

LAB 2

LINUX BASIC - SHELL SCRIPTING



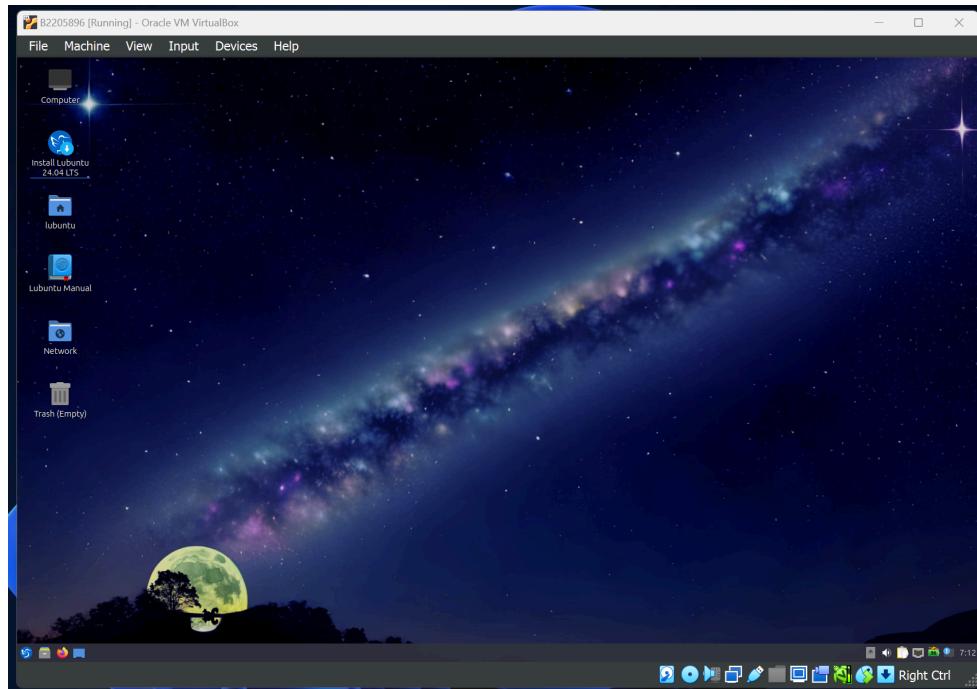
Full name: Nguyen Minh Nhut

Student ID: B2205896

- Note: screenshots need to be clear and good-looking; submissions must be in PDF format.

1. Lubuntu/Ubuntu installation

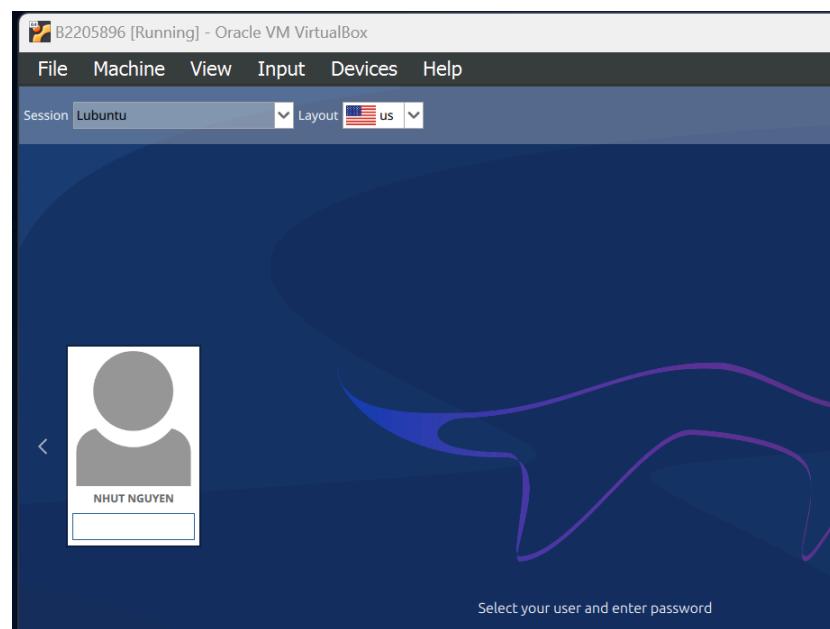
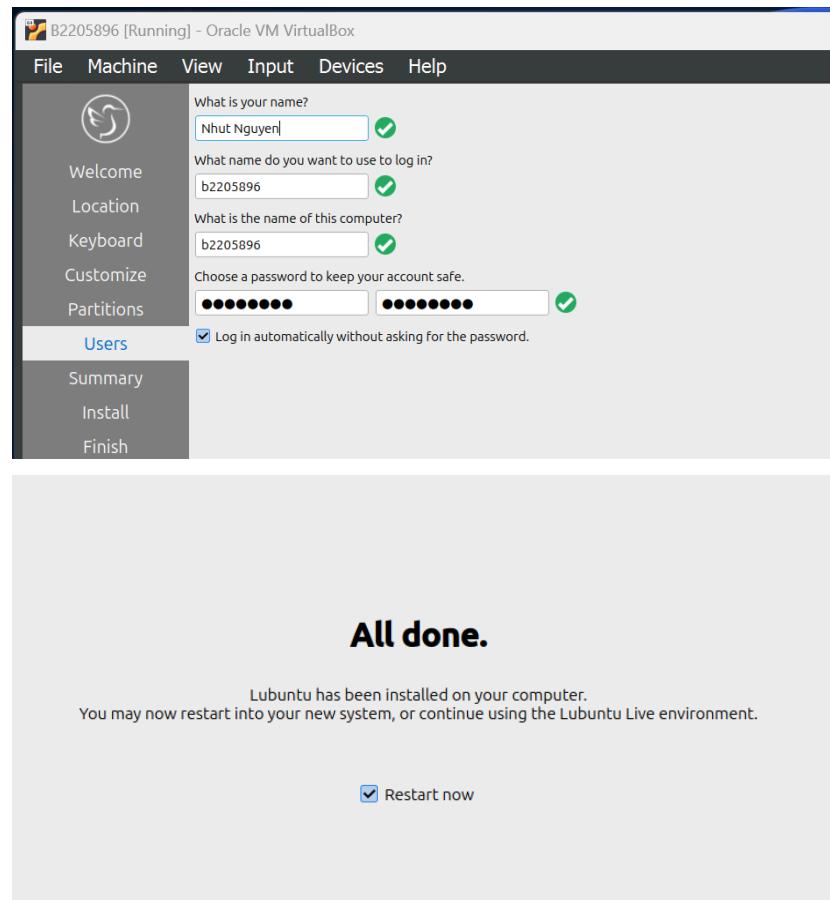
- 1.1. Create a virtual machine using VirtualBox/VMWare.



- 1.2. Install Lubuntu Desktop 24.04 LTS (or any other Linux distributions) as the OS of the VM.

During the installation process, create an account with a username being your student ID (take a screenshot after finishing the installation).

+ Please disable networking before installing the OS.

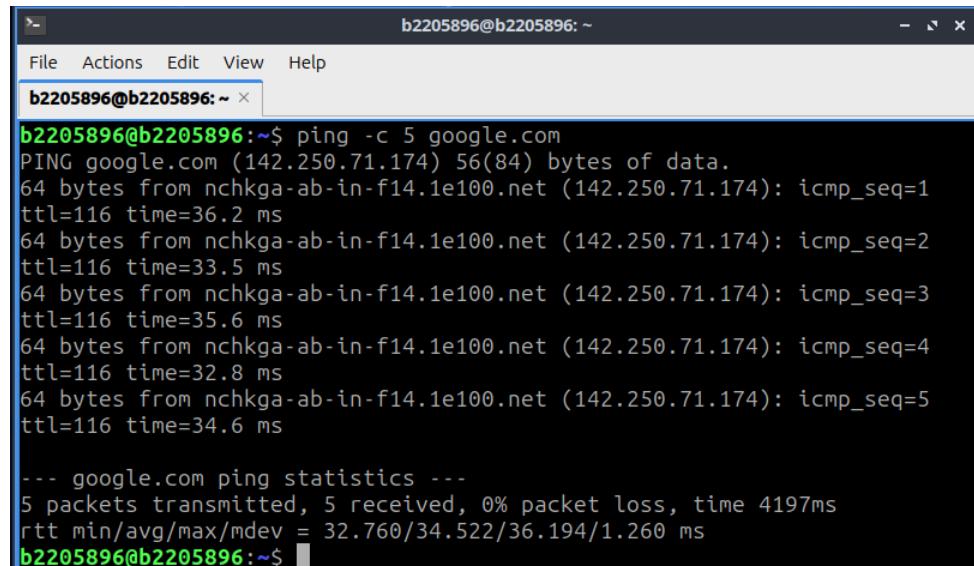


- 1.3. Configure network and proxy settings using graphical user interface (**if necessary**)
- 1.4. Setting up proxy for command line (**if necessary**)

```
$sudo featherpad /etc/environment
- Appending the below lines to the file
  http_proxy="http://proxy.ctu.edu.vn:3128"
  https_proxy="http://proxy.ctu.edu.vn:3128"
  ftp_proxy="http://proxy.ctu.edu.vn:3128"
  no_proxy=localhost,127.0.0.1
$source /etc/environment
```

1.5. Verifying network connections

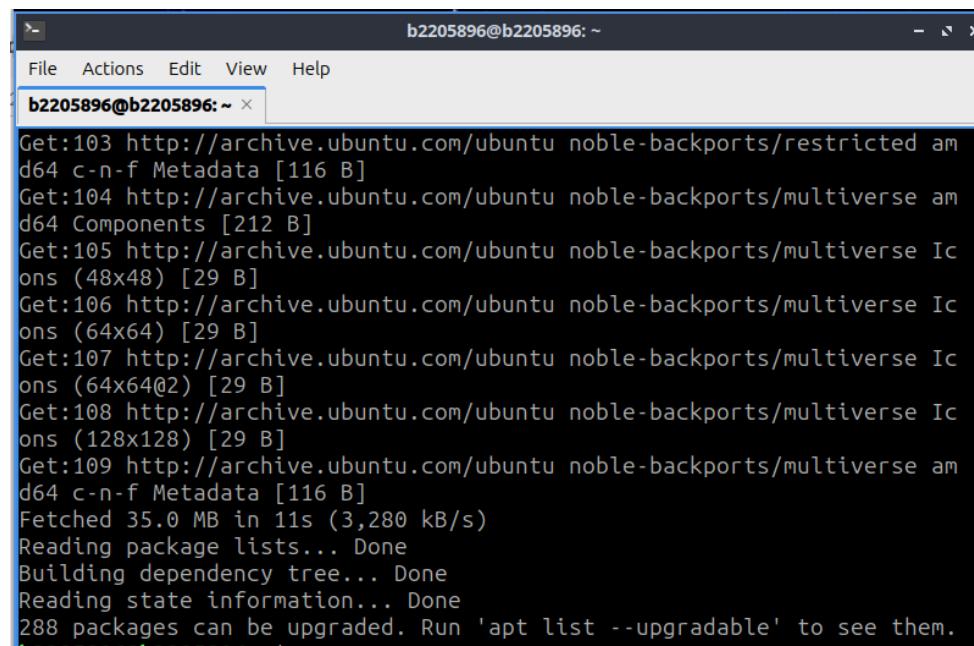
```
$ping -c 5 google.com
```



```
b2205896@b2205896:~$ ping -c 5 google.com
PING google.com (142.250.71.174) 56(84) bytes of data.
64 bytes from nchkga-ab-in-f14.1e100.net (142.250.71.174): icmp_seq=1
ttl=116 time=36.2 ms
64 bytes from nchkga-ab-in-f14.1e100.net (142.250.71.174): icmp_seq=2
ttl=116 time=33.5 ms
64 bytes from nchkga-ab-in-f14.1e100.net (142.250.71.174): icmp_seq=3
ttl=116 time=35.6 ms
64 bytes from nchkga-ab-in-f14.1e100.net (142.250.71.174): icmp_seq=4
ttl=116 time=32.8 ms
64 bytes from nchkga-ab-in-f14.1e100.net (142.250.71.174): icmp_seq=5
ttl=116 time=34.6 ms

--- google.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4197ms
rtt min/avg/max/mdev = 32.760/34.522/36.194/1.260 ms
b2205896@b2205896:~$
```

```
$sudo apt update
```



```
b2205896@b2205896:~$ sudo apt update
[sudo] password for b2205896: 
Get:103 http://archive.ubuntu.com/ubuntu noble-backports/restricted amd64 c-n-f Metadata [116 B]
Get:104 http://archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Get:105 http://archive.ubuntu.com/ubuntu noble-backports/multiverse Icons (48x48) [29 B]
Get:106 http://archive.ubuntu.com/ubuntu noble-backports/multiverse Icons (64x64) [29 B]
Get:107 http://archive.ubuntu.com/ubuntu noble-backports/multiverse Icons (64x64@2) [29 B]
Get:108 http://archive.ubuntu.com/ubuntu noble-backports/multiverse Icons (128x128) [29 B]
Get:109 http://archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 c-n-f Metadata [116 B]
Fetched 35.0 MB in 11s (3,280 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
288 packages can be upgraded. Run 'apt list --upgradable' to see them.
b2205896@b2205896:~$
```

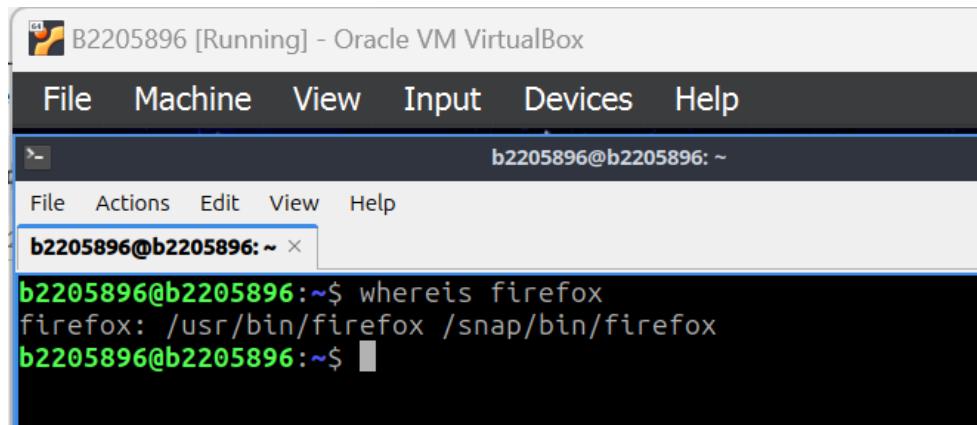
(take a screenshot of the login screen)

2. Basic operations

2.1. Accessing Directories

- Locate the application titled "firefox" using **whereis** command.

