Week 5 – Operating Systems

Student number: 581124

Assignment 5.1: Unix-like

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

-UNIX is originally developed in the 1970s by AT&T Bell Labs. It's a certified trademark and refers to systems that comply with the Single UNIX Specification(officially certified)
-Unix-like systems are inspired by UNIX but not officially certified(e.g. Linux, BSD, macOS). They follow similar design principles but are not officially UNIX.

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** worked at Bell Labs, and he co-created UNIX in the early 1970s. He also designed the first UNIX version and core system ideas. In addition, he created B programming language
- **Dennis Ritchie** also worked at Bell Labs and co-created UNIX. Besides, he invented C programming language, which become foundational for OS development
- **Bill Joy** is co-founder of Sun Microsystems, he developed BSD UNIX and contributed to SunOS and TCP/IP networking
- **Richard Stallman** is a founder of the GNU Project and Free Software Foundation. He created the Free Software Movement, GNU tools (GCC, Bash) and GNU General Public License
- **Linus Torvalds** created the Linux kernel, forming the basis of most modern Unix-like systems

c) What is the philosophy of the GNU movement?

1. Software should be free (freedom, not price): users can run, study, modify, and share software.
2. Promotes open-source collaboration and opposes proprietary restrictions.

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

Mostly yes, because Ubuntu uses the Linux kernel and many GNU tools, so it aligns with free software principles. However, it includes proprietary drivers and optional non-free software, so it does not fully adhere to GNU's strict philosophy.

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

Windows Subsystem for Linux is a Windows feature that allows running Linux environments directly on Windows. It lets users run Linux commands, tools, and apps without a virtual machine

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

- Android belongs to UNIX-like family(based on Linux)
- iOS is UNIX-based (derived from Darwin, which is BSD-based)
- ChromeOS belongs to UNIX-like family(based on Linux)

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

Supercomputers are extremely powerful computers used to solve large, complex problems much faster than ordinary computers. They are used for scientific research, engineering, weather and climate modeling, simulations (like physics, chemistry, biology), and geological or industrial research. These systems help process huge amounts of data and run simulations that are impossible on normal computers.

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 system where many PS3 game consoles are connected together to work like a high-performance computer. Scientists and researchers built clusters using multiple PS3s because the PS3's Cell Broadband Engine CPU has strong parallel computing capabilities. They were used for scientific simulations and data processing, such as astrophysical modelling, simulations of black holes and gravitational waves, and other high-performance tasks. Condor Cluster was the 33rd largest supercomputer in the world, and it was large PS3 cluster. It was used to analyze high satellite imagery.

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 cluster runs Oracle Linux (a Linux distribution) on the Raspberry Pi devices.

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, because Oracle's Raspberry Pi cluster, while large in node count, is made of low-power Raspberry Pi boards, so its total performance is far below the scale required to be among the 500 fastest supercomputers in the world. It is more a demonstration/educational project, not a top-performing supercomputer.

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?

Both PlayStation 5 and Xbox Series X use custom AMD CPUs with the x86-64 architecture and the Zen 2 microarchitecture. PlayStation 5 runs a custom Sony OS (based on FreeBSD/Linux principles) and Xbox Series X runs a custom Microsoft OS based on Windows technology.

Conclusion: modern consoles like PS5 and Xbox Series X use computer architectures very similar to PCs (x86-64) and modern OS designs, this means that modern game consoles are technologically very close to regular PCs.

Assignment 5.3: Working with Windows

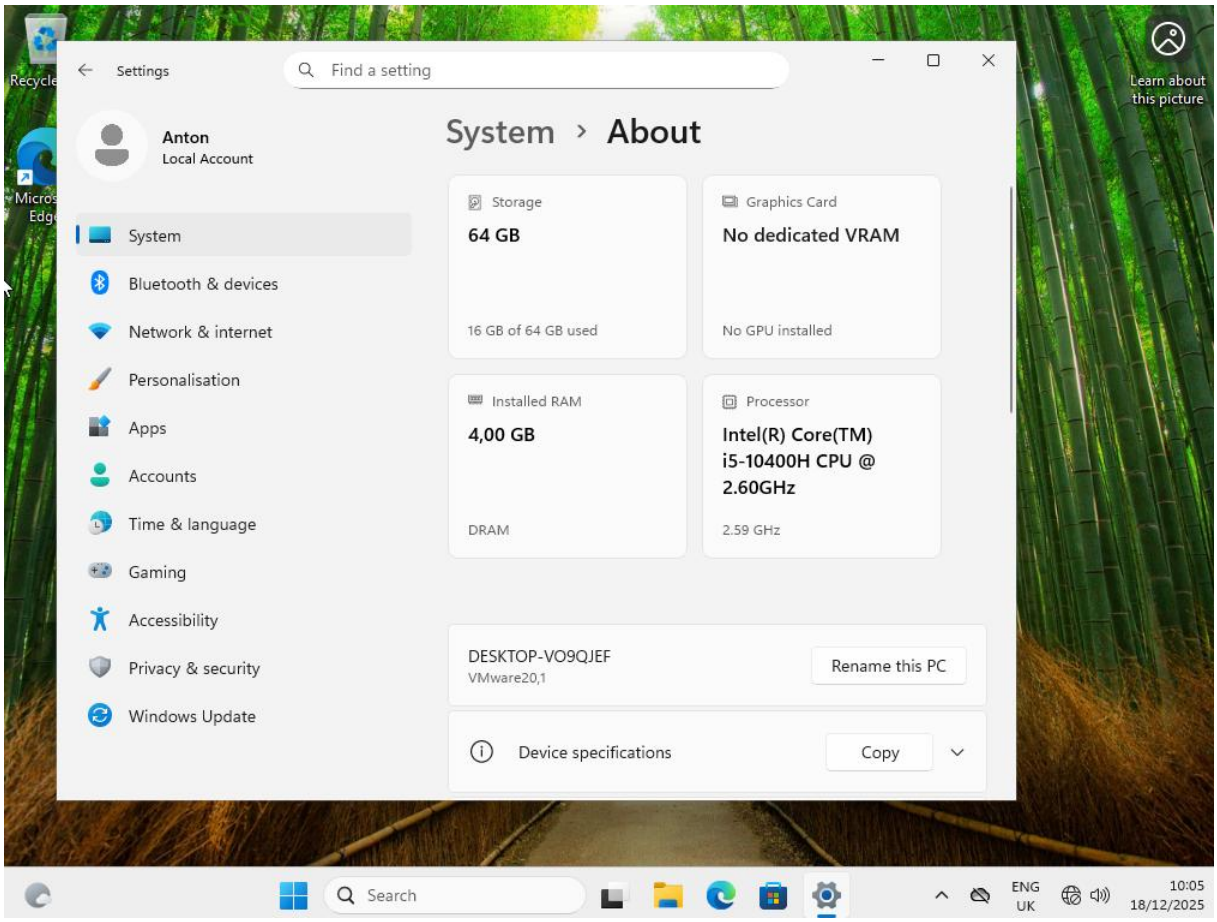
Take relevant screenshots of the assignments below

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.

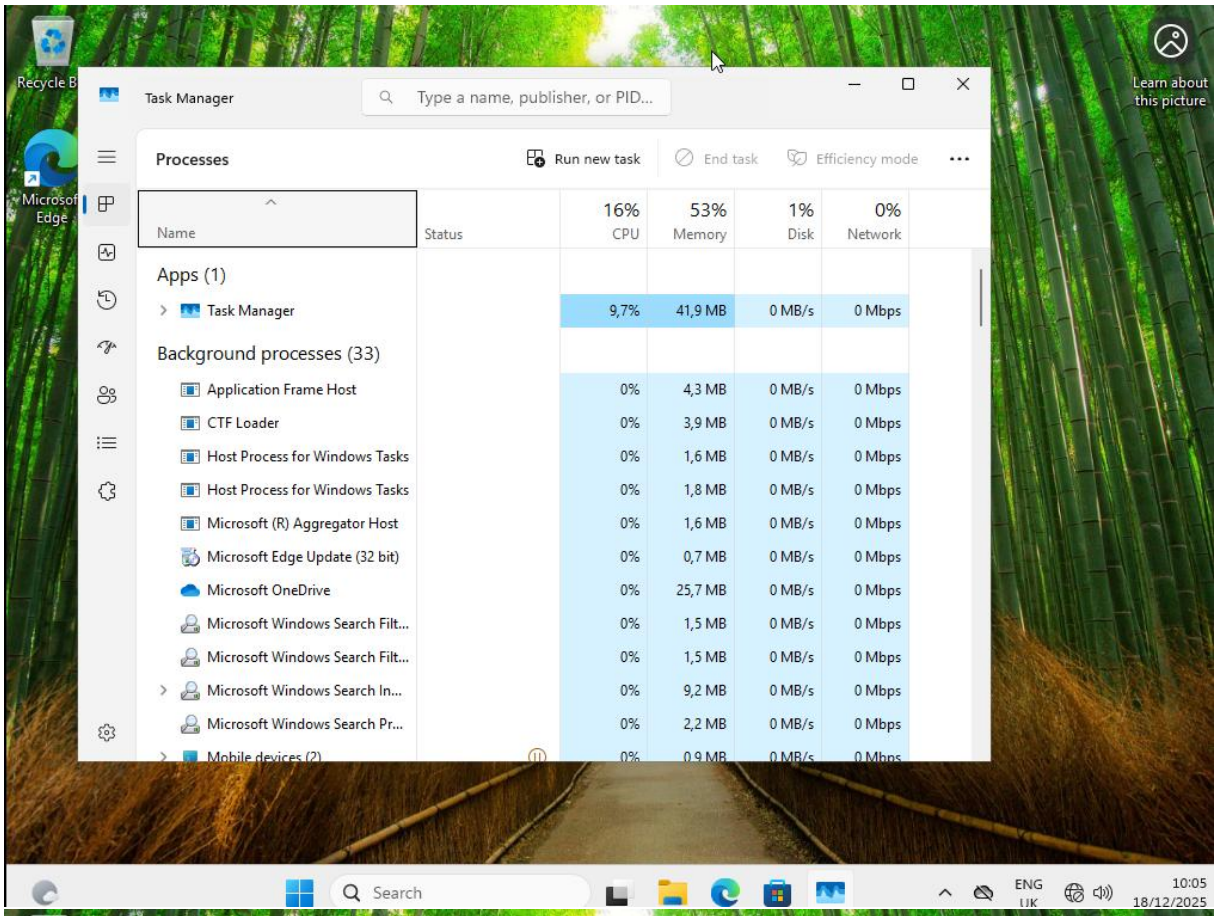
b) The file explorer can be opened with ⊞ + E, Which key combination could you also use?

