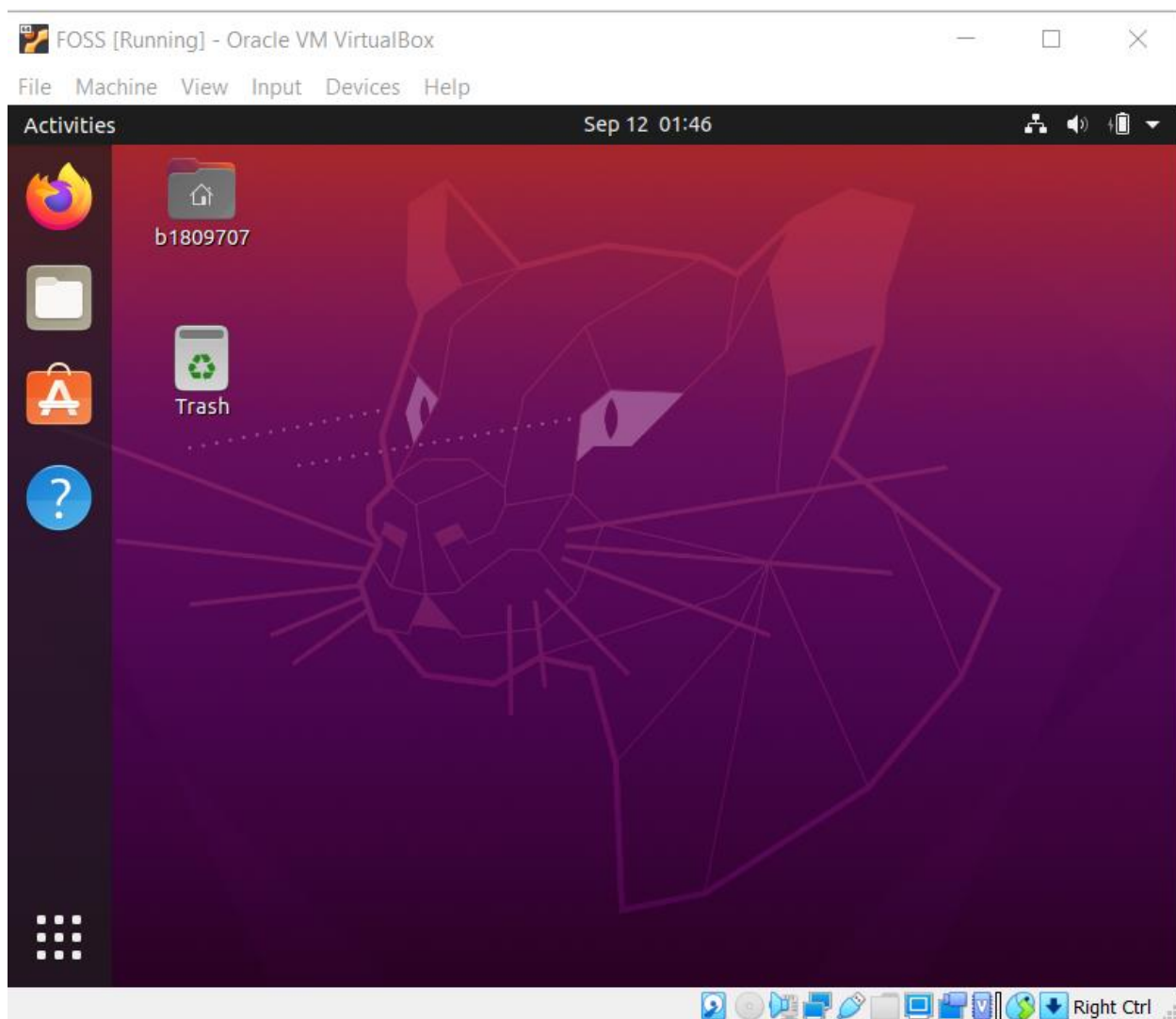**LAB 2**

LINUX BASIC - SHELL SCRIPTING
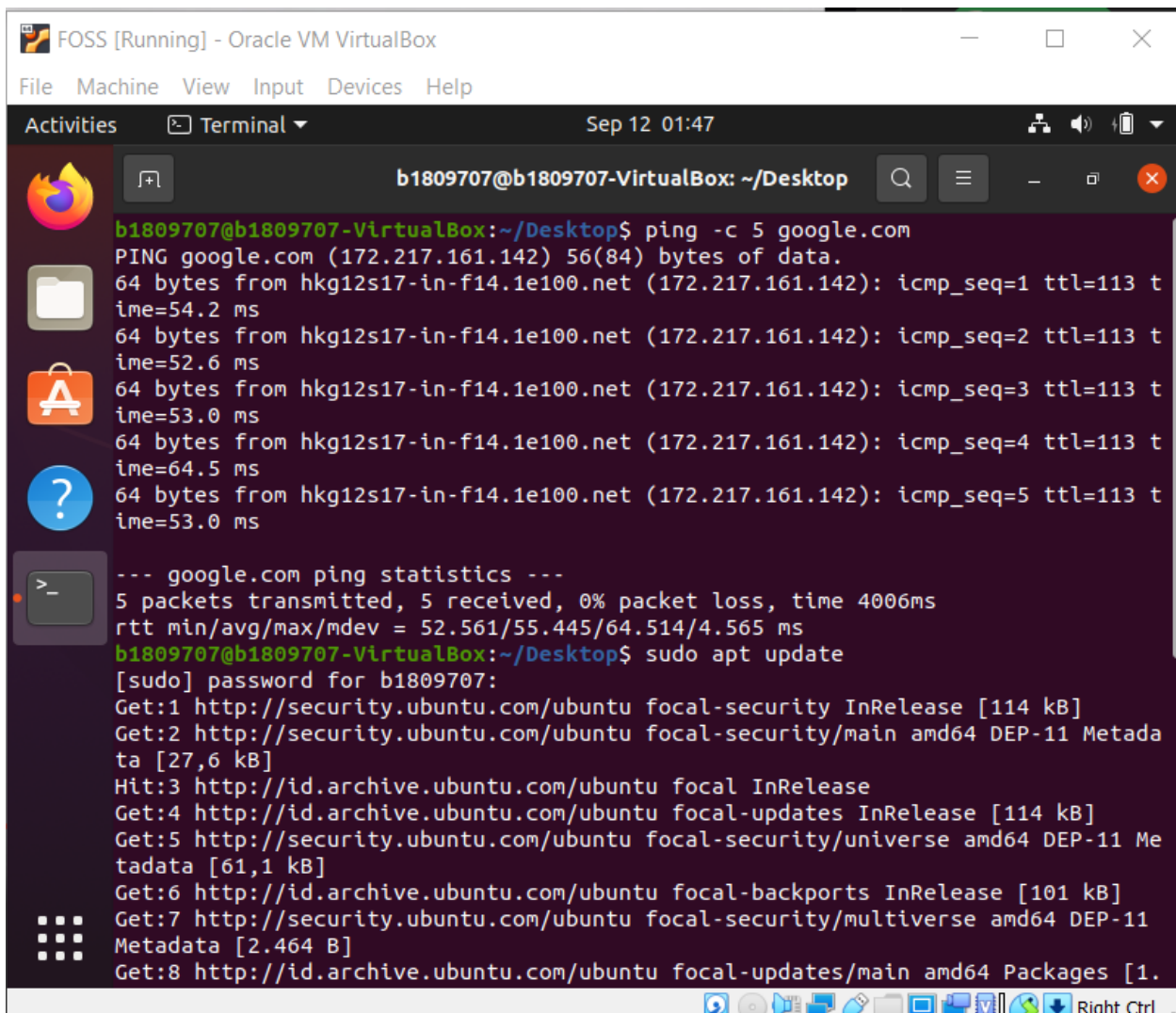
Fullname: Nguyen Chi Hoang Minh

Student ID: B1809707

- 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 20.04 LTS as the OS of the VM.

