CLOUD COMPUTING LAB
BSE (V-B)

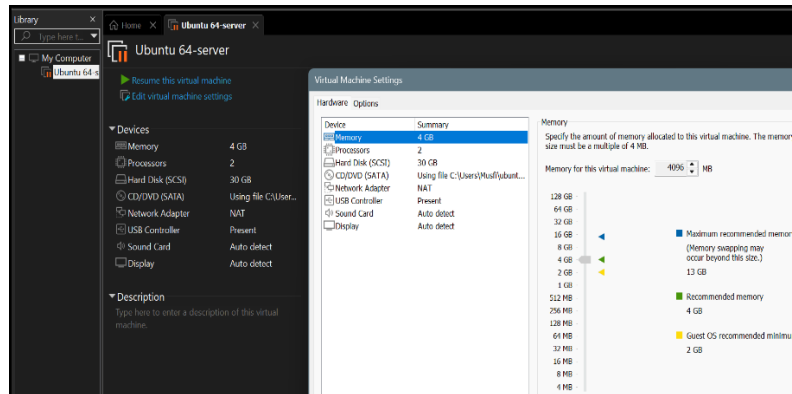Submitted By:

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Roll No:

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Submitted To:

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LAB 04

Virtualization & Linux Fundamentals

Task 1

Shows VM's CPU, RAM, disk size, and network adapter details.

Task 2

SSH connection from host terminal to Ubuntu VM.

Output of whoami and pwd commands confirming user and directory.

Task 3

1. Contents of root / directory.

```
see "snap info <snapname>" for additional versions.
musfira@ubuntu:/$ cd /
musfira@ubuntu:/$ ls -la /
total 2986076
drwxr-xr-x  23 root root       4096 Oct 19 08:09 .
drwxr-xr-x  23 root root       4096 Oct 19 08:09 ..
lrwxrwxrwx   1 root root          7 Apr 22  2024 bin -> usr/bin
drwxr-xr-x   2 root root       4096 Feb 26  2024 bin.usr-is-merged
drwxr-xr-x   4 root root       4096 Oct 19 08:09 boot
dr-xr-xr-x   2 root root       4096 Aug  5 23:53 cdrom
drwxr-xr-x  20 root root       4120 Oct 19 19:30 dev
drwxr-xr-x 108 root root       4096 Oct 19 08:45 etc
drwxr-xr-x   3 root root       4096 Oct 19 08:45 home
lrwxrwxrwx   1 root root          7 Apr 22  2024 lib -> usr/lib
lrwxrwxrwx   1 root root          9 Apr 22  2024 lib64 -> usr/lib64
drwxr-xr-x   2 root root       4096 Feb 26  2024 lib.usr-is-merged
drwx------   2 root root      16384 Oct 19 06:59 lost+found
drwxr-xr-x   2 root root       4096 Aug  5 16:54 media
drwxr-xr-x   2 root root       4096 Aug  5 16:54 mnt
drwxr-xr-x   2 root root       4096 Aug  5 16:54 opt
dr-xr-xr-x 275 root root          0 Oct 19 19:29 proc
drwx------   3 root root       4096 Aug  5 17:02 root
drwxr-xr-x  28 root root        840 Oct 19 19:31 run
lrwxrwxrwx   1 root root          8 Apr 22  2024 sbin -> usr/sbin
drwxr-xr-x   2 root root       4096 Dec 11  2024 sbin.usr-is-merged
drwxr-xr-x   2 root root       4096 Oct 19 08:45 snap
drwxr-xr-x   2 root root       4096 Aug  5 16:54 srv
-rw-------   1 root root 3057647616 Oct 19 08:09 swap.img
dr-xr-xr-x  13 root root          0 Oct 19 19:36 sys
drwxrwxrwt  13 root root       4096 Oct 19 19:29 tmp
drwxr-xr-x  12 root root       4096 Aug  5 16:54 usr
drwxr-xr-x  13 root root       4096 Oct 19 08:43 var
musfira@ubuntu:/$ _
```

2. Executable binaries in /bin.

```
drwxr-xr-x  13 root root       4096 Oct 19 08:43 var
musfira@ubuntu:/$ ls -la /bin
lrwxrwxrwx 1 root root 7 Apr 22  2024 /bin -> usr/bin
```

3. System binaries in /sbin.

```
lrwxrwxrwx 1 root root 7 Apr 22  2024 /bin -> usr/sbin
musfira@ubuntu:/$ ls -la /sbin
lrwxrwxrwx 1 root root 8 Apr 22  2024 /sbin -> usr/sbin
musfira@ubuntu:/$ ls -la /usr
```

4. Subdirectories and programs in /usr.

```
lrwxrwxrwx 1 root root 8 Apr 22  2024 /sbin -> usr/sbin
musfira@ubuntu:/$ ls -la /usr
total 96
drwxr-xr-x  12 root root  4096 Aug  5 16:54 .
drwxr-xr-x  23 root root  4096 Oct 19 08:09 ..
drwxr-xr-x   2 root root 36864 Oct 19 08:12 bin
drwxr-xr-x   2 root root  4096 Apr 22  2024 games
drwxr-xr-x  33 root root  4096 Oct 19 08:08 include
drwxr-xr-x  78 root root  4096 Oct 19 08:10 lib
drwxr-xr-x   2 root root  4096 Oct 19 08:08 lib64
drwxr-xr-x  11 root root  4096 Oct 19 08:09 libexec
drwxr-xr-x  10 root root  4096 Aug  5 16:54 local
drwxr-xr-x   2 root root 20480 Oct 19 08:13 sbin
drwxr-xr-x 124 root root  4096 Oct 19 08:10 share
drwxr-xr-x   4 root root  4096 Oct 19 08:09 src
```

