

## Assignment 4 - Process Management & Signal Handling

### Part 1: Process Exploration

#### 1. List all running processes using:

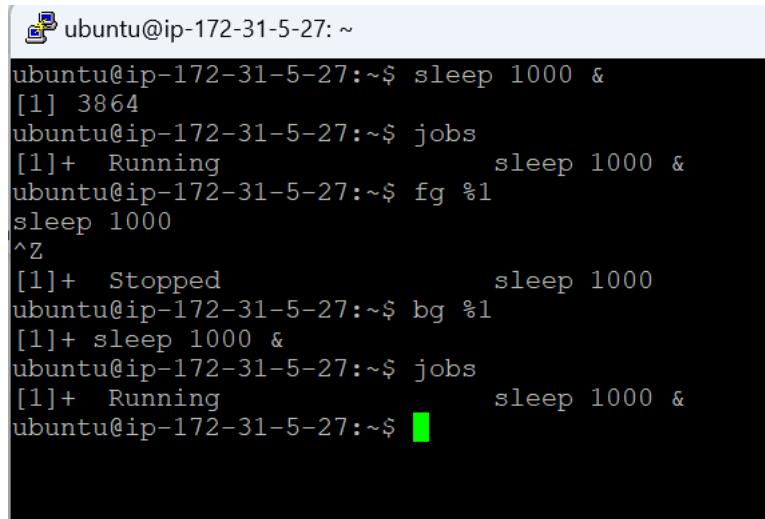
- ps -ef
- ps aux

```
ubuntu@ip-172-31-5-27:~$ ps -ef
UID      PID  PPID  C STIME TTY      TIME CMD
root      1      0  0 09:25 ?    00:00:02 /sbin/init
root      2      0  0 09:25 ?    00:00:00 [kthreadd]
root      3      2  0 09:25 ?    00:00:00 [pool_workqueue_release]
root      4      2  0 09:25 ?    00:00:00 [kworker/R-rcu_gp]
root      5      2  0 09:25 ?    00:00:00 [kworker/R-sync_wq]
root      6      2  0 09:25 ?    00:00:00 [kworker/R-kvfree_rcu_rec]
root      7      2  0 09:25 ?    00:00:00 [kworker/R-slab_flushwq]
root      8      2  0 09:25 ?    00:00:00 [kworker/R-netsns]
root     10      2  0 09:25 ?    00:00:00 [kworker/0:OH-events_high]
root     13      2  0 09:25 ?    00:00:00 [kworker/R-mm_percpu_wq]
root     14      2  0 09:25 ?    00:00:00 [rcu_tasks_rude_kthread]
root     15      2  0 09:25 ?    00:00:00 [rcu_tasks_trace_kthread]
root     16      2  0 09:25 ?    00:00:00 [ksoftirqd/0]
root     17      2  0 09:25 ?    00:00:00 [rcu_sched]
root     18      2  0 09:25 ?    00:00:00 [rcu_exp_par_gp_kthread_w]
root     19      2  0 09:25 ?    00:00:00 [rcu_exp_gp_kthread_worke
root     20      2  0 09:25 ?    00:00:00 [migration/0]
root     21      2  0 09:25 ?    00:00:00 [idle_inject/0]
root     22      2  0 09:25 ?    00:00:00 [cpuhp/0]
root     23      2  0 09:25 ?    00:00:00 [cpuhp/1]
root     24      2  0 09:25 ?    00:00:00 [idle_inject/1]
root     25      2  0 09:25 ?    00:00:00 [migration/1]
root     26      2  0 09:25 ?    00:00:00 [ksoftirqd/1]
root     28      2  0 09:25 ?    00:00:00 [kworker/l:OH-events_high]
root     29      2  0 09:25 ?    00:00:00 [kdevtmpfs]
root     30      2  0 09:25 ?    00:00:00 [kworker/R-inet_frag_wq]
root     31      2  0 09:25 ?    00:00:00 [kauditctl]
root     32      2  0 09:25 ?    00:00:00 [khungtaskd]
root     34      2  0 09:25 ?    00:00:00 [oom_reaper]
root     36      2  0 09:25 ?    00:00:00 [kworker/R-writeback]
root     37      2  0 09:25 ?    00:00:00 [kcompactd0]
root     38      2  0 09:25 ?    00:00:00 [ksmd]
root     39      2  0 09:25 ?    00:00:00 [khugepaged]
root     40      2  0 09:25 ?    00:00:00 [kworker/R-integrityd]
root     41      2  0 09:25 ?    00:00:00 [kworker/R-kblockd]
root     42      2  0 09:25 ?    00:00:00 [kworker/R-blkcg_punt_bio]
root     44      2  0 09:25 ?    00:00:00 [irq/9-acpi]
root     45      2  0 09:25 ?    00:00:00 [kworker/R-tpm_dev_wq]
root     46      2  0 09:25 ?    00:00:00 [kworker/R-ata_sff]
```

```
ubuntu@ip-172-31-5-27:~$ ps aux
root      3465  3464  0 12:39 pts/0    00:00:00 sudo -i
