Template Week 5 – Operating Systems

Student number:

582122

Assignment 5.1: Unix-like

a) Find out what the difference is between UNIX and unix-like operating systems?

UNIX is an officially certified operating system based on the original Bell Labs UNIX. Unix-like systems behave like UNIX but are not certified; most are independent or open-source implementations such as Linux and BSD.

b) Study the image above named UNIX timeline. Find out who Ken Thompson, Dennis Ritchie, Bill Joy, Richard Stallman, and Linus Torvalds are and what they have contributed to the development of UNIX or unix-like systems and to IT in general. **TIP!** English-language sources often contain more detailed information about these individuals.

Ken Thompson co-created the original UNIX system. Dennis Ritchie co-created UNIX and invented the C programming language. Bill Joy developed BSD UNIX and created tools like the vi editor. Richard Stallman founded the GNU Project and the Free Software Foundation to promote free software. Linus Torvalds created the Linux kernel, which is used in most modern unix-like systems.

c) What is the philosophy of the GNU movement?

The GNU movement promotes the idea that users should have complete freedom to run, study, modify, and share software.

d) Does Ubuntu as a Linux operating system conform to the philosophy of the GNU movement? Please explain your answer.

Ubuntu partly follows the GNU philosophy because it is based on open-source GNU/Linux, but it does not fully follow it because Ubuntu includes optional proprietary drivers and software.

e) Find out what is the Windows Subsystem for Linux?

The Windows Subsystem for Linux is a Windows feature that allows users to run real Linux distributions directly on Windows without needing a virtual machine.

f) Find out, which operating system family belongs to Android, iOS and ChromeOS?

Android belongs to the Linux family, iOS belongs to the UNIX/BSD family, and ChromeOS belongs to the Linux family.

Assignment 5.2: Supercomputers and gameconsoles

a) Research on this site what supercomputers are used for and write a short summary of it:
https://www.computerhistory.org/timeline/search/?q=Supercomputer

b) IBM is a company that has already built a number of supercomputers. One of them is IBM's Roadrunner. The CPU developed for this supercomputer was further developed at a later stage as the CPU for the PlayStation 3 console. Find out what a **PlayStation 3 cluster** is and what it was used for?

A PlayStation 3 cluster is a supercomputer built by connecting many PlayStation 3 consoles together, using their powerful Cell processors. These clusters were used for scientific research, including simulations, encryption analysis, astrophysics, and military research. One of the most famous examples was the U.S. Air Force PS3 cluster used for image processing and machine learning tasks.

c) You can build a supercomputer by putting a few computers together in a cluster. Here's what Oracle did with a collection of Raspberry Pi's, for example:
https://blogs.oracle.com/developers/post/building-the-worlds-largest-raspberry-pi-cluster
What specific operating system is running on this cluster?

Oracle's Raspberry Pi supercomputer runs **Oracle Linux**, specifically a version built for the ARM architecture.

d) Does Oracle's Raspberry Pi supercomputer appear in the list of the 500 fastest supercomputers in the world? Make a logical decision for this, without going through the entire list.
https://www.top500.org/lists/top500/list/2023/06/

No, it does not. The Raspberry Pi cluster uses very low-power ARM CPUs that are far too slow to compete with modern HPC systems, so logically it cannot reach TOP500 performance.

e) What CPU architecture is used for the PlayStation 5 and Xbox Series X?
What operating systems run on these consoles?
What conclusion can you draw from the answer to the previous question?

The PlayStation 5 and Xbox Series X both use AMD 64-bit x86-64 CPUs based on AMD Zen 2 architecture.
The PlayStation 5 runs a customized Orbis OS based on FreeBSD, while the Xbox Series X runs a specialized Windows-based OS (a modified Windows 10 kernel).
The conclusion is that modern game consoles have shifted to PC-like hardware and operating systems, making development easier and reducing costs.

Assignment 5.3: Working with Windows

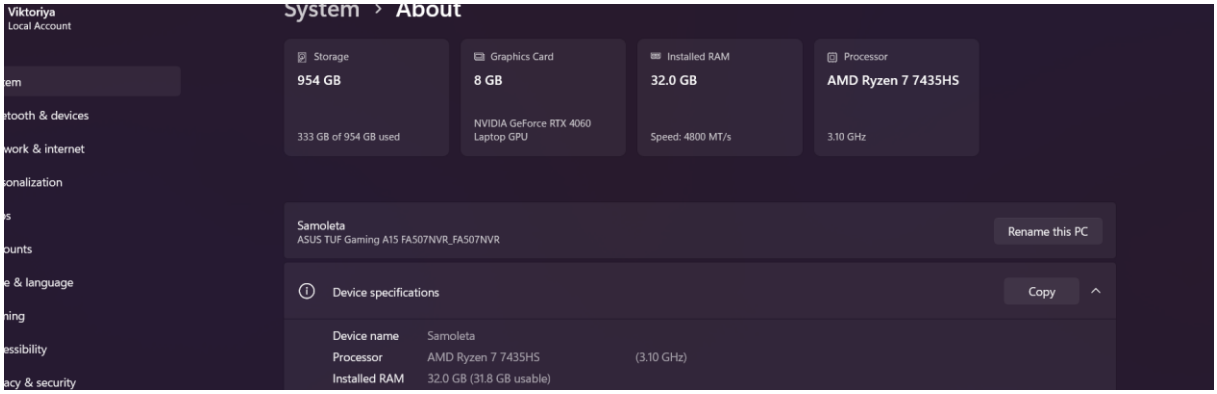
Take relevant screenshots of the assignments below

a) Practice for about 10 minutes with the ⊞ keyboard shortcuts combinations, skip the general shortcuts in this exercise. Take a look at which screens are opened.