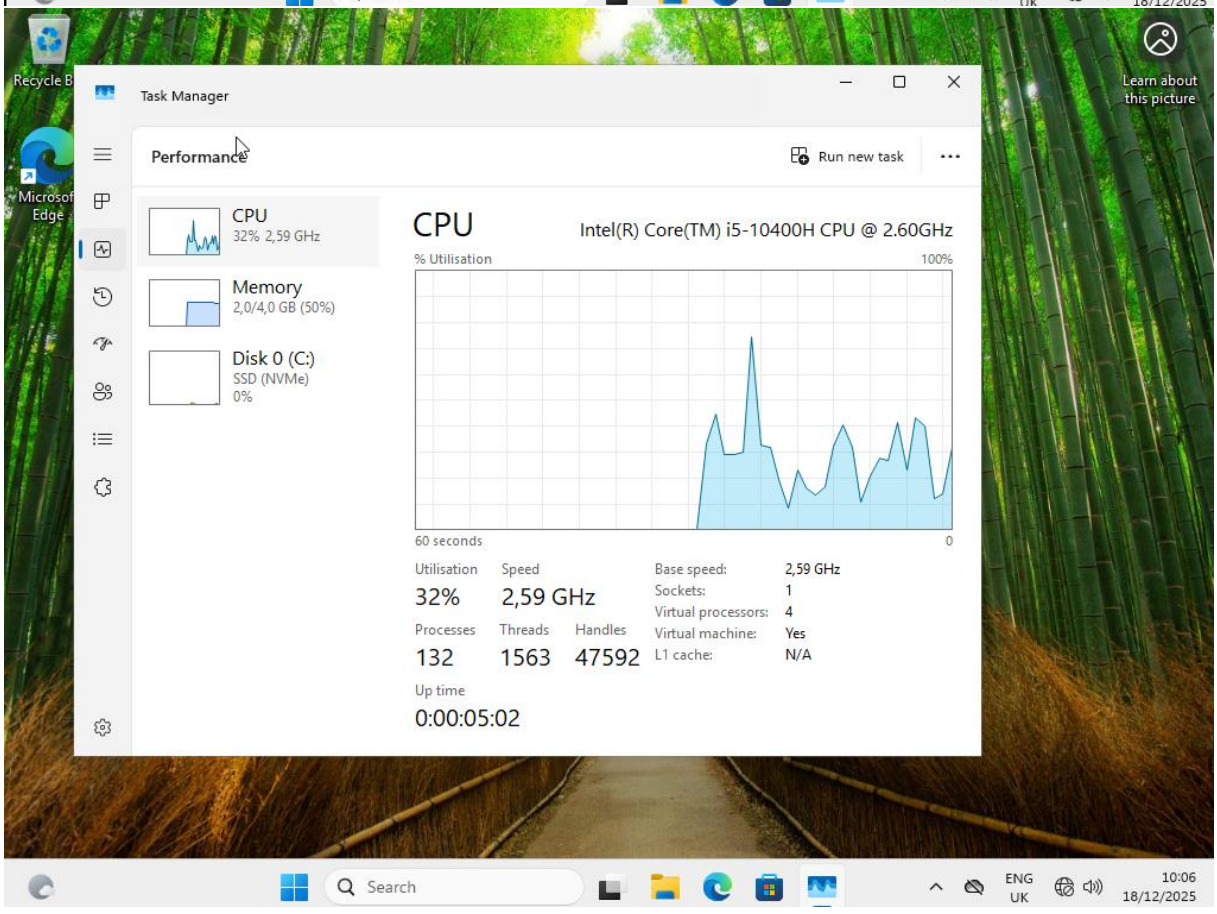
I could use ⊞ + X and choose file explorer.

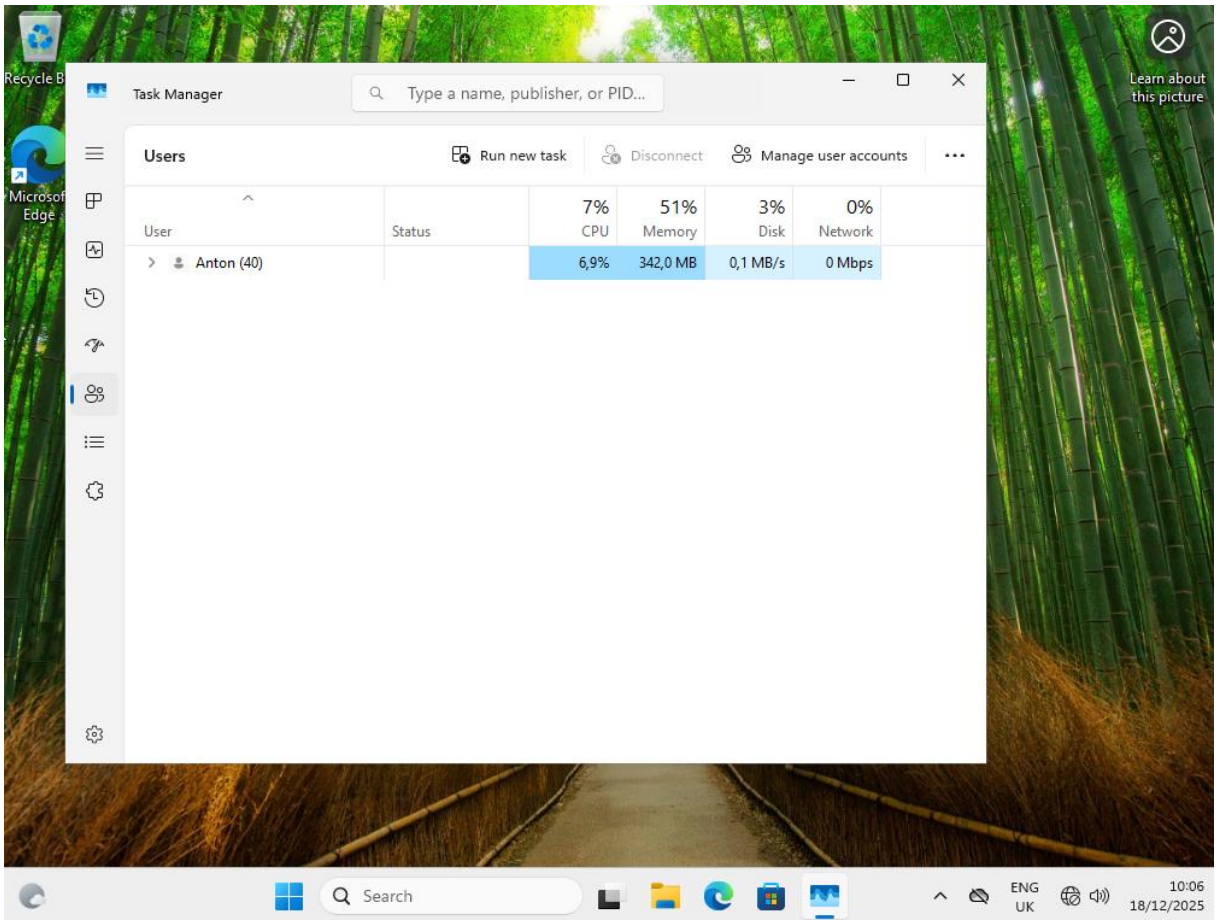
c) Open the system properties with a ⊞ key combination, take a screenshot of the open screen. Paste this screenshot into this template.



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.


Task Manager
Type a name, publisher, or PID...
Processes
Run new task
End task
Efficiency mode
Name
Status
16% CPU
53% Memory
1% Disk
0% Network
Apps (1)
Task Manager
9,7% 41,9 MB 0 MB/s 0 Mbps
Background processes (33)
Application Frame Host 0% 4,3 MB 0 MB/s 0 Mbps
CTF Loader 0% 3,9 MB 0 MB/s 0 Mbps
Host Process for Windows Tasks 0% 1,6 MB 0 MB/s 0 Mbps
Host Process for Windows Tasks 0% 1,8 MB 0 MB/s 0 Mbps
Microsoft (R) Aggregator Host 0% 1,6 MB 0 MB/s 0 Mbps
Microsoft Edge Update (32 bit) 0% 0,7 MB 0 MB/s 0 Mbps
Microsoft OneDrive 0% 25,7 MB 0 MB/s 0 Mbps
Microsoft Windows Search Filt... 0% 1,5 MB 0 MB/s 0 Mbps
Microsoft Windows Search Filt... 0% 1,5 MB 0 MB/s 0 Mbps
Microsoft Windows Search In... 0% 9,2 MB 0 MB/s 0 Mbps
Microsoft Windows Search Pr... 0% 2,2 MB 0 MB/s 0 Mbps
Learn about this picture
Search
ENG UK
10:05 18/12/2025


Task Manager
Performance
Run new task
CPU 32% 2,59 GHz
Memory 2,0/4,0 GB (50%)
Disk 0 (C:) SSD (NVMe) 0%
CPU
Intel(R) Core(TM) i5-10400H CPU @ 2.60GHz
% Utilisation
100%
60 seconds
0
Utilisation 32%
Speed 2,59 GHz
Processes 132
Threads 1563
Handles 47592
Up time 0:00:05:02
Base speed: 2,59 GHz
Sockets: 1
Virtual processors: 4
Virtual machine: Yes
L1 cache: N/A
Learn about this picture
Search
ENG UK
10:06 18/12/2025



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?