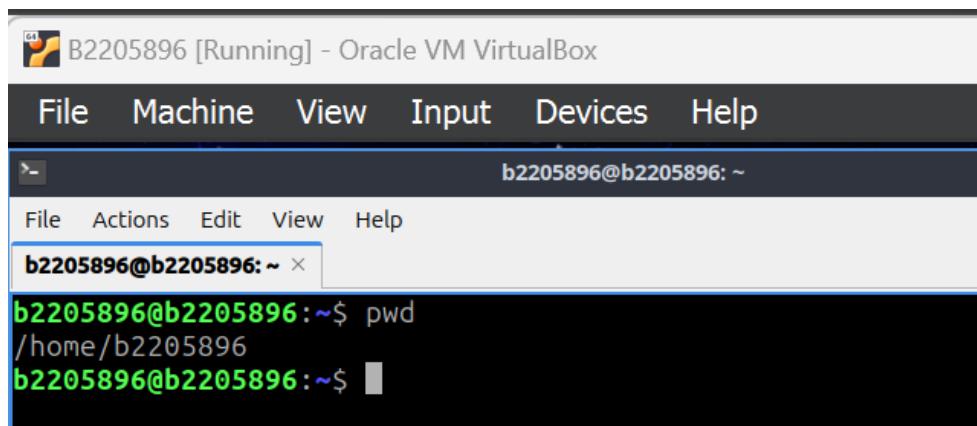
```
$whereis firefox
```



The screenshot shows a terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The window has a menu bar with File, Machine, View, Input, Devices, and Help. Below the menu bar is a toolbar with File, Actions, Edit, View, and Help. The main area of the terminal shows the command \$whereis firefox being run, followed by its output: firefox: /usr/bin/firefox /snap/bin/firefox. The prompt b2205896@b2205896:~\$ is visible at the end of the command line.

- Display the present working directory.

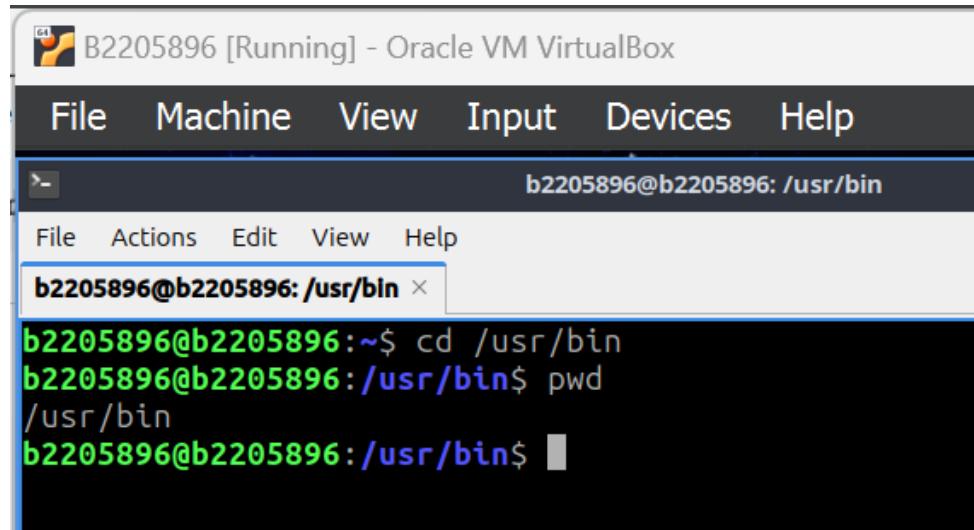
```
$pwd
```



The screenshot shows a terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The window has a menu bar with File, Machine, View, Input, Devices, and Help. Below the menu bar is a toolbar with File, Actions, Edit, View, and Help. The main area of the terminal shows the command \$pwd being run, followed by its output: /home/b2205896. The prompt b2205896@b2205896:~\$ is visible at the end of the command line.

- Change the current working directory to **/usr/bin** directory.

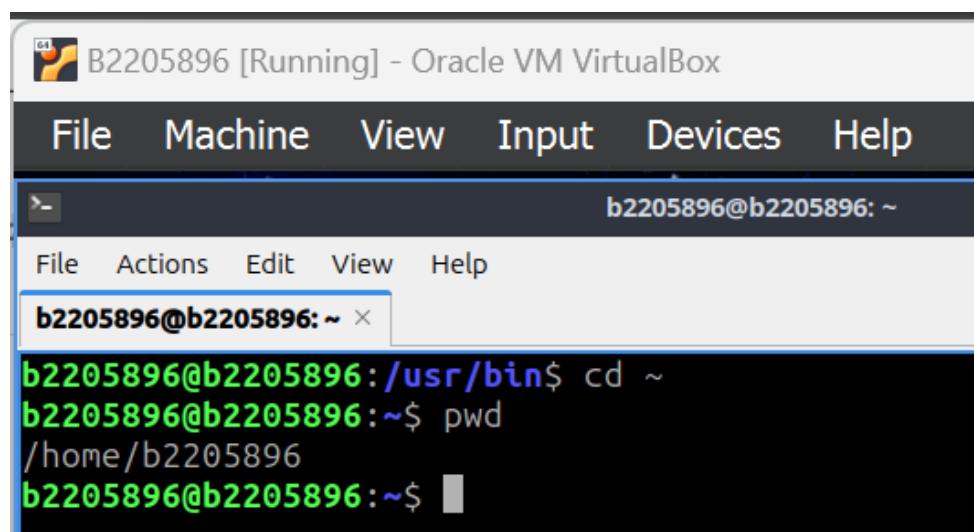
```
$cd /usr/bin
```



```
b2205896@b2205896:~$ cd /usr/bin  
b2205896@b2205896:/usr/bin$ pwd  
/usr/bin  
b2205896@b2205896:/usr/bin$
```

- Change the current working directory to \$HOME directory.

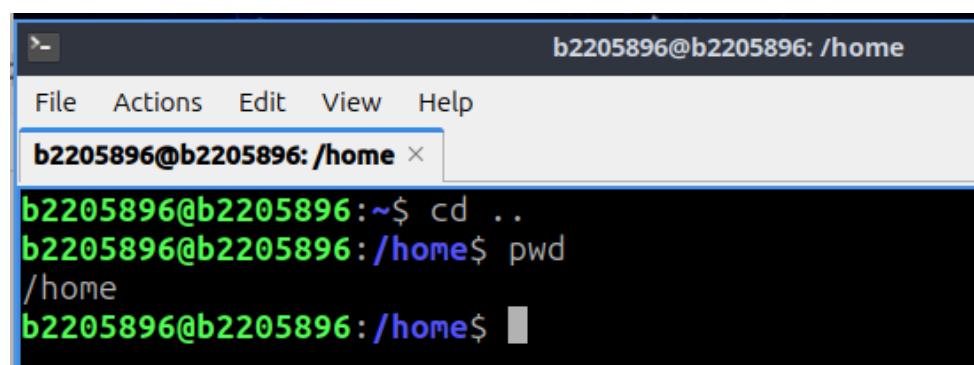
```
$cd ~
```



```
b2205896@b2205896:~$ cd ~  
b2205896@b2205896:~$ pwd  
/home/b2205896  
b2205896@b2205896:~$
```

- Move to the parent directory.

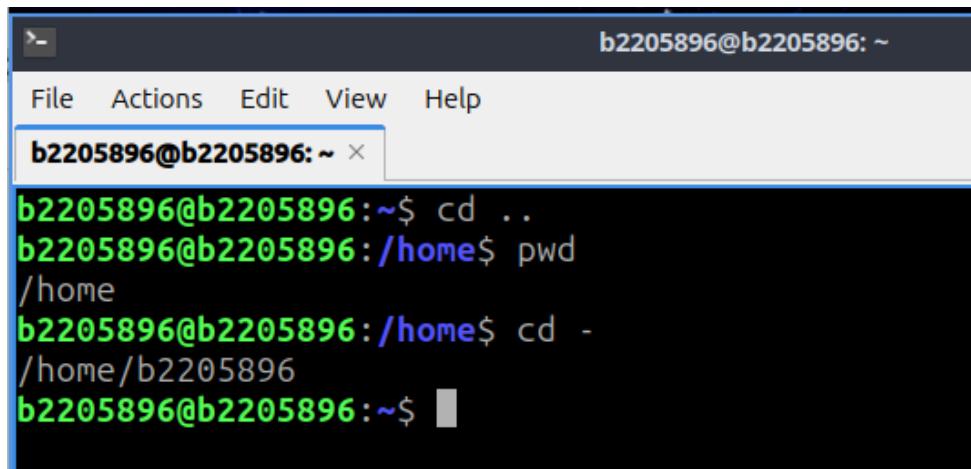
```
$cd ..
```



```
b2205896@b2205896:/home$ cd ..  
b2205896@b2205896:/home$ pwd  
/home  
b2205896@b2205896:/home$
```

- Go to the previous directory by the shortcut method, i.e., using '-' operator.

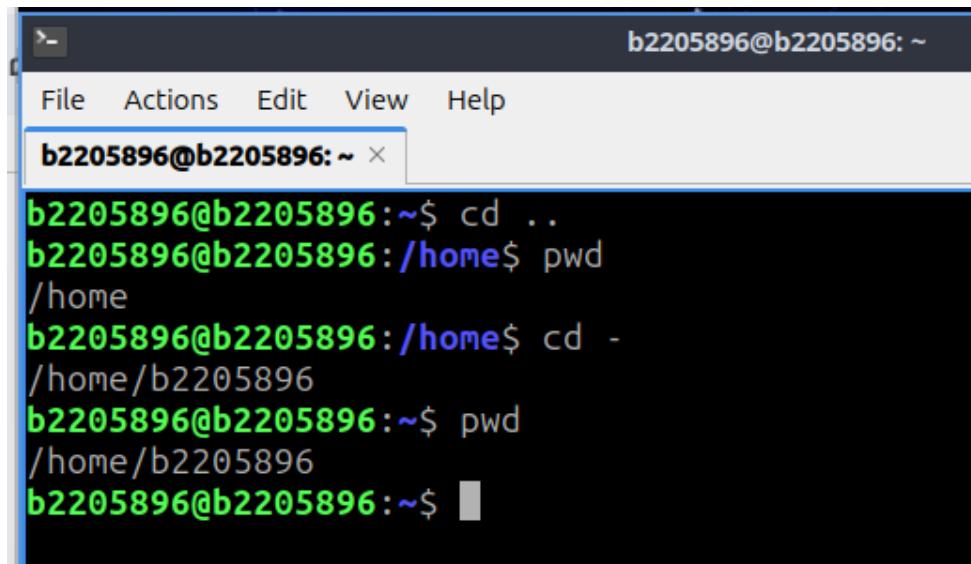
```
$cd -
```



```
b2205896@b2205896:~$ cd ..
b2205896@b2205896:/home$ pwd
/home
b2205896@b2205896:/home$ cd -
/home/b2205896
b2205896@b2205896:~$
```

- Display the present working directory.

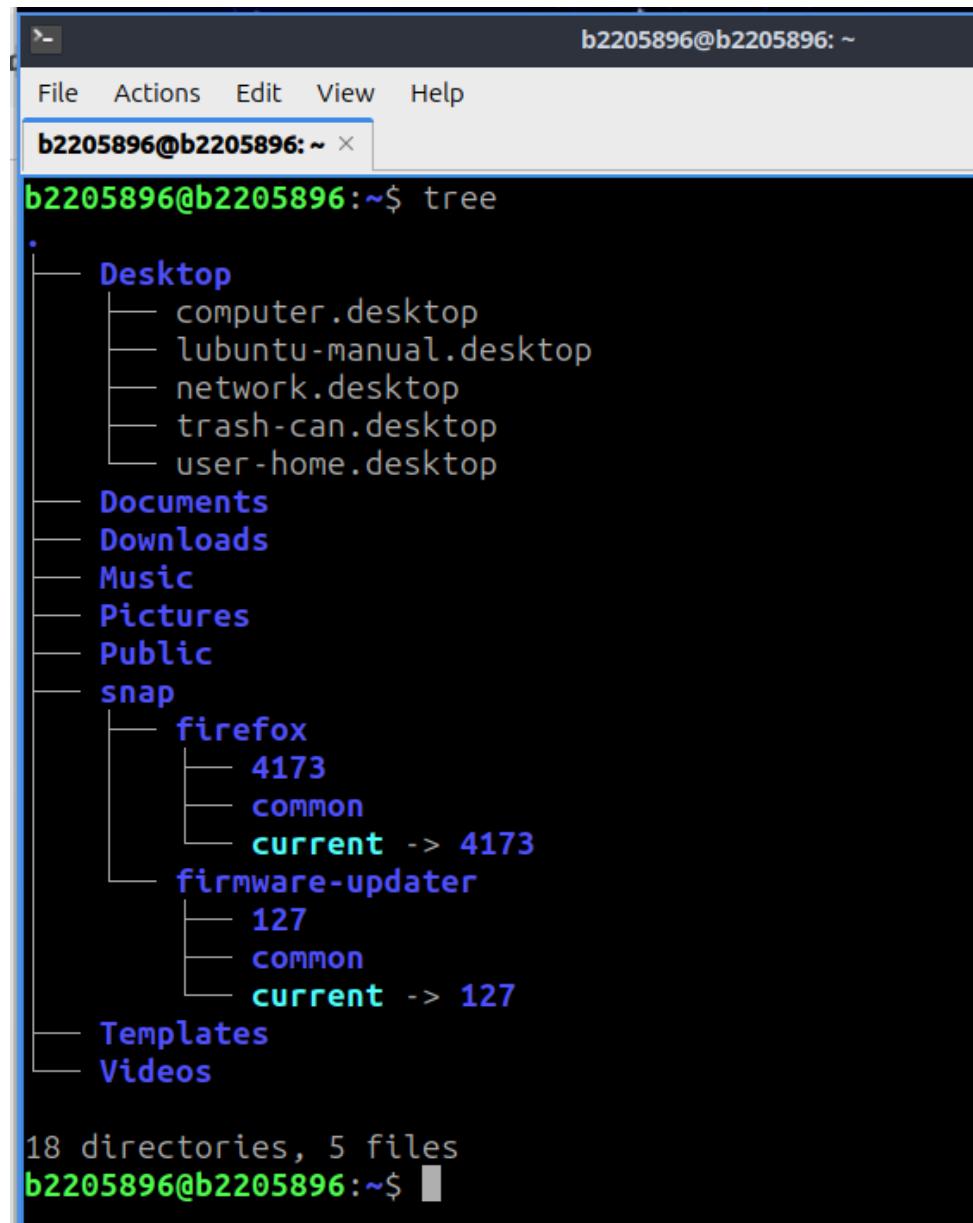
```
$pwd
```



```
b2205896@b2205896:~$ cd ..
b2205896@b2205896:/home$ pwd
/home
b2205896@b2205896:/home$ cd -
/home/b2205896
b2205896@b2205896:~$ pwd
/home/b2205896
b2205896@b2205896:~$
```

- Display the filesystem tree of the current directory

```
$tree
```



```
b2205896@b2205896:~$ tree
.
├── Desktop
│   ├── computer.desktop
│   ├── lubuntu-manual.desktop
│   ├── network.desktop
│   ├── trash-can.desktop
│   └── user-home.desktop
├── Documents
├── Downloads
├── Music
├── Pictures
├── Public
└── snap
    ├── firefox
    │   ├── 4173
    │   └── common
    │       ├── current -> 4173
    │       └── firmware-updater
    │           ├── 127
    │           └── common
    │               ├── current -> 127
    └── Templates
    └── Videos

18 directories, 5 files
b2205896@b2205896:~$
```

(take a screenshot of the console)

2.2. Working With Files and Directories

- Using **touch**, create **file1** and **file2** (two empty files) with timestamp: 20 October 2020 2:00 PM.

```
$ touch -t 202010201400 file1 file2
```

A screenshot of a terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The terminal window has a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". Below the menu bar is a toolbar with "File", "Actions", "Edit", "View", and "Help". The main area shows a command-line session:

```
b2205896@b2205896:~$ touch -t 202010201400 file1 file2
b2205896@b2205896:~$ ls -l
total 40
drwxrwxr-x 2 b2205896 b2205896 4096 Sep  6 15:04 Desktop
drwxrwxr-x 2 b2205896 b2205896 4096 Sep  6 15:19 dir1
drwxr-xr-x 2 b2205896 b2205896 4096 Sep  6 14:30 Documents
drwxr-xr-x 2 b2205896 b2205896 4096 Sep  6 14:30 Downloads
-rw-rw-r-- 1 b2205896 b2205896     0 Oct 20 2020 file1
-rw-rw-r-- 1 b2205896 b2205896     0 Oct 20 2020 file2
drwxr-xr-x 2 b2205896 b2205896 4096 Sep  6 14:30 Music
drwxr-xr-x 2 b2205896 b2205896 4096 Sep  6 14:30 Pictures
drwxr-xr-x 2 b2205896 b2205896 4096 Sep  6 14:30 Public
drwx----- 4 b2205896 b2205896 4096 Sep  6 15:00 snap
drwxr-xr-x 2 b2205896 b2205896 4096 Sep  6 14:30 Templates
drwxr-xr-x 2 b2205896 b2205896 4096 Sep  6 14:30 Videos
b2205896@b2205896:~$
```

- Check for the existence of **file1** and **file2** using **ls -l**.