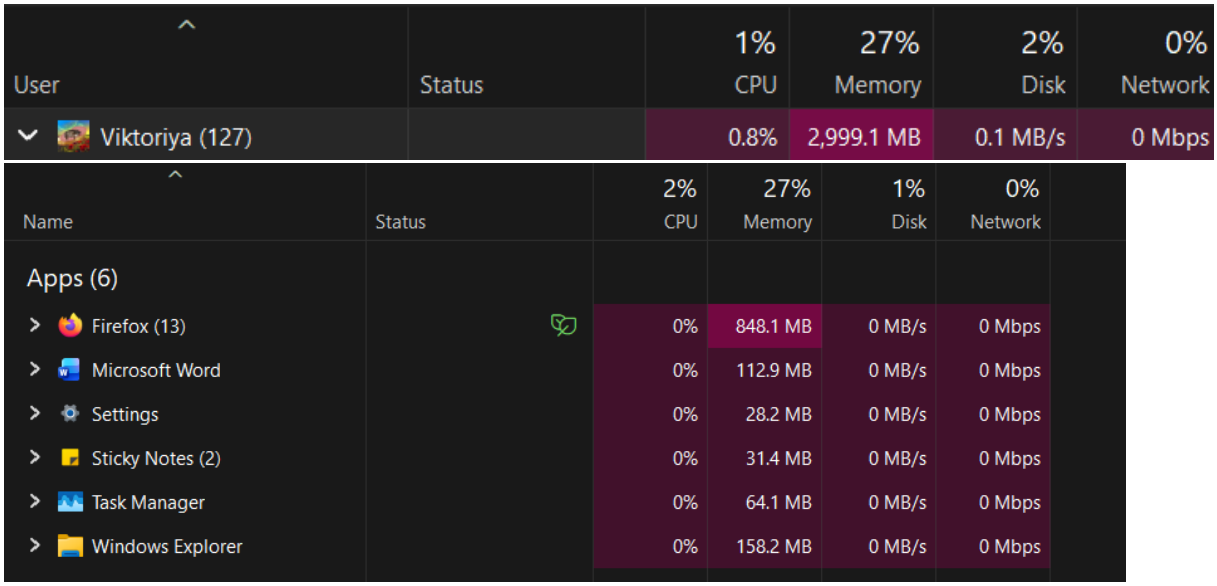
b) The file explorer can be opened with ⊞ + E, Which key combination could you also use?

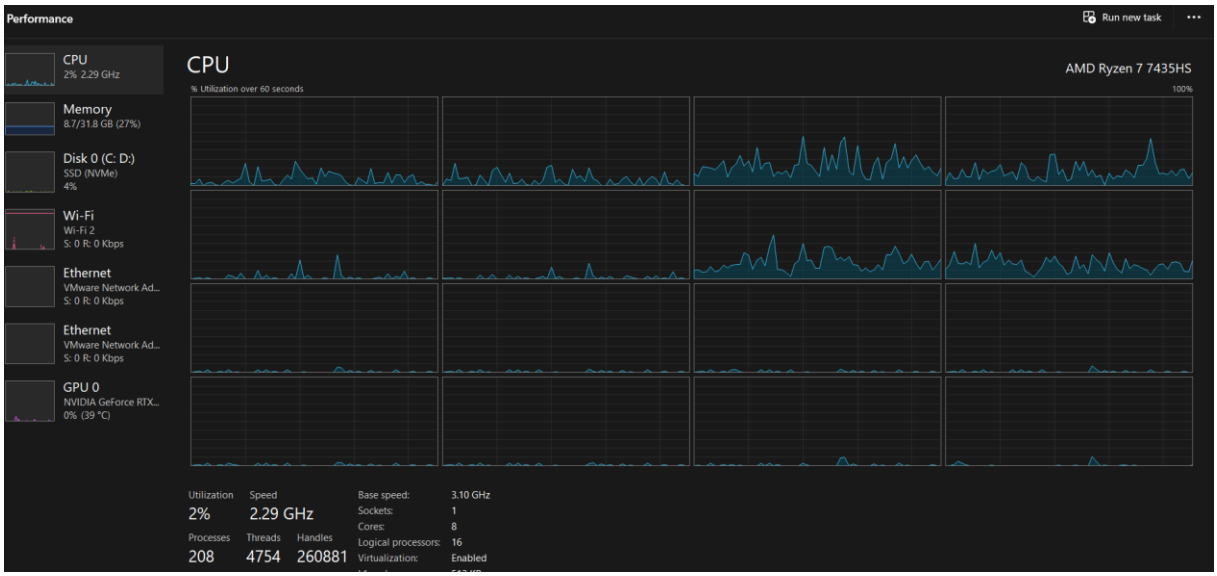
Win + E opens a new File Explorer window from anywhere. Win + ↑ maximizes the current File Explorer window. Win + ↓ minimizes or restores the current window. Win + ← or Win + → snaps the window to the left or right side of the screen. Win + Shift + ↑ stretches the File Explorer window vertically. Win + D shows the desktop, which minimizes File Explorer.

c) Open the system properties with a ⊞ key combination, take a screenshot of the open screen. Paste this screenshot into this template.



d) Open task manager with a key combination. Take screenshots of the tabs: processes (shows active processes), performance, and users. Place these three screenshots in this template.





