 sh /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/bin/code-server -
gm_os       1965       1961  0  14:34 pts/0      00:00:15 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node /home/gm_os/.vs
root        1976        1  0  14:34 ?            00:00:00 /init
root        1977       1976  0  14:34 ?            00:00:01 /init
gm_os       1978       1977  0  14:34 pts/1      00:00:03 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node -e const net =
root        1985        1  0  14:34 ?            00:00:00 /init
root        1986       1985  0  14:34 ?            00:00:02 /init
gm_os       1987       1986  0  14:34 pts/2      00:00:04 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node -e const net =
gm_os       2007       1965  0  14:34 pts/0      00:00:01 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node /home/gm_os/.vs
gm_os       2027       1965  3  14:34 pts/0      00:01:39 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node --dns-result-or
gm_os       2445       1965  0  14:38 pts/0      00:00:08 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node /home/gm_os/.vs
gm_os       8331       2445  0  15:19 pts/3      00:00:00 /bin/bash --init-file /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d78336
gm_os       8787       8331  0  15:22 pts/3      00:00:00 ps -ef
gm_os@DESKTOP-MN9JI9S:~$
```

Ps -es | grep bash



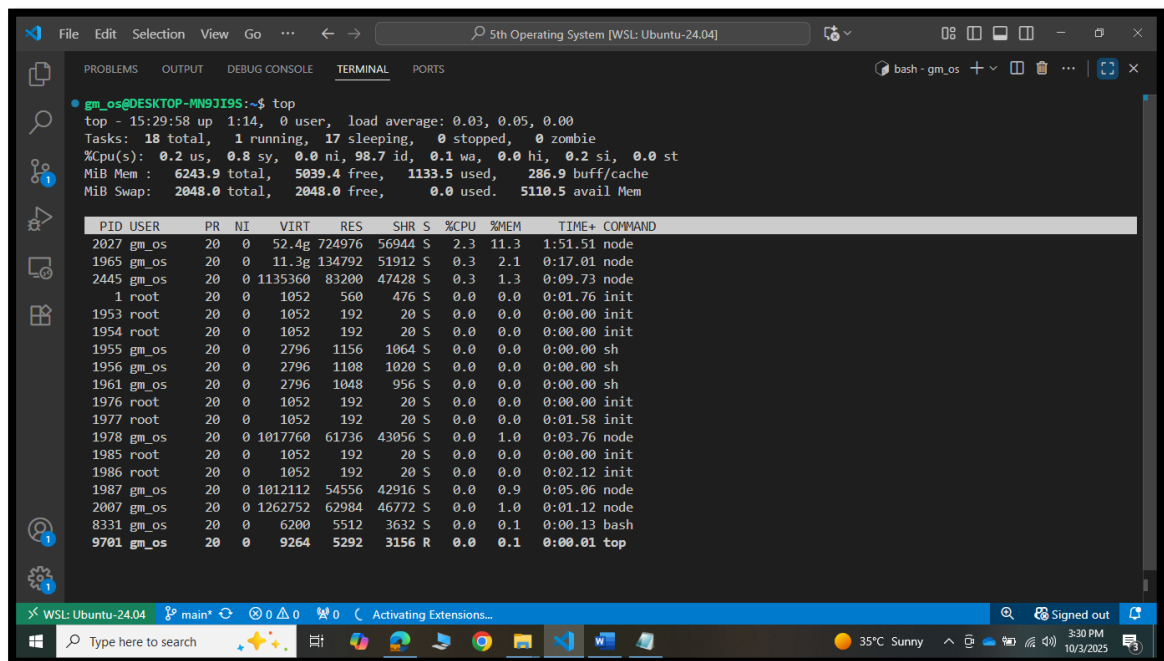
```
File Edit Selection View Go ... 5th Operating System [WSL: Ubuntu-24.04] bash - gm_os
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
gm_os@DESKTOP-MN9JI9S:~$ ps -ef | grep bash
gm_os 8331 2445 0 15:19 pts/3 00:00:00 /bin/bash --init-file /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/out/vs/workbench/contrib/terminal/common/scripts/shellIntegration-bash.sh
gm_os 9205 8331 0 15:26 pts/3 00:00:00 grep --color=auto bash
gm_os@DESKTOP-MN9JI9S:~$
```