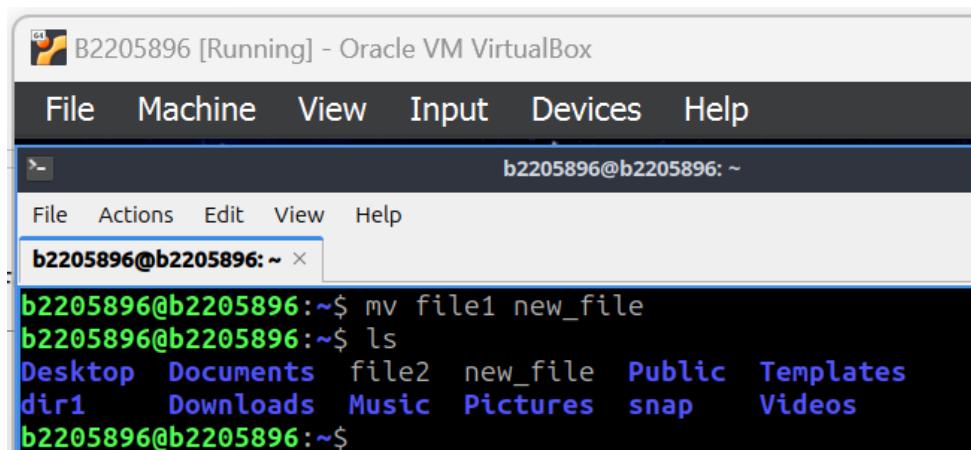
```
$ls -l file1 file2
```

A screenshot of a terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The terminal window has a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". Below the menu bar is a toolbar with "File", "Actions", "Edit", "View", and "Help". The main area shows a command-line session:

```
b2205896@b2205896:~$ ls -l file1 file2
-rw-rw-r-- 1 b2205896 b2205896 0 Oct 20 2020 file1
-rw-rw-r-- 1 b2205896 b2205896 0 Oct 20 2020 file2
b2205896@b2205896:~$
```

- Rename **file1** to **new_file1** using **mv**.

```
$mv file1 new_file1
```



B2205896 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

b2205896@b2205896: ~

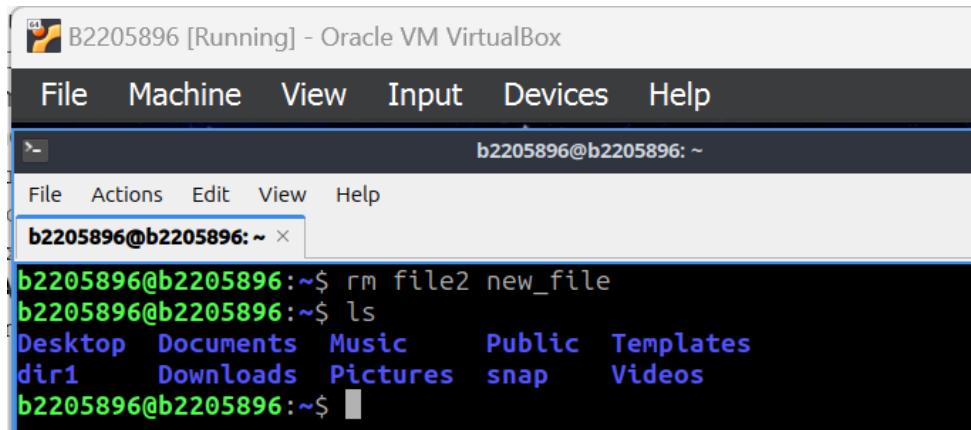
File Actions Edit View Help

b2205896@b2205896: ~ ×

```
b2205896@b2205896:~$ mv file1 new_file
b2205896@b2205896:~$ ls
Desktop Documents file2 new_file Public Templates
dir1 Downloads Music Pictures snap Videos
b2205896@b2205896:~$
```

- Remove **file2** and **new_file1** using **rm** without any options.

```
$rm file2 new_file1
```



B2205896 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

b2205896@b2205896: ~

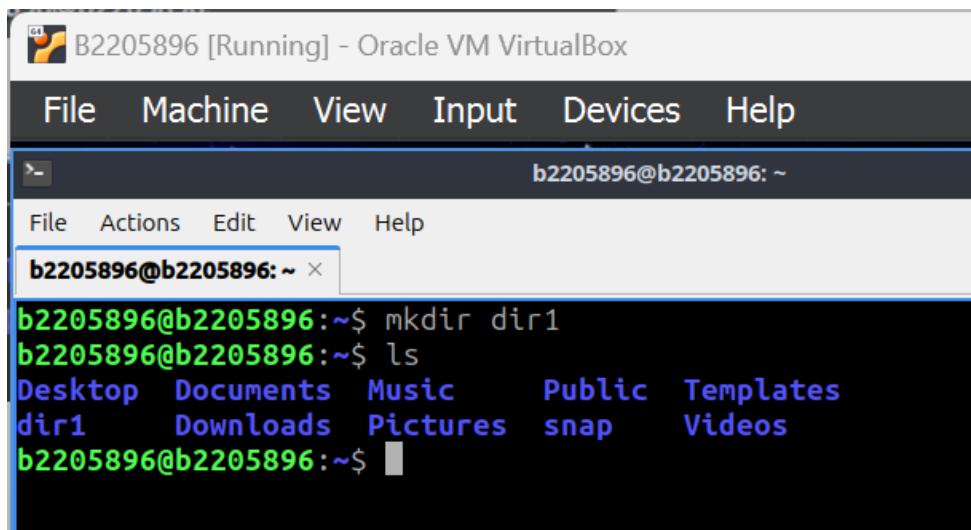
File Actions Edit View Help

b2205896@b2205896: ~ ×

```
b2205896@b2205896:~$ rm file2 new_file
b2205896@b2205896:~$ ls
Desktop Documents Music Public Templates
dir1 Downloads Pictures snap Videos
b2205896@b2205896:~$
```

- Create a directory named **dir1**, using **mkdir**.

```
$mkdir dir1
```



B2205896 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

b2205896@b2205896: ~

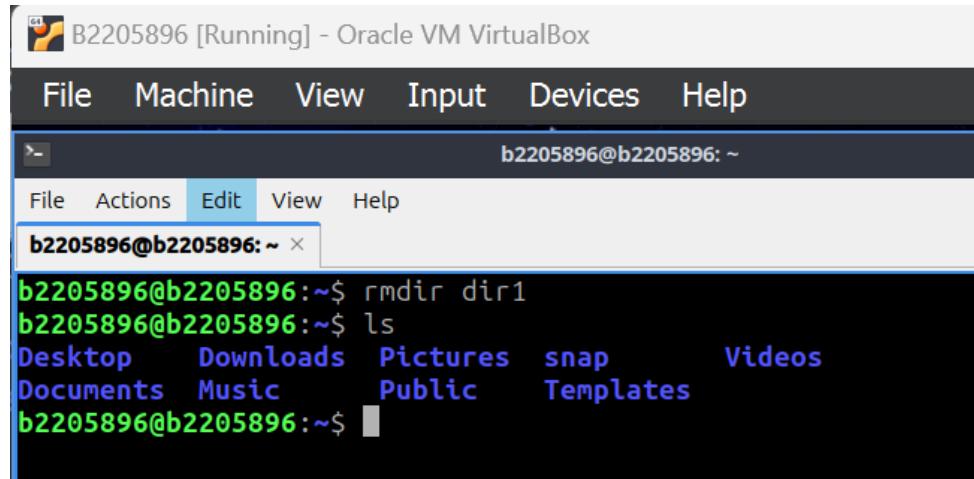
File Actions Edit View Help

b2205896@b2205896: ~ ×

```
b2205896@b2205896:~$ mkdir dir1
b2205896@b2205896:~$ ls
Desktop Documents Music Public Templates
dir1 Downloads Pictures snap Videos
b2205896@b2205896:~$
```

- Remove **dir1** using **rmdir** without any options

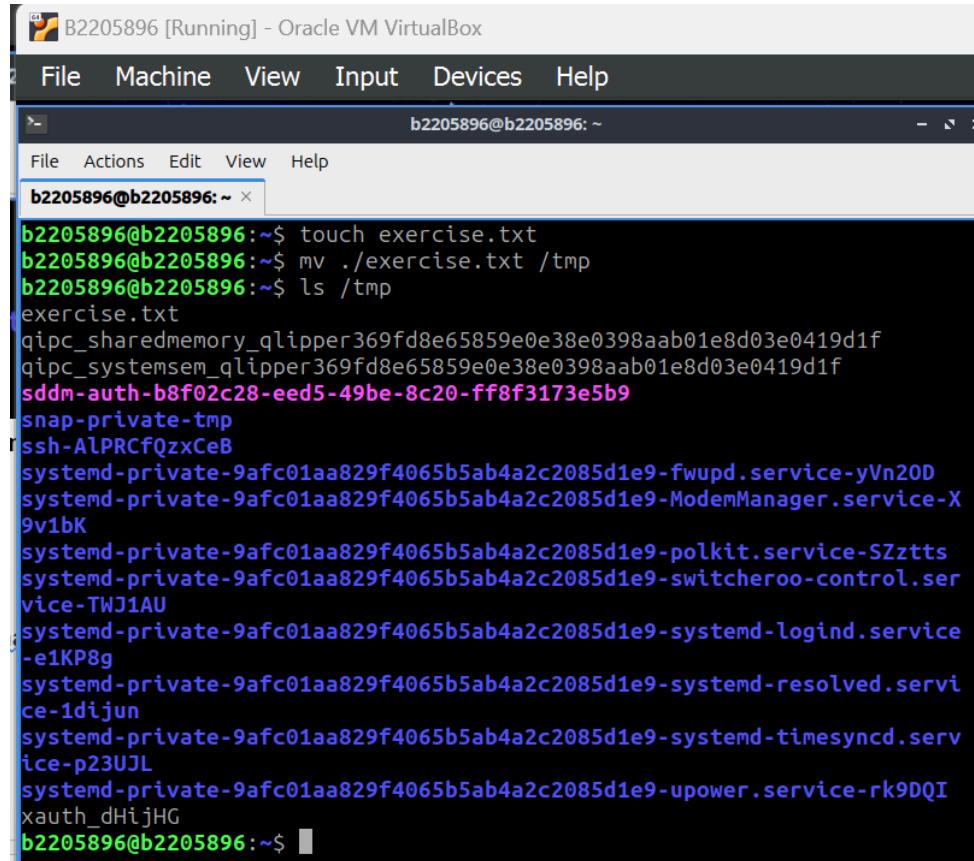
```
$rmdir dir1
```



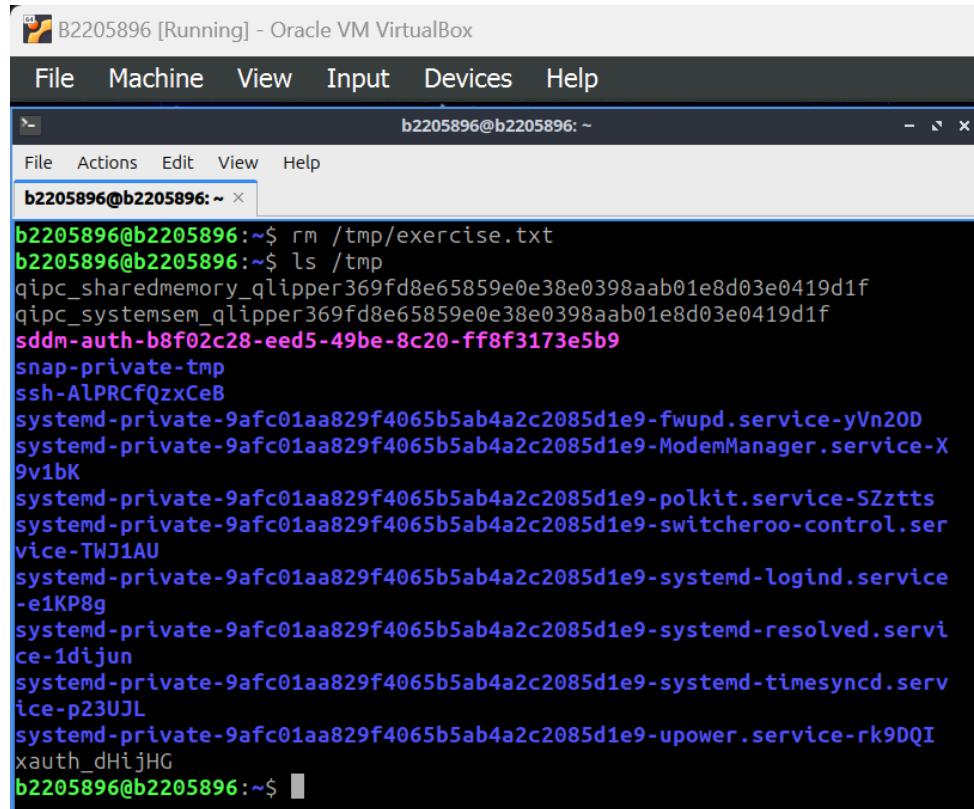
```
b2205896@b2205896:~$ rmdir dir1
b2205896@b2205896:~$ ls
Desktop  Downloads  Pictures  snap      Videos
Documents  Music    Public    Templates
b2205896@b2205896:~$
```