root      3466  3465  0 12:39 pts/0    00:00:00 -bash
root     3551  2  0 13:00 ?    00:00:00 [kworker/l:1-cgroup_destr
root     3621  2  0 13:40 ?    00:00:00 [kworker/0:1]
root     3644  2  0 13:50 ?    00:00:00 [kworker/l:0]
root     3645  2  0 13:50 ?    00:00:00 [kworker/l:3-cgroup_destr
root     3647 1009  0 13:54 ?    00:00:00 sshd: ubuntu [priv]
ubuntu   3745  3647  0 13:54 ?    00:00:00 sshd: ubuntu@pts/1
ubuntu   3746  3745  0 13:54 pts/1    00:00:00 -bash
root     3756  2  0 13:54 ?    00:00:00 [kworker/u8:1-events_unbo
ubuntu   3757  3746  0 13:54 pts/1    00:00:00 ps -ef
ubuntu@ip-172-31-5-27:~$ ps aux
USER      PID %CPU %MEM   VSZ   RSS TTY      STAT START  TIME COMMAND
root      1  0.0  1.4 22724 13412 ?      Ss 09:25 0:02 /sbin/init
root      2  0.0  0.0      0  0  ?      S 09:25 0:00 [kthreadd]
root      3  0.0  0.0      0  0  ?      S 09:25 0:00 [pool_work
root      4  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/R
root      5  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/R
root      6  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/R
root      7  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/R
root      8  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/R
root     10  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/0
root     13  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/R
root     14  0.0  0.0      0  0  ?      I 09:25 0:00 [rcu_tasks
root     15  0.0  0.0      0  0  ?      I 09:25 0:00 [rcu_tasks
root     16  0.0  0.0      0  0  ?      S 09:25 0:00 [ksoftirqd
root     17  0.0  0.0      0  0  ?      I 09:25 0:00 [rcu_sched
root     18  0.0  0.0      0  0  ?      S 09:25 0:00 [rcu_exp_p
root     19  0.0  0.0      0  0  ?      S 09:25 0:00 [rcu_exp_g
root     20  0.0  0.0      0  0  ?      S 09:25 0:00 [migration
root     21  0.0  0.0      0  0  ?      S 09:25 0:00 [idle_inje
root     22  0.0  0.0      0  0  ?      S 09:25 0:00 [cpuhp/0]
root     23  0.0  0.0      0  0  ?      S 09:25 0:00 [cpuhp/1]
root     24  0.0  0.0      0  0  ?      S 09:25 0:00 [idle_inje
root     25  0.0  0.0      0  0  ?      S 09:25 0:00 [migration
root     26  0.0  0.0      0  0  ?      S 09:25 0:00 [ksoftirqd
root     28  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/l
root     29  0.0  0.0      0  0  ?      S 09:25 0:00 [kdevtmpfs
root     30  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/R
root     31  0.0  0.0      0  0  ?      S 09:25 0:00 [kauditctl]
root     32  0.0  0.0      0  0  ?      S 09:25 0:00 [khungtask
root     34  0.0  0.0      0  0  ?      S 09:25 0:00 [oom_reape
root     36  0.0  0.0      0  0  ?      I< 09:25 0:00 [kworker/R
root     37  0.0  0.0      0  0  ?      S 09:25 0:00 [kcompactd
```