```
File Edit Selection View Go ... 5th Operating System [WSL: Ubuntu-24.04] bash - gm_os
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
gm_os@DESKTOP-MN9JI9S:~$ ps -ef | grep "gm_os"
gm_os 1955 1954 0 14:34 pts/0 00:00:00 sh -c "$VSCODE_WSL_EXT_LOCATION/scripts/wslServer.sh" 0f0d87fa9e96c856c5212fc86db137ac0d783365 stable code-server .vscode-server --host=127.0.0.1 --port=0 --connection-token=1984728235-1938762006-3157326152-4035164725 --use-host-proxy --without-browser-env-var --disable-websocket-compression --accept-server-license-terms --telemetry-level=all
gm_os 1956 1955 0 14:34 pts/0 00:00:00 sh /mnt/c/Users/GM/.vscode/extensions/ms-vscode-remote.remote-wsl-0.104.3/scripts/wslServer.sh 0f0d87fa9e96c856c5212fc86db137ac0d783365 stable code-server .vscode-server --host=127.0.0.1 --port=0 --connection-token=1984728235-1938762006-3157326152-4035164725 --use-host-proxy --without-browser-env-var --disable-websocket-compression --accept-server-license-terms --telemetry-level=all
gm_os 1961 1956 0 14:34 pts/0 00:00:00 sh /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/bin/code-server --host=127.0.0.1 --port=0 --connection-token=1984728235-1938762006-3157326152-4035164725 --use-host-proxy --without-browser-env-var --disable-websocket-compression --accept-server-license-terms --telemetry-level=all
gm_os 1965 1961 0 14:34 pts/0 00:00:16 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/out/server-main.js --host=127.0.0.1 --port=0 --connection-token=1984728235-1938762006-3157326152-4035164725 --use-host-proxy --without-browser-env-var --disable-websocket-compression --accept-server-license-terms --telemetry-level=all
gm_os 1978 1977 0 14:34 pts/1 00:00:03 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node -e const net = require('net'); process.stdin.pause(); const client = net.createConnection({ host: '127.0.0.1', port: 36001 }, () => { client.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 && (err.stack || err.message) || String(err)); });
gm_os 1987 1986 0 14:34 pts/2 00:00:05 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node -e const net = require('net'); process.stdin.pause(); const client = net.createConnection({ host: '127.0.0.1', port: 36001 }, () => { client.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 && (err.stack || err.message) || String(err)); });
gm_os 2007 1965 0 14:34 pts/0 00:00:01 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/out/bootstrap-fork --type=fileWatcher
gm_os 2027 1965 3 14:34 pts/0 00:01:47 /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/node --dns-result-order=ipv4first /home/gm_os/.vscode-server/bin/0f0d87fa9e96c856c5212fc86db137ac0d783365/out/bootstrap-fork --type=extensionHost --transformURI
```

2.2 Monitoring Processes Interactively

Top Command

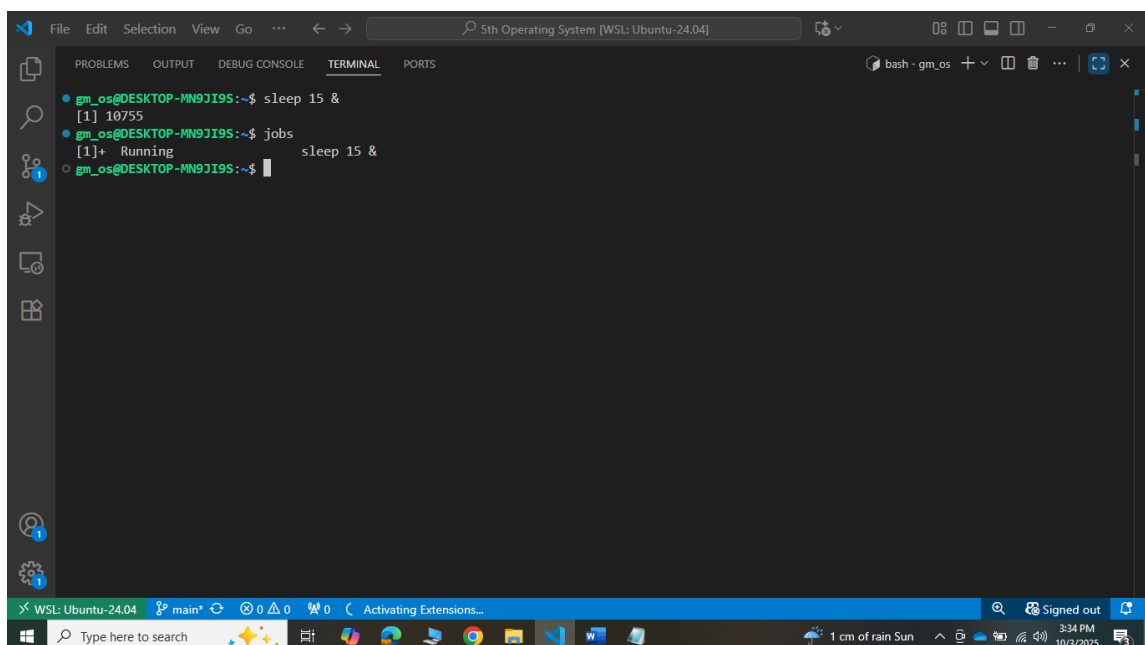