1.3. Verifying network connections
```
$ping -c 5 google.com
$sudo apt update
```


2. Basic operations

2.1. Accessing Directories
- Locate the application titled "**firefox**" using **whereis** command.
  ```
  $whereis firefox
  ```
- Display the present working directory.
  ```
  $pwd
  ```
- Change the current working directory to **/usr/bin** directory.
  ```
  $cd /usr/bin
  ```
- Change the current working directory to **$HOME** directory.

```
$cd ~
```
- Move to the parent directory.
```
$cd ..
```
- Go to the previous directory by the shortcut method, i.e., using '-' operator.
```
$cd -
```
- Display the present working directory.
```
$pwd
```
- Display filesystem tree of current directory
```
$tree
```

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
  ```
- Check for the existence of **file1** and **file2** using **ls -l** .
  ```
  $ls -l file1 file2
  ```
- Rename **file1** to **new_file1** using **mv**.
  ```
  $mv file1 new_file1
  ```
- Remove **file2** and **new_file**1 using **rm** without any options.
  ```
  $rm file2 new_file1
  ```
- Create a directory named **dir1**, using **mkdir**.
  ```
  $mkdir dir1
  ```
- Remove **dir1** using **rmdir** without any options
  ```
  $rmdir dir1
  ```
- 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
  ```
- 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
  ...
  # Ctrl o: Save file
  # Ctrl x: Quit nano
  ```
- Search for the string "**falling**" in the file **Autumn_Leaves**
  ```
  $grep "falling" Autumn_Leaves
  ```
- Display the first 2 lines of the file **Autumn_Leaves**
  ```
  $head -n 2 Autumn_Leaves
  ```
- Display the last 3 lines of the file **Autumn_Leaves**
  ```
  $tail -n 3 Autumn_Leaves
  ```

```
b1809707@b1809707-VirtualBox: ~
b1809707@b1809707-VirtualBox:~$ touch -t 202010201400 file1 file2
b1809707@b1809707-VirtualBox:~$ ls -l file1 file2
-rw-rw-r-- 1 b1809707 b1809707 0 Okt 20  2020 file1
-rw-rw-r-- 1 b1809707 b1809707 0 Okt 20  2020 file2
b1809707@b1809707-VirtualBox:~$ mv file1 new_file1
b1809707@b1809707-VirtualBox:~$ rm file2 new_file1
b1809707@b1809707-VirtualBox:~$ mkdir dir1
b1809707@b1809707-VirtualBox:~$ rm dir1/
rm: cannot remove 'dir1/': Is a directory
b1809707@b1809707-VirtualBox:~$ rmdir dir1/
b1809707@b1809707-VirtualBox:~$ touch exercise.txt
b1809707@b1809707-VirtualBox:~$ mv ./exercise.txt /tmp/
b1809707@b1809707-VirtualBox:~$ rm /tmp/exercise.txt
b1809707@b1809707-VirtualBox:~$
```

```
b1809707@b1809707-VirtualBox:~$ nano Autumn_Leaves
b1809707@b1809707-VirtualBox:~$ grep "falling" Autumn_Leaves
The falling leaves drift by my window
The falling leaves of red and gold
b1809707@b1809707-VirtualBox:~$ head -n 2 Autumn_Leaves
#Content of Autumn_Leaves file
The falling leaves drift by my window
b1809707@b1809707-VirtualBox:~$ tail -n 3 Autumn_Leaves
But I miss you most of all my darling
When autumn leaves start to fall
...
```

2.3. Finding files in a directory
- Search for a file with name **gcc** in the **/usr** folder using **find** command.
  ```
  $find /usr -name "gcc"
  ```
- Search for a directory with the name **gcc**, in the **/us**r folder using **find** command.
  ```
  $find /usr -type d -name "gcc"
  ```
- Search for files in the current directory which were modified today.
  ```
  $find ./ -mtime 0
  ```
- Search for files with size **0 bytes**
  ```
  $find ./ -size 0
  ```

```
b1809707@b1809707-VirtualBox:~$ find /usr/ -name "gcc"
/usr/src/linux-hwe-5.11-headers-5.11.0-34/scripts/dummy-tools/gcc
/usr/src/linux-headers-5.11.0-27-generic/include/config/gcc
/usr/src/linux-headers-5.11.0-27-generic/include/config/have/gcc
/usr/src/linux-headers-5.11.0-34-generic/include/config/gcc
/usr/src/linux-headers-5.11.0-34-generic/include/config/have/gcc
/usr/src/linux-hwe-5.11-headers-5.11.0-27/scripts/dummy-tools/gcc
/usr/bin/gcc
/usr/lib/gcc
/usr/share/gcc
/usr/share/bash-completion/completions/gcc
/usr/share/doc/gcc
/usr/share/doc/gcc-9-base/gcc
b1809707@b1809707-VirtualBox:~$ find /usr/ -type d -name "gcc"
/usr/src/linux-headers-5.11.0-27-generic/include/config/gcc
/usr/src/linux-headers-5.11.0-27-generic/include/config/have/gcc
/usr/src/linux-headers-5.11.0-34-generic/include/config/gcc
/usr/src/linux-headers-5.11.0-34-generic/include/config/have/gcc
/usr/lib/gcc
/usr/share/gcc
/usr/share/doc/gcc-9-base/gcc
```

