

Template Week 5 – Operating Systems

Student number:

580693

Assignment 5.1: Unix-like

- a) Find out what the difference is between UNIX and unix-like operating systems?
- 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.
- c) What is the philosophy of the GNU movement?
- d) Does Ubuntu as a Linux operating system conform to the philosophy of the GNU movement? Please explain your answer.
- e) Find out what is the Windows Subsystem for Linux?
- f) Find out, which operating system family belongs to Android, iOS and ChromeOS?

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?
- 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?
- 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/>
- 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?

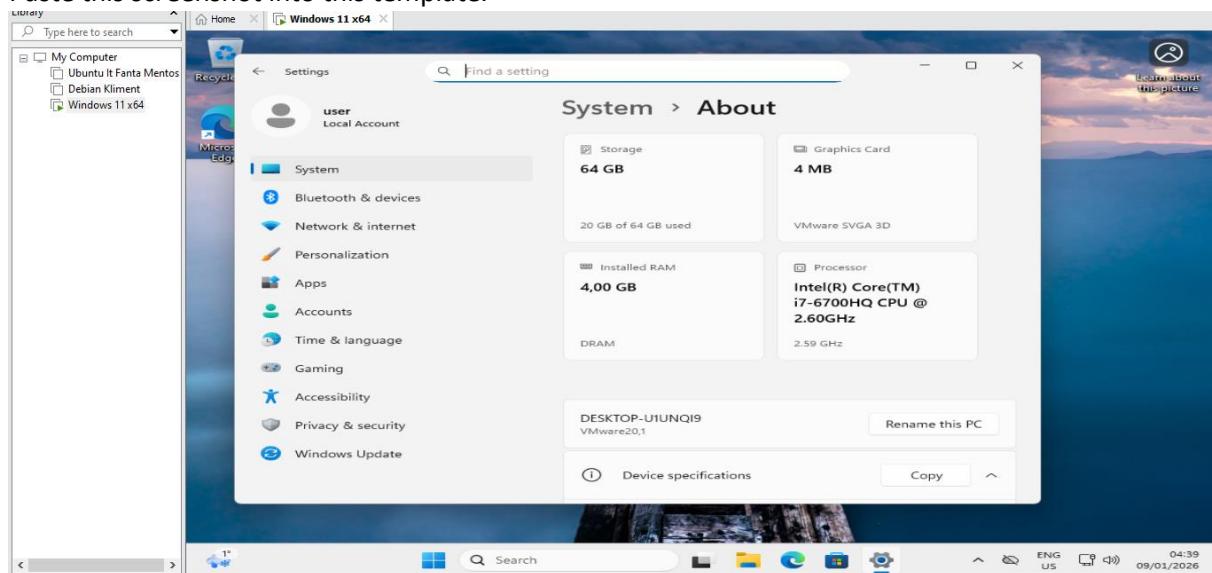
Assignment 5.3: Working with Windows

Take relevant screenshots of the assignments below

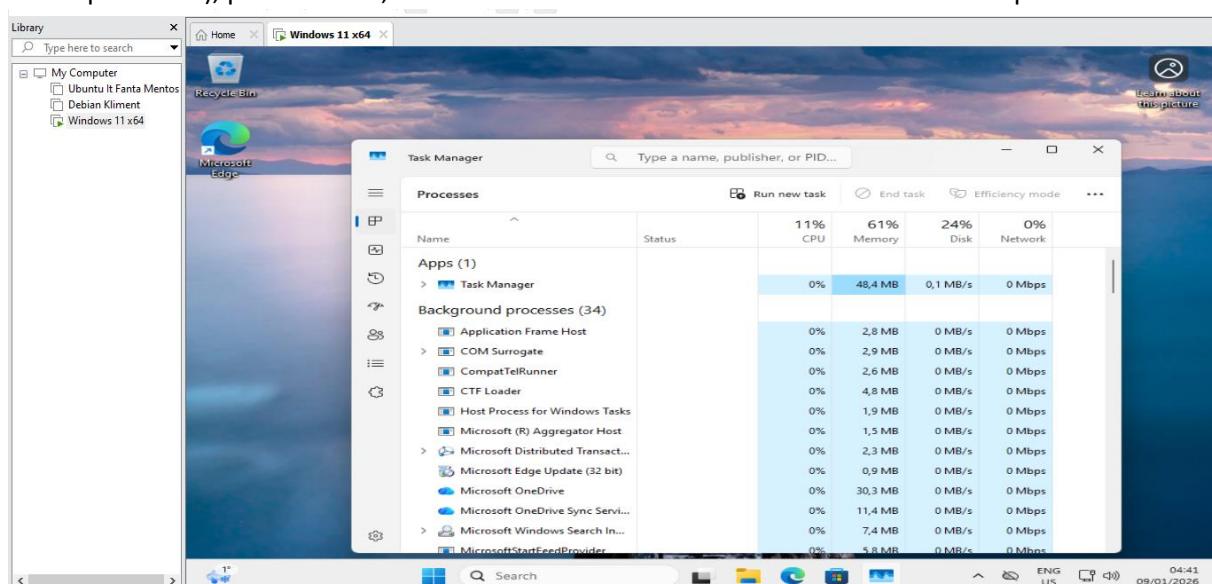
- Practice for about 10 minutes with the **Windows** keyboard shortcuts combinations, skip the general shortcuts in this exercise. Take a look at which screens are opened.
- The file explorer can be opened with **Windows** + E, Which key combination could you also use?