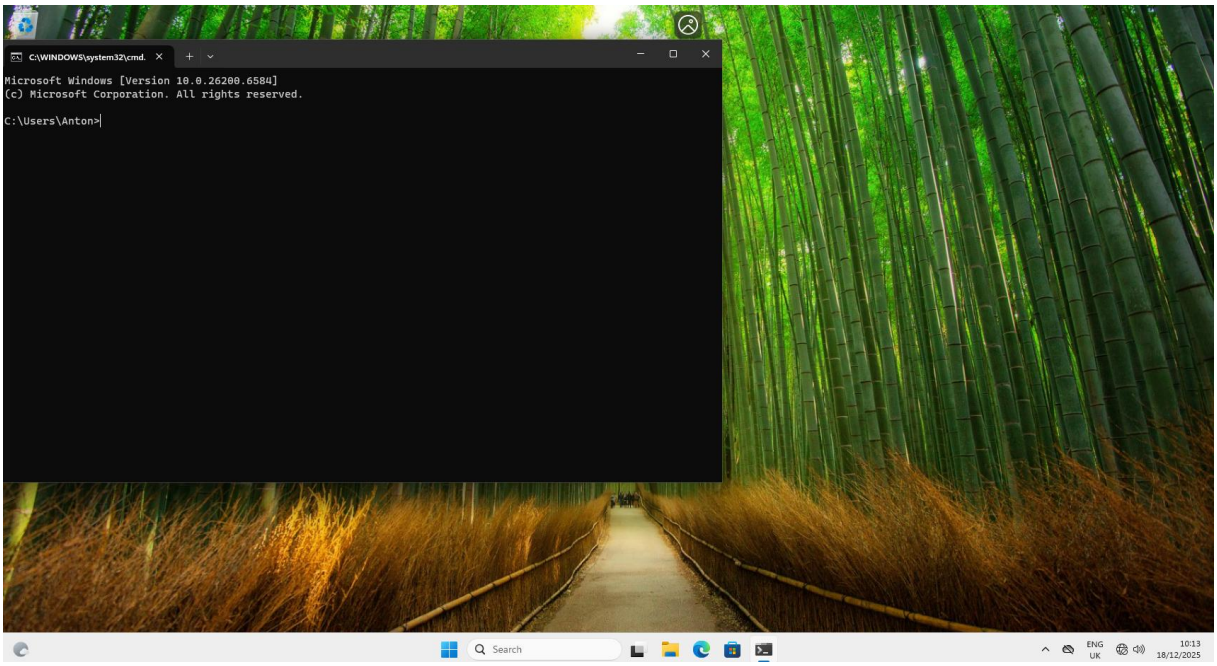
I should use ⊞ + P

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?

⊞ + L

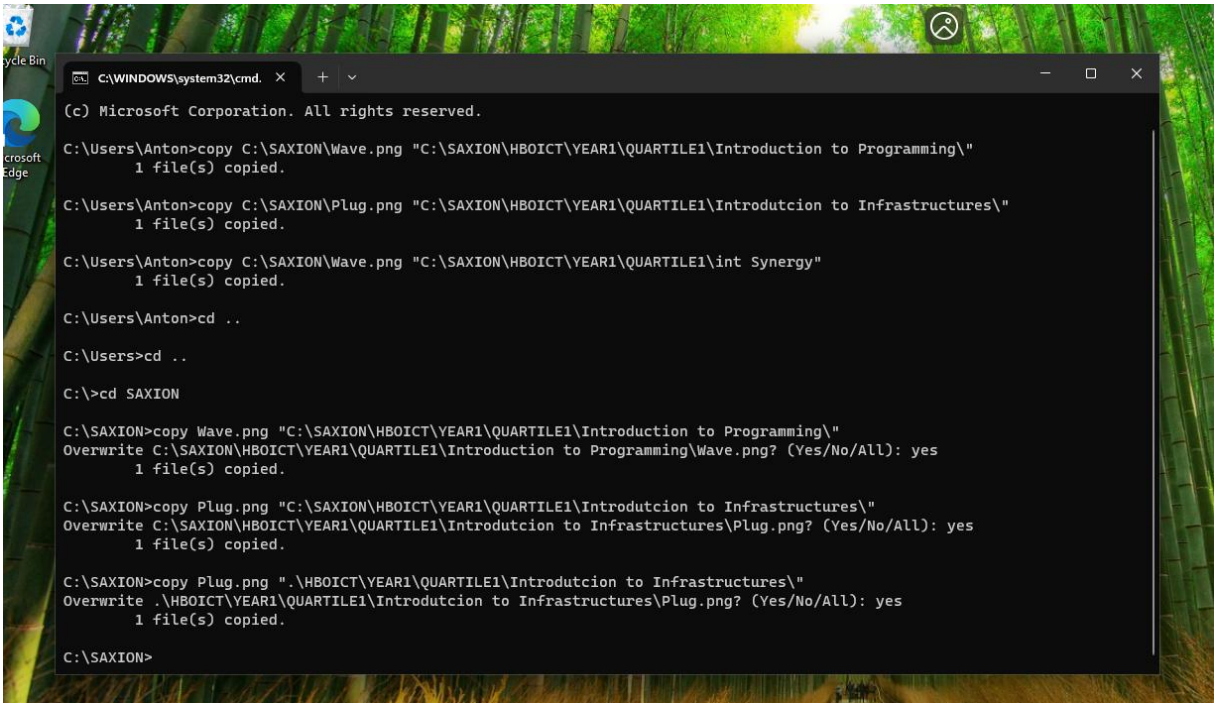
g) Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.

Combination ⊞ + R opens run screen

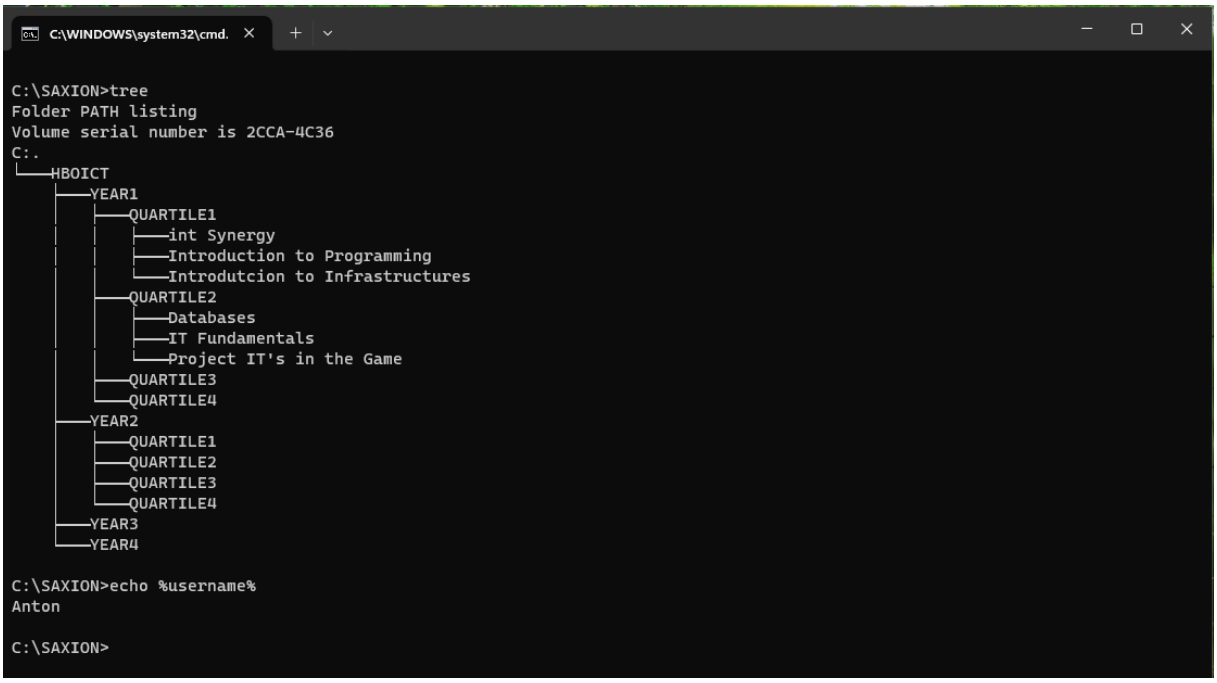


Working in the File Explorer

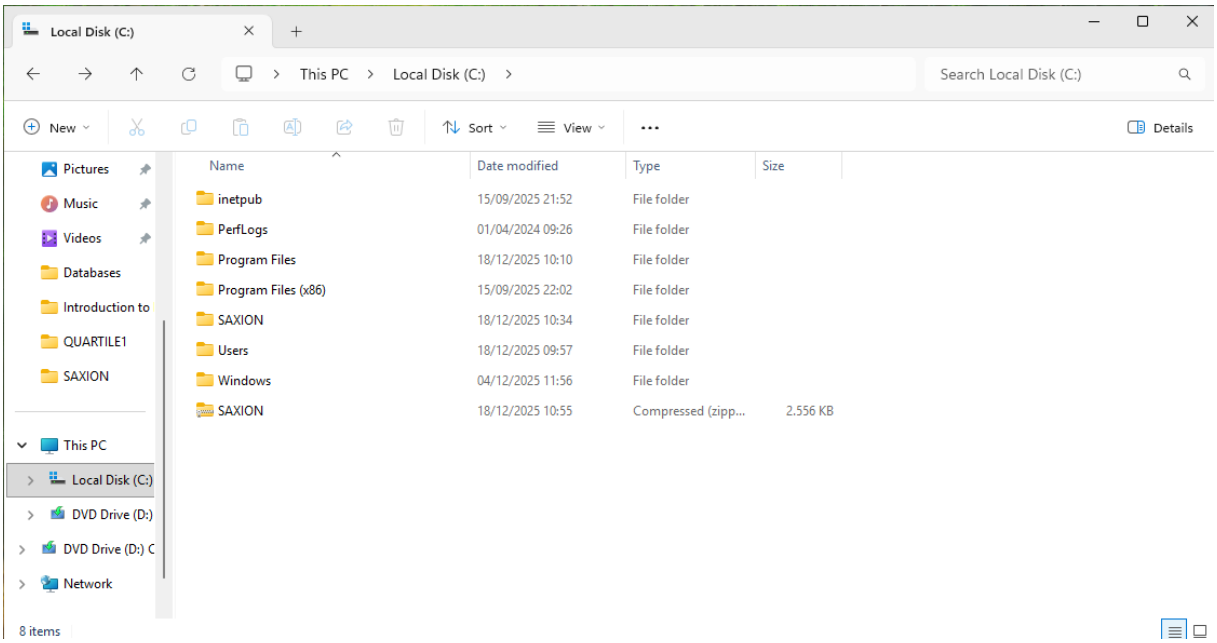
Relevant screenshots **copy** command:



Relevant screenshots **tree** command:

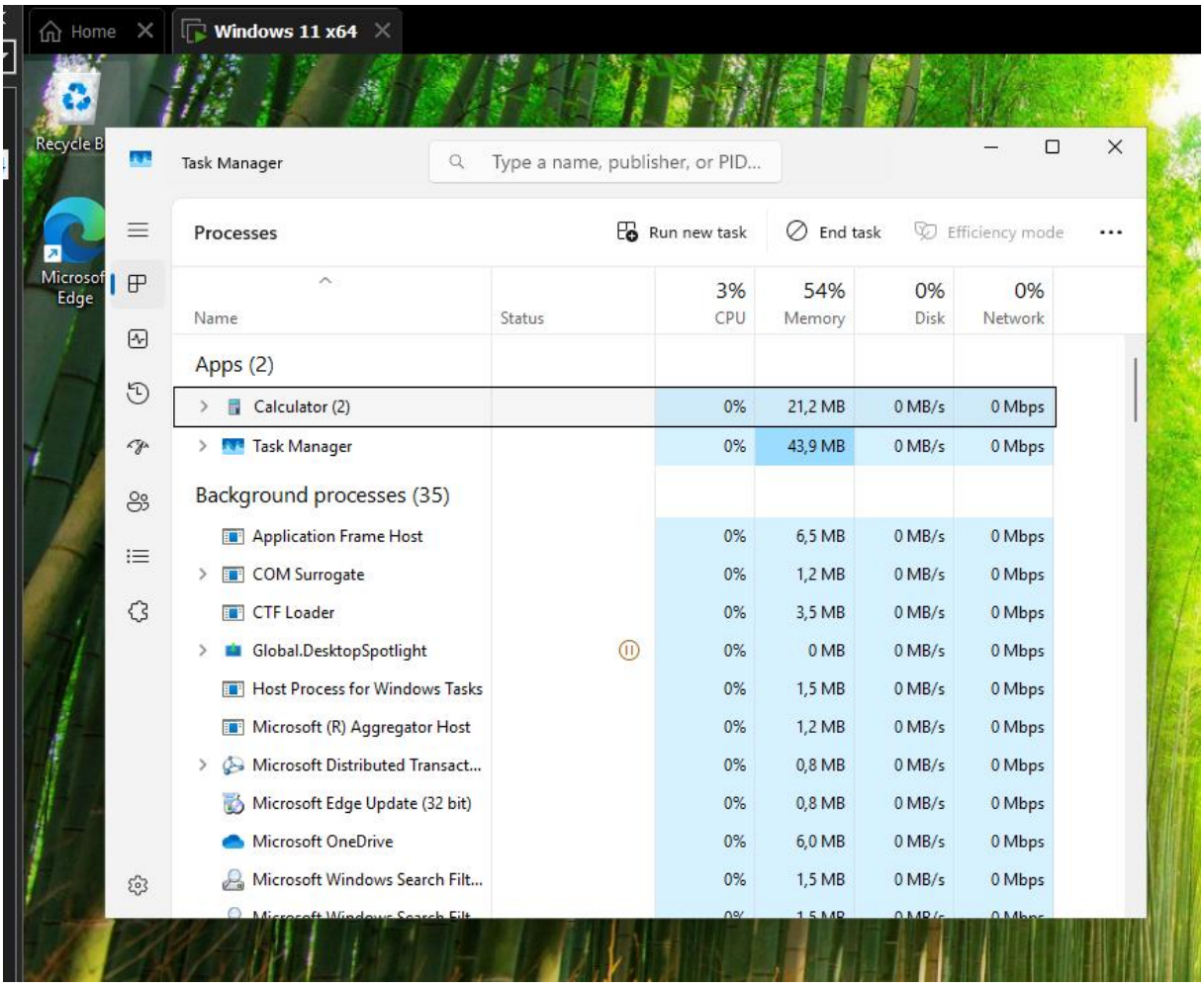


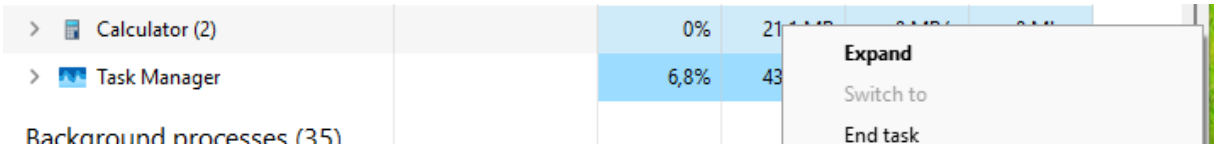
Relevant screenshots in the file explorer of the folder c:\Saxion + created zip file.



Terminating Processes

Relevant Screenshots Task Manager Window:



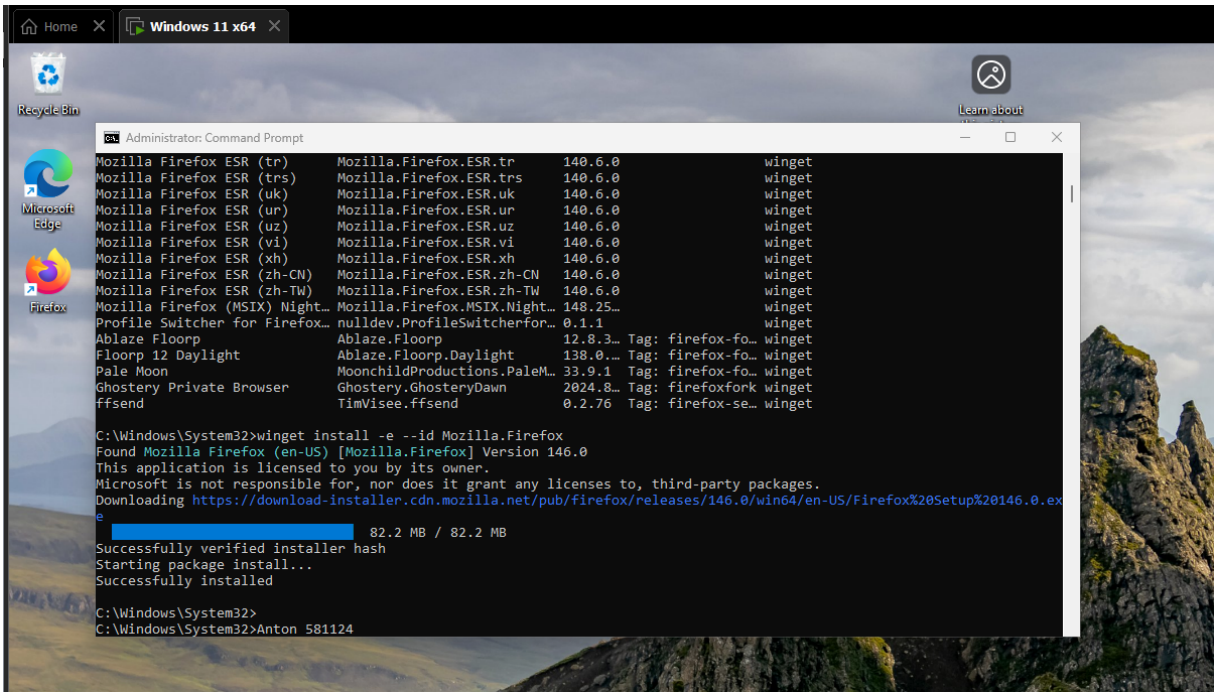


Install Software

Relevant screenshots that the following software is installed with winget:

- WinSCP
- Notepad++
- 7zip

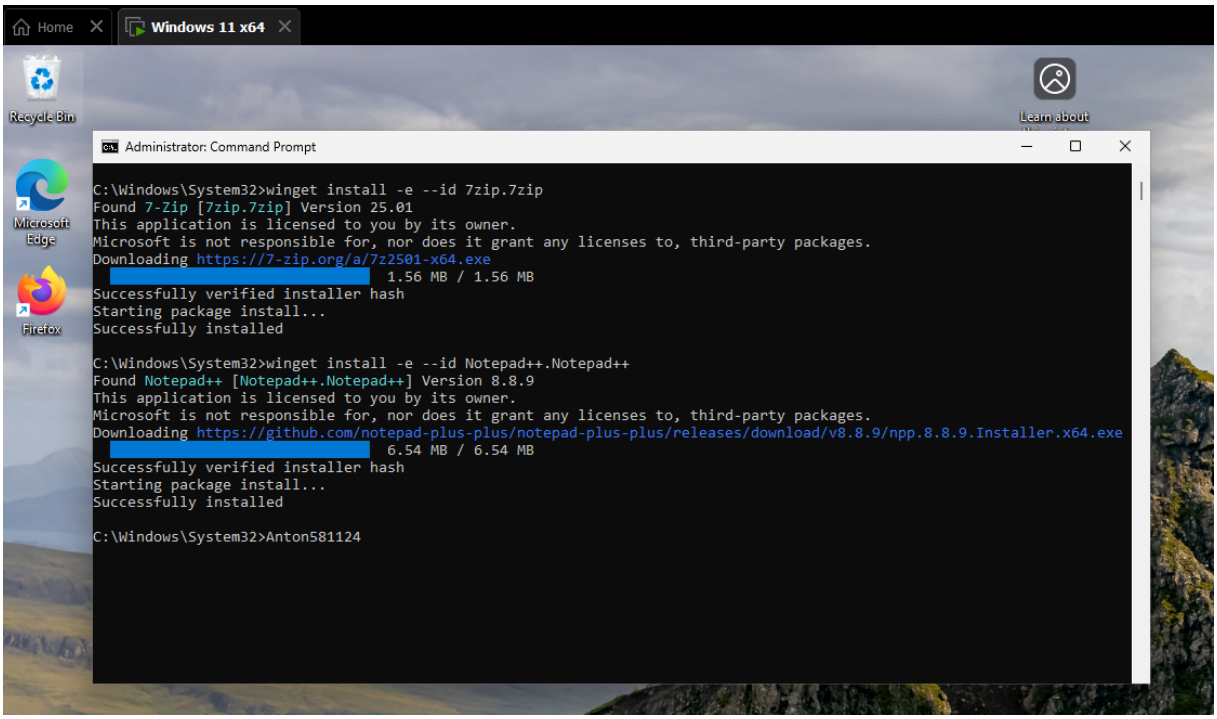
a) winget install -e --id Mozilla.Firefox