5. Optional software folder /opt.

```
lrwxrwxrwx  1 root root     0 Apr 22  2024 /sbin
musfira@ubuntu:/$ ls -la /opt
total 8
drwxr-xr-x  2 root  root  4096 Aug   5 16:54  .
drwxr-xr-x 23 root  root  4096 Oct  19 08:09  ..
```

6. Configuration files directory /etc.

```
-rw-r--r--  1 root root      208 Aug  5 16:54 .updated
drwxr-xr-x  3 root root     4096 Aug  5 17:02 update-manager
drwxr-xr-x  2 root root     4096 Aug  5 17:14 update-motd.d
drwxr-xr-x  2 root root     4096 Aug  5 17:14 update-notifier
drwxr-xr-x  2 root root     4096 Oct 19 08:09 UPower
-rw-r--r--  1 root root     1523 Aug  5 17:14 usb_modeswitch.conf
drwxr-xr-x  2 root root     4096 Aug  5 17:14 usb_modeswitch.d
lrwxrwxrwx  1 root root       16 Aug  5 17:02 vconsole.conf -> default/keyboard
drwxr-xr-x  2 root root     4096 Oct 19 08:12 vim
drwxr-xr-x  4 root root     4096 Oct 19 08:12 vmware-tools
lrwxrwxrwx  1 root root       23 Feb 26  2024 vtrgb -> /etc/alternatives/vtrgb
-rw-r--r--  1 root root     4942 Aug  5 17:14 wgetrc
drwxr-xr-x  4 root root     4096 Aug  5 17:02 X11
-rw-r--r--  1 root root      681 Apr  8  2024 xattr.conf
drwxr-xr-x  4 root root     4096 Aug  5 17:02 xdg
drwxr-xr-x  2 root root     4096 Aug  5 17:02 xml
-rw-r--r--  1 root root      460 Aug  5 17:14 zsh_command_not_found
musfira@ubuntu:/$ 
```

7. Device files directory /dev.

```
drwxr-xr-x  2 root    root         60 Oct 19 19:29 ubuntu-vg
crw-rw----  1 root    kvm     10, 124 Oct 19 19:29 udmabuf
crw-------  1 root    root    10, 239 Oct 19 19:29 uhid
crw-------  1 root    root    10, 223 Oct 19 19:29 uinput
crw-rw-rw-  1 root    root     1,   9 Oct 19 19:29 urandom
crw-------  1 root    root    10, 126 Oct 19 19:29 userfaultfd
crw-------  1 root    root    10, 240 Oct 19 19:29 userio
crw-rw----  1 root    tty      7,   0 Oct 19 19:29 vcs
crw-rw----  1 root    tty      7,   1 Oct 19 19:29 vcs1
crw-rw----  1 root    tty      7,   2 Oct 19 19:29 vcs2
crw-rw----  1 root    tty      7,   3 Oct 19 19:29 vcs3
crw-rw----  1 root    tty      7,   4 Oct 19 19:29 vcs4
crw-rw----  1 root    tty      7,   5 Oct 19 19:29 vcs5
crw-rw----  1 root    tty      7,   6 Oct 19 19:29 vcs6
crw-rw----  1 root    tty      7, 128 Oct 19 19:29 vcsa
```

8. Variable files like logs in /var.

```
musfira@ubuntu:/$ ls -la /var
total 56
drwxr-xr-x 13 root root    4096 Oct 19 08:43 .
drwxr-xr-x 23 root root    4096 Oct 19 08:09 ..
drwxr-xr-x  2 root root    4096 Apr 22  2024 backups
drwxr-xr-x 14 root root    4096 Oct 19 08:44 cache
drwxrwsrwt  2 root root    4096 Aug  5 17:02 crash
drwxr-xr-x 44 root root    4096 Oct 19 08:45 lib
drwxrwsr-x  2 root staff   4096 Apr 22  2024 local
lrwxrwxrwx  1 root root       9 Aug  5 16:54 lock -> /run/lock
drwxrwxr-x 10 root syslog  4096 Oct 19 19:49 log
drwxrwsr-x  2 root mail    4096 Aug  5 16:54 mail
drwxr-xr-x  2 root root    4096 Aug  5 16:54 opt
lrwxrwxrwx  1 root root       4 Aug  5 16:54 run -> /run
drwxr-xr-x  2 root root    4096 May 21 15:46 snap
drwxr-xr-x  4 root root    4096 Aug  5 17:14 spool
drwxrwxrwt  7 root root    4096 Oct 19 19:29 tmp
-rw-r--r--  1 root root     208 Aug  5 16:54 .updated
musfira@ubuntu:/$ 
```