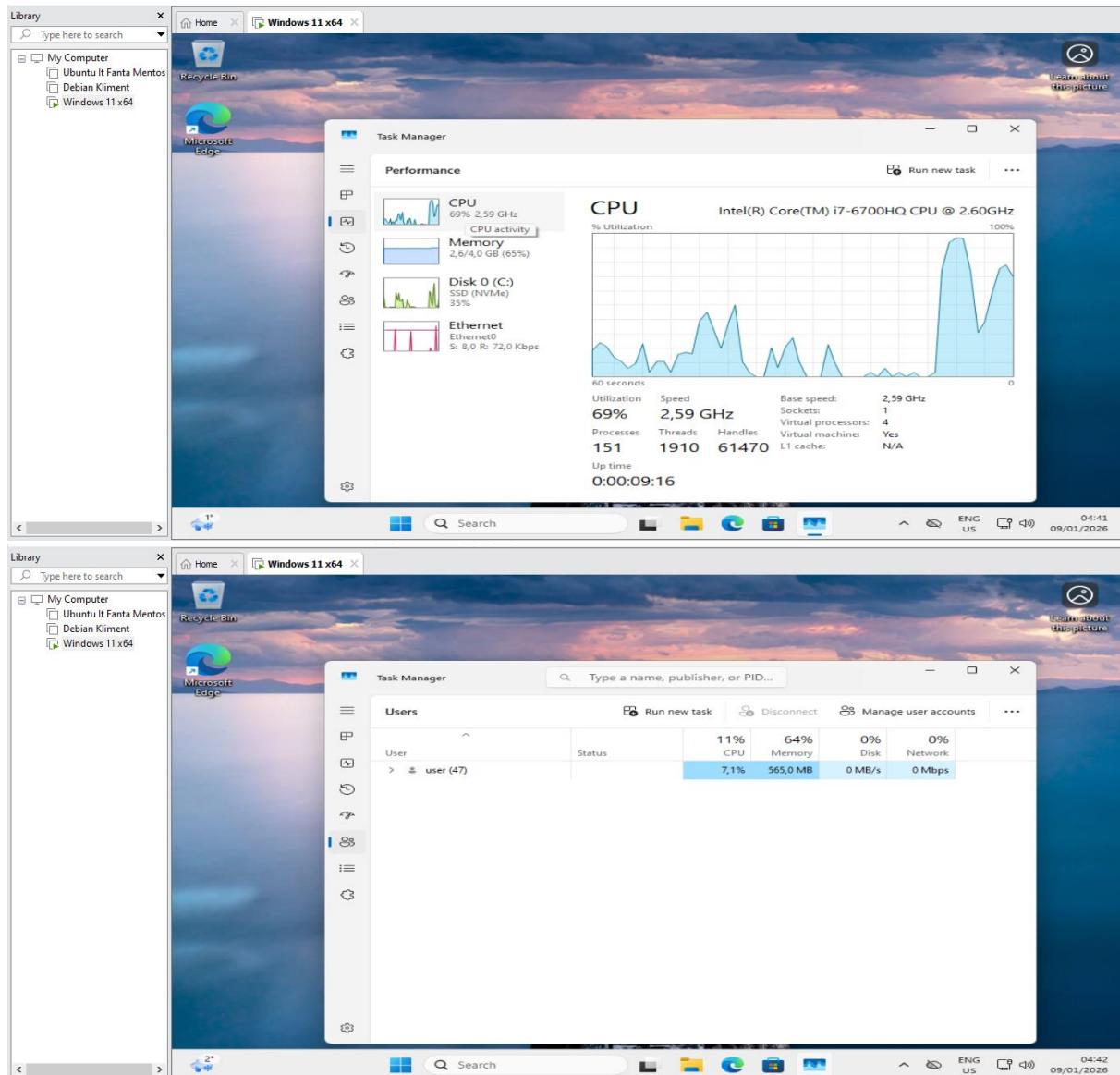
The **Windows** + number could also be used if the file explorer is pinned in the task bar

- Open the system properties with a **Windows** key combination, take a screenshot of the open screen. Paste this screenshot into this template.

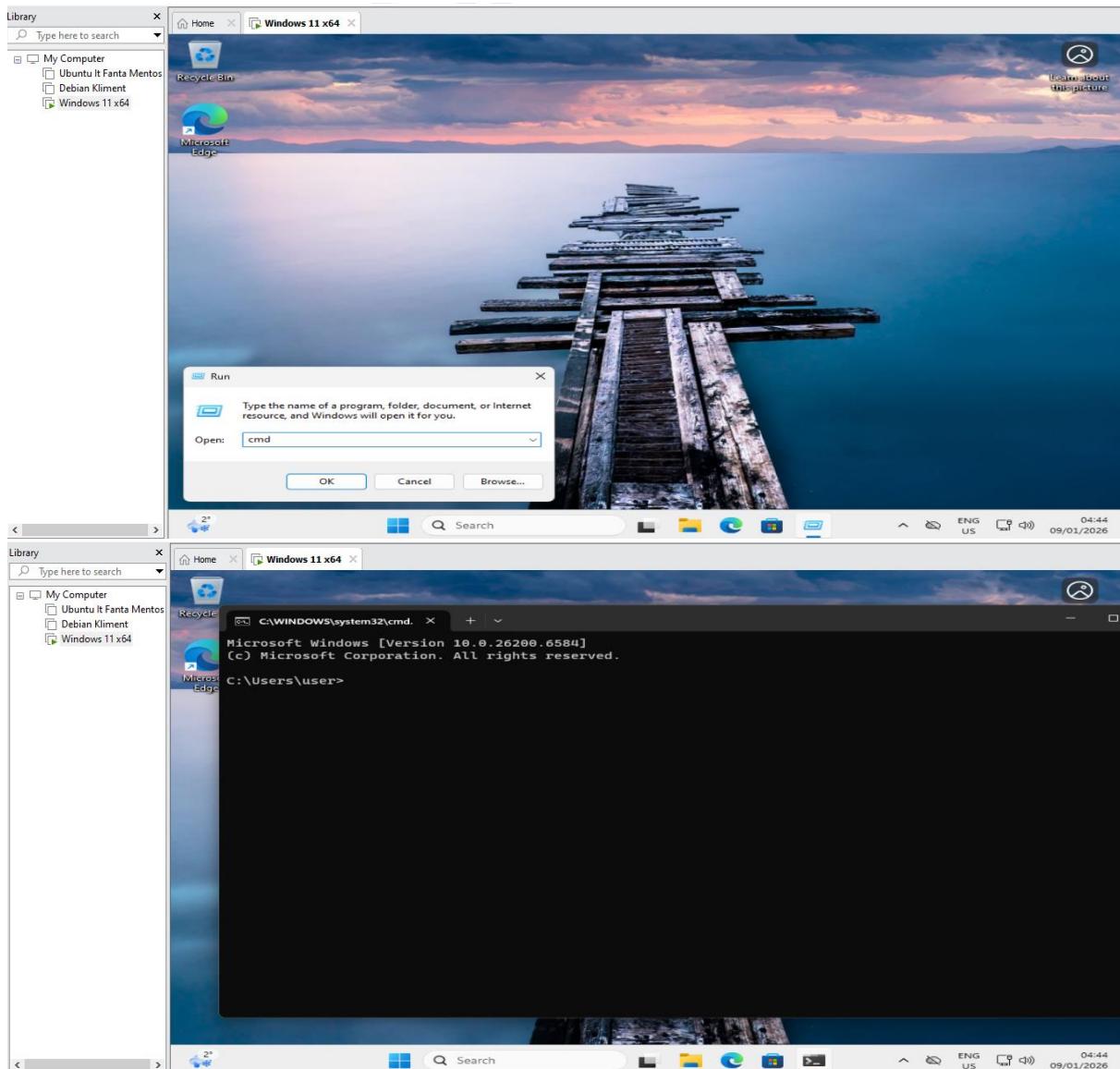


- Open task manager with a key combination. Take screenshots of the tabs: processes (shows active processes), performance, and users. Place these three screenshots in this template.