- Create an empty file named **exercise.txt** and move it to **/tmp** using relative pathname. Then delete this file using an absolute pathname

```
$touch exercise.txt
$mv ./exercise.txt /tmp
$rm /tmp/exercise.txt
```



```
b2205896@b2205896:~$ touch exercise.txt
b2205896@b2205896:~$ mv ./exercise.txt /tmp
b2205896@b2205896:~$ ls /tmp
exercise.txt
qipc_sharedmemory_qlipper369fd8e65859e0e38e0398aab01e8d03e0419d1f
qipc_systemsem_qlipper369fd8e65859e0e38e0398aab01e8d03e0419d1f
sddm-auth-b8f02c28-eed5-49be-8c20-ff8f3173e5b9
snap-private-tmp
ssh-AlPRCfQzxCeB
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-fwupd.service-yVn20D
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-ModemManager.service-X
9v1bK
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-polkit.service-SZttS
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-switcheroo-control.ser
vice-TWJ1AU
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-systemd-logind.service
-e1KP8g
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-systemd-resolved.servi
ce-1dijun
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-systemd-timesyncd.serv
ice-p23UJL
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-upower.service-rk9DQI
xauth_dHijHG
b2205896@b2205896:~$
```



The screenshot shows a terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The window has a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". Below the menu is a toolbar with "File", "Actions", "Edit", "View", and "Help". The main area is a terminal window with the prompt "b2205896@b2205896: ~". The user has run the command "ls /tmp" which lists several temporary files and services. The output includes:

```
b2205896@b2205896:~$ rm /tmp/exercise.txt
b2205896@b2205896:~$ ls /tmp
qipc_sharedmemory_qlipper369fd8e65859e0e38e0398aab01e8d03e0419d1f
qipc_systemsem_qlipper369fd8e65859e0e38e0398aab01e8d03e0419d1f
sddm-auth-b8f02c28-eed5-49be-8c20-ff8f3173e5b9
snap-private-tmp
ssh-ALPRCfQzxCeB
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-fwupd.service-yVn20D
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-ModemManager.service-X
9v1bK
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-polkit.service-SZzttS
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-switcheroo-control.ser
vice-TWJ1AU
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-systemd-logind.service
-e1KP8g
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-systemd-resolved.servi
ce-1dijun
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-systemd-timesyncd.serv
ice-p23UJL
systemd-private-9afc01aa829f4065b5ab4a2c2085d1e9-upower.service-rk9DQI
xauth_dHijHG
b2205896@b2205896:~$
```

- Create a file **Autumn_Leaves** with its content as below using **nano** tool.

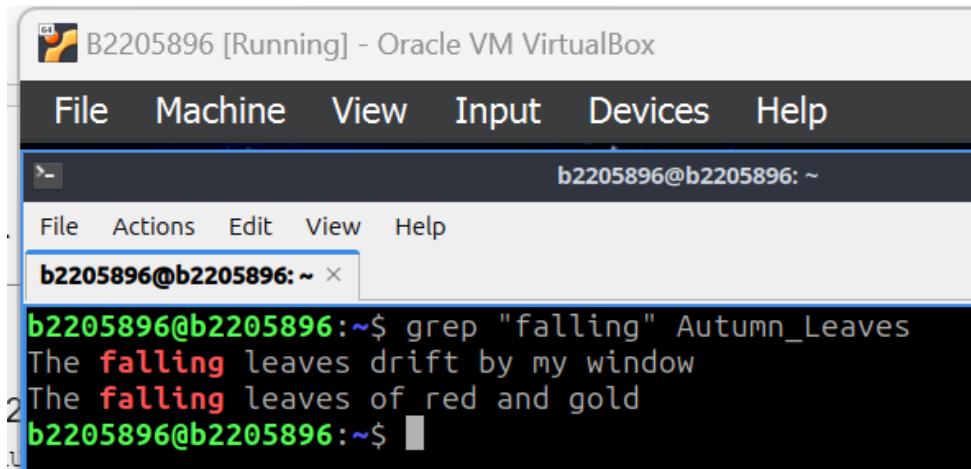
```
$nano Autumn_Leaves
#Content of Autumn_Leaves file
The falling leaves drift by my window
The falling leaves of red and gold
I see your lips the summer kisses
The sunburned hands I used to hold
Since you went away the days grow long
And soon I will hear old winter's song
But I miss you most of all my darling
When autumn leaves start to fall
...
...
```

```
b2205896 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
b2205896@b2205896: ~
File Actions Edit View Help
b2205896@b2205896: ~ x
GNU nano 7.2          Autumn_Leaves *
The falling leaves drift by my window
The falling leaves of red and gold
I see your lips the summer kisses
The sunburned hands I used to hold
Since you went away the days grow long
And soon I will hear old winter's song
But I miss you most of all my darling
When autumn leaves start to fall

# Ctrl o: Save file
# Ctrl x: Quit nano

b2205896@b2205896: ~
File Actions Edit View Help
b2205896@b2205896: ~ x
b2205896@b2205896:~$ cat Autumn_Leaves
The falling leaves drift by my window
The falling leaves of red and gold
I see your lips the summer kisses
The sunburned hands I used to hold
Since you went away the days grow long
And soon I will hear old winter's song
But I miss you most of all my darling
When autumn leaves start to fall
b2205896@b2205896:~$
```

- Search for the string “**falling**” in the file **Autumn_Leaves**
\$grep “falling” Autumn_Leaves



B2205896 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

b2205896@b2205896: ~

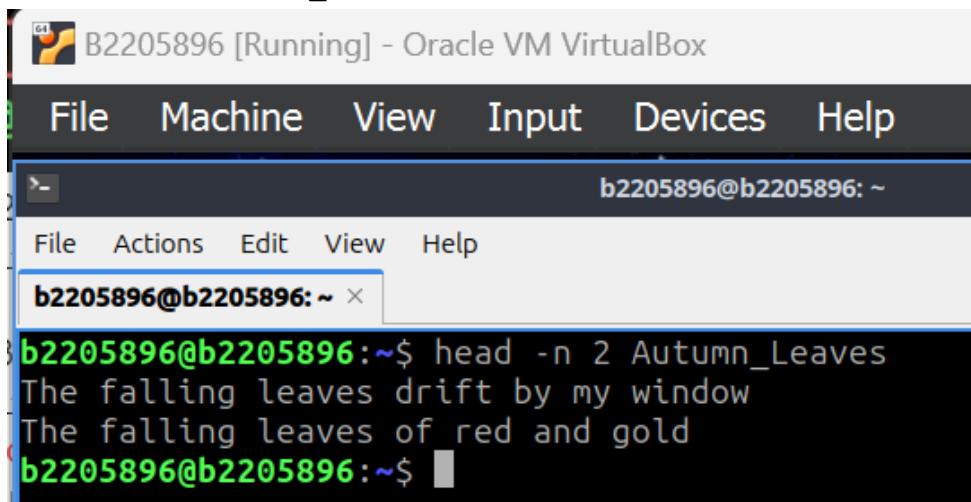
File Actions Edit View Help

b2205896@b2205896: ~

```
b2205896@b2205896:~$ grep "falling" Autumn_Leaves
The falling leaves drift by my window
The falling leaves of red and gold
b2205896@b2205896:~$
```

- Display the first 2 lines of the file **Autumn_Leaves**

```
$head -n 2 Autumn_Leaves
```



B2205896 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

b2205896@b2205896: ~

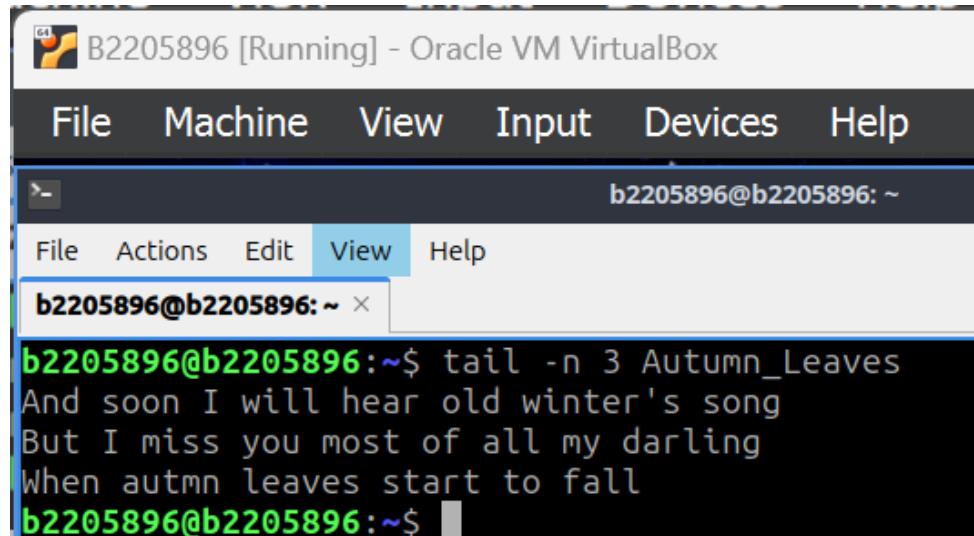
File Actions Edit View Help

b2205896@b2205896: ~

```
b2205896@b2205896:~$ head -n 2 Autumn_Leaves
The falling leaves drift by my window
The falling leaves of red and gold
b2205896@b2205896:~$
```

- Display the last 3 lines of the file **Autumn_Leaves**

```
$tail -n 3 Autumn_Leaves
```



B2205896 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

b2205896@b2205896: ~

File Actions Edit View Help

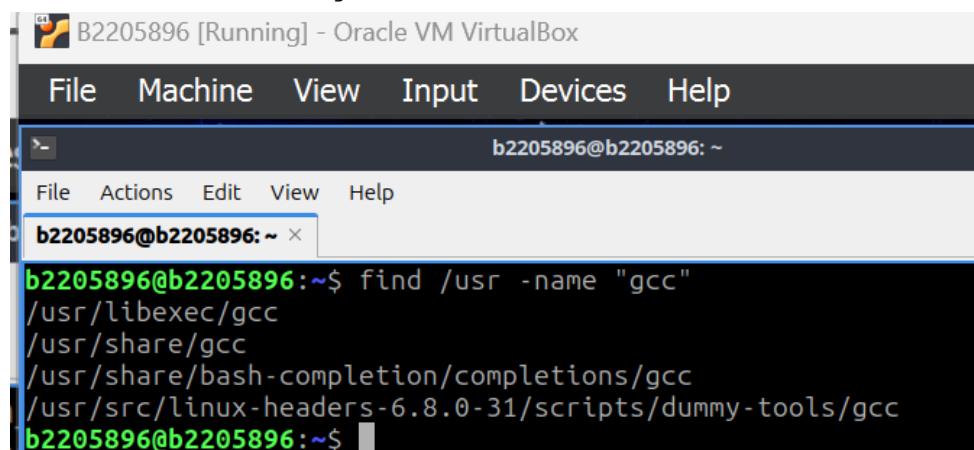
b2205896@b2205896: ~ ×

```
b2205896@b2205896:~$ tail -n 3 Autumn_Leaves
And soon I will hear old winter's song
But I miss you most of all my darling
When autumn leaves start to fall
b2205896@b2205896:~$
```

(take a screenshot of the console)

2.3. Finding files in a directory

- Search for a file with the name **gcc** in the **/usr** folder using **find** command.
\$find /usr -name "gcc"



B2205896 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

b2205896@b2205896: ~

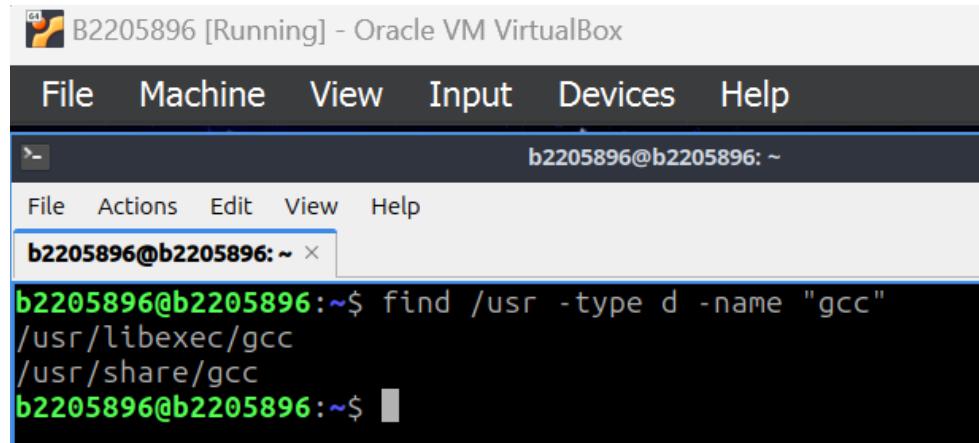
File Actions Edit View Help

b2205896@b2205896: ~ ×

```
b2205896@b2205896:~$ find /usr -name "gcc"
/usr/libexec/gcc
/usr/share/gcc
/usr/share/bash-completion/completions/gcc
/usr/src/linux-headers-6.8.0-31/scripts/dummy-tools/gcc
b2205896@b2205896:~$
```

- Search for a directory with the name **gcc**, in the **/usr** folder using **find** command.

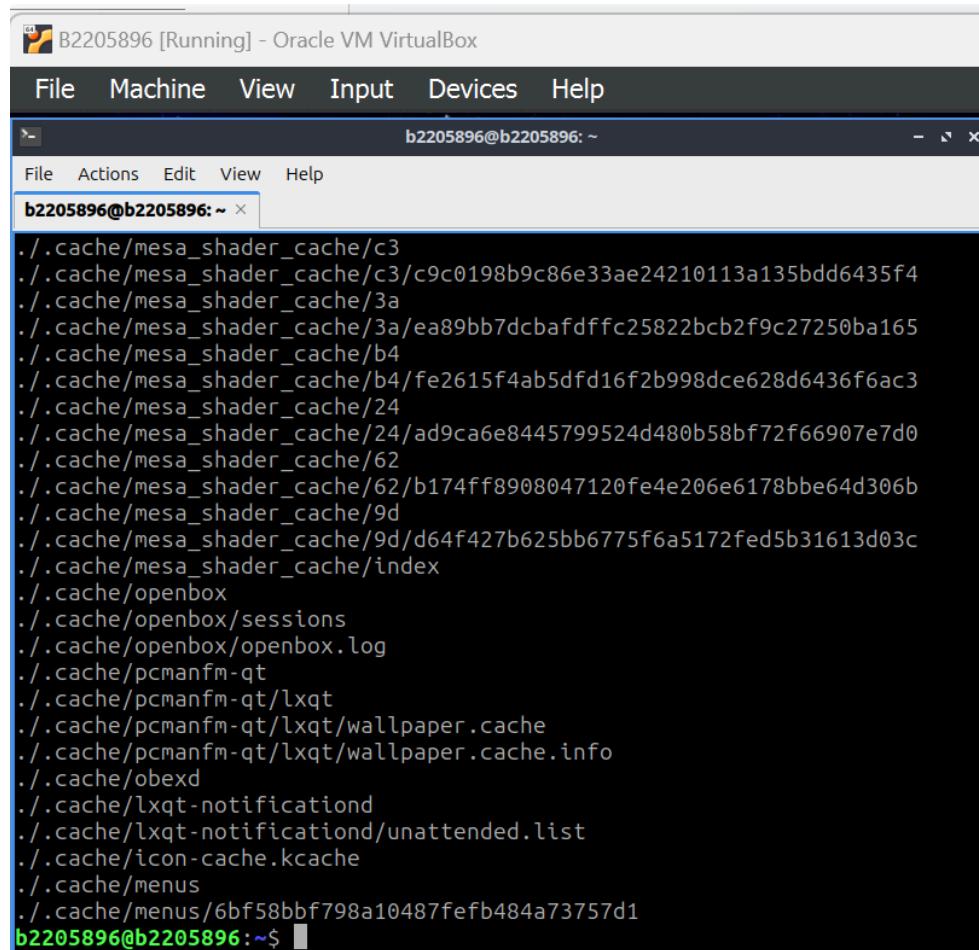
\$find /usr -type d -name "gcc"



```
b2205896 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
b2205896@b2205896: ~
File Actions Edit View Help
b2205896@b2205896: ~
b2205896@b2205896:~$ find /usr -type d -name "gcc"
/usr/libexec/gcc
/usr/share/gcc
b2205896@b2205896:~$
```

- Search for files in the current directory that were modified today.