```
b1809707@b1809707-VirtualBox:~$ find ./ -mtime 0 | head -n 10
./
./Desktop
./Desktop/VBoxGuestAdditions_6.1.26.iso
./.bash_history
./.cache
./.cache/libgweather
./.cache/mozilla
./.cache/mozilla/firefox
./.cache/mozilla/firefox/vqsklxcl.default
./.cache/mozilla/firefox/qwzn4ctp.default-release
b1809707@b1809707-VirtualBox:~$ find ./ -size 0
./safe_rm_recycle/123.txt
./.local/share/gnome-shell/gnome-overrides-migrated
./.local/share/gnome-settings-daemon/input-sources-converted
./.sudo_as_admin_successful
./.mozilla/firefox/qwzn4ctp.default-release/.parentlock
./.config/enchant/en_US.dic
./.config/enchant/en_US.exc
b1809707@b1809707-VirtualBox:~$
```

3. Installing and Removing software packages

    3.1. Install from default repositories

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

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

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

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

        - Install **apache2** package using apt tool

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

```
chromium-browser/focal-updates,now 1:85.0.4183.83-0ubuntu0.20.04.2 amd64 [insta
lled]
  Transitional package - chromium-browser -> chromium snap

chromium-browser-l10n/focal-updates,focal-updates 1:85.0.4183.83-0ubuntu0.20.04
.2 all
  Transitional package - chromium-browser-l10n -> chromium snap

b1809707@b1809707-VirtualBox:~$ sudo apt update && sudo apt remove chromium-bro
wser && sudo apt install chromium-browser -y
Hit:1 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:2 http://id.archive.ubuntu.com/ubuntu focal InRelease
Hit:3 http://id.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:4 http://id.archive.ubuntu.com/ubuntu focal-backports InRelease
Reading package lists... Done
Building dependency tree
Reading state information... Done
26 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be REMOVED:
  chromium-browser
0 upgraded, 0 newly installed, 1 to remove and 26 not upgraded.
After this operation, 164 kB disk space will be freed.
Do you want to continue? [Y/n] y
```
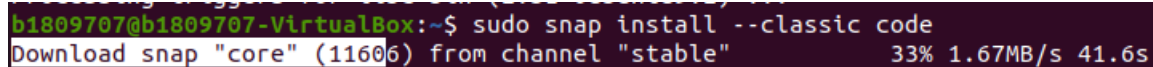
```
b1809707@b1809707-VirtualBox:~$ sudo apt install -y apache2
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap libcurl4 liblua5.2-0
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap libcurl4 liblua5.2-0
0 upgraded, 10 newly installed, 0 to remove and 26 not upgraded.
Need to get 2.054 kB of archives.
After this operation, 8.643 kB of additional disk space will be used.
Get:1 http://id.archive.ubuntu.com/ubuntu focal/main amd64 libapr1 amd64 1.6.5-
1ubuntu1 [91,4 kB]
Get:2 http://id.archive.ubuntu.com/ubuntu focal/main amd64 libaprutil1 amd64 1.
6.1-4ubuntu2 [84,7 kB]
Get:3 http://id.archive.ubuntu.com/ubuntu focal/main amd64 libaprutil1-dbd-sqli
te3 amd64 1.6.1-4ubuntu2 [10,5 kB]
Get:4 http://id.archive.ubuntu.com/ubuntu focal/main amd64 libaprutil1-ldap amd
64 1.6.1-4ubuntu2 [8.736 B]
Get:5 http://id.archive.ubuntu.com/ubuntu focal-updates/main amd64 libcurl4 amd
64 7.68.0-1ubuntu2.6 [234 kB]
Get:6 http://id.archive.ubuntu.com/ubuntu focal/main amd64 liblua5.2-0 amd64 5.
```

3.2. Install using snap
- Install VScode using snap tool
  ```
  $sudo snap install --classic code
  ```