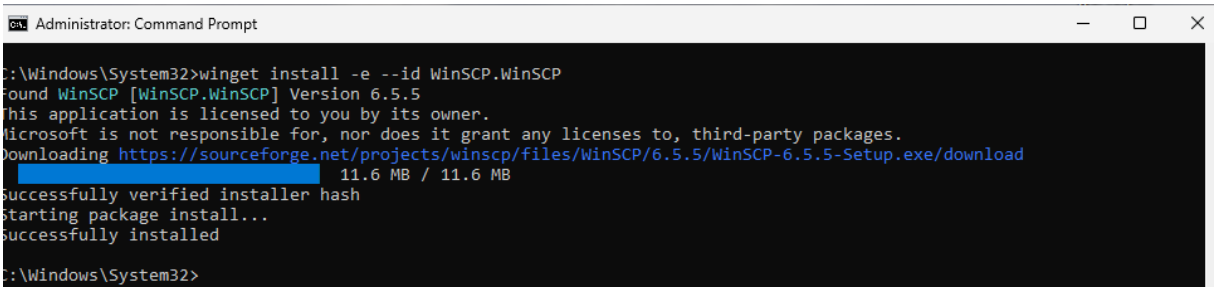


b)This command installs Mozilla Firefox using Windows Package Manager (winget):

- winget install - tells winget to download and install a software
- -e (exact) - ensures that winget matches the exact package ID, not similar name
- --id Mozilla.Firefox - specifies the unique identifier of the application in the winget repository (this avoids problems if multiple apps have similar names)

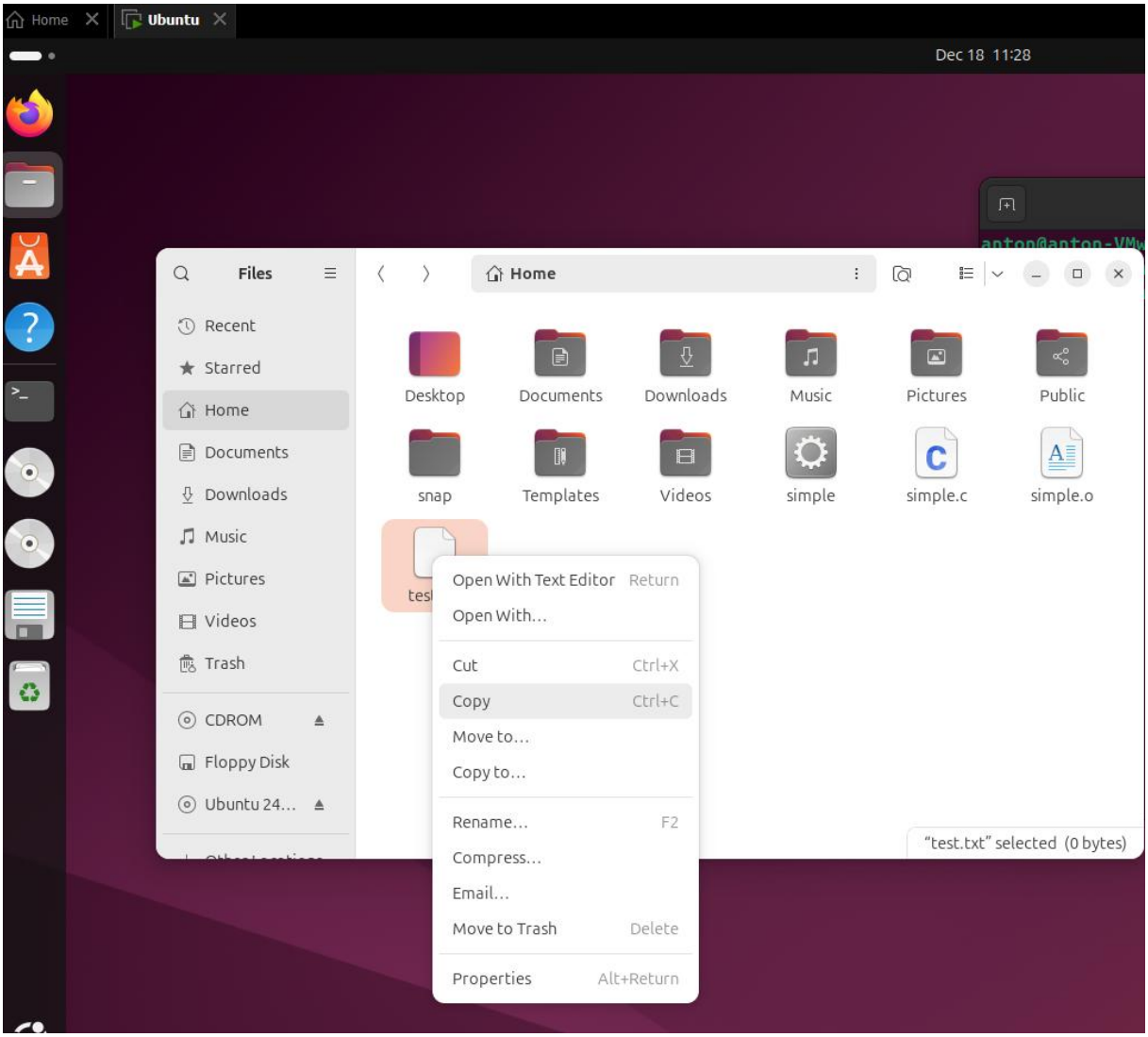
c)

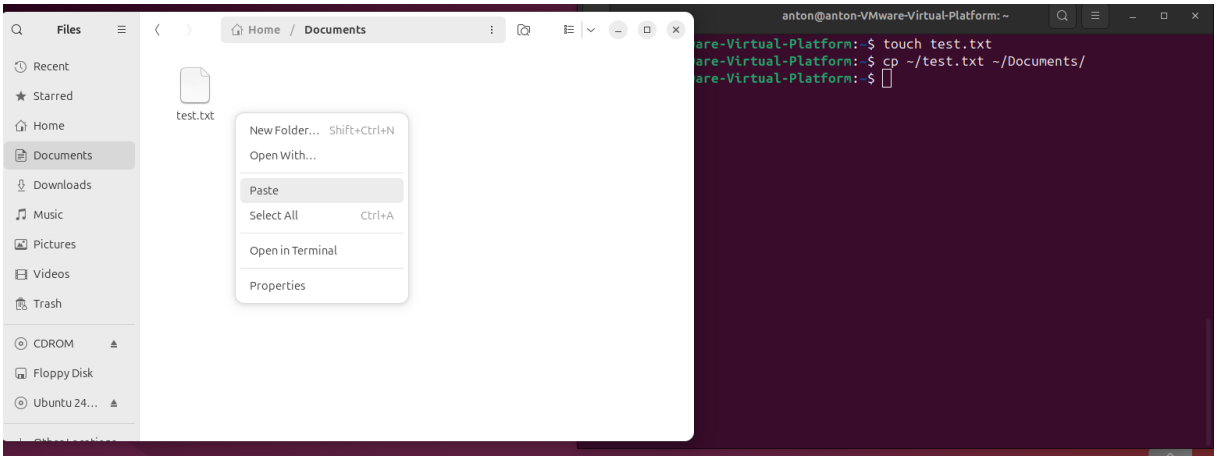


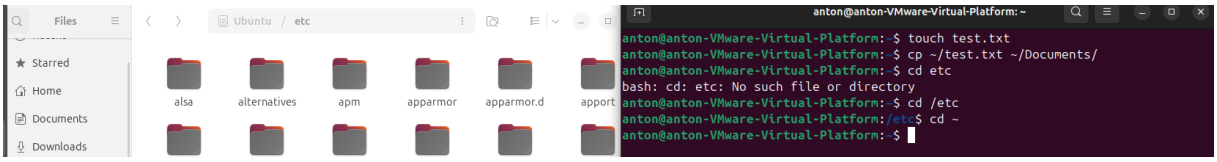

Administrator: Command Prompt
:\Windows\System32>winget install -e --id WinSCP.WinSCP
ound WinSCP [WinSCP.WinSCP] Version 6.5.5
his application is licensed to you by its owner.
icrosoft is not responsible for, nor does it grant any licenses to, third-party packages.
ownloading https://sourceforge.net/projects/winscp/files/WinSCP/6.5.5/WinSCP-6.5.5-Setup.exe/download
11.6 MB / 11.6 MB
uccessfully verified installer hash
tarting package install...
uccessfully installed
:\Windows\System32>