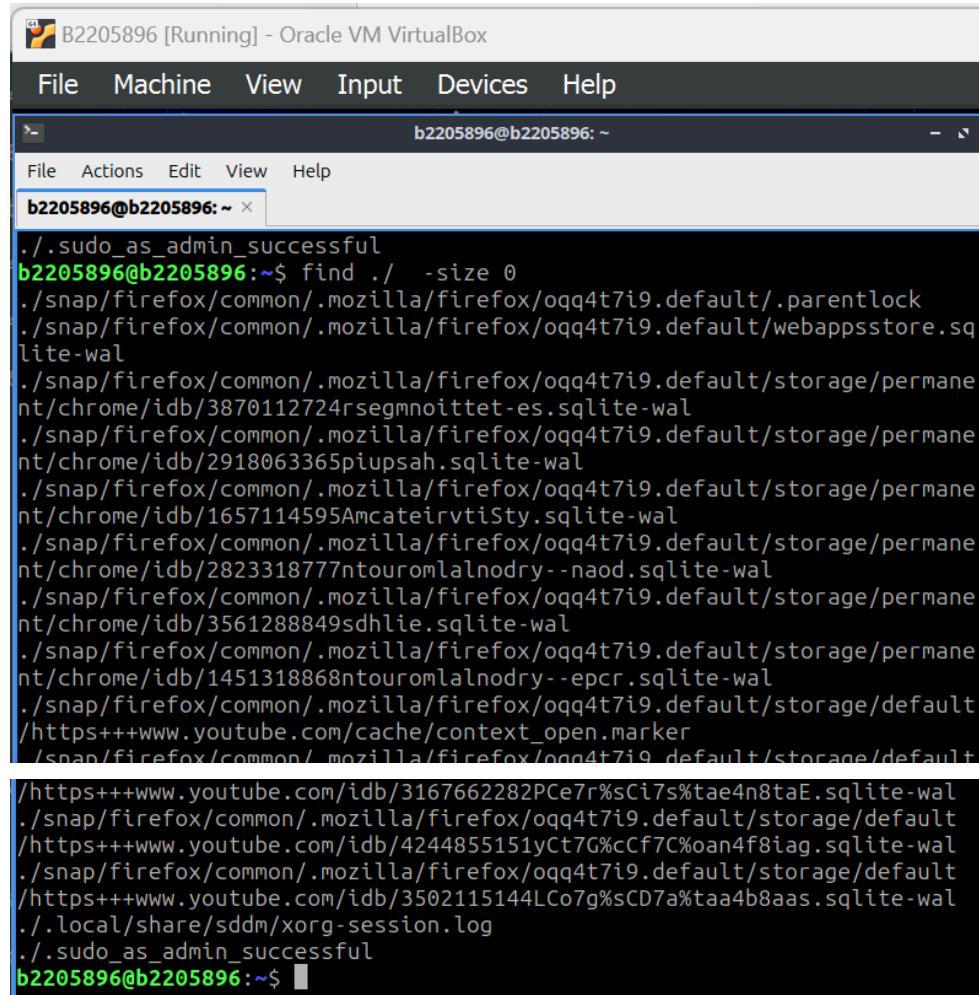
```
$find ./ -mtime 0
```



```
b2205896 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
b2205896@b2205896: ~
File Actions Edit View Help
b2205896@b2205896: ~
./.cache/mesa_shader_cache/c3
./.cache/mesa_shader_cache/c3/c9c0198b9c86e33ae24210113a135bdd6435f4
./.cache/mesa_shader_cache/3a
./.cache/mesa_shader_cache/3a/ea89bb7dcbafdffc25822bcb2f9c27250ba165
./.cache/mesa_shader_cache/b4
./.cache/mesa_shader_cache/b4/fe2615f4ab5dfd16f2b998dce628d6436f6ac3
./.cache/mesa_shader_cache/24
./.cache/mesa_shader_cache/24/ad9ca6e8445799524d480b58bf72f66907e7d0
./.cache/mesa_shader_cache/62
./.cache/mesa_shader_cache/62/b174ff8908047120fe4e206e6178bbe64d306b
./.cache/mesa_shader_cache/9d
./.cache/mesa_shader_cache/9d/d64f427b625bb6775f6a5172fed5b31613d03c
./.cache/mesa_shader_cache/index
./.cache/openbox
./.cache/openbox/sessions
./.cache/openbox/openbox.log
./.cache/pcmanfm-qt
./.cache/pcmanfm-qt/lxqt
./.cache/pcmanfm-qt/lxqt/wallpaper.cache
./.cache/pcmanfm-qt/lxqt/wallpaper.cache.info
./.cache/obexd
./.cache/lxqt-notificationd
./.cache/lxqt-notificationd/unattended.list
./.cache/icon-cache.kcache
./.cache/menus
./.cache/menus/6bf58bbf798a10487fefb484a73757d1
b2205896@b2205896:~$
```

- Search for files with size **0 bytes**

```
$find ./ -size 0
```



The screenshot shows a terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The terminal window has a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". Below the menu bar is a toolbar with "File", "Actions", "Edit", "View", and "Help". The main area of the terminal shows the following command-line session:

```
./.sudo_as_admin_successful
b2205896@b2205896:~$ find ./ -size 0
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/.parentlock
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/webappsstore.sqlite-wal
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/permanent/chrome/idb/3870112724rsegmnoittet-es.sqlite-wal
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/permanent/chrome/idb/2918063365piupsah.sqlite-wal
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/permanent/chrome/idb/1657114595AmcateirvtiSty.sqlite-wal
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/permanent/chrome/idb/2823318777ntouromlalnodry--naod.sqlite-wal
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/permanent/chrome/idb/3561288849sdhlie.sqlite-wal
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/default/https+++www.youtube.com/cache/context_open.marker
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/default
/hhttps+++www.youtube.com/idb/3167662282PCe7r%sc7s%tae4n8taE.sqlite-wal
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/default
/hhttps+++www.youtube.com/idb/4244855151yCt7G%ccF7C%oan4f8iag.sqlite-wal
./snap/firefox/common/.mozilla/firefox/oqq4t7i9.default/storage/default
/hhttps+++www.youtube.com/idb/3502115144LC07g%scD7a%taa4b8aas.sqlite-wal
./.local/share/sddm/xorg-session.log
./.sudo_as_admin_successful
b2205896@b2205896:~$
```

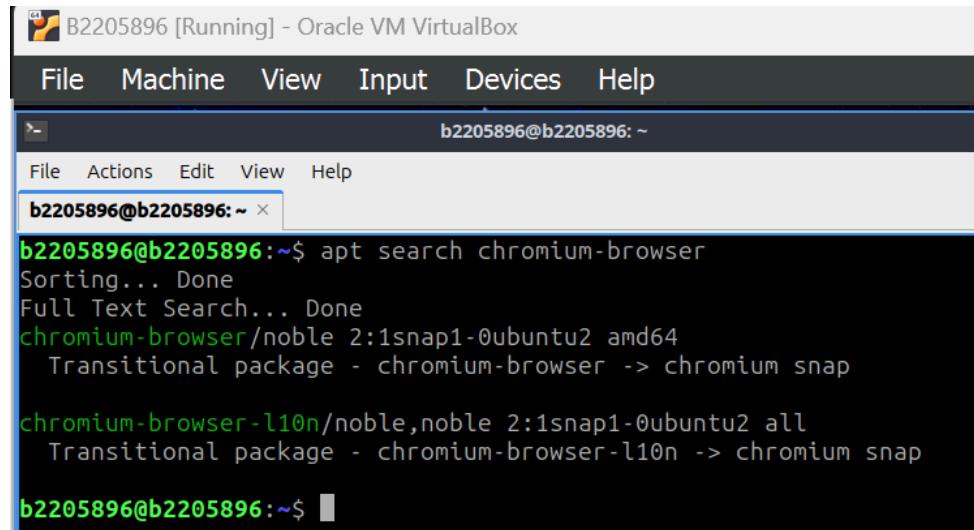
(take a screenshot of the console)

3. Installing and Removing software packages

3.1. Install from default repositories

- Using apt tool, find the **chromium-browser** package.

```
$apt search chromium-browser
```



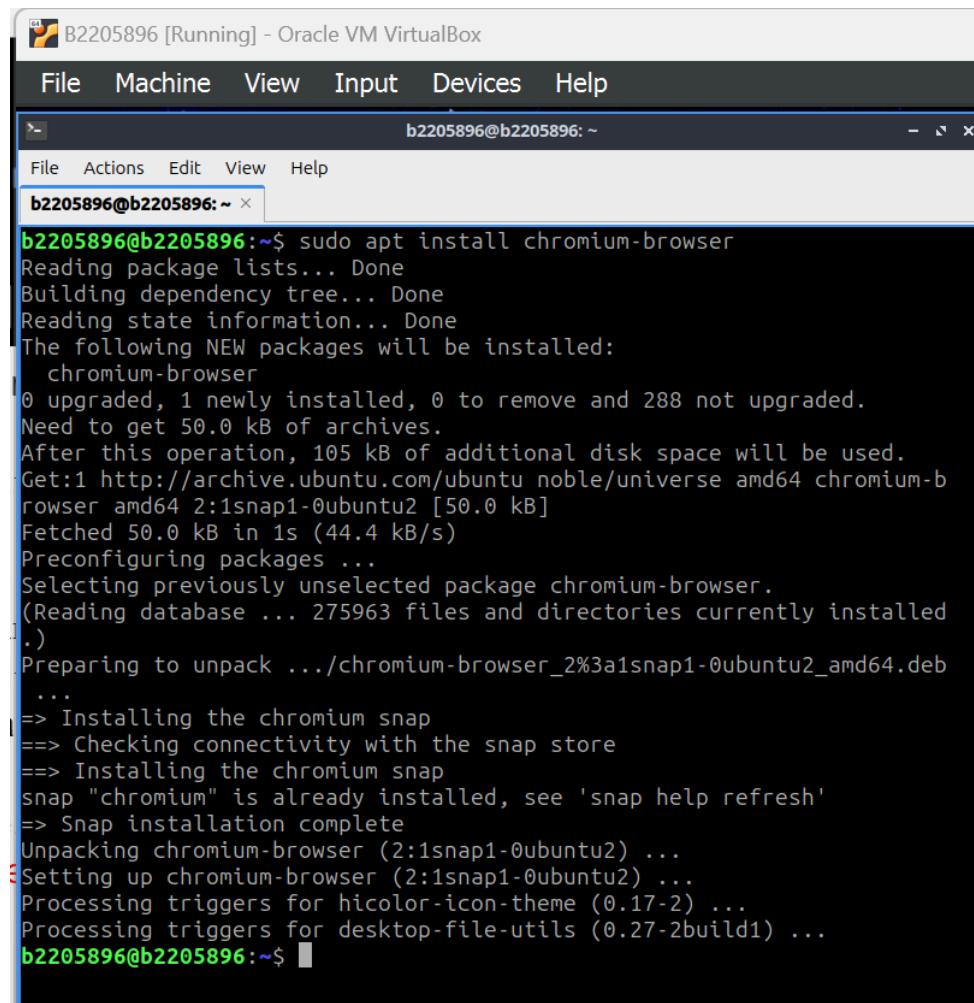
```
b2205896@b2205896:~$ apt search chromium-browser
Sorting... Done
Full Text Search... Done
chromium-browser/noble 2:1snap1-0ubuntu2 amd64
  Transitional package - chromium-browser -> chromium snap

chromium-browser-l10n/noble,noble 2:1snap1-0ubuntu2 all
  Transitional package - chromium-browser-l10n -> chromium snap

b2205896@b2205896:~$
```

- If it is not installed, install it; otherwise, remove it, and then re-install it.

```
$sudo apt update
$sudo apt install chromium-browser
```



```
b2205896@b2205896:~$ sudo apt install chromium-browser
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  chromium-browser
0 upgraded, 1 newly installed, 0 to remove and 288 not upgraded.
Need to get 50.0 kB of archives.
After this operation, 105 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble/universe amd64 chromium-brower amd64 2:1snap1-0ubuntu2 [50.0 kB]
Fetched 50.0 kB in 1s (44.4 kB/s)
Preconfiguring packages ...
Selecting previously unselected package chromium-browser.
(Reading database ... 275963 files and directories currently installed
.)
Preparing to unpack .../chromium-browser_2%3a1snap1-0ubuntu2_amd64.deb
...
--> Installing the chromium snap
==> Checking connectivity with the snap store
==> Installing the chromium snap
snap "chromium" is already installed, see 'snap help refresh'
=> Snap installation complete
Unpacking chromium-browser (2:1snap1-0ubuntu2) ...
Setting up chromium-browser (2:1snap1-0ubuntu2) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for desktop-file-utils (0.27-2build1) ...
b2205896@b2205896:~$
```

```
#  
$sudo apt remove chromium-browser
```