- 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?
Windows + 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?
Windows + 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:

```
C:\Windows\System32\cmd.exe Microsoft Windows [Version 10.0.26200.6584]
(c) Microsoft Corporation. All rights reserved.

C:\SAXION>copy "C:\SAXION\Wave.png" "C:\SAXION\HBOICT\YEAR1\QUARTILE1\Introduction to Programming\"
The system cannot find the path specified.
    0 file(s) copied.

C:\SAXION>copy "C:\SAXION\Wave.png" "C:\SAXION\HBOICT\YEAR1\QUARTILE1\Introduction to Programming\"
    1 file(s) copied.

C:\SAXION>copy "C:\SAXION\Plug.png" "C:\SAXION\HBOICT\YEAR1\QUARTILE1\Introduction to Infrastructures"
    1 file(s) copied.

C:\SAXION>copy "C:\SAXION\Tumble.png" "C:\SAXION\HBOICT\YEAR1\QUARTILE1\Int Synergy\"
    1 file(s) copied.

C:\SAXION>
```

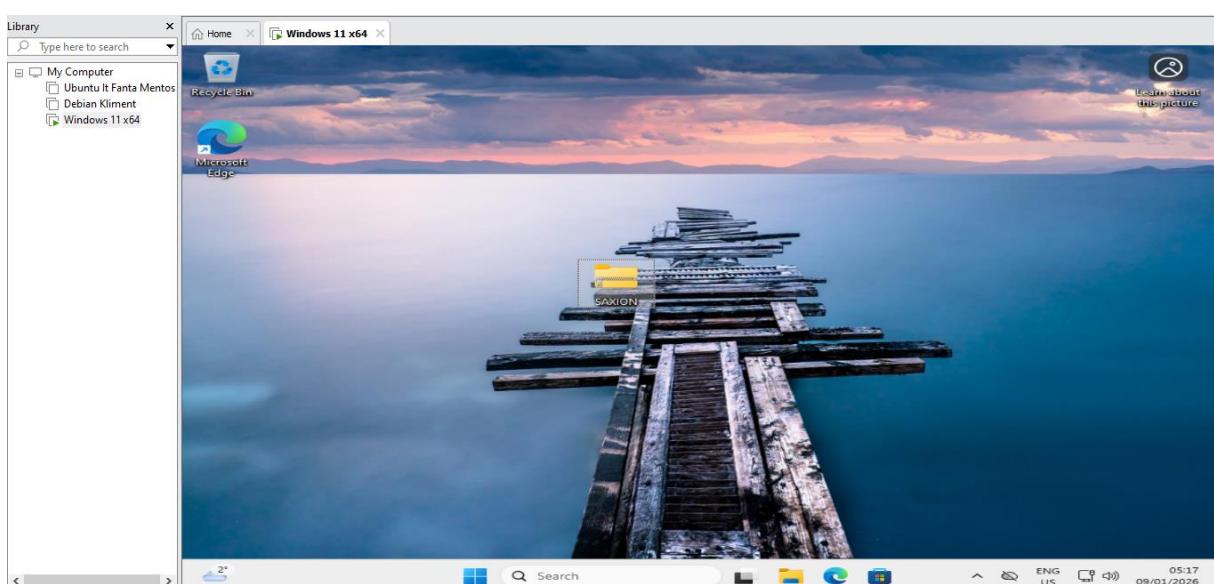
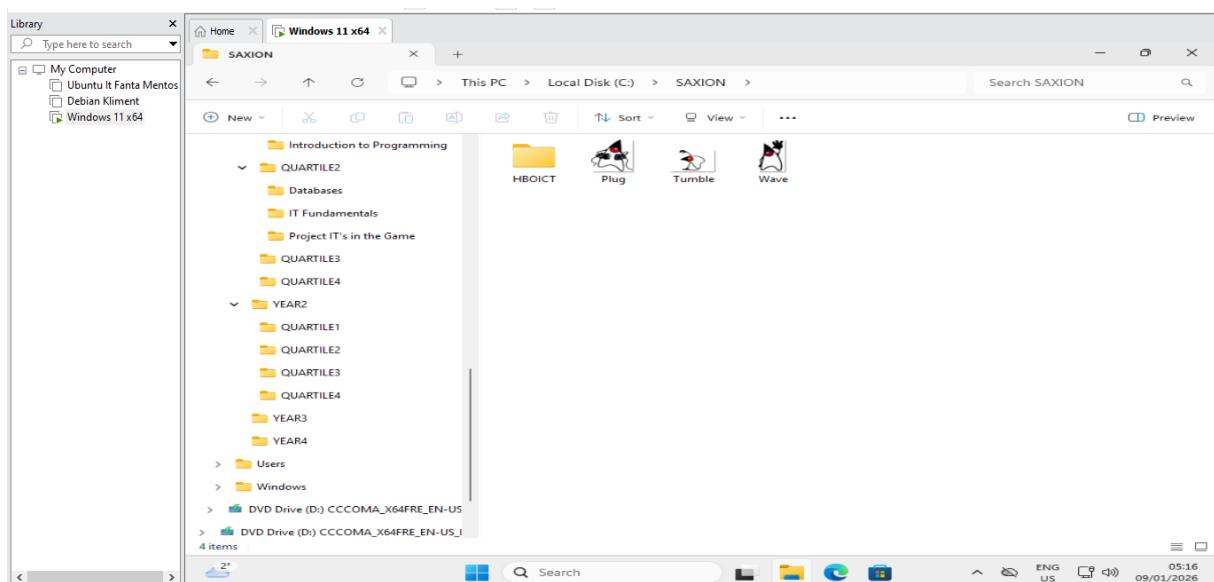
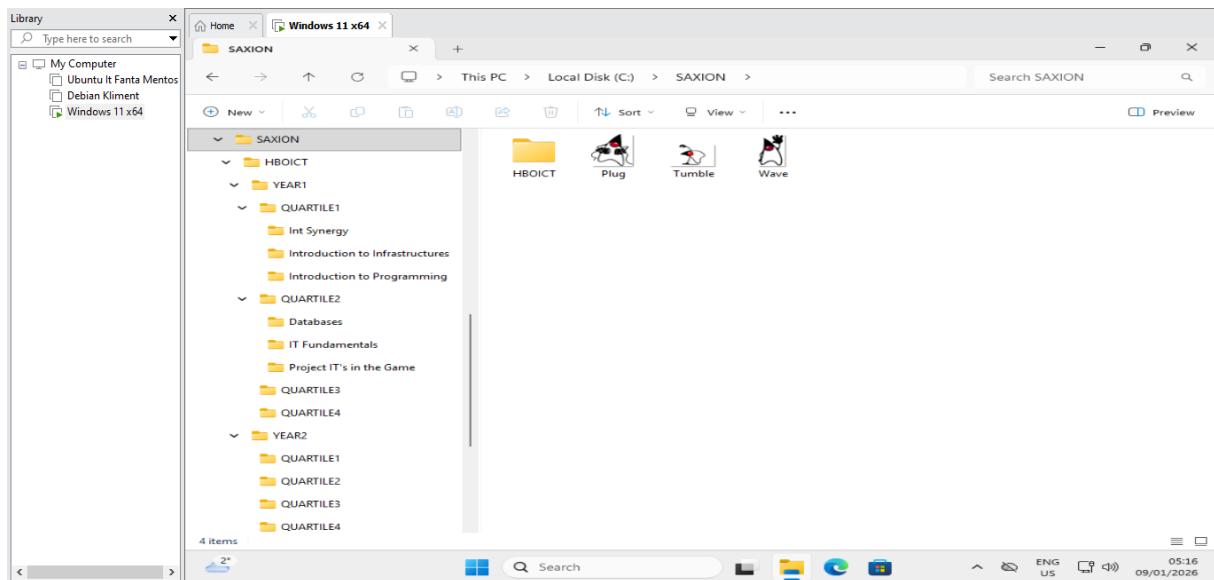
Relevant screenshots tree command:

```
1 file(s) copied.

C:\SAXION>copy "C:\SAXION\Tumble.png" "C:\SAXION\HBOICT\YEAR1\QUARTILE1\Int Synergy\"
    1 file(s) copied.

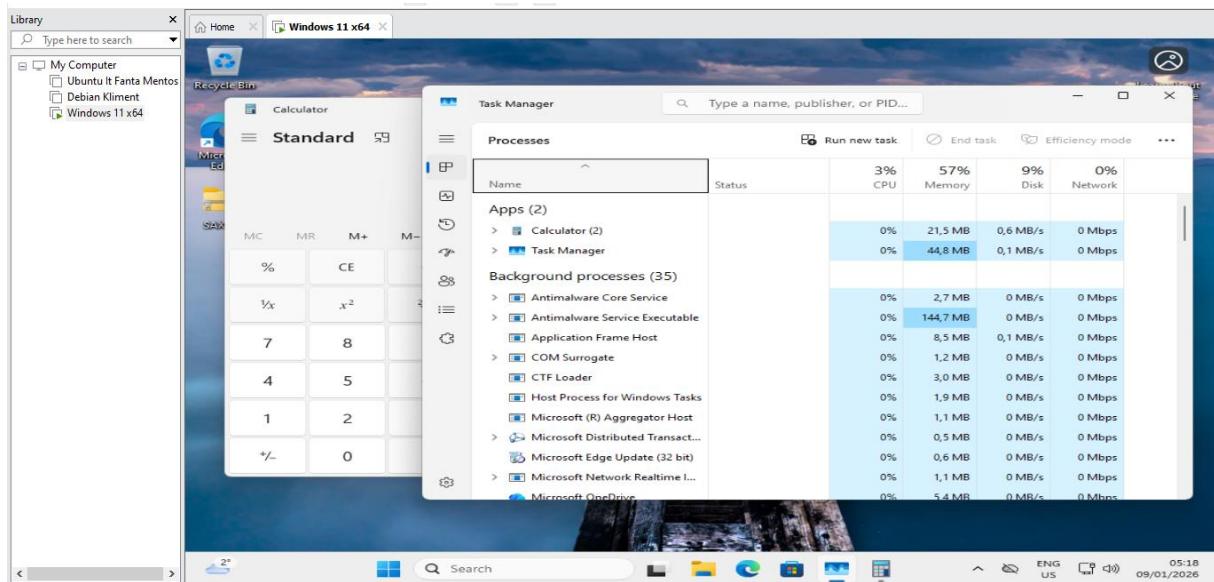
C:\SAXION>tree
Folder PATH listing
Volume serial number is 3683-D65E
C:.
    HBOICT
        YEAR1
            QUARTILE1
                -Int Synergy
                -Introduction to Infrastructures
                -Introduction to Programming
            QUARTILE2
                Databases
                IT Fundamentals
                Project IT's in the Game
            QUARTILE3
            QUARTILE4
        YEAR2
            QUARTILE1
            QUARTILE2
            QUARTILE3
            QUARTILE4
            YEAR3
            YEAR4
C:\SAXION>echo %88693|
```

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

--id is used to specify that the application installed should have this id

--e means exact, which means that it checks the exact string in the query, including a casesensitivity check

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.26200.6584]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\System32>winget install -e --id Mozilla.Firefox
The msstore source requires that you view the following agreements before using.
  Terms of Transaction: https://aka.ms/microsoft-store-terms-of-transaction
  This source requires the current machine's 2-letter geographic region to be sent to the backend service to function properly (ex: "US").