```
gm_os@DESKTOP-MN9JI9S:~$ top
top - 15:29:58 up 1:14, 0 user, load average: 0.03, 0.05, 0.00
Tasks: 18 total, 1 running, 17 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0.2 us, 0.8 sy, 0.0 ni, 98.7 id, 0.1 wa, 0.0 hi, 0.2 si, 0.0 st
MiB Mem : 6243.9 total, 5039.4 free, 1133.5 used, 286.9 buff/cache
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used, 5110.5 avail Mem

  PID USER      PR  NI   VIRT   RES   SHR  S  %CPU  %MEM     TIME+ COMMAND
 2027 gm_os    20   0   52.4g  724976 56944 S   2.3   11.3   1:51.51 node
 1965 gm_os    20   0   11.3g  134792 51912 S   0.3    2.1   0:17.01 node
 2445 gm_os    20   0 1135360  83200  47428 S   0.3    1.3   0:09.73 node
    1 root      20   0    1052    560    476 S   0.0    0.0   0:01.76 init
 1953 root      20   0    1052    192    20 S   0.0    0.0   0:00.00 init
 1954 root      20   0    1052    192    20 S   0.0    0.0   0:00.00 init
 1955 gm_os    20   0    2796   1156   1064 S   0.0    0.0   0:00.00 sh
 1956 gm_os    20   0    2796   1108   1020 S   0.0    0.0   0:00.00 sh
 1961 gm_os    20   0    2796   1048    956 S   0.0    0.0   0:00.00 sh
 1976 root      20   0    1052    192    20 S   0.0    0.0   0:00.00 init
 1977 root      20   0    1052    192    20 S   0.0    0.0   0:01.58 init
 1978 gm_os    20   0 1017760  61736  43056 S   0.0    1.0   0:03.76 node
 1985 root      20   0    1052    192    20 S   0.0    0.0   0:00.00 init
 1986 root      20   0    1052    192    20 S   0.0    0.0   0:02.12 init
 1987 gm_os    20   0 1012112  54556  42916 S   0.0    0.9   0:05.06 node
 2007 gm_os    20   0 1262752  62984  46772 S   0.0    1.0   0:01.12 node
 8331 gm_os    20   0    6200    512    3632 S   0.0    0.1   0:00.13 bash
 9701 gm_os    20   0    9264    5292   3156 R   0.0    0.1   0:00.01 top
```

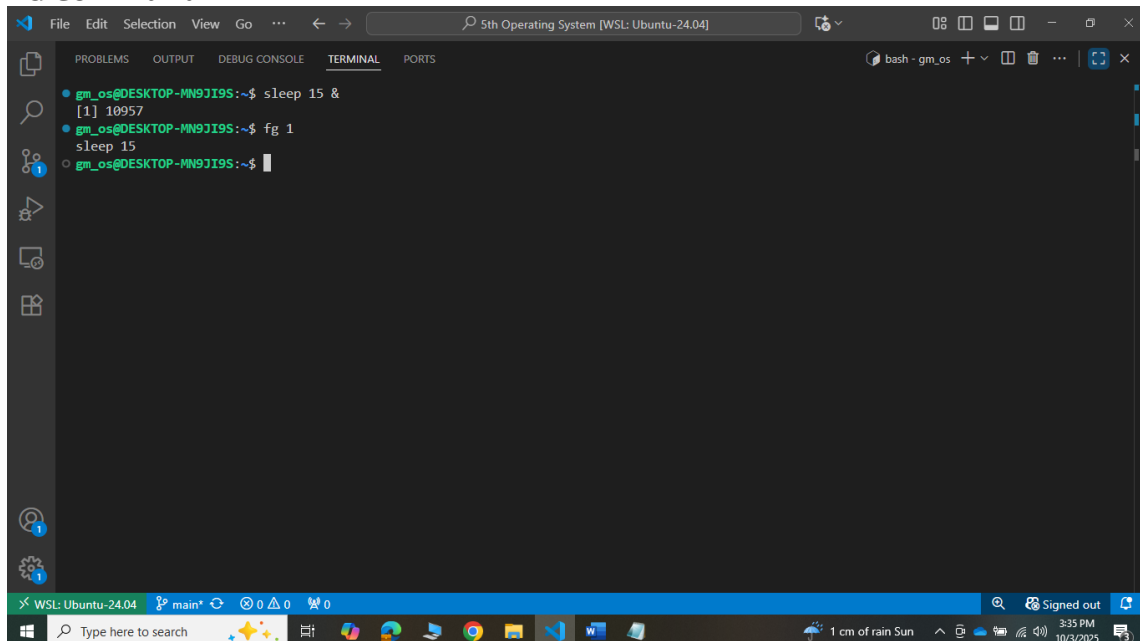
2.3 Foreground and Background Jobs

Sleep & Job Command:



```
gm_os@DESKTOP-MN9JI9S:~$ sleep 15 &
[1] 10755
gm_os@DESKTOP-MN9JI9S:~$ jobs
[1]+  Running                  sleep 15 &
gm_os@DESKTOP-MN9JI9S:~$
```

FG Command



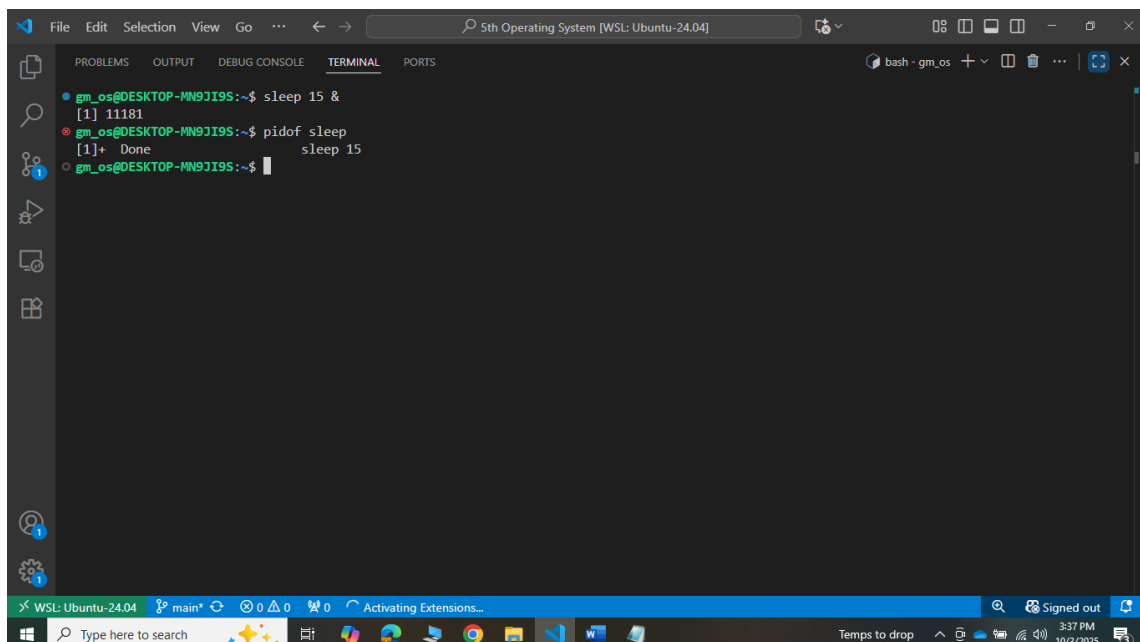
```
File Edit Selection View Go ... 5th Operating System [WSL: Ubuntu-24.04] bash - gm_os
```