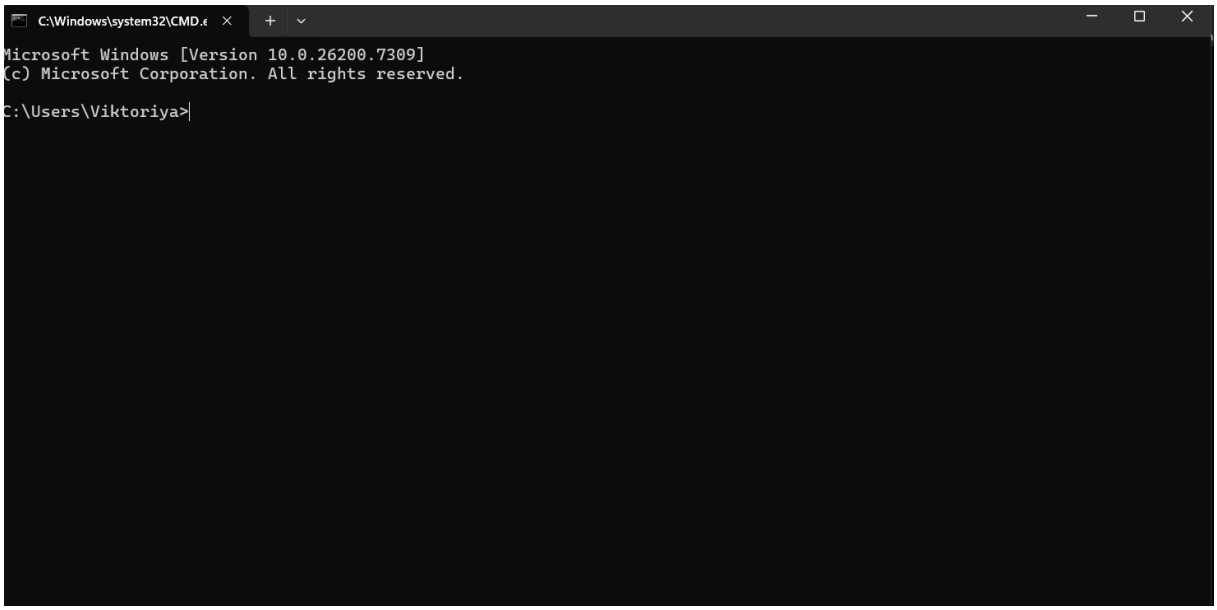
e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector, or the second screen. Which key combination should you use for this?

You press Windows key + P.

f) If you leave the classroom for a while and you leave your laptop behind, it is wise to lock the screen. Your Apps will continue to run in the background. So, for example, if you're waiting for a download that takes a while, lock the screen and get a cup of coffee. Which key combination do you use for this?

You press Windows key + L.

g) Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.



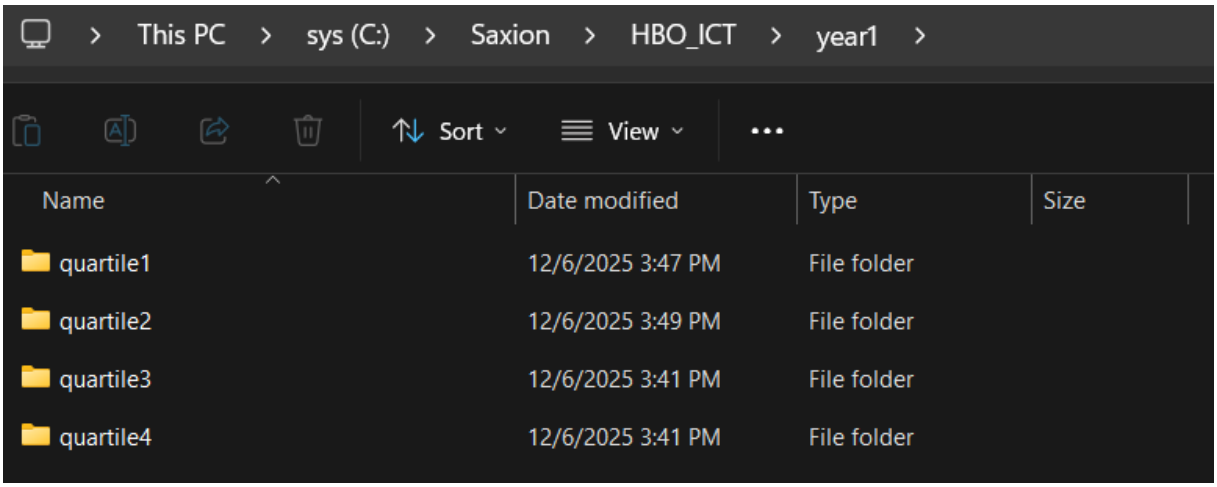
Working in the File Explorer

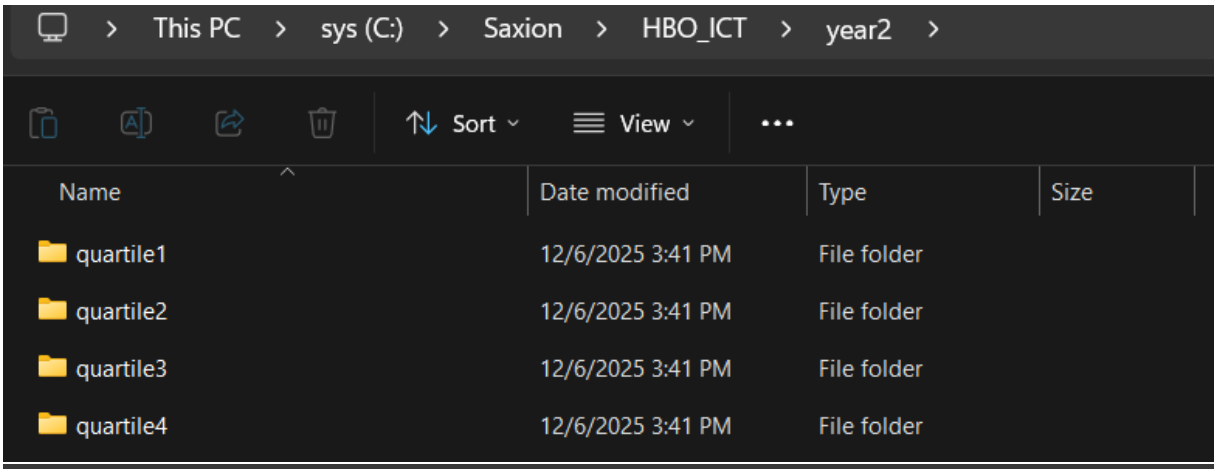
Relevant screenshots **copy** command:

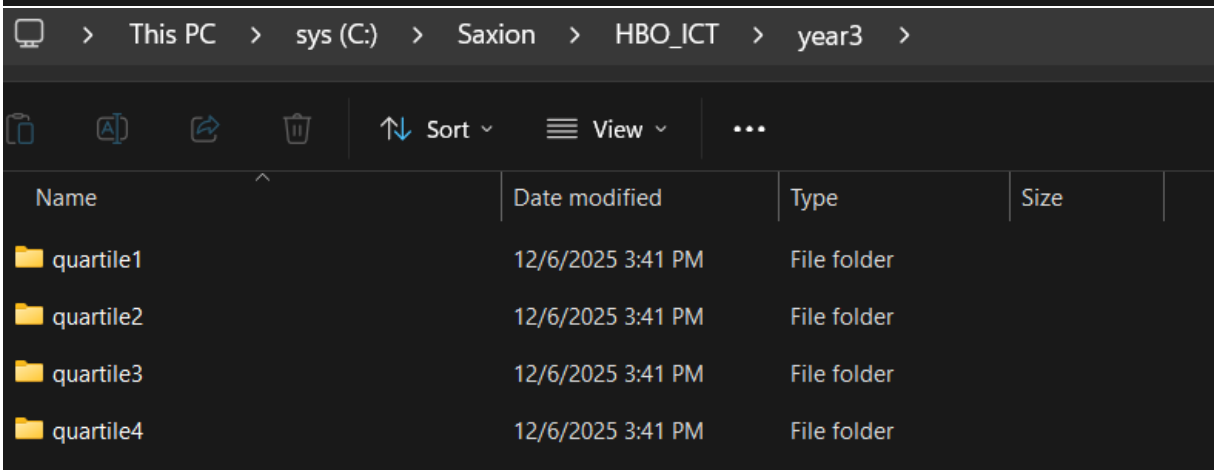
Relevant screenshots **tree** command:

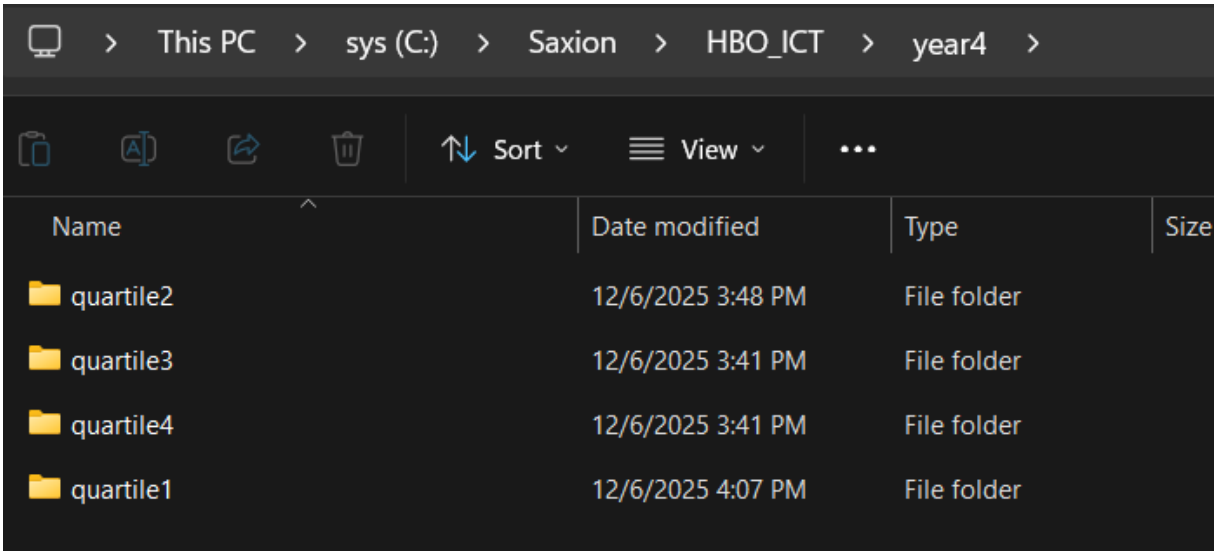
```
(c) Microsoft Corporation. All rights reserved.

C:\Saxion\HBO_ICT\year1\quartile2>copy "Wave.png" "C:\Saxion\HBO_ICT\year1\quartile1\ip"
        1 file(s) copied.

C:\Saxion\HBO_ICT\year1\quartile2>copy "Plug.png" "C:\Saxion\HBO_ICT\year1\quartile1\infra"
        1 file(s) copied.

C:\Saxion\HBO_ICT\year1\quartile2>copy "Tumble.png" "C:\Saxion\HBO_ICT\year1\quartile1\intSynergy"
        1 file(s) copied.

C:\Saxion\HBO_ICT\year1\quartile2>tree
Folder PATH listing for volume sys
Volume serial number is 3ED4-0CE2
C:.
├───databses
├───itfundamentals
└───project

C:\Saxion\HBO_ICT\year1\quartile2>viktoriakrastanova582122
```

Relevant screenshots in the file explorer of the folder c:\Saxion + created zip file.