9. Temporary files directory /tmp.

```
musfira@ubuntu:/$ ls -la /tmp
total 52
drwxrwxrwt 13 root root 4096 Oct 19 19:29 .
drwxr-xr-x 23 root root 4096 Oct 19 08:09 ..
drwxrwxrwt  2 root root 4096 Oct 19 19:29 .font-unix
drwxrwxrwt  2 root root 4096 Oct 19 19:29 .ICE-unix
drwx------  2 root root 4096 Oct 19 19:29 snap-private-tmp
drwx------  3 root root 4096 Oct 19 19:29 systemd-private-395acbc63afd4a25b4c9780bdb00ca1a-ModemManager.service-3AqmCq
drwx------  3 root root 4096 Oct 19 19:29 systemd-private-395acbc63afd4a25b4c9780bdb00ca1a-polkit.service-TdQvFo
drwx------  3 root root 4096 Oct 19 19:29 systemd-private-395acbc63afd4a25b4c9780bdb00ca1a-systemd-logind.service-vPNGTN
drwx------  3 root root 4096 Oct 19 19:29 systemd-private-395acbc63afd4a25b4c9780bdb00ca1a-systemd-resolved.service-kIFF1s
drwx------  3 root root 4096 Oct 19 19:29 systemd-private-395acbc63afd4a25b4c9780bdb00ca1a-systemd-timesyncd.service-58PGuG
drwx------  2 root root 4096 Oct 19 19:29 vmware-root_750-2957714542
drwxrwxrwt  2 root root 4096 Oct 19 19:29 .X11-unix
drwxrwxrwt  2 root root 4096 Oct 19 19:29 .XIM-unix
musfira@ubuntu:/$ _
```

10. Contents and hidden (dot) files in home directory.

```
musfira@ubuntu:/$ ls -la ~
total 28
drwxr-x--- 4 musfira musfira 4096 Oct 19 08:44 .
drwxr-xr-x 3 root    root    4096 Oct 19 08:45 ..
-rw-r--r-- 1 musfira musfira  220 Mar 31  2024 .bash_logout
-rw-r--r-- 1 musfira musfira 3771 Mar 31  2024 .bashrc
drwx------ 2 musfira musfira 4096 Oct 19 08:44 .cache
-rw-r--r-- 1 musfira musfira  807 Mar 31  2024 .profile
drwx------ 2 musfira musfira 4096 Oct 19 08:45 .ssh
musfira@ubuntu:/$
```

11. Explanation of /bin, /usr/bin, and /usr/local/bin written in nano editor.

```
musfira@ubuntu:/$ cat ~/answers.md
/bin has basic systems commands
/usr/bin has normal user programs
/usr/local/bin has programs installed by the user
musfira@ubuntu:/$
```

Task 4

1. Created and saved README.md file.

```
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

musfira@ubuntu:~$ mkdir -p ~/lab4/workspace/python_project
musfira@ubuntu:~$ cd ~/lab4/workspace/python_project
```

2. Created and saved main.py with print statement.

```
musfira@ubuntu:~$ mkdir -p ~/lab4/workspace/python_project
musfira@ubuntu:~$ cd ~/lab4/workspace/python_project
```

3. Created .env file with environment variable.

```
musfira@ubuntu:~/lab4/workspace/python_project$ pwd
/home/musfira/lab4/workspace/python_project
```

4. Listed all files (including hidden).

```
musfira@ubuntu:~/lab4/workspace/python_project$ cat README.md
LAB 4 README
musfira@ubuntu:~/lab4/workspace/python_project$
```

5. Copied README.md to README.copy.md.

```
musfira@ubuntu:~/lab4/workspace/python_project$ cat main.py
print ("hello lab4")
musfira@ubuntu:~/lab4/workspace/python_project$
```

6. Renamed copied file to README.dev.md.

```
musfira@ubuntu:~/lab4/workspace/python_project$ cat .env
ENV=lab4
musfira@ubuntu:~/lab4/workspace/python_project$
```

7. Deleted the renamed file.

```
musfira@ubuntu:~/lab4/workspace/python_project$ ls -la
total 20
drwxrwxr-x 2 musfira musfira 4096 Oct 20 10:25 .
drwxrwxr-x 3 musfira musfira 4096 Oct 20 10:00 ..
-rw-rw-r-- 1 musfira musfira    9 Oct 20 10:25 .env
-rw-rw-r-- 1 musfira musfira   21 Oct 20 10:23 main.py
-rw-rw-r-- 1 musfira musfira   13 Oct 20 10:07 README.md
musfira@ubuntu:~/lab4/workspace/python_project$
```

8. Created new folder java_app.

```
-rw-rw-r-- 1 musfira musfira   13 Oct 20 10:07 README.md
musfira@ubuntu:~/lab4/workspace/python_project$ cp README.md README.copy.md
musfira@ubuntu:~/lab4/workspace/python_project$
```

9. Copied entire folder recursively.

```
-rw-rw-r-- 1 musfira musfira    13 Oct 20 10:07 README.md
musfira@ubuntu:~/lab4/workspace/python_project$ cp README.md README.copy.md
musfira@ubuntu:~/lab4/workspace/python_project$ mv README.copy.md README.dev.md
musfira@ubuntu:~/lab4/workspace/python_project$
```