```
gm_os@DESKTOP-MN9JI9S:~$ sleep 15 &
[1] 10957
gm_os@DESKTOP-MN9JI9S:~$ fg 1
sleep 15
gm_os@DESKTOP-MN9JI9S:~$
```

The screenshot shows a Windows terminal window with the title bar "5th Operating System [WSL: Ubuntu-24.04]". The terminal interface includes a sidebar with icons for Explorer, Search, Source Control, Run and Debug, and Extensions. The main area displays the command prompt history. The user runs `sleep 15 &`, which starts a background process with PID 10957. Then, they run `fg 1`, which brings the background process to the foreground. The prompt changes to show the process name `sleep 15`. The Windows taskbar at the bottom shows the system clock as 3:35 PM on 10/3/2025.

2.4 Process Identification

PIDOF Command

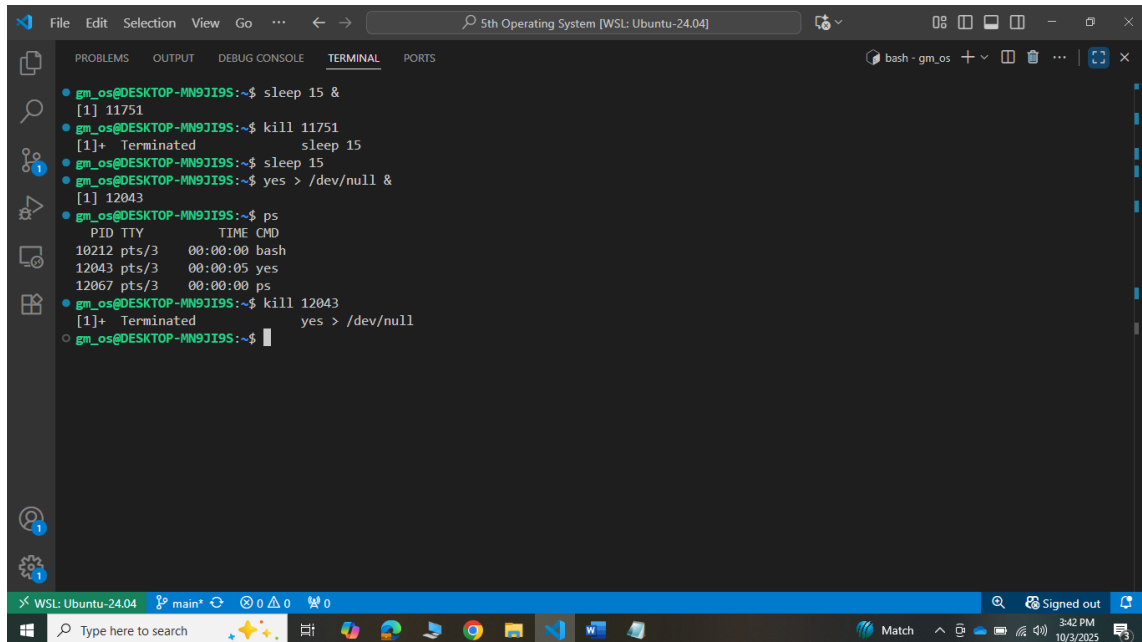


```
File Edit Selection View Go ... 5th Operating System [WSL: Ubuntu-24.04] bash - gm_os
```