## Part 2: Background Jobs

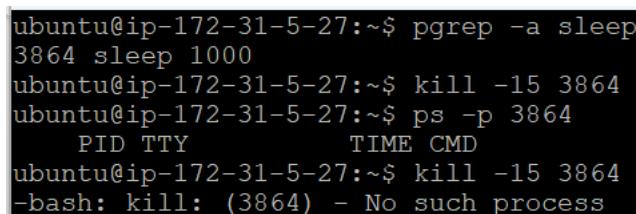
1. Start a long-running command: sleep 1000 &
2. View running background jobs.
3. Bring the job to foreground and send it back to background.



```
ubuntu@ip-172-31-5-27:~$ sleep 1000 &
[1] 3864
ubuntu@ip-172-31-5-27:~$ jobs
[1]+  Running                  sleep 1000 &
ubuntu@ip-172-31-5-27:~$ fg %1
sleep 1000
^Z
[1]+  Stopped                  sleep 1000
ubuntu@ip-172-31-5-27:~$ bg %1
[1]+ sleep 1000 &
ubuntu@ip-172-31-5-27:~$ jobs
[1]+  Running                  sleep 1000 &
ubuntu@ip-172-31-5-27:~$ kill -9 3864
```

## Part 3: Process Termination & Signals

1. Gracefully stop the sleep process using: ○ SIGTERM
2. Verify if the process still exists.
3. Forcefully terminate it using: ○ SIGKILL
4. Explain the difference between: ○ kill -15 ○ kill -9



```
ubuntu@ip-172-31-5-27:~$ pgrep -a sleep
3864 sleep 1000
ubuntu@ip-172-31-5-27:~$ kill -15 3864
ubuntu@ip-172-31-5-27:~$ ps -p 3864
  PID TTY      TIME CMD
ubuntu@ip-172-31-5-27:~$ kill -15 3864
-bash: kill: (3864) - No such process
```

Kill – 15 SIGTERM (Graceful shutdown that allows clean up)

Kill- 9 SIGKILL (Force kill or immediate kill)

## Part 4: Real-Time Monitoring

1. Use top to:
  - Identify top CPU-consuming processes
  - Sort by memory usage
2. Observe changes in real time.

To sort by CPU we use - p

To sort by memory usage we use - m

```
ubuntu@ip-172-31-5-27: ~
top - 14:28:11 up 5:02, 6 users, load average: 0.05, 0.02, 0.00
Tasks: 132 total, 1 running, 131 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0.0 us, 0.2 sy, 0.0 ni, 99.8 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 80.3/914.2 [|||||||||||||||||||||||||||||]
MiB Swap: 0.0/0.0 []

 PID USER      PR  NI    VIRT    RES    SHR   S %CPU %MEM TIME+ COMMAND
 740 mysql     20   0 1786480 363048 6080 S  0.3 38.8 1:43.42 mysqld
  1 root      20   0  22724 13412 9116 S  0.0  1.4 0:02.26 systemd
  2 root      20   0      0      0  0 S  0.0  0.0 0:00.01 kthreadd
  3 root      20   0      0      0  0 S  0.0  0.0 0:00.00 pool_wq+
  4 root      0 -20      0      0  0 I  0.0  0.0 0:00.00 kworker+
  5 root      0 -20      0      0  0 I  0.0  0.0 0:00.00 kworker+
  6 root      0 -20      0      0  0 I  0.0  0.0 0:00.00 kworker+
  7 root      0 -20      0      0  0 I  0.0  0.0 0:00.00 kworker+
  8 root      0 -20      0      0  0 I  0.0  0.0 0:00.00 kworker+
 10 root     0 -20      0      0  0 I  0.0  0.0 0:00.00 kworker+
 13 root     0 -20      0      0  0 I  0.0  0.0 0:00.00 kworker+
 14 root     20   0      0      0  0 I  0.0  0.0 0:00.00 rcu_tas+
 15 root     20   0      0      0  0 I  0.0  0.0 0:00.00 rcu_tas+
 16 root     20   0      0      0  0 S  0.0  0.0 0:00.05 ksoftirq+
 17 root     20   0      0      0  0 I  0.0  0.0 0:00.37 rcu_sch+
 18 root     20   0      0      0  0 S  0.0  0.0 0:00.00 rcu_expt+
 19 root     20   0      0      0  0 S  0.0  0.0 0:00.00 rcu_expt+
```