10. Verified copied folders in workspace.

```
musfira@ubuntu:~/lab4/workspace/python_project$ rm README.dev.md
musfira@ubuntu:~/lab4/workspace/python_project$ ls -la
```

11. Displayed recent command history.

```
musfira@ubuntu:~/lab4/workspace/python_project$ mkdir -p ~/lab4/workspace/java_app
musfira@ubuntu:~/lab4/workspace/python_project$ cp -r ~/lab4/workspace/python_project
```

12. Demonstrated Linux tab auto-completion.

```
musfira@ubuntu:~/lab4/workspace/python_project$ mkdir -p ~/lab4/workspace/java_app
musfira@ubuntu:~/lab4/workspace/python_project$ cp -r ~/lab4/workspace/python_project ~/lab4/workspace/java_app_copy
```

13.   Verifying copy.

```
musfira@ubuntu:~/lab4/workspace/python_project$ ls -la ~/lab4/worksp
total 20
drwxrwxr-x 5 musfira musfira 4096 Oct 20 10:34 .
drwxrwxr-x 3 musfira musfira 4096 Oct 20 10:00 ..
drwxrwxr-x 2 musfira musfira 4096 Oct 20 10:33 java_app
drwxrwxr-x 2 musfira musfira 4096 Oct 20 10:34 java_app_copy
drwxrwxr-x 2 musfira musfira 4096 Oct 20 10:31 python_project
musfira@ubuntu:~/lab4/workspace/python_project$
```

14. History.

```
musfira@ubuntu:~/lab4/workspace/python_project$ history
     1  mkdir -p ~/lab4/workspace/python_project
     2  cd ~/lab4/workspace/python_project
     3  pwd
     4  nano README.md
     5  cccar README,md
     6  cat README.md
     7  nano main.py
     8  cat main.py
     9  nano .env
    10  cat .env
    11  ls -la
    12  cp README.md README.copy.md
    13  mv README.copy.md README.dev.md
    14  rm README.dev.md
    15  ls -la
    16  mkdir -p ~/lab4/workspace/java_app
    17  cp -r ~/lab4/workspace/python_project ~/lab4/workspace/java_app_copy
    18  ls -la ~/lab4/workspace
    19  history
```

15. Tab completion.

```
musfira@ubuntu:~/lab4/workspace/python_project$ cd ~/lab4/workspace/python_project/
musfira@ubuntu:~/lab4/workspace/python_project$
```

Task 5

1. Shows kernel and OS information.

```
musfira@ubuntu:~/lab4/workspace/python_project$ uname -a
Linux ubuntu 6.8.0-85-generic #85-Ubuntu SMP PREEMPT_DYNAMIC Thu Sep 18 15:26:59 UTC 2025 x86_64 x86_64 x86_64 GNU/Linux
musfira@ubuntu:~/lab4/workspace/python_project$ _
```

2. CPU details with model name.

```
processor       : 1
vendor_id       : AuthenticAMD
cpu family      : 23
model           : 96
model name      : AMD Ryzen 5 4500U with Radeon Graphics
stepping        : 1
microcode       : 0xffffffff
cpu MHz         : 2370.486
cache size      : 512 KB
physical id     : 2
siblings        : 1
core id         : 0
cpu cores       : 1
apicid          : 2
initial apicid  : 2
fpu             : yes
fpu_exception   : yes
cpuid level     : 13
wp              : yes
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 syscall nx mmxext pdpe1gb rdtscp lm constant
_tsc rep_good nopl tsc_reliable nonstop_tsc cpuid extd_apicid tsc_known_freq pni pclmulqdq ssse3 fma cx16 sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx f16c r
drand hypervisor lahf_lm cr8_legacy abm sse4a misalignsse 3dnowprefetch osvw topoext ssbd ibpb vmmcall fsgsbase bmi1 avx2 smep bmi2 rdseed adx smap clflushopt c
lub sha_ni xsaveopt xsavec xgetbv1 clzero arat umip rdpid overflow_recov succor
bugs            : fxsave_leak sysret_ss_attrs null_seg spectre_v1 spectre_v2 spec_store_bypass retbleed smt_rsb srso ibpb_no_ret
bogomips        : 4740.97
TLB size        : 3072 4K pages
clflush size    : 64
cache_alignment : 64
address sizes   : 45 bits physical, 48 bits virtual
power management:
```

3. Memory statistics using free -h.

```
Linux ubuntu 6.8.0-85-generic #85-Ubuntu SMP PREEMPT_DYNAMIC Thu Sep 18 15:26:59 UTC 2025
musfira@ubuntu:~/lab4/workspace/python_project$ free -h
              total        used        free      shared  buff/cache   available
Mem:          3.8Gi       518Mi       2.9Gi       1.5Mi       635Mi       3.3Gi
Swap:         2.8Gi          0B       2.8Gi
musfira@ubuntu:~/lab4/workspace/python_project$ _
```