```
gm_os@DESKTOP-MN9JI9S:~$ sleep 15 &
[1] 11181
gm_os@DESKTOP-MN9JI9S:~$ pidof sleep
[1]+  Done                  sleep 15
gm_os@DESKTOP-MN9JI9S:~$
```

The screenshot shows a Windows terminal window with the title bar "5th Operating System [WSL: Ubuntu-24.04]". The terminal interface is similar to the previous one. The user runs `sleep 15 &`, starting a background process with PID 11181. Then, they run `pidof sleep`, which returns the PID of the running process. The prompt changes to show the process name `sleep 15`. The Windows taskbar at the bottom shows the system clock as 3:37 PM on 10/3/2025.

2.5 Killing Processes

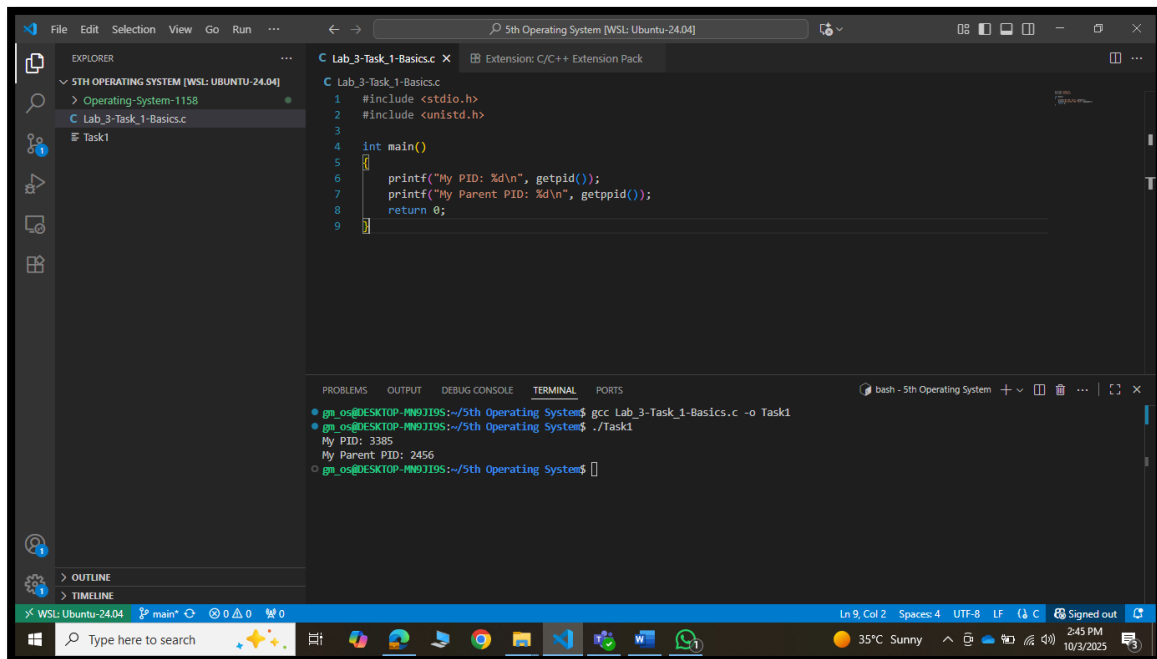


The screenshot shows a Windows terminal window titled "5th Operating System [WSL: Ubuntu-24.04]". The terminal displays the following commands and output:

```
gm_os@DESKTOP-MN9JI9S:~$ sleep 15 &
[1] 11751
gm_os@DESKTOP-MN9JI9S:~$ kill 11751
[1]+  Terminated                  sleep 15
gm_os@DESKTOP-MN9JI9S:~$ sleep 15
gm_os@DESKTOP-MN9JI9S:~$ yes > /dev/null &
[1] 12043
gm_os@DESKTOP-MN9JI9S:~$ ps
  PID TTY          TIME CMD
 10212 pts/3        00:00:00 bash
 12043 pts/3        00:00:05 yes
 12067 pts/3        00:00:00 ps
gm_os@DESKTOP-MN9JI9S:~$ kill 12043
[1]+  Terminated                  yes > /dev/null
gm_os@DESKTOP-MN9JI9S:~$
```

C Program & Processes

Program 1: Print PID and PPID



The screenshot shows a Windows IDE window titled "5th Operating System [WSL: Ubuntu-24.04]". The IDE displays a C program named "Lab_3-Task_1-Basics.c" and its execution output in the terminal.

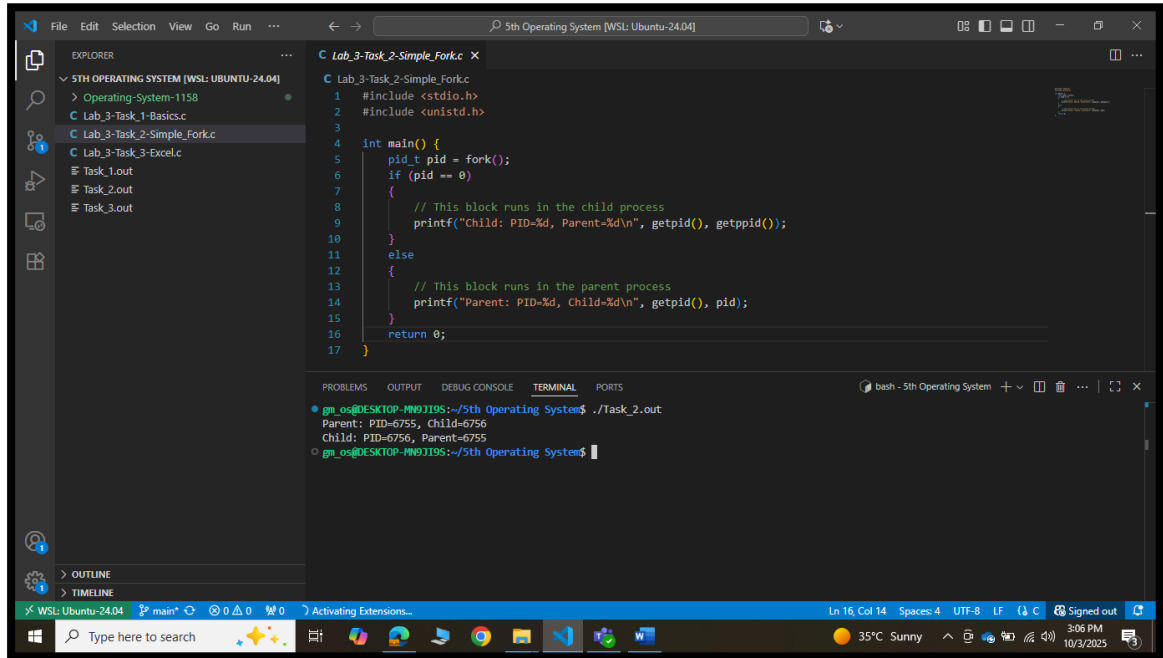
Source Code:

```
1 #include <stdio.h>
2 #include <unistd.h>
3
4 int main()
5 {
6     printf("My PID: %d\n", getpid());
7     printf("My Parent PID: %d\n", getppid());
8     return 0;
9 }
```

Terminal Output:

```
gm_os@DESKTOP-MN9JI9S:~/5th Operating System$ gcc Lab_3-Task_1-Basics.c -o Task1
gm_os@DESKTOP-MN9JI9S:~/5th Operating System$ ./Task1
My PID: 3385
My Parent PID: 2456
gm_os@DESKTOP-MN9JI9S:~/5th Operating System$
```

Program 2: Fork – Creating Child Process



The screenshot shows a Visual Studio Code editor window with a C file named `Lab_3-Task_2-Simple_Fork.c`. The code implements a simple fork() system call. The parent process prints its PID and the child's PID. The child process prints its own PID and the parent's PID. The terminal output shows the execution of the program, with the parent process (PID 6755) and the child process (PID 6756) both printing their PIDs.

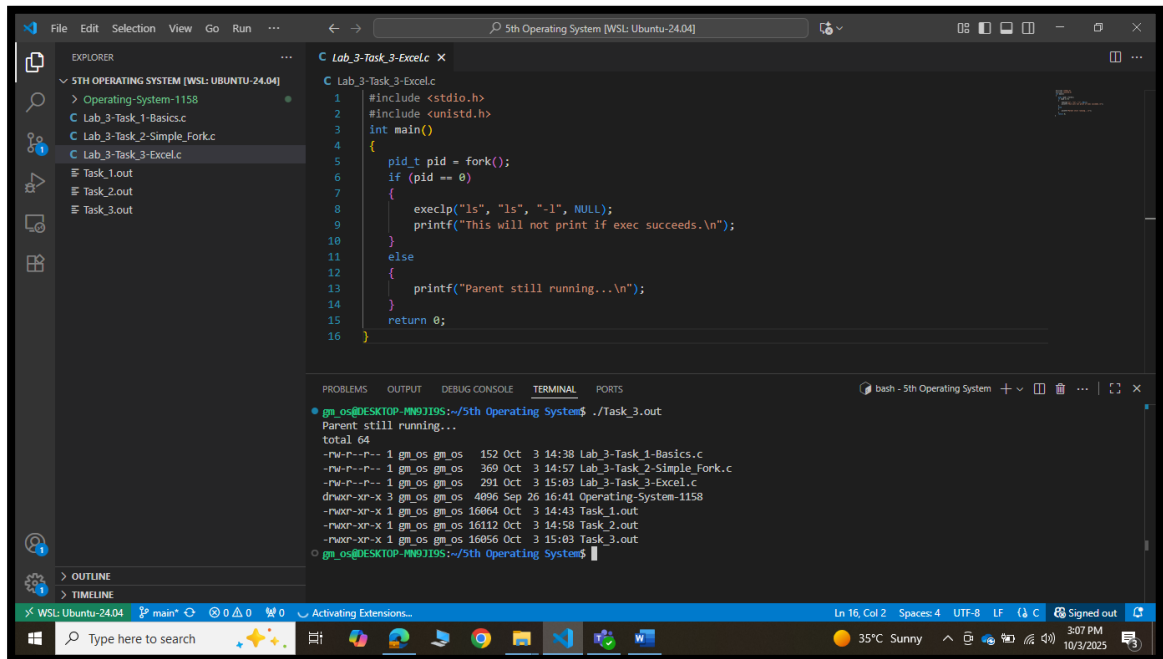
```
#include <stdio.h>
#include <unistd.h>