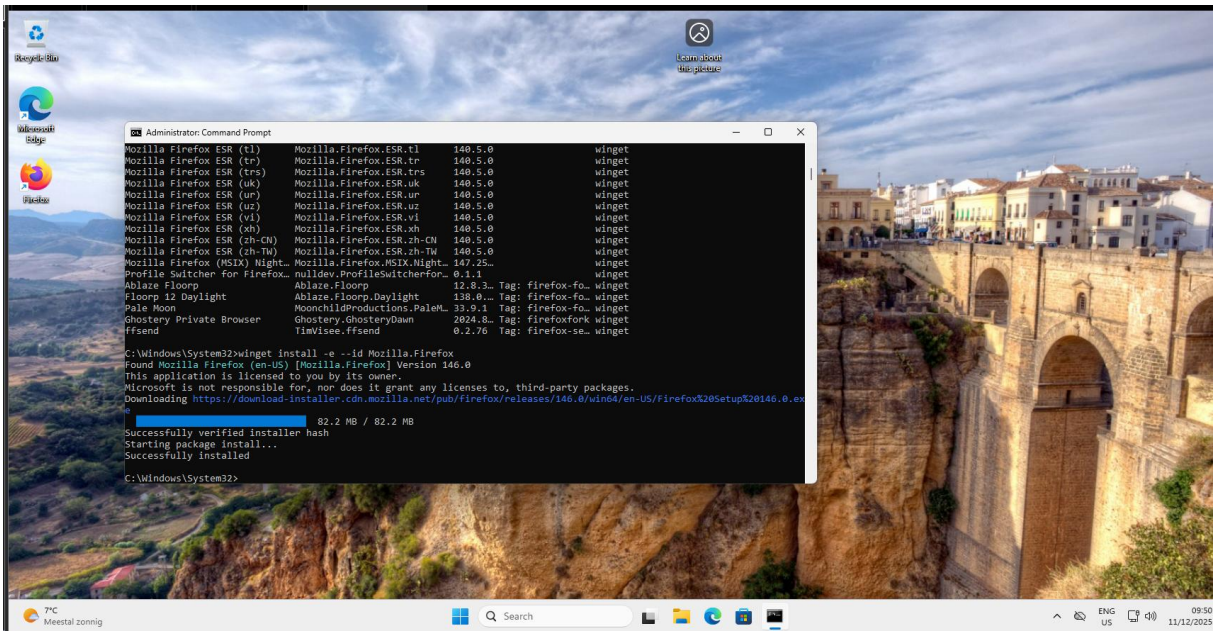
Terminating Processes

Relevant Screenshots Task Manager Window:

Install Software

Relevant screenshots that the following software is installed with winget:

- WinSCP
- Notepad++
- 7zip



Explain in your own words what exactly the above command does, explain the -e and --id options used as well.

The id option is to limit the instal to the exact one we want, Firefox in this case. The -e means extract and is to check for case sensitivity.

Assignment 5.4: Working with Linux

Relevant screenshots + motivation

```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ nano myfile.txt
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ [redacted]

viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ cp myfile.txt Documents/
cp: cannot stat 'myfile.txt': No such file or directory
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ cp myfile.txt Documents/
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ ls Documents
myfile.txt
```

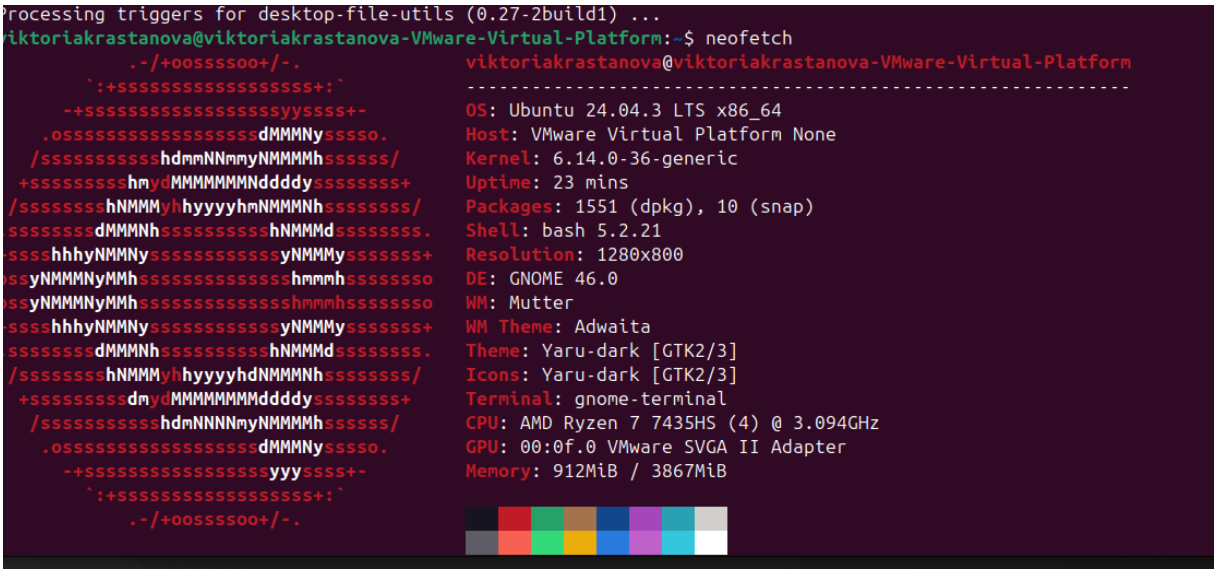
```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ ls Documents
myfile.txt
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ cd /etc
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:/etc$ cd $HOME
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ tar -cvf archive_name.tar myfile.txt
myfile.txt
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ tar -xvf archive_name.tar
myfile.txt
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ tar -cvzf my_compressed_archive.tar.gz myfile.txt
myfile.txt
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ htop
Command 'htop' not found, but can be installed with:
sudo snap install htop  # version 3.4.1, or
sudo apt  install htop  # version 3.2.2-2
See 'snap info htop' for additional versions.
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ sudo apt install htop
```

Htop Top Header: Shows overall system usage (CPU, Memory).