4. Disk space usage using df -h.

```
musfira@ubuntu:~/lab4/workspace/python_project$ df -h
Filesystem                         Size  Used Avail Use% Mounted on
tmpfs                              387M  1.5M  386M   1% /run
/dev/mapper/ubuntu--vg-ubuntu--lv   14G  5.5G  7.6G  42% /
tmpfs                              1.9G     0  1.9G   0% /dev/shm
tmpfs                              5.0M     0  5.0M   0% /run/lock
/dev/sda2                          2.0G  100M  1.7G   6% /boot
tmpfs                              387M   12K  387M   1% /run/user/1000
musfira@ubuntu:~/lab4/workspace/python_project$ _
```

5. Ubuntu version information.

```
cat: /etc/os-release: No such file or directory
musfira@ubuntu:~/lab4/workspace/python_project$ cat /etc/os-release
PRETTY_NAME="Ubuntu 24.04.3 LTS"
NAME="Ubuntu"
VERSION_ID="24.04"
VERSION="24.04.3 LTS (Noble Numbat)"
VERSION_CODENAME=noble
ID=ubuntu
ID_LIKE=debian
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
UBUNTU_CODENAME=noble
LOGO=ubuntu-logo
musfira@ubuntu:~/lab4/workspace/python_project$
```

6. List of active processes using ps aux.

```
musfira    1426  0.0  0.2  20092 11008 ?        Ss   10:08   0:00 /usr/lib/systemd/systemd --user
musfira    1427  0.0  0.0  21152  3520 ?        S    10:08   0:00 (sd-pam)
musfira    1438  0.0  0.1   8788  5504 tty1     S    10:08   0:00 -bash
root       1491  0.0  0.0      0     0 ?        I<   10:09   0:00 [kworker/R-tls-s]
systemd+   1766  0.0  0.2  18992  9472 ?        Ss   10:22   0:00 /usr/lib/systemd/systemd-networkd
root       1996  0.0  0.0      0     0 ?        I<   10:24   0:00 [kworker/1:2H-kblockd]
root       2061  0.0  0.0      0     0 ?        I    10:27   0:01 [kworker/1:0-cgroup_destroy]
root       2453  0.0  0.0      0     0 ?        I    10:30   0:00 [kworker/u257:1-events_power_efficient]
root       2468  0.2  0.0      0     0 ?        I    10:35   0:02 [kworker/0:3-events]
root       2476  0.2  1.0 594880 43456 ?        Ssl  10:35   0:03 /usr/libexec/fwupd/fwupd
root       2483  0.0  0.2 313996  8960 ?        Ssl  10:35   0:00 /usr/libexec/upowerd
root       2508  0.0  0.0  81380  2872 ?        Ss   10:36   0:00 gpg-agent --homedir /var/lib/fwupd/gnupg --use-standard-socket --daemon
root       2524  0.0  0.0      0     0 ?        I    10:37   0:00 [kworker/u257:3-events_power_efficient]
root       2526  0.0  0.0      0     0 ?        I    10:38   0:00 [kworker/u258:2-events_unbound]
root       2643  0.0  0.0      0     0 ?        I    10:40   0:00 [kworker/0:0]
root       2667  0.1  0.0      0     0 ?        I    10:46   0:01 [kworker/1:2-events]
root       2670  0.0  0.0      0     0 ?        I    10:47   0:00 [kworker/u257:2-events_power_efficient]
root       2674  0.0  0.0      0     0 ?        I    10:49   0:00 [kworker/u258:0-events_power_efficient]
root       2681  0.1  0.0      0     0 ?        I    10:54   0:00 [kworker/1:1-events]
root       2686  0.0  0.0      0     0 ?        I    10:55   0:00 [kworker/u257:0-events_power_efficient]
musfira    2691  150  0.1  10884  4480 tty1     R+   10:57   0:00 ps aux
musfira@ubuntu:~/lab4/workspace/python_project$ _
```

Task 6

1. User lab4user created successfully.

```
musfira@ubuntu:~/lab4/workspace/python_project$ sudo adduser lab4user
[sudo] password for musfira:
info: Adding user `lab4user' ...
info: Selecting UID/GID from range 1000 to 59999 ...
info: Adding new group `lab4user' (1001) ...
info: Adding new user `lab4user' (1001) with group `lab4user (1001)' ...
info: Creating home directory `/home/lab4user' ...
info: Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for lab4user
Enter the new value, or press ENTER for the default
        Full Name []: musfira
        Room Number []:
        Work Phone []:
        Home Phone []:
        Other []:
Is the information correct? [Y/n] y
info: Adding new user `lab4user' to supplemental / extra groups `users' ...
info: Adding user `lab4user' to group `users' ...
musfira@ubuntu:~/lab4/workspace/python_project$
```

2. Verified user entry in system database.

```
musfira@ubuntu:~/lab4/workspace/python_project$ getent passwd lab4user
lab4user:x:1001:1001:musfira,,,:/home/lab4user:/bin/bash
musfira@ubuntu:~/lab4/workspace/python_project$
```

3. Logged in as lab4user.

```
lab4user:x:1001:1001:musfira,,,:/home/lab4user:/bin/bash
musfira@ubuntu:~/lab4/workspace/python_project$ su - lab4user
Password:
lab4user@ubuntu:~$ _
```

4. Attempt to use sudo (expected failure).

```
Password:
lab4user@ubuntu:~$ sudo whoami
[sudo] password for lab4user:
lab4user is not in the sudoers file.
lab4user@ubuntu:~$ _
```