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 Output:

```
gn_os@DESKTOP-HN0J19S:~/5th Operating System$ ./Task_2.out
Parent: PID=6755, Child=6756
Child: PID=6756, Parent=6755
```

Program 3: Execl – Replacing a Process



The screenshot shows a Visual Studio Code editor window with a C file named `Lab_3-Task_3-Exec.c`. The code implements an execl() system call. The parent process prints its PID and the child's PID. The child process replaces itself with the `ls` command. The terminal output shows the execution of the program, with the parent process (PID 16064) and the child process (PID 16066) both printing their PIDs. The child process then replaces itself with the `ls` command, and the terminal output shows the output of the `ls` command.

```
#include <stdio.h>
#include <unistd.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 {
        printf("Parent still running...\n");
    }
    return 0;
}
```

Terminal Output:

```
gn_os@DESKTOP-HN0J19S:~/5th Operating System$ ./Task_3.out
Parent still running...
total 64
-rw-r--r-- 1 gn_os gn_os 152 Oct 3 14:38 Lab_3-Task_1-Basics.c
-rw-r--r-- 1 gn_os gn_os 369 Oct 3 14:57 Lab_3-Task_2-Simple_Fork.c
-rw-r--r-- 1 gn_os gn_os 291 Oct 3 15:03 Lab_3-Task_3-Exec.c
drwxr-xr-x 3 gn_os gn_os 4096 Sep 26 16:41 Operating-System-1158
-rwxr-xr-x 1 gn_os gn_os 16064 Oct 3 14:43 Task_1.out
-rwxr-xr-x 1 gn_os gn_os 16112 Oct 3 14:58 Task_2.out
-rwxr-xr-x 1 gn_os gn_os 16066 Oct 3 15:00 Task_3.out
```

Program 4: Wait – Synchronization

```
File Edit Selection View Go Run ... 5th Operating System [WSL: Ubuntu-24.04]

EXPLORER
5TH OPERATING SYSTEM [WSL: UBUNTU-24.04]
  > Operating-System-1158
  C Lab_3-Task_1-Basics.c
  C Lab_3-Task_2-Simple_Fork.c
  C Lab_3-Task_3-Excel.c
  C Lab_3-Task_4-Synchronization.c
    Task_1.out
    Task_2.out
    Task_3.out
    Task_4.out

C Lab_3-Task_4-Synchronization.c
1 #include <stdio.h>
2 #include <unistd.h>
3 #include <sys/wait.h>
4 int main()
5 {
6     pid_t pid = fork();
7     if (pid == 0)
8     {
9         execlp("ls", "ls", "-l", NULL);
10        printf("This will not print if exec succeeds.\n");
11    }
12    else
13    {
14        waitpid(pid, NULL, 0); // Wait for the child process to finish
15        printf("Parent still running...\n");
16    }
17    return 0;
18 }

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
gn_os@DESKTOP-MN9J19S:~/5th Operating System$ gcc Lab_3-Task_4-Synchronization.c -o Task_4.out
gn_os@DESKTOP-MN9J19S:~/5th Operating System$ ./Task_4.out
total 84
-rw-r--r-- 1 gn_os gn_os 152 Oct 3 14:38 Lab_3-Task_1-Basics.c
-rw-r--r-- 1 gn_os gn_os 369 Oct 3 14:57 Lab_3-Task_2-Simple_Fork.c
-rw-r--r-- 1 gn_os gn_os 291 Oct 3 15:03 Lab_3-Task_3-Excel.c
-rw-r--r-- 1 gn_os gn_os 379 Oct 3 15:10 Lab_3-Task_4-Synchronization.c
drwxr-xr-x 3 gn_os gn_os 4096 Sep 26 16:41 Operating-System-1158
-rwxr-xr-x 1 gn_os gn_os 16064 Oct 3 14:43 Task_1.out
-rwxr-xr-x 1 gn_os gn_os 16112 Oct 3 14:58 Task_2.out
-rwxr-xr-x 1 gn_os gn_os 16056 Oct 3 15:03 Task_3.out
-rwxr-xr-x 1 gn_os gn_os 16112 Oct 3 15:11 Task_4.out
Parent still running...
gn_os@DESKTOP-MN9J19S:~/5th Operating System$
```