Do you agree to all the source agreements terms?
[Y/N] Y
Found Mozilla Firefox (en-US) [Mozilla.Firefox] Version 146.0.1
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://download-installer.cdn.mozilla.net/pub/firefox/releases/146.0.1/win64/en-US/Firefox%20Setup%20146.0.exe
  1.exe [redacted] 82.3 MB / 82.3 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>
```

```
Administrator: Command Prompt
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
EdDownloading https://download-installer.cdn.mozilla.net/pub/firefox/releases/146.0.1/win64/en-US/Firefox%20Setup%20146.0.exe
  1.exe [redacted] 82.3 MB / 82.3 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>winget install -e --id 7zip.7zip
Found 7-Zip [7zip.7zip] Version 25.01
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://7-zip.org/a/7z2501-x64.exe
  1.exe [redacted] 1.56 MB / 1.56 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>winget install -e --id WinsCP.WinSCP
Found WinSCP [WinsCP.WinSCP] Version 6.5.5
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://sourceforge.net/projects/winscp/files/WinSCP/6.5.5/WinSCP-6.5.5-Setup.exe/download
  1.exe [redacted] 11.6 MB / 11.6 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>
```

```
File Edit View VM Tabs Help || Library Home Windows 11 x64 Administrator: Command Prompt
Found 7-Zip [7zip.7zip] Version 25.01
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://7-zip.org/a/7z2501-x64.exe
  1.exe [redacted] 1.56 MB / 1.56 MB
Successfully verified installer hash
Starting package install...
Successfully installed

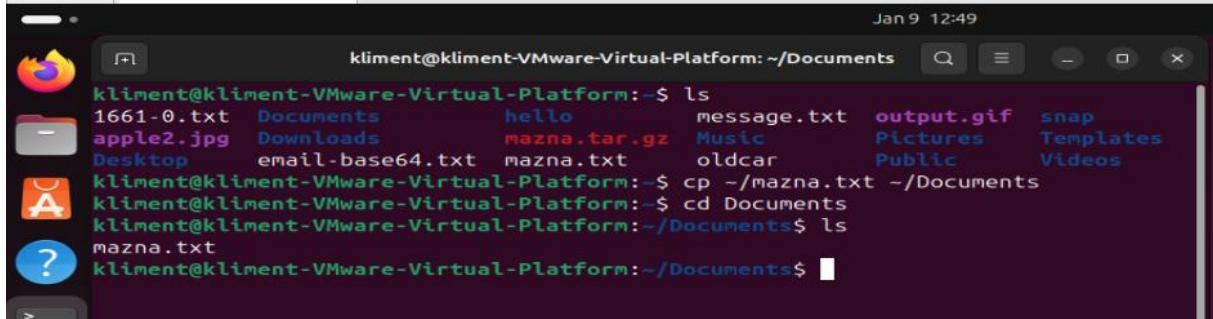
C:\Windows\System32>winget install -e --id WinsCP.WinSCP
Found WinSCP [WinsCP.WinSCP] Version 6.5.5
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://sourceforge.net/projects/winscp/files/WinSCP/6.5.5/WinSCP-6.5.5-Setup.exe/download
  1.exe [redacted] 11.6 MB / 11.6 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>winget install -e --id Notepad++.Notepad++
Found Notepad++ [Notepad++.Notepad++] Version 8.9
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://github.com/notepad-plus-plus/notepad-plus-plus/releases/download/v8.9/npp.8.9.Installer.x64.exe
  1.exe [redacted] 6.54 MB / 6.54 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>
```

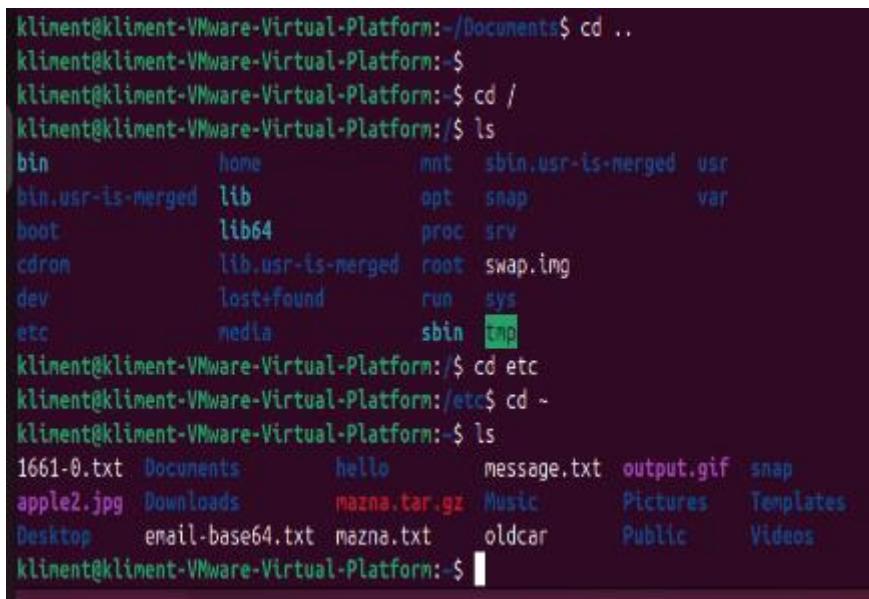
Assignment 5.4: Working with Linux

Relevant screenshots + motivation



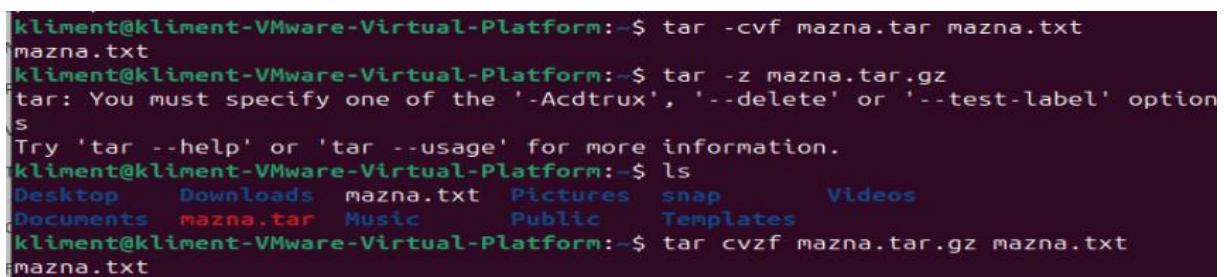
A screenshot of a Linux desktop environment showing a terminal window. The terminal window title is "kliment@kliment-VMware-Virtual-Platform: ~/Documents". The terminal shows the following command sequence:

```
kliment@kliment-VMware-Virtual-Platform:~/Documents$ ls  
1661-0.txt Documents hello message.txt output.gif snap  
apple2.jpg Downloads mazna.tar.gz Music Pictures Templates  
Desktop email-base64.txt mazna.txt oldcar Public Videos  
kliment@kliment-VMware-Virtual-Platform:$ cp ~/mazna.txt ~/Documents  
kliment@kliment-VMware-Virtual-Platform:$ cd Documents  
kliment@kliment-VMware-Virtual-Platform:~/Documents$ ls  
mazna.txt  
kliment@kliment-VMware-Virtual-Platform:~/Documents$
```



A screenshot of a Linux desktop environment showing a terminal window. The terminal window title is "kliment@kliment-VMware-Virtual-Platform: ~/Documents". The terminal shows the following command sequence:

```
kliment@kliment-VMware-Virtual-Platform:~/Documents$ cd ..  
kliment@kliment-VMware-Virtual-Platform: $  
kliment@kliment-VMware-Virtual-Platform: $ cd /  
kliment@kliment-VMware-Virtual-Platform:/$ ls  
bin home mnt sbin usr-is-merged usr  
bin usr-is-merged lib opt snap var  
boot lib64 proc srv  
cdrom lib usr-is-merged root swap.img  
dev lost+found run sys  
etc media sbin tmp  
kliment@kliment-VMware-Virtual-Platform:$ cd etc  
kliment@kliment-VMware-Virtual-Platform:/etc$ cd ~  
kliment@kliment-VMware-Virtual-Platform: $ ls  
1661-0.txt Documents hello message.txt output.gif snap  
apple2.jpg Downloads mazna.tar.gz Music Pictures Templates  
Desktop email-base64.txt mazna.txt oldcar Public Videos  
kliment@kliment-VMware-Virtual-Platform: $
```



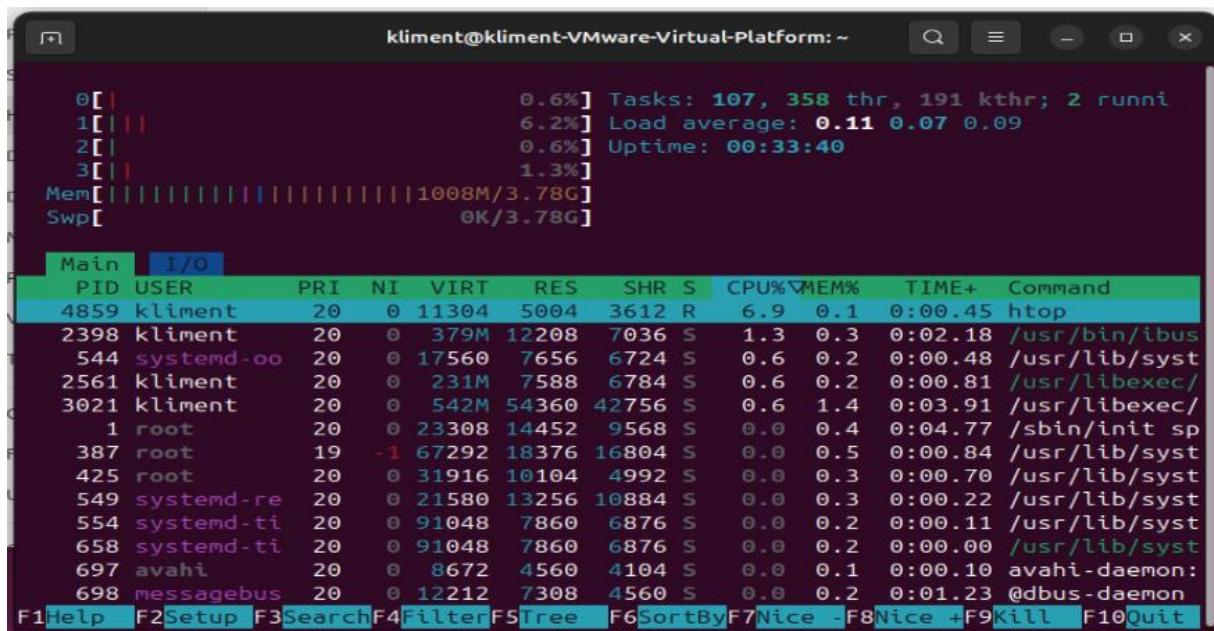
A screenshot of a Linux desktop environment showing a terminal window. The terminal window title is "kliment@kliment-VMware-Virtual-Platform: ~". The terminal shows the following command sequence:

```
kliment@kliment-VMware-Virtual-Platform:~$ tar -cvf mazna.tar mazna.txt  
mazna.txt  
kliment@kliment-VMware-Virtual-Platform:~$ tar -z mazna.tar.gz  
tar: You must specify one of the '-Acdtrux', '--delete' or '--test-label' option  
s  
Try 'tar --help' or 'tar --usage' for more information.  
kliment@kliment-VMware-Virtual-Platform:~$ ls  
Desktop Downloads mazna.txt Pictures snap Videos  
Documents mazna.tar Music Public Templates  
kliment@kliment-VMware-Virtual-Platform:~$ tar cvzf mazna.tar.gz mazna.txt  
mazna.txt
```

```

kliment@kliment-VMware-Virtual-Platform:~$ ls
Desktop    Downloads  mazna.txt  Pictures  snap      Videos
Documents  mazna.tar  Music     Public    Templates
kliment@kliment-VMware-Virtual-Platform:~$ tar cvzf mazna.tar.gz mazna.txt
mazna.txt
kliment@kliment-VMware-Virtual-Platform:~$ ls -l
total 56
drwxr-xr-x 2 kliment kliment 4096 Dec  9 16:48 Desktop
drwxr-xr-x 2 kliment kliment 4096 Dec 11 09:57 Documents
drwxr-xr-x 2 kliment kliment 4096 Dec  9 16:48 Downloads
-rw-rw-r-- 1 kliment kliment 10240 Dec 11 10:19 mazna.tar
-rw-rw-r-- 1 kliment kliment 143 Dec 11 10:22 mazna.tar.gz
-rw-rw-r-- 1 kliment kliment 18 Dec 11 09:56 mazna.txt
drwxr-xr-x 2 kliment kliment 4096 Dec  9 16:48 Music
drwxr-xr-x 2 kliment kliment 4096 Dec  9 16:48 Pictures
drwxr-xr-x 2 kliment kliment 4096 Dec  9 16:48 Public
drwx----- 4 kliment kliment 4096 Dec  9 18:14 snap
drwxr-xr-x 2 kliment kliment 4096 Dec  9 16:48 Templates
drwxr-xr-x 2 kliment kliment 4096 Dec  9 16:48 Videos
kliment@kliment-VMware-Virtual-Platform:~$ rm mazna.tar
kliment@kliment-VMware-Virtual-Platform:~$ ls
Desktop    Downloads  mazna.txt  Pictures  snap      Videos
Documents  mazna.tar.gz  Music    Public   Templates
kliment@kliment-VMware-Virtual-Platform:~$ S

```