5. Returned to main account.

```
musfira@ubuntu:~/lab4/workspace/python_project$
```

6. (Optional) Deleted the test user.

```
musfira@ubuntu:~/lab4/workspace/python_project$ sudo deluser --remove-home lab4user
info: Looking for files to backup/remove ...
info: Removing files ...
info: Removing crontab ...
info: Removing user `lab4user' ...
musfira@ubuntu:~/lab4/workspace/python_project$
```

Bonus Task 7

1. Script content in nano editor.


```
  GNU nano 7.2
#!/bin/bash
echo "Lab 4 demo: current user is $(whoammi)"
echo "Current time: $(date)"
uptime
free -h
```

2. Script made executable.


```
musfira@ubuntu:~/lab4/workspace/python_project$ chmod +x ~/lab4/workspace/run-demo.sh
musfira@ubuntu:~/lab4/workspace/python_project$ ~/lab4/workspace/run-demo.sh
```

3. Script executed successfully.


```
musfira@ubuntu:~/lab4/workspace/python_project$ ~/lab4/workspace/run-demo.sh
/home/musfira/lab4/workspace/run-demo.sh: line 2: whoammi: command not found
Lab 4 demo: current user is
Current time: Mon Oct 20 11:28:37 AM UTC 2025
 11:28:37 up  1:20,  1 user,  load average: 0.00, 0.00, 0.00
               total        used        free      shared  buff/cache   available
Mem:           3.8Gi       521Mi       2.9Gi       1.5Mi       645Mi       3.3Gi
Swap:          2.8Gi          0B       2.8Gi
musfira@ubuntu:~/lab4/workspace/python_project$
```

4. (Optional) Script run with sudo privileges.


```
Swap:          2.8Gi          0B       2.8Gi
musfira@ubuntu:~/lab4/workspace/python_project$ sudo ~/lab4/workspace/run-demo.sh
/home/musfira/lab4/workspace/run-demo.sh: line 2: whoammi: command not found
Lab 4 demo: current user is
Current time: Mon Oct 20 11:30:34 AM UTC 2025
 11:30:34 up  1:22,  1 user,  load average: 0.00, 0.00, 0.00
               total        used        free      shared  buff/cache   available
Mem:           3.8Gi       522Mi       2.9Gi       1.5Mi       645Mi       3.3Gi
Swap:          2.8Gi          0B       2.8Gi
musfira@ubuntu:~/lab4/workspace/python_project$
```

Exam Evaluation Questions

Q1 – Remote Access Verification

1. Remote SSH connection established.

```
 musfira@ubuntu: ~          ×    +  ∨
Microsoft Windows [Version 10.0.26100.6899]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Musfi>ssh musfira@192.168.111.136
musfira@192.168.111.136's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.8.0-85-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Mon Oct 20 11:33:56 AM UTC 2025

  System load:  0.0              Processes:             219
  Usage of /:   39.7% of 13.67GB Users logged in:       1
  Memory usage: 9%               IPv4 address for ens33: 192.168.111.136
  Swap usage:   0%

Expanded Security Maintenance for Applications is not enabled.

26 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Last login: Sun Oct 19 19:31:31 2025 from 192.168.111.1
musfira@ubuntu:~$ |
```

2. Verified user and home directory.


```
musfira@ubuntu:~/lab4/workspace/python_project$ whoami
musfira
musfira@ubuntu:~/lab4/workspace/python_project$ echo $HOME
/home/musfira
musfira@ubuntu:~/lab4/workspace/python_project$
```

3. Confirmed correct host system.


```
musfira@ubuntu:~/lab4/workspace/python_project$ hostname
ubuntu
musfira@ubuntu:~/lab4/workspace/python_project$ uname -n
ubuntu
```

Q2 – Filesystem Inspection for Forensic Evidence

1. Root directory listing.


```
musfira@ubuntu:~/lab4/workspace/python_project$ ls /
bin            boot  dev  home  lib64              lost+found  mnt  proc  run   sbin.usr
bin.usr-is-merged  cdrom  etc  lib   lib.usr-is-merged  media       opt  root  sbin  snap
musfira@ubuntu:~/lab4/workspace/python_project$ _
```

2. OS version and release info.


```
musfira@ubuntu:~/lab4/workspace/python_project$ cat /etc/os-release
PRETTY_NAME="Ubuntu 24.04.3 LTS"
NAME="Ubuntu"
VERSION_ID="24.04"
VERSION="24.04.3 LTS (Noble Numbat)"
VERSION_CODENAME=noble
ID=ubuntu
ID_LIKE=debian
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
UBUNTU_CODENAME=noble
LOGO=ubuntu-logo
musfira@ubuntu:~/lab4/workspace/python_project$
```