Process List: A list of all running processes. Key columns include:

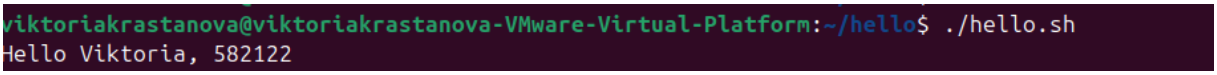
- PID (Process ID): A unique number for each process.
- USER: The user who owns the process.
- PRI/NI: Priority and Niceness of the process.
- VIRT/RES/SHR: Memory usage (Virtual, Resident, Shared).
- S: Process status (e.g., Running, Sleeping, Zombie).
- CPU%: Percentage of CPU time the process is using.
- MEM%: Percentage of physical memory the process is using.
- COMMAND: The command that started the process.

Function Keys (F1-F10): Shortcuts at the bottom for common doings like searching, filtering, killing a process, or changing the display setup.



Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation



Assignment 5.6: View the contents of files

Relevant screenshots + motivation

```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/holmes$ wc SherlockHolmes.txt
 12306 107562 607504 SherlockHolmes.txt
```

```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/holmes$ grep -in 'kingdom' SherlockHolmes.txt
490:“I tell you that I would give one of the provinces of my kingdom to
1124:And that was how a great scandal threatened to affect the kingdom of
```

```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/holmes$ head -n 1404 SherlockHolmes.tx
ail -n 10
there was to be any competition in the matter I stood as good a chance
as any man that I had ever met. Vincent Spaulding seemed to know so
much about it that I thought he might prove useful, so I just ordered
him to put up the shutters for the day and to come right away with me.
He was very willing to have a holiday, so we shut the business up and
started off for the address that was given us in the advertisement.

“I never hope to see such a sight as that again, Mr. Holmes. From
north, south, east, and west every man who had a shade of red in his
hair had tramped into the city to answer the advertisement. Fleet
```

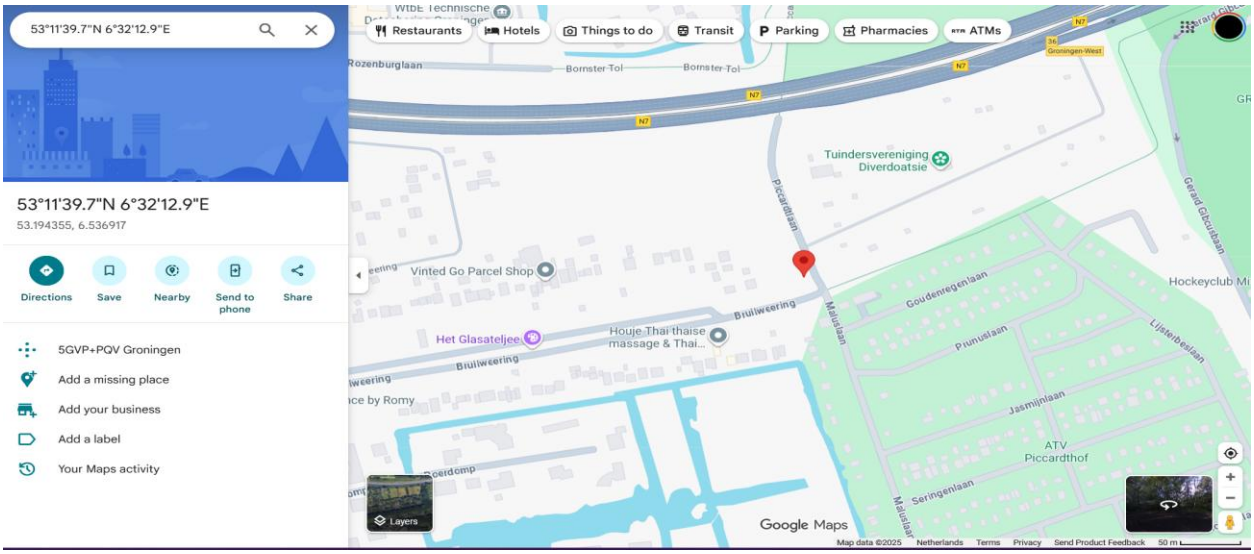
```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/holmes$ tail -n +1406 SherlockHolmes.txt |
head -n 10
coster’s orange barrow. I should not have thought there were so many in
the whole country as were brought together by that single
advertisement. Every shade of colour they were—straw, lemon, orange,
brick, Irish-setter, liver, clay; but, as Spaulding said, there were
not many who had the real vivid flame-coloured tint. When I saw how
many were waiting, I would have given it up in despair; but Spaulding
would not hear of it. How he did it I could not imagine, but he pushed
and pulled and butted until he got me through the crowd, and right up
to the steps which led to the office. There was a double stream upon
the stair, some going up in hope, and some coming back dejected; but we
```

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform: ~/Downloads
Selecting previously unselected package libunicode-linebreak-perl.
Preparing to unpack .../6-libunicode-linebreak-perl_0.0.20190101-1build7_amd64.d
eb ...
Unpacking libunicode-linebreak-perl (0.0.20190101-1build7) ...
Setting up libsombok3:amd64 (2.4.0-2build1) ...
Setting up libarchive-zip-perl (1.68-1) ...
Setting up libimage-exiftool-perl (12.76+dfsg-1) ...
Setting up libcompress-raw-lzma-perl:amd64 (2.209-1build2) ...
Setting up libio-compress-brotli-perl (0.004001-2build3) ...
Setting up libmime-charset-perl (1.013.1-2) ...
Setting up libunicode-linebreak-perl (0.0.20190101-1build7) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for libc-bin (2.39-0ubuntu8.6) ...
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ exiftool oldcar.jpg
Error: File not found - oldcar.jpg
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ find ~ -name "oldcar.jpg"
/home/viktoriakrastanova/Downloads/oldcar.jpg
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~$ cd ~/Downloads
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ exiftool -Make -Model oldca
r.jpg
Make                            : motorola
Camera Model Name               : moto g(6) play
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ exiftool -gpslatitude -gpsl
ongitude -c "%.6f" oldcar.jpg
GPS Latitude                    : 53.194355 N
GPS Longitude                   : 6.536917 E
```

Google Maps location:




```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ S^C
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ mv oldcar.jpg oldcar
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ mv oldcar.jpg oldcar
mv: cannot stat 'oldcar.jpg': No such file or directory
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ file oldcar
oldcar: JPEG image data, JFIF standard 1.01, aspect ratio, density 1x1, segment length 16, Exif Standa
rd: [TIFF image data, big-endian, direntries=10, manufacturer=motorola, model=moto g(6) play, xresolut
ion=160, yresolution=168, resolutionunit=2, software=aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release-ke
ys, datetime=2020:11:07 15:08:57, GPS-Data], baseline, precision 8, 4160x3120, components 3
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$
```

Yes. Even without the .jpg extension, Ubuntu will still identify it correctly.