```
b1809707@b1809707-VirtualBox:~$ sudo snap install --classic code
Download snap "core" (11606) from channel "stable"          33% 1.67MB/s 41.6s
```

4.   Process and daemons (services)
- Launch **chromium-browser** application; then find its PID using **pgrep** command
  ```
  $chromium
  $pgrep chrome
  ```
- Stop/continue/terminate **chromium-browser** application using **kill** command
  ```
  $kill -s STOP <PID>
  $kill -s CONT <PID>
  $kill -s KILL <PID>
  ```
- Start and then display the status of **apache2** web server using systemctl command
  ```
  $sudo systemctl start apache2
  $sudo systemctl status apache2
  ```
- Enable **apache2** web server starting on booting time
  ```
  $sudo systemctl enable apache2
  ```

```
Activities          Terminal ▼                        Sep 12 02:43

                         b1809707@b1809707-VirtualBox: ~

       b1809707@b1809707-VirtualBox: ~    ×      b1809707@b1809707-VirtualBox: ~    ×

b1809707@b1809707-VirtualBox:~$ pgrep chrome
5519
5658
5659
5661
5687
5689
5702
5703
5754
5756
5763
b1809707@b1809707-VirtualBox:~$ 
```
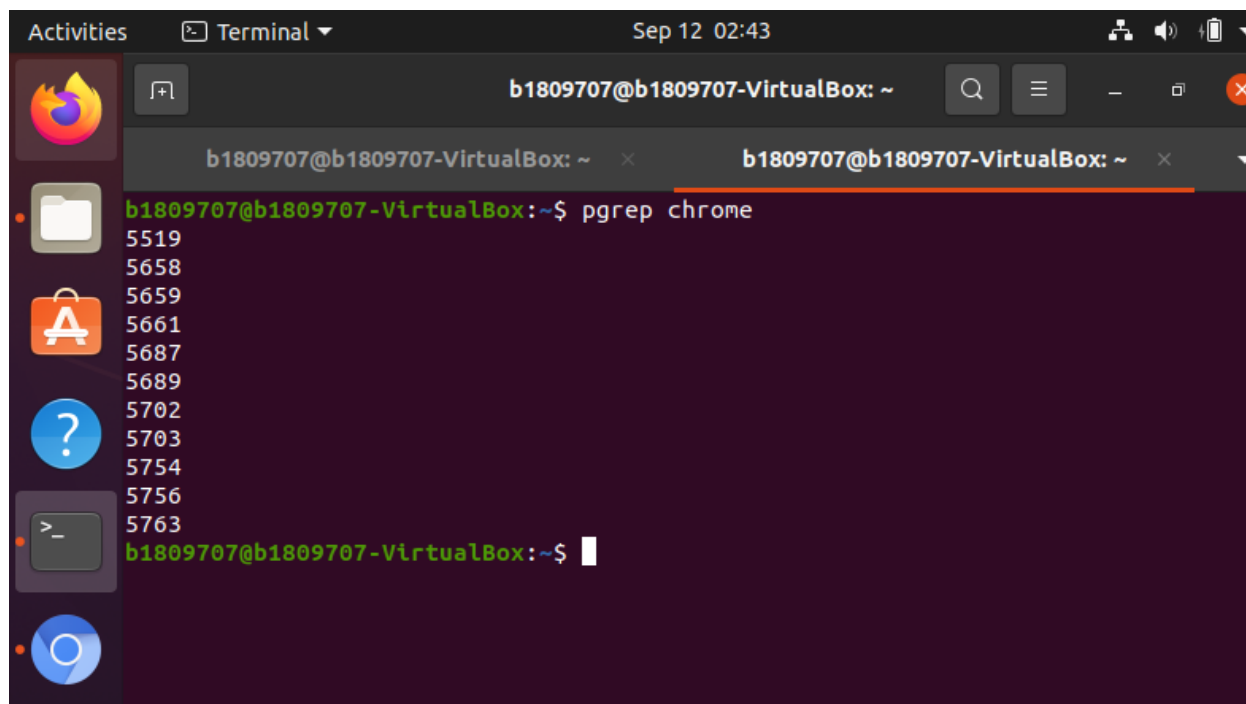
```
b1809707@b1809707-VirtualBox:~$ kill -s STOP 5519
b1809707@b1809707-VirtualBox:~$ kill -s CONT 5658
b1809707@b1809707-VirtualBox:~$ kill -s KILL 5659
b1809707@b1809707-VirtualBox:~$ sudo systemctl start apache2
[sudo] password for b1809707:
b1809707@b1809707-VirtualBox:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
     Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor pres>
     Active: active (running) since Sun 2021-09-12 02:39:36 WIB; 5min ago
       Docs: https://httpd.apache.org/docs/2.4/
   Main PID: 4284 (apache2)
      Tasks: 55 (limit: 4651)
     Memory: 4.7M
     CGroup: /system.slice/apache2.service
             ├─4284 /usr/sbin/apache2 -k start
             ├─4286 /usr/sbin/apache2 -k start
             └─4287 /usr/sbin/apache2 -k start