Assignment 5.4: Working with Linux

Relevant screenshots + motivation







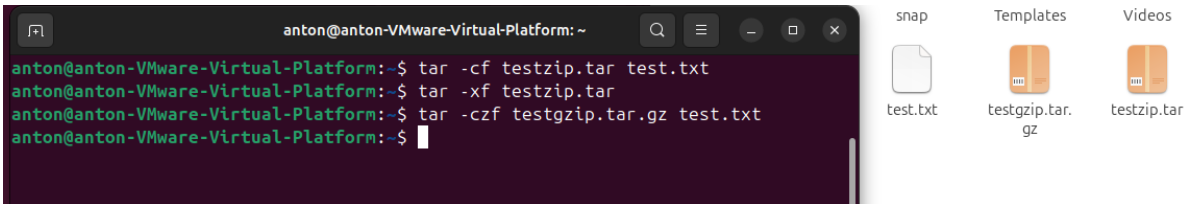
cd ~ moves you back to home folder

One significant difference between Linux and Windows file structure

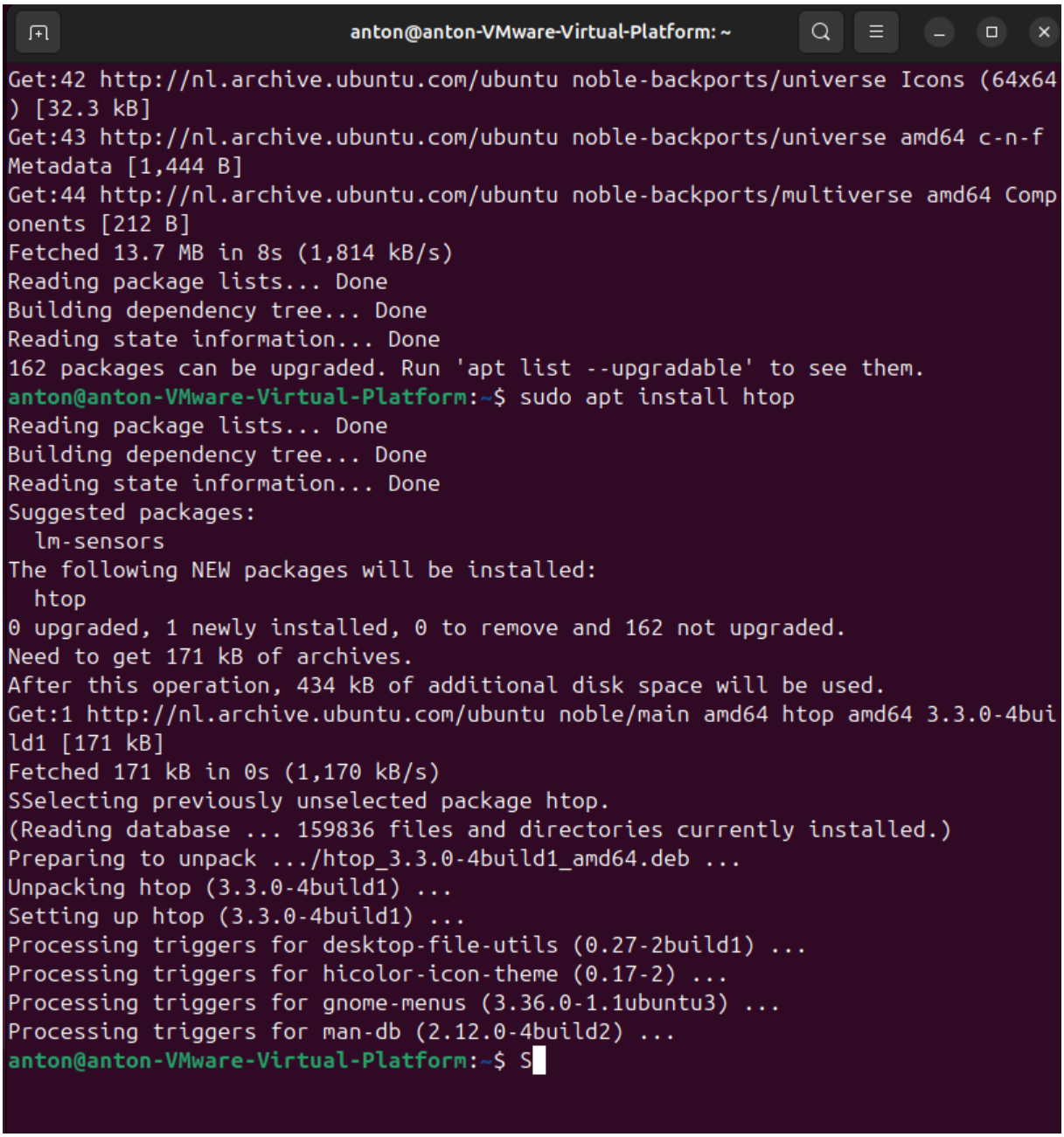
Linux has one single root directory (/), while Windows uses multiple drive letters such as C: and D:

What is the /etc directory used for?

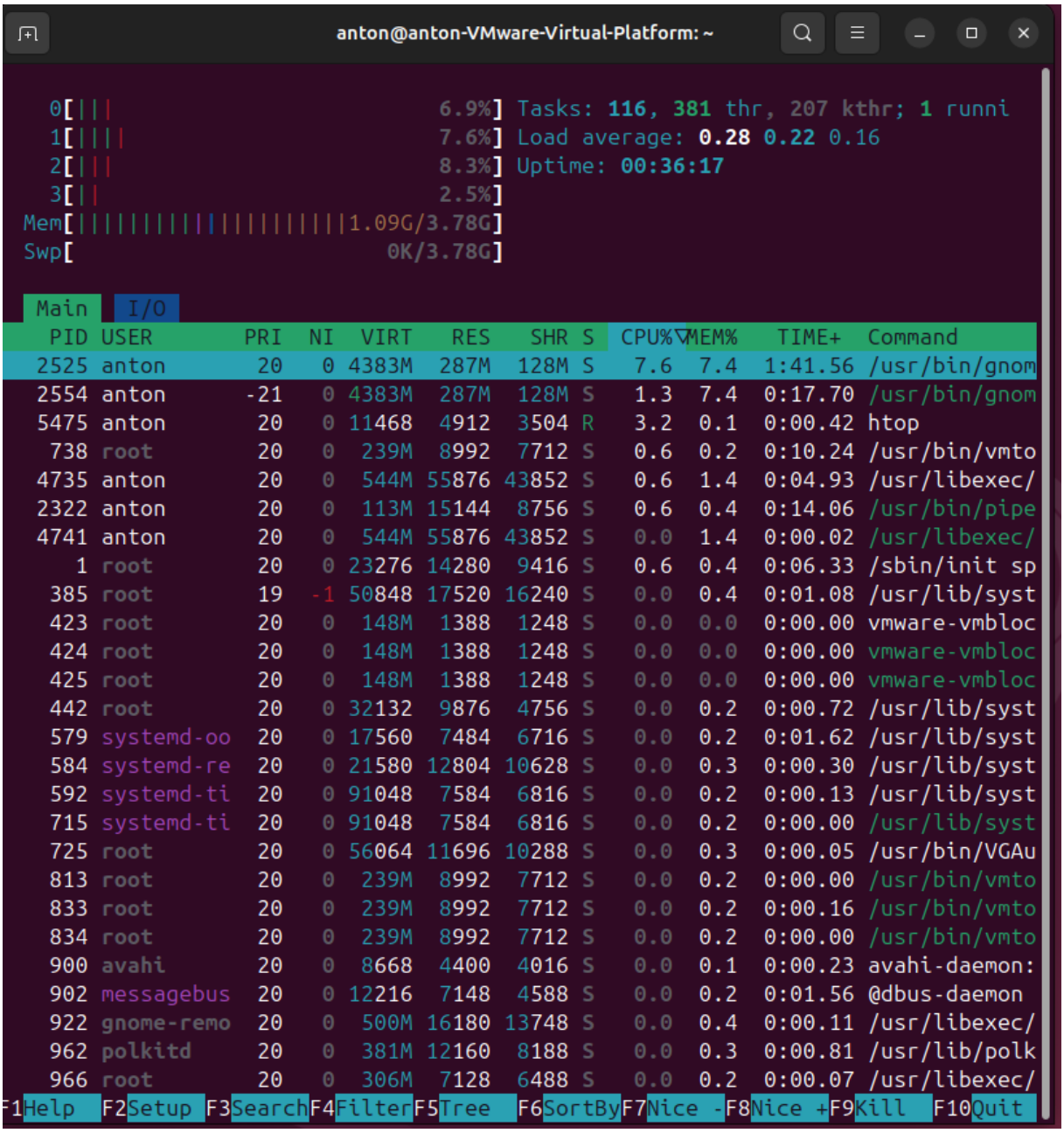
The /etc directory contains system-wide configuration files for the operating system and installed applications



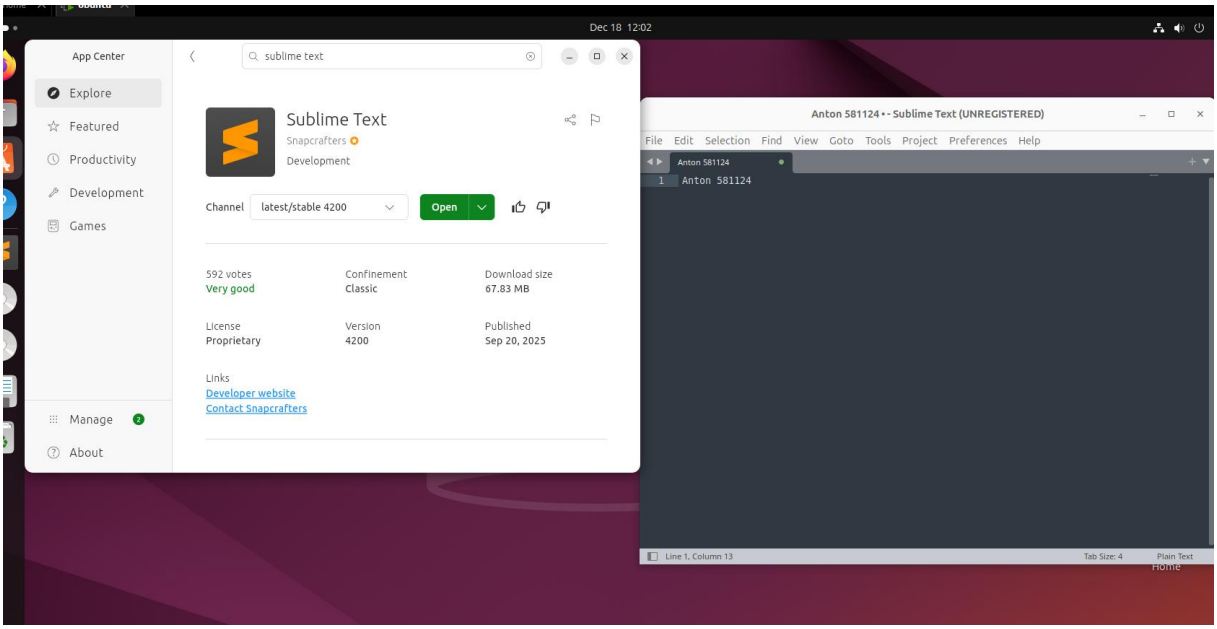
First command compresses file into tar archive, second extracts a tar file, and last compresses a text file in a tar archive with gzip(option -c means create, -f – file name of the archive, -x means extract, -z is compress using gzip)