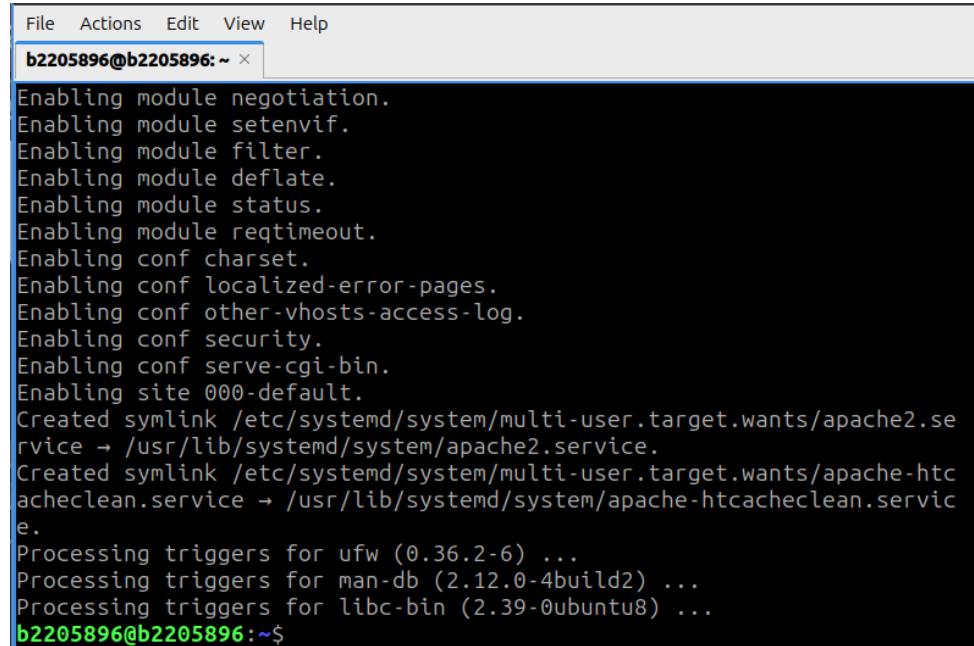
```
b2205896 [Running] - Oracle VM VirtualBox  
File Machine View Input Devices Help  
File Actions Edit View Help  
b2205896@b2205896: ~  
b2205896@b2205896:~$ sudo apt remove chromium-browser  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The following packages will be REMOVED:  
  chromium-browser  
0 upgraded, 0 newly installed, 1 to remove and 288 not upgraded.  
After this operation, 105 kB disk space will be freed.  
Do you want to continue? [Y/n] Y  
(Reading database ... 275977 files and directories currently installed.)  
Removing chromium-browser (2:1snap1-0ubuntu2) ...  
Processing triggers for hicolor-icon-theme (0.17-2) ...  
Processing triggers for desktop-file-utils (0.27-2build1) ...  
b2205896@b2205896:~$
```

```
$sudo apt install chromium-browser
```

- Install **apache2** package using apt tool

```
$sudo apt update  
$sudo apt install apache2
```

```
b2205896 [Running] - Oracle VM VirtualBox  
File Machine View Input Devices Help  
File Actions Edit View Help  
b2205896@b2205896: ~  
b2205896@b2205896:~$ sudo apt install apache2  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The following additional packages will be installed:  
  apache2-bin apache2-data apache2-utils libapr1t64  
    libaprutil1-dbd-sqlite3 libaprutil1-ldap libaprutil1t64  
Suggested packages:  
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom  
The following NEW packages will be installed:  
  apache2 apache2-bin apache2-data apache2-utils libapr1t64  
    libaprutil1-dbd-sqlite3 libaprutil1-ldap libaprutil1t64  
0 upgraded, 8 newly installed, 0 to remove and 288 not upgraded.  
Need to get 1,899 kB of archives.  
After this operation, 7,455 kB of additional disk space will be used.
```



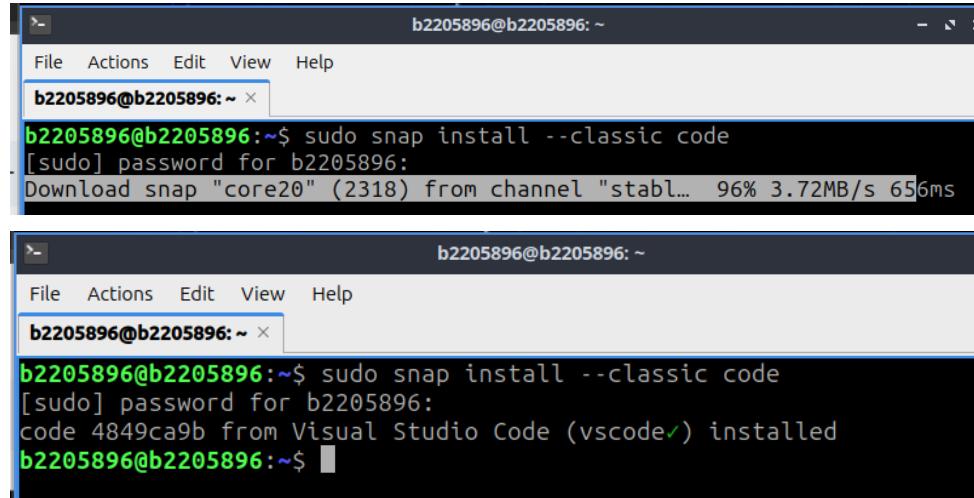
```
File Actions Edit View Help
b2205896@b2205896: ~
Enabling module negotiation.
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module reqtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf serve-cgi-bin.
Enabling site 000-default.
Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service → /usr/lib/systemd/system/apache2.service.
Created symlink /etc/systemd/system/multi-user.target.wants/apache-htcacheclean.service → /usr/lib/systemd/system/apache-htcacheclean.service.
Processing triggers for ufw (0.36.2-6) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for libc-bin (2.39-0ubuntu8) ...
b2205896@b2205896:~$
```

(take a screenshot of the console)

3.2. Install using snap

- Install VScode using snap tool

```
$sudo snap install --classic code
```



```
b2205896@b2205896: ~
File Actions Edit View Help
b2205896@b2205896: ~
b2205896@b2205896:~$ sudo snap install --classic code
[sudo] password for b2205896:
Download snap "core20" (2318) from channel "stabl... 96% 3.72MB/s 656ms
```

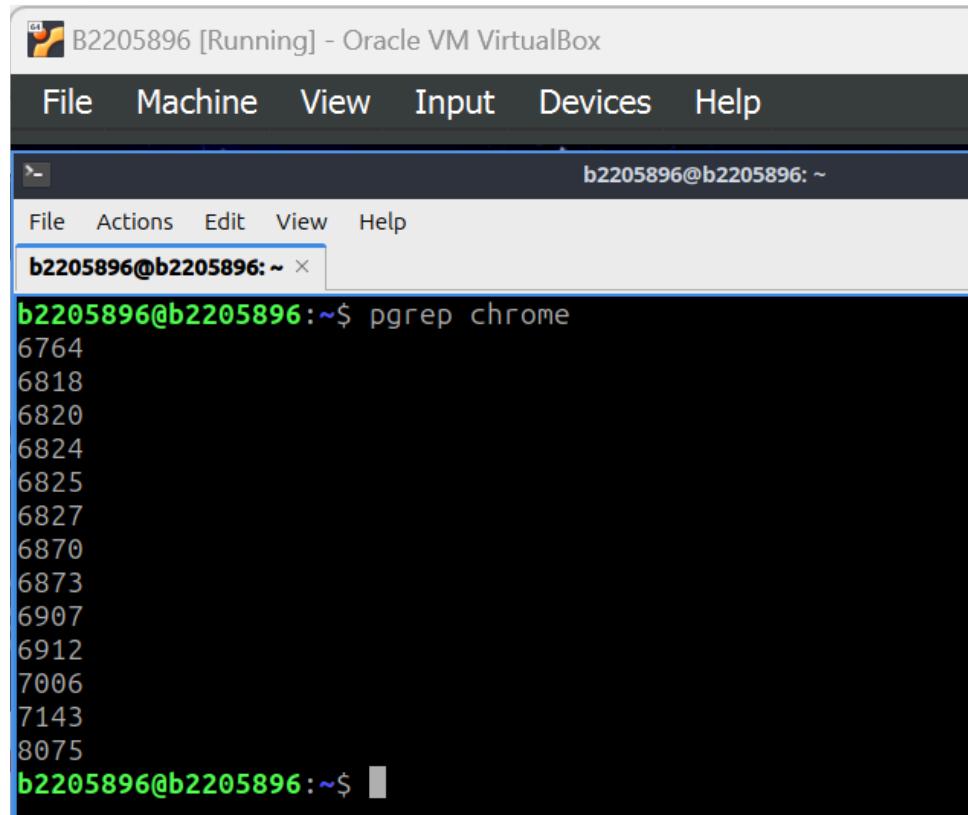


```
b2205896@b2205896: ~
File Actions Edit View Help
b2205896@b2205896: ~
b2205896@b2205896:~$ sudo snap install --classic code
[sudo] password for b2205896:
code 4849ca9b from Visual Studio Code (vscode✓) installed
b2205896@b2205896:~$
```

(take a screenshot of the console)

4. Process and daemons (services)

- Launch **chromium-browser** application; then find its PID using **pgrep** command
- ```
$chromium
```
- ```
$pgrep chrome
```



B2205896 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

b2205896@b2205896: ~

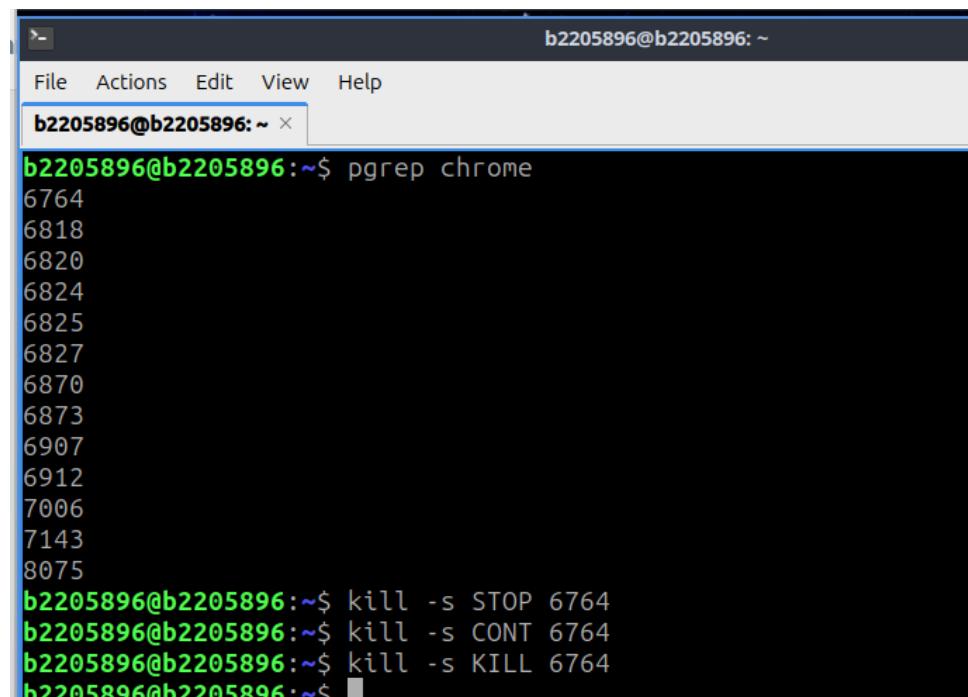
File Actions Edit View Help

b2205896@b2205896: ~ ×

```
b2205896@b2205896:~$ pgrep chrome
6764
6818
6820
6824
6825
6827
6870
6873
6907
6912
7006
7143
8075
b2205896@b2205896:~$
```

- Stop/continue/terminate **chromium-browser** application using **kill** command

```
$kill -s STOP <PID>
$kill -s CONT <PID>
$kill -s KILL <PID>
```



b2205896@b2205896: ~

File Actions Edit View Help

b2205896@b2205896: ~ ×

```
b2205896@b2205896:~$ pgrep chrome
6764
6818
6820
6824
6825
6827
6870
6873
6907
6912
7006
7143
8075
b2205896@b2205896:~$ kill -s STOP 6764
b2205896@b2205896:~$ kill -s CONT 6764
b2205896@b2205896:~$ kill -s KILL 6764
b2205896@b2205896:~$
```

- Start and then display the status of **apache2** web server using **systemctl** command

```
$sudo systemctl start apache2  
$sudo systemctl status apache2
```

```
b2205896@b2205896:~$ sudo systemctl start apache2  
b2205896@b2205896:~$ sudo systemctl status apache2  
● apache2.service - The Apache HTTP Server  
    Loaded: loaded (/usr/lib/systemd/system/apache2.service; enabled; preset: >  
      Active: active (running) since Fri 2024-09-06 16:47:10 WIB; 39s ago  
        Docs: https://httpd.apache.org/docs/2.4/  
        Main PID: 10375 (apache2)  
          Tasks: 55 (limit: 6988)  
         Memory: 5.5M (peak: 6.0M)  
            CPU: 54ms  
           CGroup: /system.slice/apache2.service  
                   ├─10375 /usr/sbin/apache2 -k start  
                   ├─10376 /usr/sbin/apache2 -k start  
                   └─10378 /usr/sbin/apache2 -k start  
  
Sep 06 16:47:10 b2205896 systemd[1]: Starting apache2.service - The Apache HTTP>  
Sep 06 16:47:10 b2205896 apachectl[10374]: AH00558: apache2: Could not reliably>  
Sep 06 16:47:10 b2205896 systemd[1]: Started apache2.service - The Apache HTTP >  
lines 1-16/16 (END)
```

- Enable **apache2** web server starting on booting time

```
$sudo systemctl enable apache2
```

```
b2205896@b2205896:~$ sudo systemctl enable apache2  
Synchronizing state of apache2.service with SysV service script with /usr/lib/sys  
temd/systemd-sysv-install.  
Executing: /usr/lib/systemd/systemd-sysv-install enable apache2  
b2205896@b2205896:~$
```

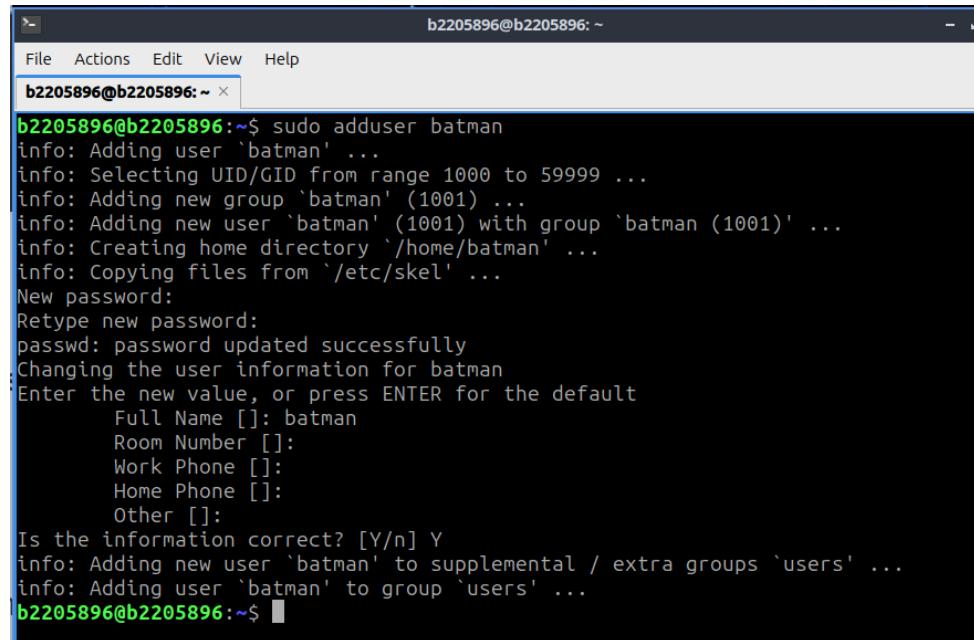
(take a screenshot of the console)