Sep 12 02:39:36 b1809707-VirtualBox systemd[1]: Starting The Apache HTTP Serve>
Sep 12 02:39:36 b1809707-VirtualBox apachectl[4283]: AH00558: apache2: Could n>
Sep 12 02:39:36 b1809707-VirtualBox systemd[1]: Started The Apache HTTP Server.
b1809707@b1809707-VirtualBox:~$ sudo systemctl enable apache2
Synchronizing state of apache2.service with SysV service script with /lib/syste
md/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable apache2
```

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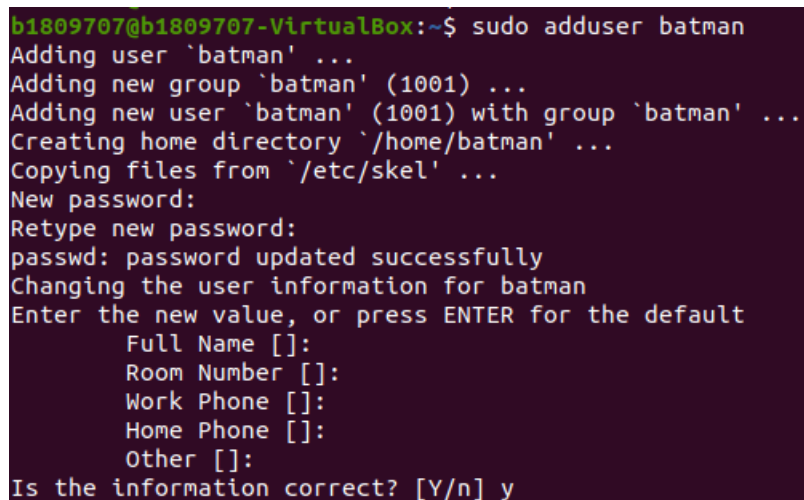
- Configure this user to be able to use **sudo** command

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

- 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
```

```
b1809707@b1809707-VirtualBox:~$ sudo adduser batman
Adding user `batman' ...
Adding new group `batman' (1001) ...
Adding new user `batman' (1001) with group `batman' ...
Creating home directory `/home/batman' ...
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 []:
        Room Number []:
        Work Phone []:
        Home Phone []:
        Other []:
Is the information correct? [Y/n] y
```

```
b1809707@b1809707-VirtualBox:~$ sudo passwd batman
New password:
Retype new password:
passwd: password updated successfully
b1809707@b1809707-VirtualBox:~$ sudo usermod -aG sudo batman
b1809707@b1809707-VirtualBox:~$ su batman
Password:
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

batman@b1809707-VirtualBox:/home/b1809707$ sudo cat /etc/shadow
[sudo] password for batman:
root:!:18881:0:99999:7:::
d Terminal 18858:0:99999:7:::
bin:*:18858:0:99999:7:::
sys:*:18858:0:99999:7:::
sync:*:18858:0:99999:7:::
games:*:18858:0:99999:7:::
man:*:18858:0:99999:7:::
lp:*:18858:0:99999:7:::
mail:*:18858:0:99999:7:::
news:*:18858:0:99999:7:::
uucp:*:18858:0:99999:7:::
proxy:*:18858:0:99999:7:::
www-data:*:18858:0:99999:7:::
backup:*:18858:0:99999:7:::
list:*:18858:0:99999:7:::
irc:*:18858:0:99999:7:::
```

5.2. Password aging

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

  ```
  $sudo chage -l batman
  ```
- Modify the expiration date for the user, setting it to be something that has passed, and check to see what has changed.