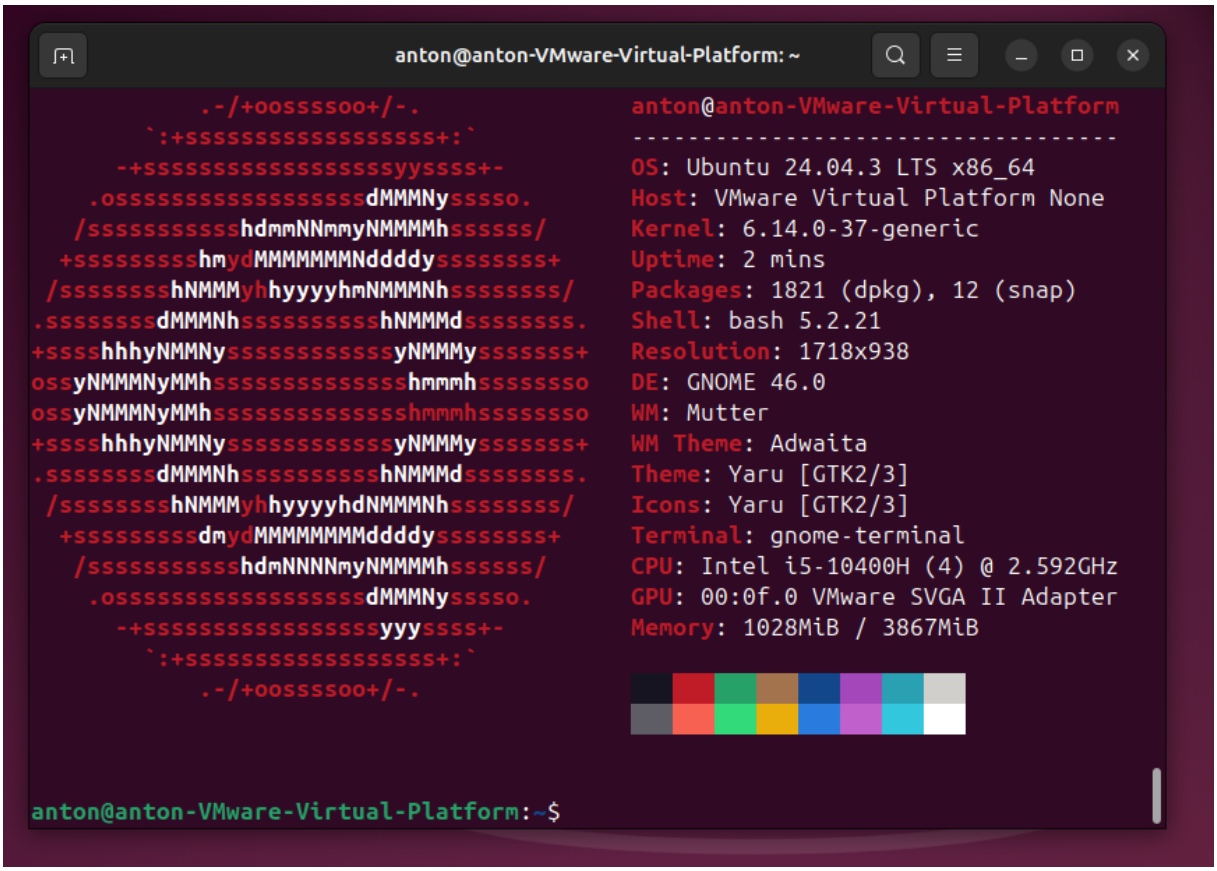


I updated the package list with sudo apt update. After that, I installed htop using sudo apt install htop.



On the screenshot it's shown htop. It shows running processes, CPU usage, memory usage, and system load in a real-time, interactive view.



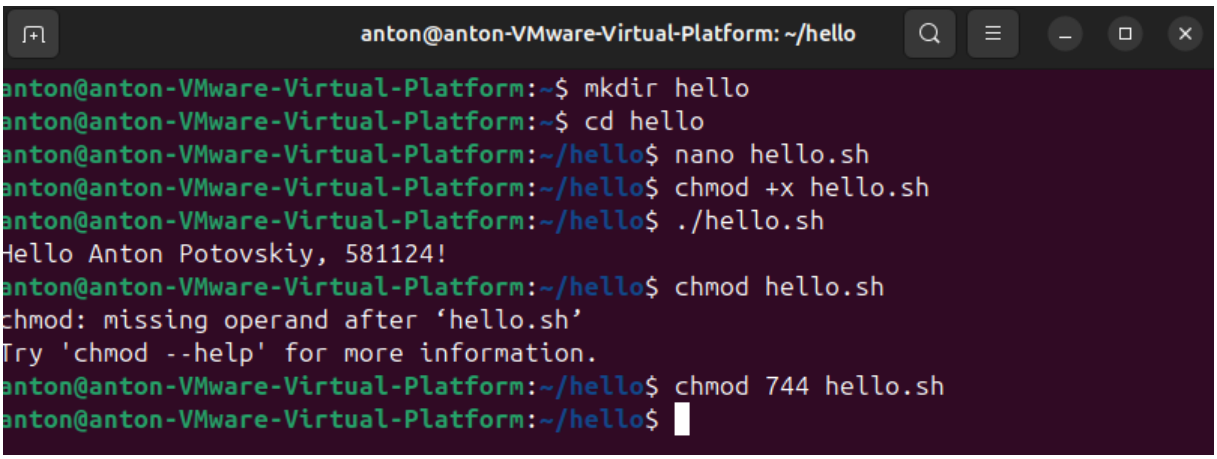


neofetch displays system information, such as:

- OS version
- Kernel
- CPU and GPU
- RAM usage
- Desktop environment

Assignment 5.5: Users and permissions on Linux

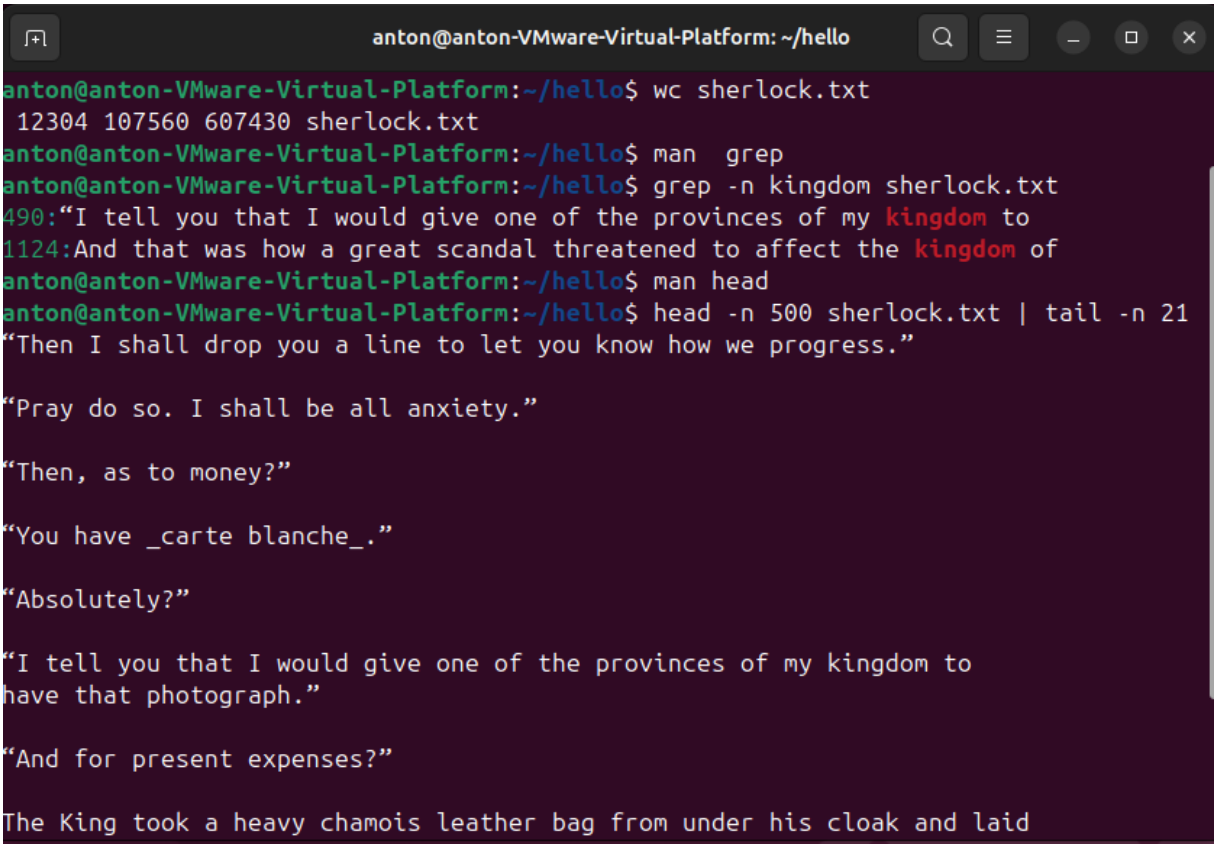
Relevant screenshots + motivation



chmod +x made my file executable for everyon, and **chmod 744** made my file only readable for groups and others, and gave all permissions for logged-in user(read(4) + write(2) + execute(1) = 7)

Assignment 5.6: View the contents of files

Relevant screenshots + motivation



wc command shows amount of lines(12304), words(107560) and characters(607430) in the file.