5. Local Security Principles

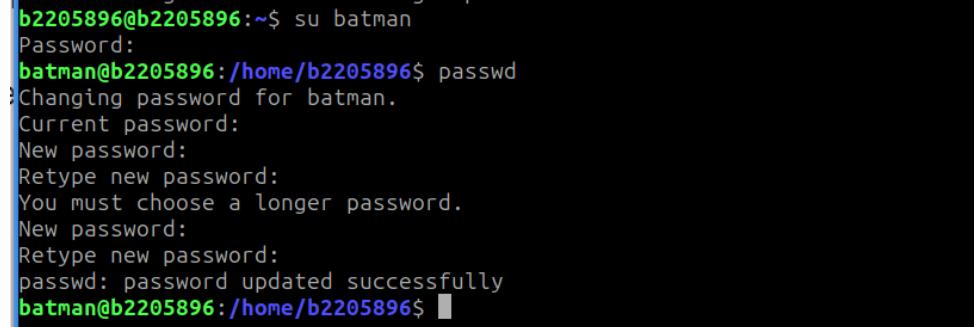
5.1. Create a new user and sudo

- Create a new user (batman), using **adduser**, and give the user an initial password with **passwd**.

```
$sudo adduser batman  
$sudo passwd batman
```



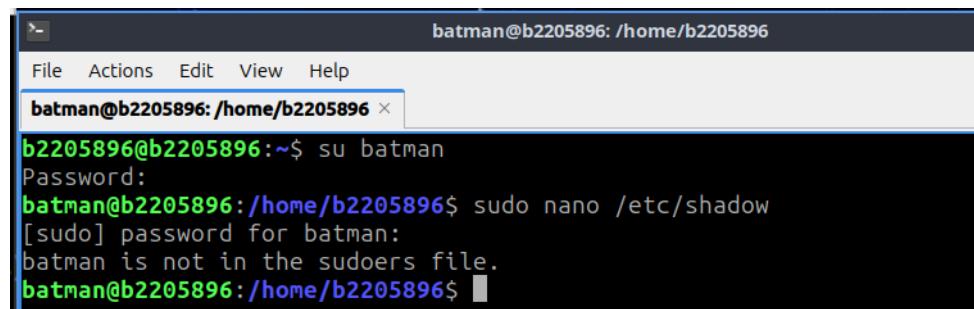
```
b2205896@b2205896:~$ sudo adduser batman
info: Adding user `batman' ...
info: Selecting UID/GID from range 1000 to 59999 ...
info: Adding new group `batman' (1001) ...
info: Adding new user `batman' (1001) with group `batman (1001)' ...
info: Creating home directory `/home/batman' ...
info: Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for batman
Enter the new value, or press ENTER for the default
    Full Name []: batman
    Room Number []:
    Work Phone []:
    Home Phone []:
    Other []:
Is the information correct? [Y/n] Y
info: Adding new user `batman' to supplemental / extra groups `users' ...
info: Adding user `batman' to group `users' ...
b2205896@b2205896:~$ 
```

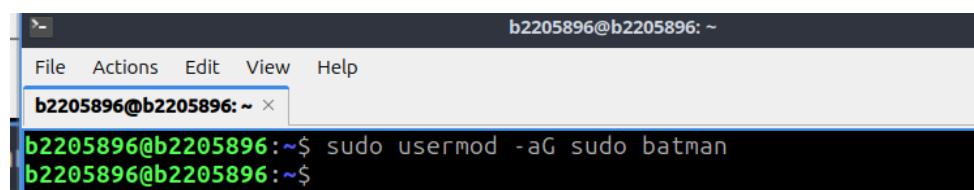
```
b2205896@b2205896:~$ su batman
Password:
batman@b2205896:/home/b2205896$ passwd
Changing password for batman.
Current password:
New password:
Retype new password:
You must choose a longer password.
New password:
Retype new password:
passwd: password updated successfully
batman@b2205896:/home/b2205896$ 
```

- Configure this user to be able to use **sudo** command

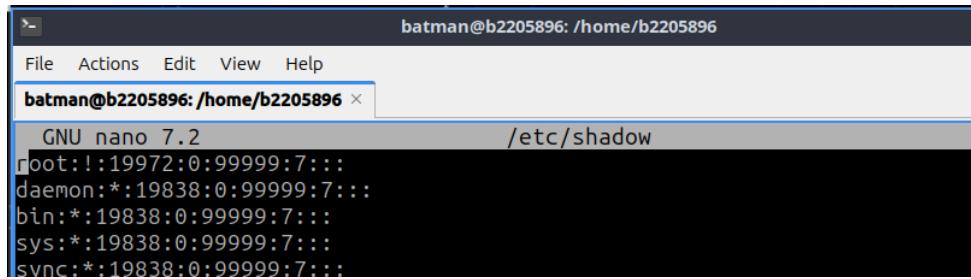
```
$sudo usermod -aG sudo batman
```



```
batman@b2205896:/home/b2205896
File Actions Edit View Help
batman@b2205896:/home/b2205896 x
b2205896@b2205896:~$ su batman
Password:
batman@b2205896:/home/b2205896$ sudo nano /etc/shadow
[sudo] password for batman:
batman is not in the sudoers file.
batman@b2205896:/home/b2205896$ 
```

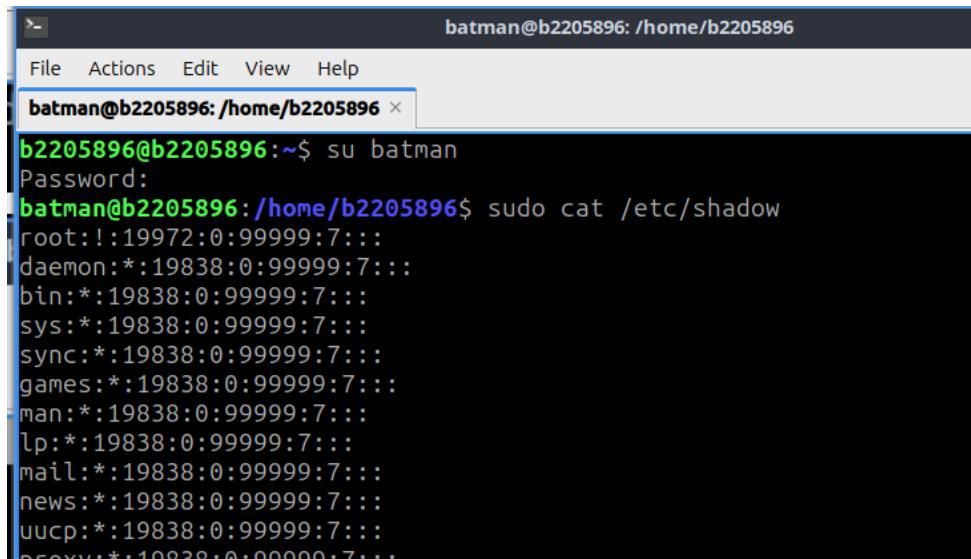
```
b2205896@b2205896:~
File Actions Edit View Help
b2205896@b2205896:~ x
b2205896@b2205896:~$ sudo usermod -aG sudo batman
b2205896@b2205896:~$ 
```



```
batman@b2205896: /home/b2205896
File Actions Edit View Help
batman@b2205896: /home/b2205896 x
GNU nano 7.2
/etc/shadow
root:!:19972:0:99999:7:::
daemon:*:19838:0:99999:7:::
bin:*:19838:0:99999:7:::
sys:*:19838:0:99999:7:::
sync:*:19838:0:99999:7:::
```

- Login as or switch to this new user and make sure you can execute a command (cat /etc/shadow) that requires root privilege.

```
$su batman
$sudo cat /etc/shadow
```



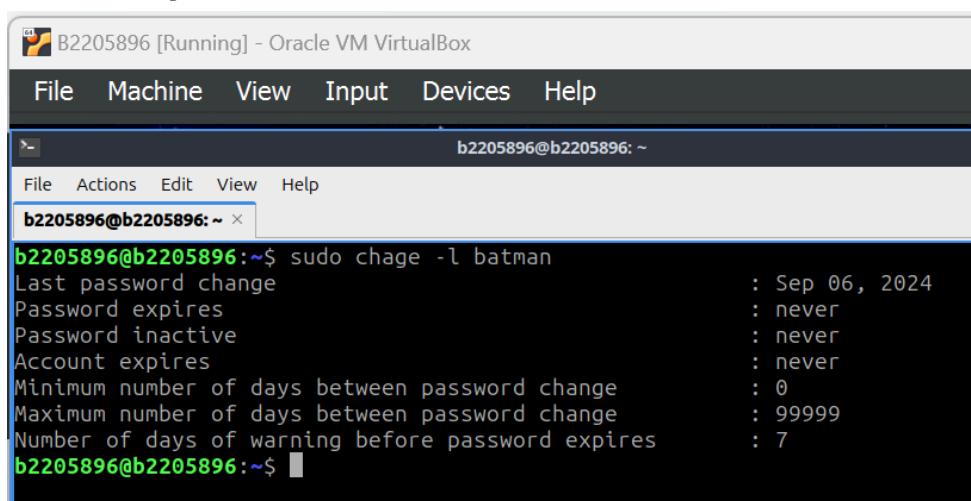
```
batman@b2205896: /home/b2205896
File Actions Edit View Help
batman@b2205896: /home/b2205896 x
b2205896@b2205896:~$ su batman
Password:
batman@b2205896:/home/b2205896$ sudo cat /etc/shadow
root:!:19972:0:99999:7:::
daemon:*:19838:0:99999:7:::
bin:*:19838:0:99999:7:::
sys:*:19838:0:99999:7:::
sync:*:19838:0:99999:7:::
games:*:19838:0:99999:7:::
man:*:19838:0:99999:7:::
lp:*:19838:0:99999:7:::
mail:*:19838:0:99999:7:::
news:*:19838:0:99999:7:::
uucp:*:19838:0:99999:7:::
proxy.*:19838:0:99999:7:::
```

(take a screenshot of the console)

5.2. Password aging

- With the newly created user from 5.1, look at the password aging for the user.

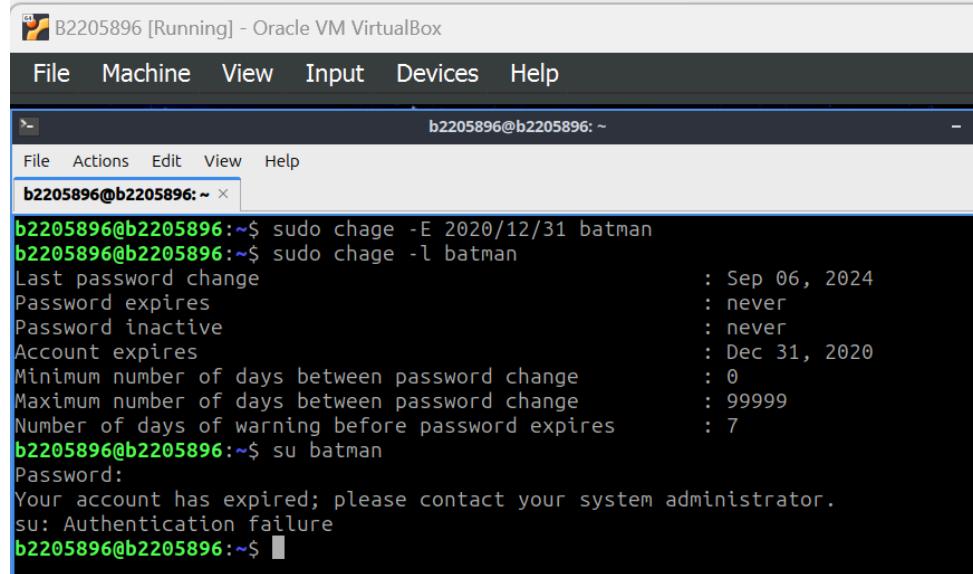
```
$sudo chage -l batman
```



```
B2205896 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
b2205896@b2205896: ~
File Actions Edit View Help
b2205896@b2205896: ~ x
b2205896@b2205896:~$ sudo chage -l batman
Last password change : Sep 06, 2024
Password expires : never
Password inactive : never
Account expires : never
Minimum number of days between password change : 0
Maximum number of days between password change : 99999
Number of days of warning before password expires : 7
b2205896@b2205896:~$
```

- Modify the expiration date for the user, setting it to something that has passed, and check to see what has changed.

```
$sudo chage -E 2020/12/31 batman
$su batman
```



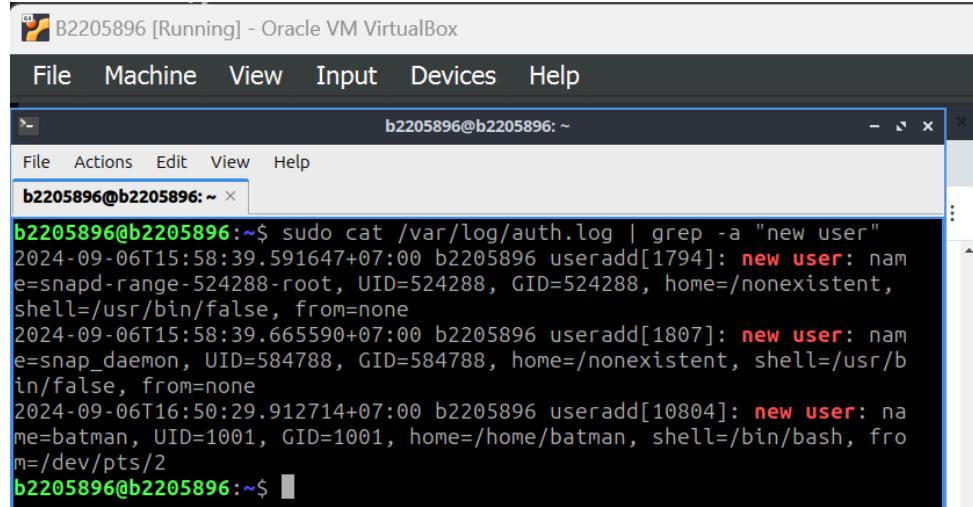
```
b2205896 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
File Actions Edit View Help
b2205896@b2205896: ~
b2205896@b2205896:~$ sudo chage -E 2020/12/31 batman
b2205896@b2205896:~$ sudo chage -l batman
Last password change : Sep 06, 2024
Password expires : never
Password inactive : never
Account expires : Dec 31, 2020
Minimum number of days between password change : 0
Maximum number of days between password change : 99999
Number of days of warning before password expires : 7
b2205896@b2205896:~$ su batman
Password:
Your account has expired; please contact your system administrator.
su: Authentication failure
b2205896@b2205896:~$
```

(take a screenshot of the console)