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

```
b1809707@b1809707-VirtualBox:~$ sudo chage -l batman
Last password change                                    : Sep 11, 2021
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
b1809707@b1809707-VirtualBox:~$ sudo chage -E 2020/12/31 batman
b1809707@b1809707-VirtualBox:~$ su batman
Password:
Your account has expired; please contact your system administrator
su: Authentication failure
```

5.3. Log files

- Display the time when the user in 5.1 created

  ```
  $cat /var/log/auth.log | grep "new user"
  ```
- Find the time of the last log in to the system

  ```
  $last
  ```

```
b1809707@b1809707-VirtualBox:~$ cat /var/log/auth.log | grep "new user"
Sep 12 02:15:45 b1809707-VirtualBox useradd[17628]: new user: name=vboxadd, UID
=998, GID=1, home=/var/run/vboxadd, shell=/bin/false, from=/dev/pts/1
Sep 12 02:46:46 b1809707-VirtualBox useradd[6418]: new user: name=batman, UID=1
001, GID=1001, home=/home/batman, shell=/bin/bash, from=/dev/pts/1
b1809707@b1809707-VirtualBox:~$ last
b1809707 :0           :0             Sun Sep 12 02:20   still logged in
reboot   system boot  5.11.0-34-generi Sun Sep 12 02:19   still running
b1809707 :0           :0             Sun Sep 12 02:00 - crash  (00:19)
reboot   system boot  5.11.0-34-generi Sun Sep 12 02:00   still running
b1809707 :0           :0             Sun Sep 12 00:57 - crash  (01:02)
reboot   system boot  5.11.0-34-generi Sun Sep 12 00:57   still running
b1809707 :0           :0             Sun Sep 12 00:23 - crash  (00:33)
reboot   system boot  5.11.0-34-generi Sun Sep 12 00:23   still running
b1809707 :0           :0             Sat Sep 11 10:12 - crash  (14:10)
reboot   system boot  5.11.0-34-generi Sat Sep 11 10:12   still running
b1809707 :0           :0             Sat Sep 11 10:02 - crash  (00:09)
reboot   system boot  5.11.0-34-generi Sat Sep 11 10:02   still running

wtmp begins Sat Sep 11 10:02:34 2021
```

6.   File permissions

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

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

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

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

```
b1809707@b1809707-VirtualBox:~$ touch newfile
b1809707@b1809707-VirtualBox:~$ sudo chmod 750 newfile
b1809707@b1809707-VirtualBox:~$ sudo chown batman:batman newfile
b1809707@b1809707-VirtualBox:~$ ls -l newfile
-rwxr-x--- 1 batman batman 0 Sep 12 02:53 newfile
```

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 do 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 are 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 in the current working directory.

```
b1809707@b1809707-VirtualBox:~$ ls
Autumn_Leaves  Documents  Music     Public        safe_rm.sh  Templates
Desktop        Downloads  Pictures  safe_rm_recycle  snap       Videos
b1809707@b1809707-VirtualBox:~$ ./safe_rm.sh
 Failed to execute sript: No argument or more than one argument are provided
b1809707@b1809707-VirtualBox:~$ ./safe_rm.sh Autumn_Leaves
 Executed successfully
b1809707@b1809707-VirtualBox:~$ ls safe_rm_recycle/
Autumn_Leaves  newfile
b1809707@b1809707-VirtualBox:~$
```

```
#!/bin/sh
if [ "$#" -ne 1 ]; then
  echo "\033[0;31m Failed to execute sript: No argument or more than one argum>
  exit 1
fi
if ! [ -d "~/safe_rm_recycle" ]; then
  mkdir -p ~/safe_rm_recycle
fi
if [ -e "$1" ]; then
  mv "$1" ~/safe_rm_recycle
  echo "\033[0;32m Executed successfully"
  exit 1
fi
```

---END---