```
kliment@kliment-VMware-Virtual-Platform:~ Processing triggers for man-db (2.12.0-4build2) ... Processing triggers for desktop-file-utils (0.27-2build1) ... kliment@kliment-VMware-Virtual-Platform:~$ neofetch .-/+oossssoot+/- .:+ssssssssssssssssssssss+- .osssssssssssssssssssdMMMNyssso. /sssssssssshdmmNNmmyNMMMHsssss/ +ssssssssshydmMMMMMMMNdddyssssss+ /sssssssshNMMMyhhyyyhNmMMNhssssss/ .sssssssssdMMMNhssssssssshNMMMdssssss. +ssshhhyNMMNyssssssssssyNMMMyssssss+ ossyNMMMNyMMhsssssssssssshmmhssssso ossyNMMMNyMMhsssssssssssshmmhssssso +sssshhhyNMMNyssssssssssyNMMMyssssss+ .ssssssssdMMMNhssssssssshNMMMdssssss. /sssssssshNMMMyhhyyyhdNMMNhssssss/ +sssssssssdmydMMMMMMMdddyssssss+ /sssssssssshdmNNNmyNMMMHsssss/ .ossssssssssssssssdMMMNyssso. +ssssssssssssssssssssyssss+- :+ssssssssssssssssss+- .-/+oossssoot+/-
```

kliment@kliment-VMware-Virtual-Platform:~-----
OS: Ubuntu 24.04.3 LTS x86_64
Host: VMware Virtual Platform None
Kernel: 6.14.0-36-generic
Uptime: 1 hour, 6 mins
Packages: 1526 (dpkg), 12 (snap)
Shell: bash 5.2.21
Resolution: 1280x800
DE: GNOME 46.0
WM: Mutter
WM Theme: Adwaita
Theme: Yaru [GTK2/3]
Icons: Yaru [GTK2/3]
Terminal: gnome-terminal
CPU: Intel i7-6700HQ (4) @ 2.592GHz
GPU: 00:0f.0 VMware SVGA II Adapter
Memory: 988MiB / 3867MiB

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

```
kliment@kliment-VMware-Virtual-Platform:~$ pwd /home/kliment  
kliment@kliment-VMware-Virtual-Platform:~$ ls Desktop Downloads mazna.txt Pictures snap Videos Documents mazna.tar.gz Music Public Templates  
kliment@kliment-VMware-Virtual-Platform:~$ nano Sto.txt  
kliment@kliment-VMware-Virtual-Platform:~$ mv Sto.txt hello.sh  
kliment@kliment-VMware-Virtual-Platform:~$ ls Desktop Downloads mazna.tar.gz Music Public Templates Documents hello.sh mazna.txt Pictures snap Videos  
kliment@kliment-VMware-Virtual-Platform:~$ mkdir hello  
kliment@kliment-VMware-Virtual-Platform:~$ ls Desktop Downloads hello.sh mazna.txt Pictures snap Videos Documents hello mazna.tar.gz Music Public Templates  
kliment@kliment-VMware-Virtual-Platform:~$ mv hello.sh hello/  
kliment@kliment-VMware-Virtual-Platform:~$ ls Desktop Downloads mazna.tar.gz Music Public Templates Documents hello mazna.txt Pictures snap Videos  
kliment@kliment-VMware-Virtual-Platform:~$ ls hello  
hello.sh  
kliment@kliment-VMware-Virtual-Platform:~$
```

```
kliment@kliment-VMware-Virtual-Platform:~$ ls hello  
hello.sh  
kliment@kliment-VMware-Virtual-Platform:~$ chmod 744 /hello/hello.sh  
chmod: cannot access '/hello/hello.sh': No such file or directory  
kliment@kliment-VMware-Virtual-Platform:~$ cd hello  
kliment@kliment-VMware-Virtual-Platform:~/hello$ chmod 744 hello.sh  
kliment@kliment-VMware-Virtual-Platform:~/hello$
```

```
kliment@kliment-VMware-Virtual-Platform:~/hello$ ./hello.sh  
Hello Kliment, 580693!
```

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

cat – displays the content of a file

wc – used to count lines, words and bytes of the content in the file

less – used to view the content of a file one page at a time

tail – prints the last couple of lines of a file

head – prints the first few lines of a file

grep – allows the user to search for specific patterns in the content

```
kliment@kliment-VMware-Virtual-Platform:~/hello$ mv 1661-0.txt ~/ 1661-0.txt
mv: target '1661-0.txt': Not a directory
kliment@kliment-VMware-Virtual-Platform:~/hello$ mv 1661-0.txt ~/
kliment@kliment-VMware-Virtual-Platform:~/hello$ ls
hello.sh
kliment@kliment-VMware-Virtual-Platform:~/hello$ cd ..
kliment@kliment-VMware-Virtual-Platform:~$ ls
1661-0.txt  Documents  hello      mazna.txt  Pictures  snap       Videos
Desktop    Downloads  mazna.tar.gz  Music     Public    Templates
kliment@kliment-VMware-Virtual-Platform:~$
```

```
kliment@kliment-VMware-Virtual-Platform:~$ wc 1661-0.txt
12306 107562 607504 1661-0.txt
```

```
kliment@kliment-VMware-Virtual-Platform:~$ grep -n kingdom 1661-0.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
```

```
kliment@kliment-VMware-Virtual-Platform:~$ head -n 508 1661-0.txt | tail -30
"Then I shall drop you a line to let you know how we progress."
"Pray do so. I shall be all anxiety."
"Then, as to money?"
"You have carte blanche."
"Absolutely?"
"I tell you that I would give one of the provinces of my kingdom to
have that photograph."
"And for present expenses?"
```

```
kliment@kliment-VMware-Virtual-Platform:~$ head -n 1141 1661-0.txt | tail -36
held it out upon the palm of his hand.

>Your Majesty has something which I should value even more highly," said Holmes.

>You have but to name it."
>This photograph!"