5.3. Log files

- Display the time when the user in 5.1 created

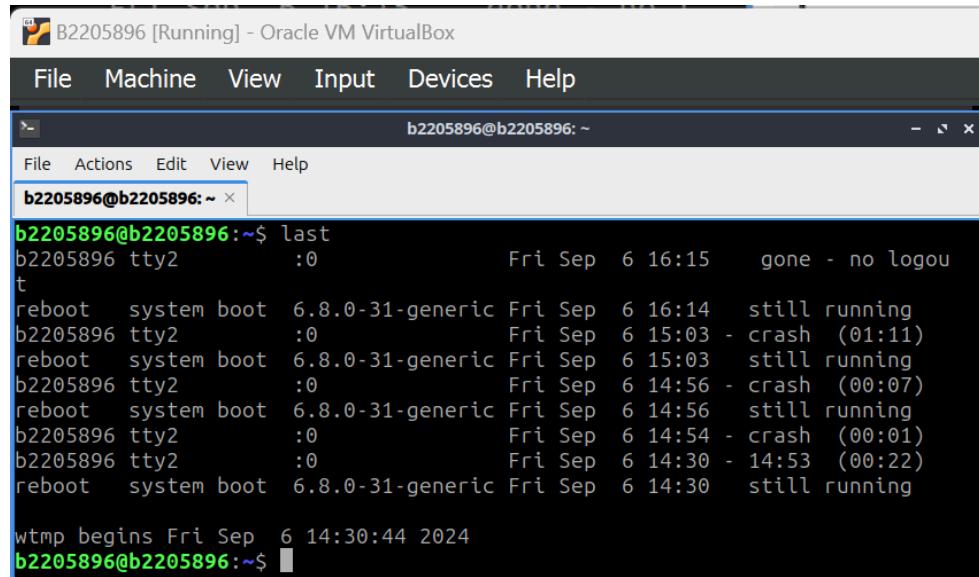
```
$cat /var/log/auth.log | grep "new user"
```



```
b2205896 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
File Actions Edit View Help
b2205896@b2205896: ~
b2205896@b2205896:~$ sudo cat /var/log/auth.log | grep -a "new user"
2024-09-06T15:58:39.591647+07:00 b2205896 useradd[1794]: new user: name=snapd-range-524288-root, UID=524288, GID=524288, home=/nonexistent, shell=/usr/bin/false, from=None
2024-09-06T15:58:39.665590+07:00 b2205896 useradd[1807]: new user: name=snap_daemon, UID=584788, GID=584788, home=/nonexistent, shell=/usr/bin/false, from=None
2024-09-06T16:50:29.912714+07:00 b2205896 useradd[10804]: new user: name=batman, UID=1001, GID=1001, home=/home/batman, shell=/bin/bash, from=/dev/pts/2
b2205896@b2205896:~$
```

- Find the time of the last log in to the system

```
$last
```



A screenshot of a Linux terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The terminal shows the output of the "last" command, which displays system boot logs. The logs show multiple boots and crashes. The terminal window has a dark background with white text.

```
b2205896@b2205896:~$ last
b2205896    :0          Fri Sep  6 16:15      gone - no logou
t
reboot  system boot  6.8.0-31-generic Fri Sep  6 16:14      still running
b2205896  tty2       :0          Fri Sep  6 15:03 - crash  (01:11)
reboot  system boot  6.8.0-31-generic Fri Sep  6 15:03      still running
b2205896  tty2       :0          Fri Sep  6 14:56 - crash  (00:07)
reboot  system boot  6.8.0-31-generic Fri Sep  6 14:56      still running
b2205896  tty2       :0          Fri Sep  6 14:54 - crash  (00:01)
b2205896  tty2       :0          Fri Sep  6 14:30 - 14:53  (00:22)
reboot  system boot  6.8.0-31-generic Fri Sep  6 14:30      still running

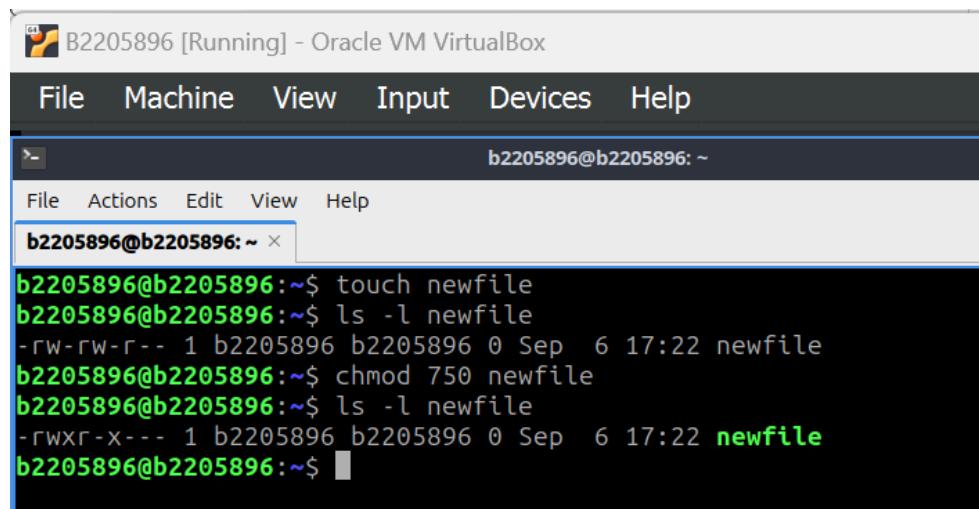
wtmp begins Fri Sep  6 14:30:44 2024
b2205896@b2205896:~$
```

(take a screenshot of the console)

6. File permissions

- Create a new file **newfile**; then change its permissions to **rwxr-x---**

```
$touch newfile
$chmod 750 newfile
```

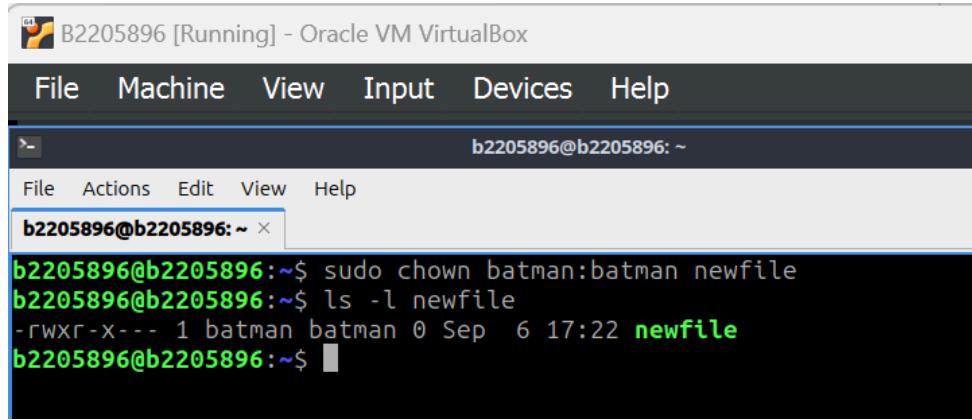


A screenshot of a Linux terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The terminal shows the creation of a file named "newfile" and changing its permissions. The terminal window has a dark background with white text.

```
b2205896@b2205896:~$ touch newfile
b2205896@b2205896:~$ ls -l newfile
-rw-r-- 1 b2205896 b2205896 0 Sep  6 17:22 newfile
b2205896@b2205896:~$ chmod 750 newfile
b2205896@b2205896:~$ ls -l newfile
-rwxr-x--- 1 b2205896 b2205896 0 Sep  6 17:22 newfile
b2205896@b2205896:~$
```

- Change the user and group ownership of **newfile** to the user 5.1

```
$sudo chown batman:batman newfile
```



The screenshot shows a terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The window has a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". Below the menu is a toolbar with "File", "Actions", "Edit", "View", and "Help". The terminal itself has a title bar "b2205896@b2205896: ~" and a status bar "b2205896@b2205896: ~". The main area contains a command-line session:

```
b2205896@b2205896:~$ sudo chown batman:batman newfile
b2205896@b2205896:~$ ls -l newfile
-rwxr-x--- 1 batman batman 0 Sep  6 17:22 newfile
b2205896@b2205896:~$
```

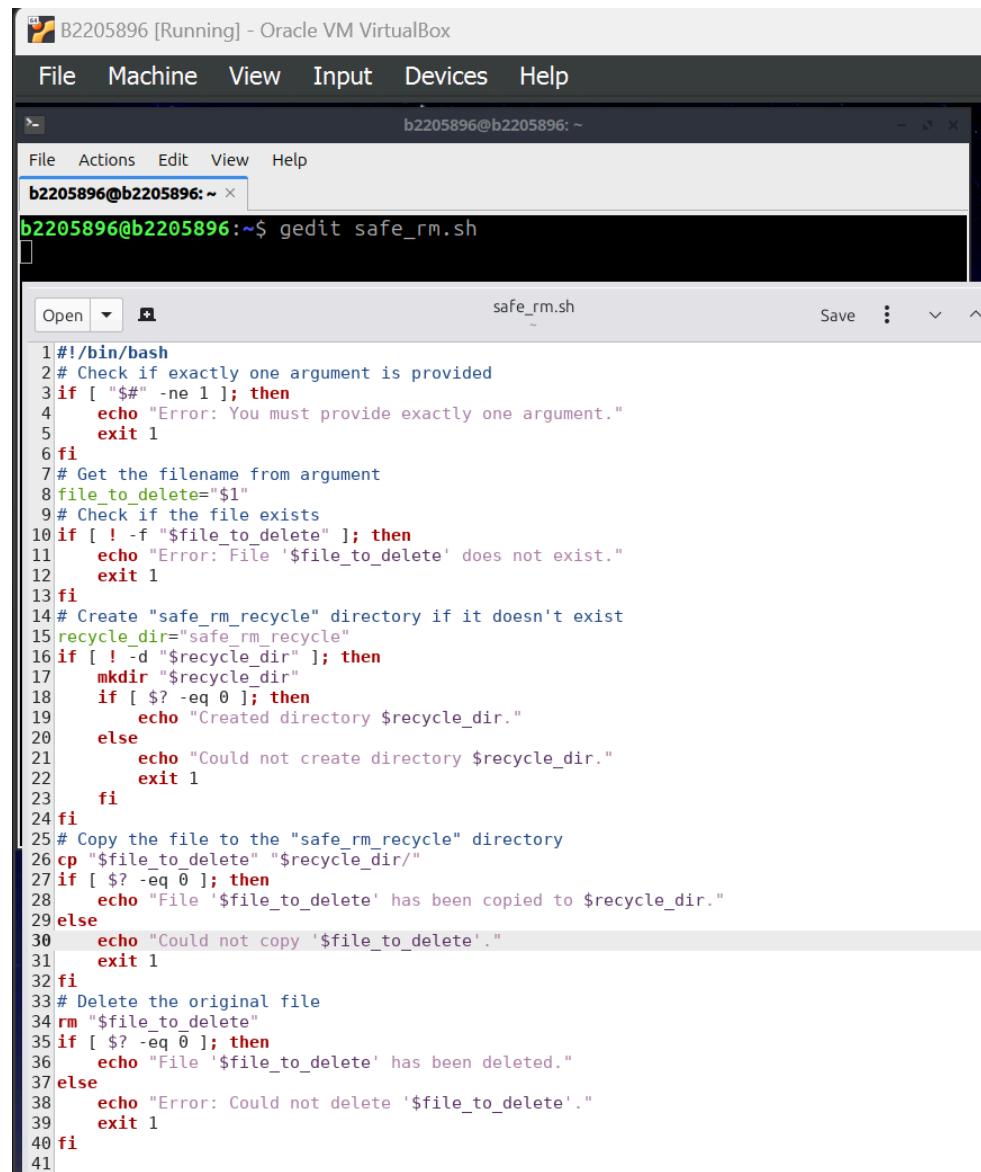
(take a screenshot of the console)

7. Shell scripting

The default rm command will not confirm before it deletes any regular files. Write a short script called *safe_rm.sh*, such that it will make a copy before deleting a single file (that is, we do not use wildcard expressions for this problem) by doing the following:

- Take one and only one argument at the command line (hint: search for an expression representing the number of arguments in the shell scripts). Print out an error message if no argument or more than one argument is provided (hint: use echo).
- Create a directory “safe_rm_recycle” in the current one if it is not already created. Copy the file indicated by the first argument to this “safe_rm_recycle” folder. Remove this file from the current working directory.

Run the script, then take screenshots to show that you finish this exercise. Please also take screenshots of your code.



The screenshot shows a virtual machine window titled "B2205896 [Running] - Oracle VM VirtualBox". Inside, a terminal window displays the command "b2205896@b2205896:~\$ gedit safe_rm.sh". The gedit editor is open, showing the contents of the "safe_rm.sh" file. The file is a bash script that checks if exactly one argument is provided, creates a "safe_rm_recycle" directory if it doesn't exist, copies the file to this directory, and then deletes the original file.

```
1#!/bin/bash
2# Check if exactly one argument is provided
3if [ "$#" -ne 1 ]; then
4    echo "Error: You must provide exactly one argument."
5    exit 1
6fi
7# Get the filename from argument
8file_to_delete="$1"
9# Check if the file exists
10if [ ! -f "$file_to_delete" ]; then
11    echo "Error: File '$file_to_delete' does not exist."
12    exit 1
13fi
14# Create "safe_rm_recycle" directory if it doesn't exist
15recycle_dir="safe_rm_recycle"
16if [ ! -d "$recycle_dir" ]; then
17    mkdir "$recycle_dir"
18    if [ $? -eq 0 ]; then
19        echo "Created directory $recycle_dir."
20    else
21        echo "Could not create directory $recycle_dir."
22        exit 1
23    fi
24fi
25# Copy the file to the "safe_rm_recycle" directory
26cp "$file_to_delete" "$recycle_dir/"
27if [ $? -eq 0 ]; then
28    echo "File '$file_to_delete' has been copied to $recycle_dir."
29else
30    echo "Could not copy '$file_to_delete'."
31    exit 1
32fi
33# Delete the original file
34rm "$file_to_delete"
35if [ $? -eq 0 ]; then
36    echo "File '$file_to_delete' has been deleted."
37else
38    echo "Error: Could not delete '$file_to_delete'."
39    exit 1
40fi
41
```

The screenshot shows a Linux terminal window titled "B2205896 [Running] - Oracle VM VirtualBox". The terminal menu bar includes File, Machine, View, Input, Devices, and Help. The window title bar shows "b2205896@b2205896: ~". The terminal window itself has a menu bar with File, Actions, Edit, View, and Help, and a tab labeled "b2205896@b2205896: ~". The terminal session content is as follows:

```
b2205896@b2205896:~$ gedit safe_rm.sh
b2205896@b2205896:~$ sudo chmod 777 safe_rm.sh
b2205896@b2205896:~$ touch testfile
b2205896@b2205896:~$ ls
Autumn_Leaves  Downloads  Pictures      snap      Videos
Desktop        Music      Public       Templates
Documents      newfile    safe_rm.sh  testfile
b2205896@b2205896:~$ ./safe_rm.sh testfile
Created directory safe_rm_recycle.
File 'testfile' has been copied to safe_rm_recycle.
File 'testfile' has been deleted.
b2205896@b2205896:~$ ls
Autumn_Leaves  Downloads  Pictures      safe_rm.sh  Videos
Desktop        Music      Public       snap
Documents      newfile    safe_rm_recycle Templates
b2205896@b2205896:~$ ls safe_rm_recycle
testfile
b2205896@b2205896:~$
```

---END---