```
iktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ base64 -d email-base64.txt
 decoded_image.gif
iktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ file decoded_image.gif
ecoded_image.gif: GIF image data, version 89a, 108 x 52
```

My colleague was right, the binary data was indeed a hidden image.

Since I previously found the coordinates 53.194355, 6.536917, here is the final piece of info:

- City: Groningen
- Location: The photo was taken at the Noorderplantsoen park. You can see the old car parked on the side of a leaf-covered path.

Assignment 5.8: Steganography

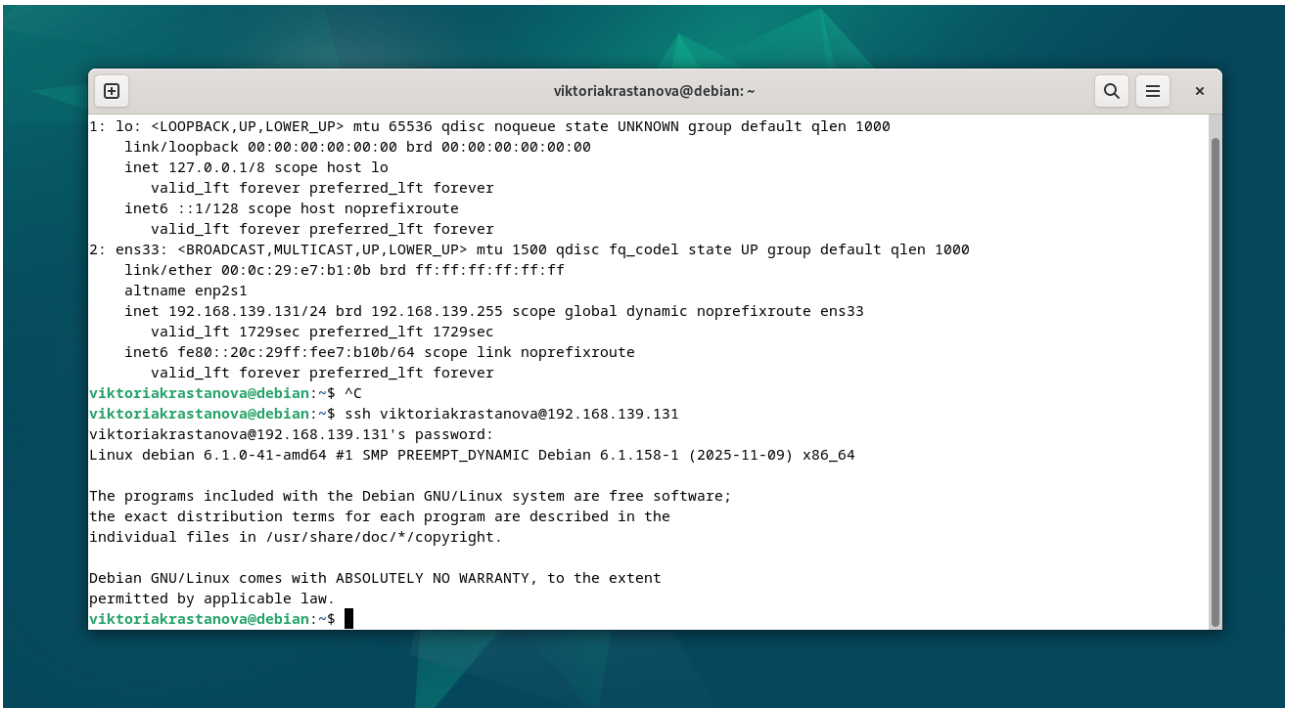
Relevant screenshots + motivation