3. Listings for /bin, /sbin, /usr, /opt, /etc, /dev, /var, /tmp.

4. Hidden files in home directory.

```
musfira@ubuntu:~/lab4/workspace/python_project$ ls -la ~
total 40
drwxr-x--- 6 musfira musfira 4096 Oct 20 11:11 .
drwxr-xr-x 3 root    root    4096 Oct 20 11:18 ..
-rw-rw-r-- 1 musfira musfira  116 Oct 19 19:55 answers.md
-rw-r--r-- 1 musfira musfira  220 Mar 31  2024 .bash_logout
-rw-r--r-- 1 musfira musfira 3771 Mar 31  2024 .bashrc
drwx------ 2 musfira musfira 4096 Oct 19 08:44 .cache
drwxrwxr-x 3 musfira musfira 4096 Oct 20 10:00 lab4
drwxrwxr-x 3 musfira musfira 4096 Oct 19 19:53 .local
-rw-r--r-- 1 musfira musfira  807 Mar 31  2024 .profile
drwx------ 2 musfira musfira 4096 Oct 19 08:45 .ssh
-rw-r--r-- 1 musfira musfira    0 Oct 20 11:11 .sudo_as_admin_successful
musfira@ubuntu:~/lab4/workspace/python_project$
```

5. Markdown summary of findings.

```
/bin : Basic user commands
/sbin : system tools for admin use
/usr : user programs and files
/opt : Extra or optional software
/etc : system and app setting
/dev : hardware device files
/var : logs and variable data
/tmp : temporary files
```

Q3 – Evidence Handling & File Operations

1. Created structured workspace.

```
musfira@ubuntu:~/lab4/workspace/python_project$ mkdir -p ~/analysis_workspace/suspicious_files
musfira@ubuntu:~/lab4/workspace/python_project$ _
```

2. Three text files created (one hidden).

```
musfira@ubuntu:~/lab4/workspace/python_project$ mkdir -p ~/analysis_workspace/susp
musfira@ubuntu:~/lab4/workspace/python_project$ cd ~/analysis_workspace
musfira@ubuntu:~/analysis_workspace$ touch file1.txt file2.txt .hidden_note.txt
musfira@ubuntu:~/analysis_workspace$ ls -la
total 12
drwxrwxr-x 3 musfira musfira 4096 Oct 20 11:55 .
drwxr-x--- 7 musfira musfira 4096 Oct 20 11:54 ..
-rw-rw-r-- 1 musfira musfira    0 Oct 20 11:55 file1.txt
-rw-rw-r-- 1 musfira musfira    0 Oct 20 11:55 file2.txt
-rw-rw-r-- 1 musfira musfira    0 Oct 20 11:55 .hidden_note.txt
drwxrwxr-x 2 musfira musfira 4096 Oct 20 11:54 suspicious_files
musfira@ubuntu:~/analysis_workspace$
```

3. Backup copy, rename, and delete demonstrated.

```
musfira@ubuntu:~/analysis_workspace$ cp file1.txt file1_backup.txt
musfira@ubuntu:~/analysis_workspace$ mv file1_backupp.txt file1_copy.txt
mv: cannot stat 'file1_backupp.txt': No such file or directory
musfira@ubuntu:~/analysis_workspace$ mv file1_backup.txt file1_copy.txt
musfira@ubuntu:~/analysis_workspace$ rm file1_copy.txt
musfira@ubuntu:~/analysis_workspace$ _
```

4. Copied workspace as backup folder.

```
musfira@ubuntu:~/analysis_workspace$ cp -r ~/analysis_workspace ~/analysis_backup
musfira@ubuntu:~/analysis_workspace$ ls ~
analysis_backup  analysis_workspace  answers.md  lab4
musfira@ubuntu:~/analysis_workspace$ _
```

5. Displayed command history for documentation.

```
   57  cat /etc/os-release
   58  ls /bin /sbin /usr /opt /etc /dev /var /tmp
   59  cleaaar
   60  clear
   61  ls -la ~
   62  nano ~/lab4/workspace/filesystem_report.md
   63  cat filesystem_report.md
   64  clear
   65  mkdir -p ~/analysis_workspace/suspicious_files
   66  cd ~/analysis_workspace
   67  touch file1.txt file2.txt .hidden_note.txt
   68  ls -la
   69  cp file1.txt file1_backup.txt
   70  mv file1_backupp.txt file1_copy.txt
   71  mv file1_backup.txt file1_copy.txt
   72  rm file1_copy.txt
   73  cp -r ~/analysis_workspace ~/analysis_backup
   74  ls ~
   75  history
musfira@ubuntu:~/analysis_workspace$ _
```
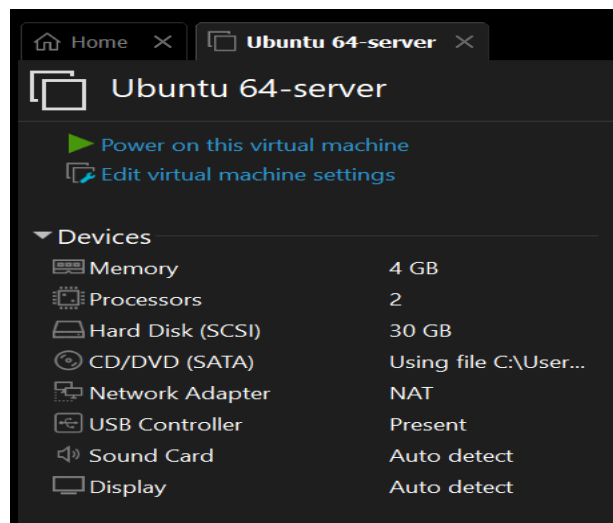
6. Shown tab auto-completion example.

```
musfira@ubuntu:~/analysis_workspace$ cat  f
f                   file1_backup.txt        file1.txt               filesystem_report.md
file1_backupp.txt   file1_copy.txt          file2.txt               free
musfira@ubuntu:~/analysis_workspace$ cat  f
```