The King stared at him in amazement.

>Irene's photograph!" he cried. "Certainly, if you wish it."

>I thank your Majesty. Then there is no more to be done in the matter. I have the honour to wish you a very good morning." He bowed, and, turning away without observing the hand which the King had stretched
```

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

The screenshot shows a digital forensic analysis interface. At the top left, there are two entries: "Camera Brand" listed as "motorola" and "Camera Model" listed as "moto g(6) play". Below this, under the heading "Coordinates", it shows "53.194355° N 6.536917° E (42 m)". The main part of the interface is a Google Maps search results page for the coordinates. The map shows a street view with a red location pin. Labels on the map include "Bruilweering", "Houje Thai thaise massage & Thai...", "Tuindersvereniging Diverdoatsie", "Goudenregenlaan", "Prunuslaan", "Jasmijnlaan", "Seringenlaan", and "Malvazijnenlaan". To the left of the map, there is a sidebar with various options like "Route", "Opslaan", "In de buurt", "Naar telefoon verzenden", and "Delen". Below the sidebar, there are three buttons: "5GVP+PQV Groningen", "Ontbrekende plaats toevoegen", and "Je bedrijf toevoegen". At the bottom of the sidebar, there are links for "Haal alles uit Google Maps" and "Inloggen". The bottom right corner of the map area has a "Google Maps" watermark.

```
kliment@kliment-Virtual-Platform:~$ mv oldcar.jpg oldcard
kliment@kliment-Virtual-Platform:~$ ls
1661-0.txt  Documents  hello      mazna.txt  oldcard  Public  Templates
Desktop    Downloads  mazna.tar.gz  Music      Pictures  snap   Videos
kliment@kliment-Virtual-Platform:~$ mv oldcard oldcar
kliment@kliment-Virtual-Platform:~$ ls
1661-0.txt  Documents  hello      mazna.txt  oldcar  Public  Templates
Desktop    Downloads  mazna.tar.gz  Music      Pictures  snap   Videos
kliment@kliment-Virtual-Platform:~$ file oldcar
oldcar: JPEG image data, JFIF standard 1.01, aspect ratio, density 1x1, segment
length 16, Exif Standard: [TIFF image data, big-endian, direntries=10, manufac-
rer=motorola, model=moto g(6) play, xresolution=160, yresolution=168, resolution
unit=2, software=aljeter-user 9 PPPS29.55-35-18-7 6a0d0 release-keys, datatime=2
020:11:07 15:08:57, GPS-Data], baseline, precision 8, 4160x3120, components 3
kliment@kliment-Virtual-Platform:~$
```

```

kliment@kliment-VMware-Virtual-Platform:~$ ls
1661-0.txt  Downloads      mazna.tar.gz  oldcar    snap
Desktop     email-base64.txt  mazna.txt    Pictures   Templates
Documents   hello          Music       Public    Videos
kliment@kliment-VMware-Virtual-Platform:~$ base64 -d email-base64.txt > output.g
if
kliment@kliment-VMware-Virtual-Platform:~$ ls
1661-0.txt  Downloads      mazna.tar.gz  oldcar    Public    Videos
Desktop     email-base64.txt  mazna.txt    output.gif  snap
Documents   hello          Music       Pictures  Templates
kliment@kliment-VMware-Virtual-Platform:~$ 

```

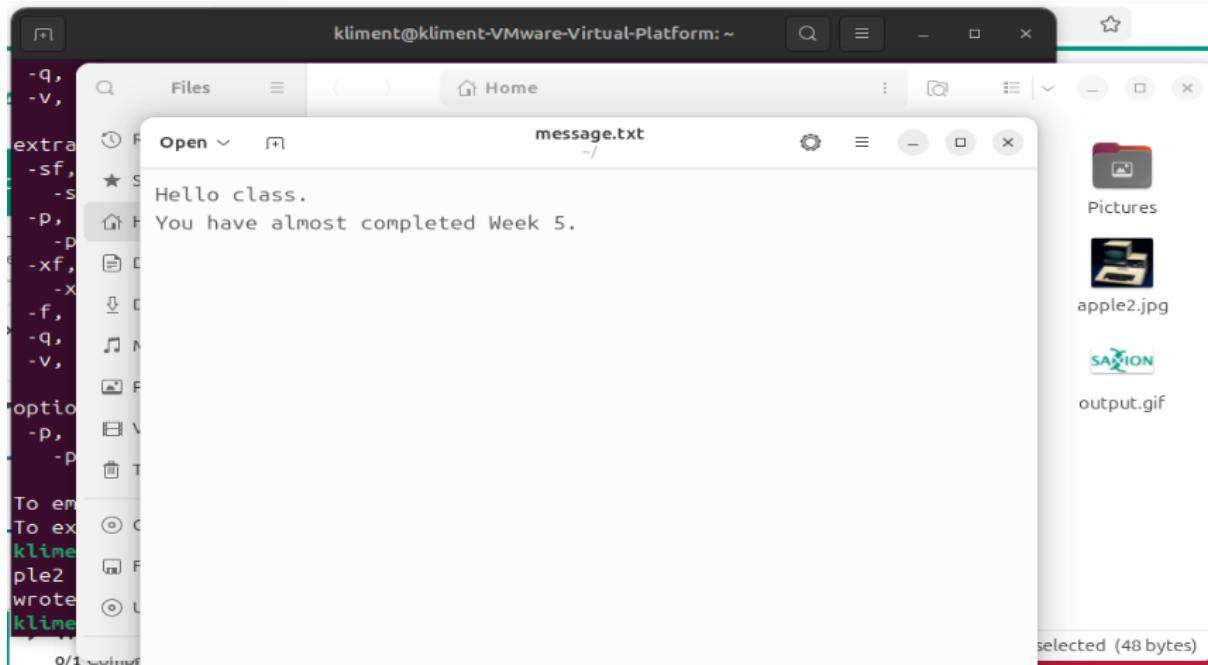
Assignment 5.8: Steganography

Relevant screenshots + motivation

```

kliment@kliment-VMware-Virtual-Platform:~$ steghide extract -sf apple2.jpg -p ap
ple2
wrote extracted data to "message.txt".
kliment@kliment-VMware-Virtual-Platform:~$ 

```



Assignment 5.9: Capture disk images

Make relevant screenshots + motivation:

- 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.

Ready? Save this file and export it as a pdf file with the name: [week5.pdf](#)