Kingdom is mentioned on the lines 490 and 1124, and head displays first 500 lines of the file and tail shows only last 21(to show 10 above, and 10 below kingdom)

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

```
anton@anton-VMware-Virtual-Platform:~/tasks$ exiftool oldcar
ExifTool Version Number         : 12.76
File Name                       : oldcar
Directory                       : .
File Size                       : 2.4 MB
File Modification Date/Time     : 2025:12:19 11:47:21+01:00
File Access Date/Time           : 2025:12:19 11:48:56+01:00
File Inode Change Date/Time     : 2025:12:19 11:48:51+01:00
File Permissions                : -rwxrw-rw-
File Type                       : JPEG
File Type Extension             : jpg
MIME Type                       : image/jpeg
JFIF Version                    : 1.01
Exif Byte Order                 : Big-endian (Motorola, MM)
Make                            : motorola
Camera Model Name               : moto g(6) play
```

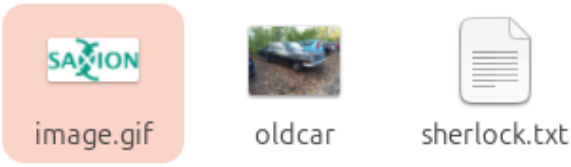
Phone brand is **Motorola** and model is **moto g(6) play**.

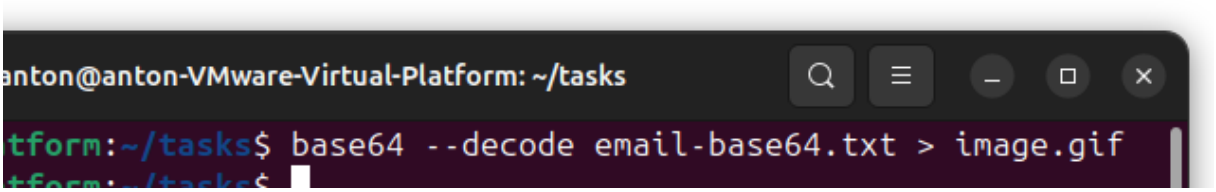
```
GPS Altitude                    : 42 m Above Sea Level
GPS Date/Time                   : 2020:11:07 14:08:57Z
GPS Latitude                    : 53 deg 11' 39.68" N
GPS Longitude                   : 6 deg 32' 12.90" E
Focal Length                    : 3.5 mm
GPS Position                    : 53 deg 11' 39.68" N, 6 deg 32' 12.90" E
Light Value                     : 7.7
```

GPS coordinates are: **53 deg 11' 39.68" N, 6 deg 32' 12.90" E**

The photo was taken in **Groningen,** on the street **Piccardtlaan.**

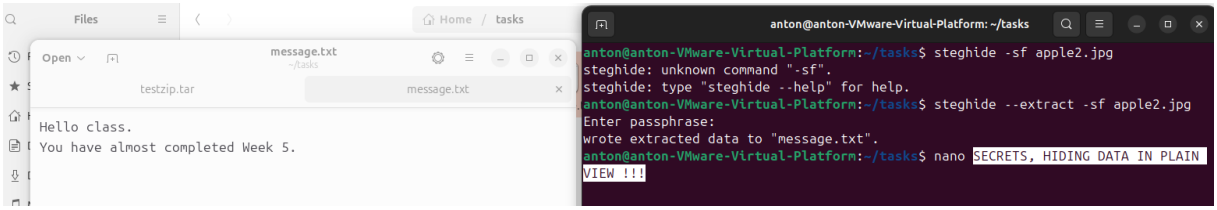
After renaming oldcar.jpg to oldcar, the command **file oldcar** shows that the file is still a jpg file. This is because Linux determines the file type by its content (file signature), not by the filename extension.





Assignment 5.8: Steganography

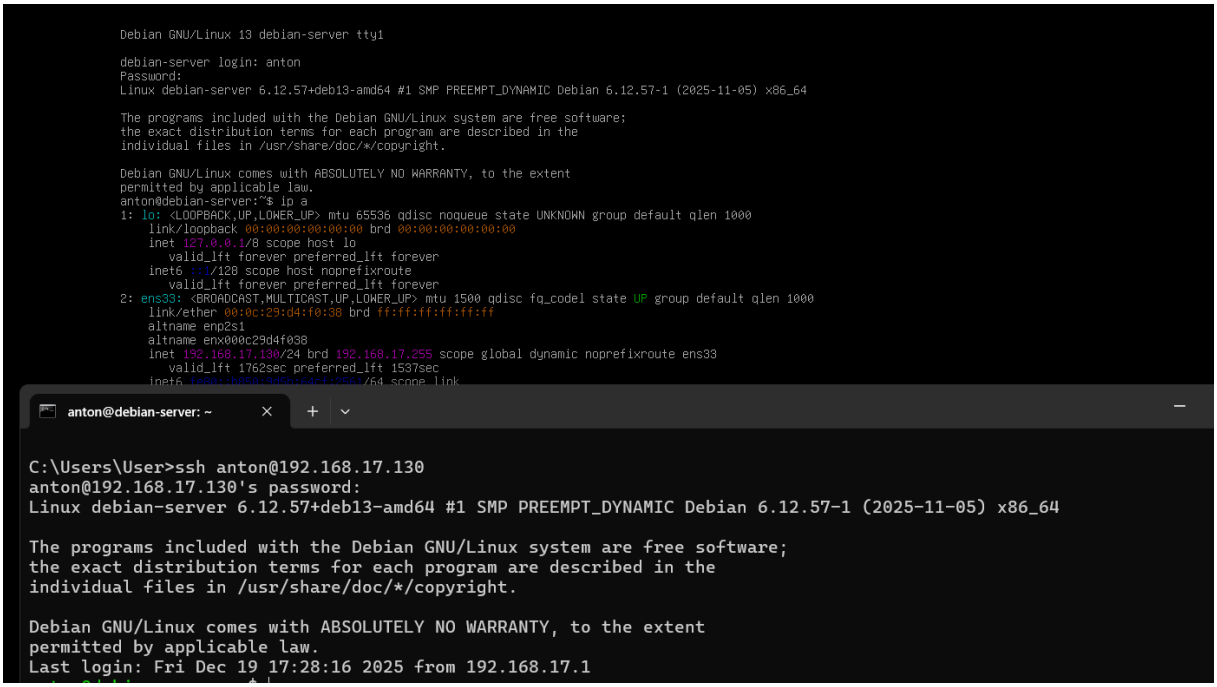
Relevant screenshots + motivation



steghide was used to extract a hidden text file from an image using least significant bit (LSB) steganography with a password apple2.

Assignment 5.9: Capture disk images

Make relevant screenshots + motivation:



The screenshot shows a Debian 13 server running and successfully accessed via SSH from a Windows host.

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

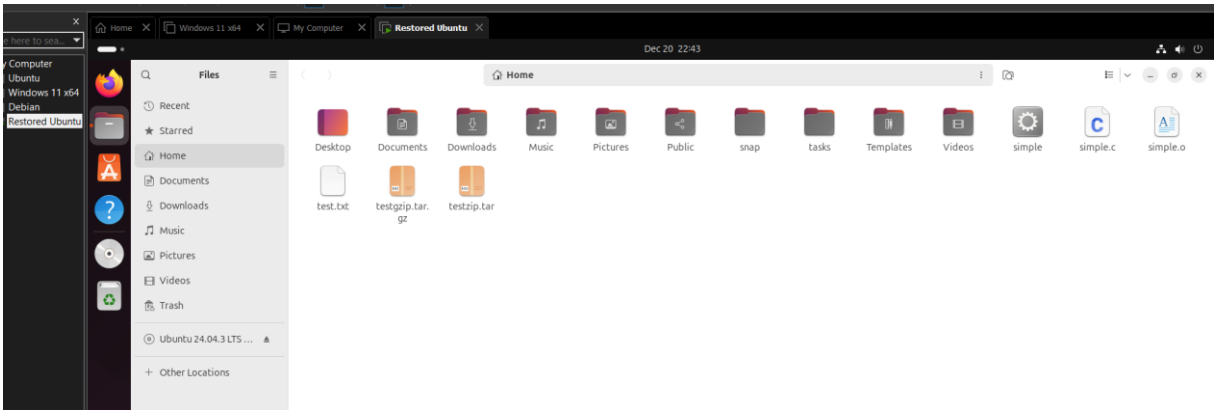
```
anton@debian-server:~$ ls -lh /srv/images
total 6.5G
-rw-rw-r-- 1 anton anton 6.5G Dec 19 21:45 ubuntu2404_vm.img.gz
anton@debian-server:~$
```

The Debian 13 server successfully stored a compressed disk image of the Ubuntu 24.04 Desktop VM(ubuntu2024_vm.img.gz)

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

```
ubuntu@ubuntu: ~
ubuntu@ubuntu:~$ ssh anton@192.168.17.130 "cat /srv/images/ubuntu2404_vm.img.gz"
 | gzip -d | sudo dd of=/dev/nvme0n1 bs=4M status=progress
anton@192.168.17.130's password:
68631461888 bytes (69 GB, 64 GiB) copied, 587 s, 117 MB/s
0+2076224 records in
0+2076224 records out
68719476736 bytes (69 GB, 64 GiB) copied, 588.46 s, 117 MB/s
ubuntu@ubuntu:~$
```

The screenshot shows the disk image being restored from the Debian image server to an empty Ubuntu VM using SSH and gzip decompression.



The screenshot shows the successfully booted Ubuntu virtual machine after restoring the disk image from the Debian image server. This confirms that the backup image was restored correctly.