Q4 – System Profiling & Process Monitoring

1. Kernel and OS version.

```
musfira@ubuntu:~$ uname -a
Linux ubuntu 6.8.0-85-generic #85-Ubuntu SMP PREEMPT_DYNAMIC Thu Sep 18 15:26:59 UTC 2025 x86_64 x86_64 x86_64 GNU/Linux
musfira@ubuntu:~$ _
```

2. CPU, memory, and disk stats.

⌂ Home ✕	▭ **Ubuntu 64-server** ✕
▭ **Ubuntu 64-server**	
▶ Power on this virtual machine	
⌨ Edit virtual machine settings	
▼ **Devices**	
▦ Memory	4 GB
▦ Processors	2
⊟ Hard Disk (SCSI)	30 GB
⊙ CD/DVD (SATA)	Using file C:\User…
⊡ Network Adapter	NAT
⊡ USB Controller	Present
◁» Sound Card	Auto detect
⊟ Display	Auto detect

3. Running processes list.

```
root        1278  0.0  0.0      0     0 ?        I<   19:35   0:00 [kworker/1:2H-kblockd]
root        1291  0.0  0.0      0     0 ?        I<   19:35   0:00 [kworker/0:2H]
root        1292  0.0  0.0      0     0 ?        I    19:35   0:00 [kworker/u258:5-events_unbound]
root        1316  0.0  0.0      0     0 ?        I    19:41   0:00 [kworker/u258:0-events_unbound]
root        1416  0.0  0.0      0     0 ?        S    19:44   0:00 [psimon]
root        1418  0.0  0.0      0     0 ?        I    19:44   0:00 [kworker/0:0-events]
musfira      1419  0.1  0.2  20276 11136 ?        Ss   19:44   0:00 /usr/lib/systemd/systemd --user
musfira      1420  0.0  0.0  21152  3520 ?        S    19:44   0:00 (sd-pam)
musfira      1431  0.0  0.1   8652  5504 tty1     S    19:44   0:00 -bash
root        1472  0.0  0.0      0     0 ?        I<   19:44   0:00 [kworker/R-tls-s]
root        1474  0.1  0.0      0     0 ?        I    19:44   0:00 [kworker/1:0-events]
root        1476  0.0  0.0      0     0 ?        I<   19:44   0:00 [kworker/0:0H]
root        1484  0.0  0.0      0     0 ?        I    19:46   0:00 [kworker/u257:0-events_power_efficient]
root        1485  0.0  0.0      0     0 ?        I    19:47   0:00 [kworker/u258:1-events_power_efficient]
musfira      1486  200  0.1  10884  4480 tty1     R+   19:47   0:00 ps aux
musfira@ubuntu:~$ _
```

Q5 – User Account Audit & Privilege Escalation Simulation

1. New user lab4user added.

```
musfira@ubuntu:~/analysis_workspace$ sudo add user lab4user
[sudo] password for musfira:
sudo: add: command not found
musfira@ubuntu:~/analysis_workspace$ sudo adduser lab4user
info: Adding user `lab4user' ...
info: Selecting UID/GID from range 1000 to 59999 ...
info: Adding new group `lab4user' (1001) ...
info: Adding new user `lab4user' (1001) with group `lab4user (1001)' ...
info: Creating home directory `/home/lab4user' ...
info: Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for lab4user
Enter the new value, or press ENTER for the default
        Full Name []:
        Room Number []:
        Work Phone []:
        Home Phone []:
        Other []:
Is the information correct? [Y/n] y
info: Adding new user `lab4user' to supplemental / extra groups `users' ...
info: Adding user `lab4user' to group `users' ...
musfira@ubuntu:~/analysis_workspace$
```

2. Verified user record in system.

```
info: Adding user `lab4user' to group `users' ...
musfira@ubuntu:~/analysis_workspace$ getent passwd lab4user
lab4user:x:1001:1001:,,,:/home/lab4user:/bin/bash
musfira@ubuntu:~/analysis_workspace$
```

3. Logged in as lab4user.

```
musfira@ubuntu:~/analysis_workspace$ su - lab4user
Password:
lab4user@ubuntu:~$ _
```

4. Attempted sudo command (denied).

```
lab4user@ubuntu:~$ sudo ls /root
[sudo] password for lab4user:
lab4user is not in the sudoers file.
lab4user@ubuntu:~$
```

5. Returned to main analyst account.

```
musfira@ubuntu:~/analysis_workspace$
```

6. Checked authentication logs for login attempts.

7. (Optional) Deleted test user after audit.


```
musfira@ubuntu:~/analysis_workspace$ sudo deluser --remove-home lab4user
info: Looking for files to backup/remove ...
info: Removing files ...
info: Removing crontab ...
info: Removing user `lab4user' ...
musfira@ubuntu:~/analysis_workspace$ getent passwd lab4user
musfira@ubuntu:~/analysis_workspace$
```