```
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ steghide extract -sf apple2.jpg
Enter passphrase:
wrote extracted data to "message.txt".
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platf[redacted]
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$
viktoriakrastanova@viktoriakrastanova-VMware-Virtual-Platform:~/Downloads$ cat message.txt
Hello class.
You have almost completed Week 5.
```

Assignment 5.9: Capture disk images

Make relevant screenshots + motivation:

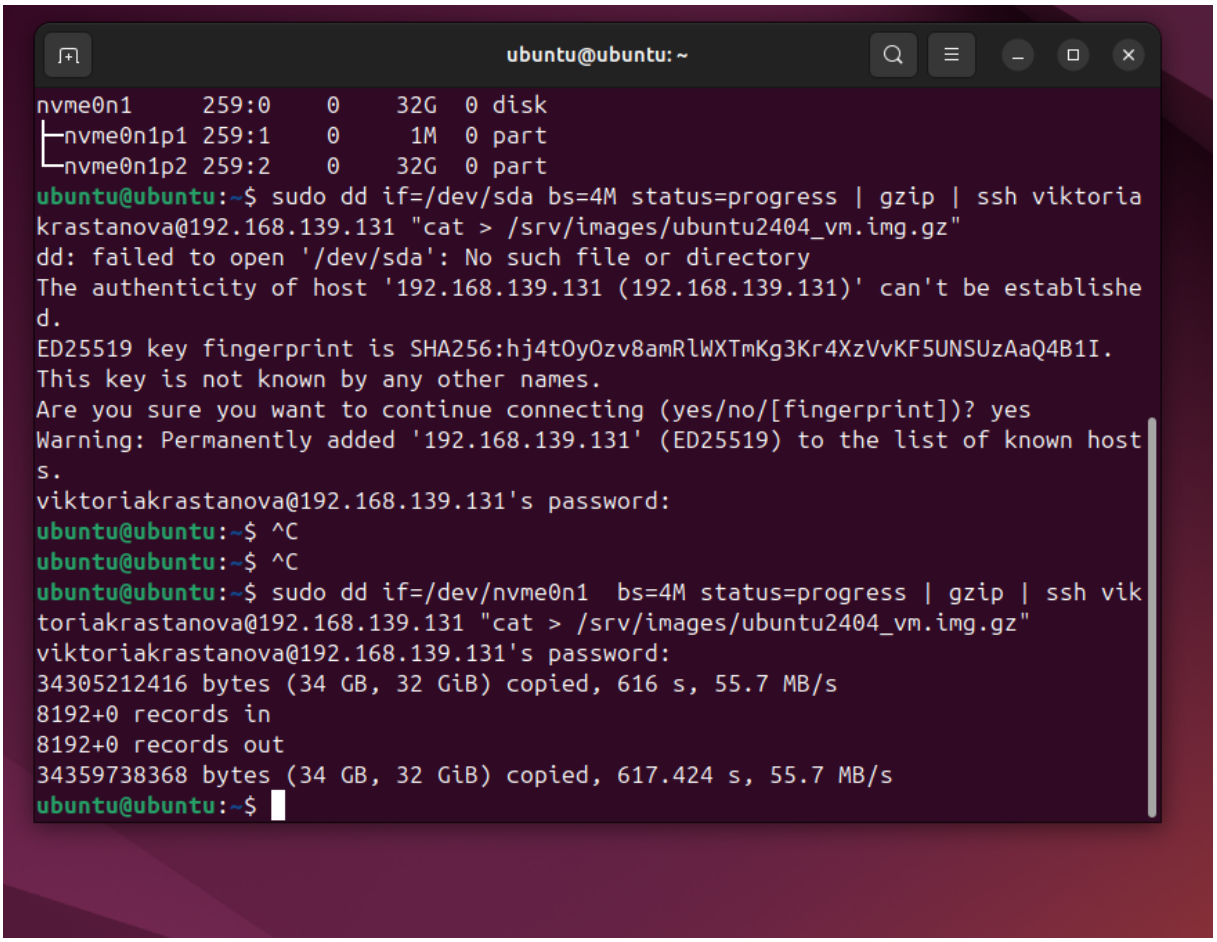
```
viktoriakrastanova@debian:~$ sudo mkdir -p /srv/images
viktoriakrastanova@debian:~$ sudo cHOWN $USEr;4user /srv/images
sudo: cHOWN: command not found
bash: 4user: command not found
viktoriakrastanova@debian:~$ sudo chown $USER:$USER /srv/images
viktoriakrastanova@debian:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
       valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:e7:b1:0b brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.131/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
       valid_lft 1334sec preferred_lft 1334sec
    inet6 fe80::20c:29ff:fee7:b10b/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
viktoriakrastanova@debian:~$
```



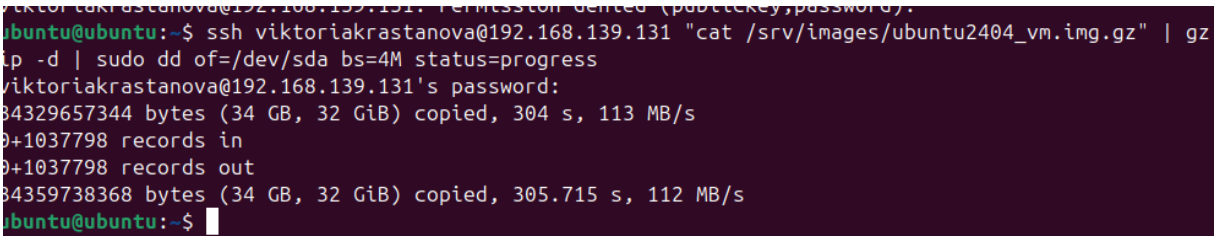
After command lsblk:

```
ubuntu@ubuntu:~$ lsblk
NAME        MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
fd0           2:0    1   1.4M  0 disk
loop0         7:0    0   1.7G  1 loop /rofs
loop1         7:1    0 523.3M  1 loop
loop2         7:2    0 925.9M  1 loop
loop3         7:3    0     4K  1 loop /snap/bare/5
loop4         7:4    0  73.9M  1 loop /snap/core22/2045
loop5         7:5    0 245.1M  1 loop /snap/firefox/6565
loop6         7:6    0  91.7M  1 loop /snap/gtk-common-themes/1535
loop7         7:7    0  11.1M  1 loop /snap/firmware-updater/167
loop8         7:8    0   516M  1 loop /snap/gnome-42-2204/202
loop9         7:9    0  10.8M  1 loop /snap/snap-store/1270
loop10        7:10   0   576K  1 loop /snap/snapd-desktop-integration/315
loop11        7:11   0  49.3M  1 loop /snap/snapd/24792
loop12        7:12   0   210M  1 loop /snap/thunderbird/769
loop13        7:13   0 112.6M  1 loop /snap/ubuntu-desktop-bootstrap/413
sr0          11:0    1  95.3M  0 rom
sr1          11:1    1   5.9G  0 rom  /cdrom
nvme0n1     259:0    0    32G  0 disk
├─nvme0n1p1 259:1    0     1M  0 part
└─nvme0n1p2 259:2    0    32G  0 part
```

- Proof that the Debian 13 server stored a back-up image of the Ubuntu 24.04 Desktop VM.



- Proof that you can restore the back-up image into an empty VM.



Took me 3 hours, but we are finally here WOHOO.

Ready? Save this file and export it as a pdf file with the name: **week5.pdf**