Template Week 5 – Operating Systems

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Assignment 5.1: Unix-like

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

UNIX is the *original* operating system created in the 1970s at Bell Labs. It is a certified, commercial system.

A Unix-like operating system is *not the original UNIX*, but it behaves like UNIX, follows similar concepts, commands, and POSIX standards. Examples: Linux, macOS, BSD (shown on page 13 as "Unix-like" 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.

Ken Thompson
One of the creators of the original **UNIX** at Bell Labs. He helped design early UNIX concepts and tools (shell, filesystem ideas).
Dennis Ritchie
Co-creator of **UNIX** and inventor of the **C programming language**, which allowed UNIX to be rewritten in C. This made UNIX portable and influenced almost all modern OSes.

Bill Joy

Developer of **BSD UNIX** at Berkeley. He created the **vi editor** and contributed to networking features in BSD that influenced the internet.
Richard Stallman
Founder of the **GNU movement**. He started the idea of free software and wrote important tools like the GNU Compiler Collection (GCC). His project aimed to build a completely free UNIX-like system.
Linus Torvalds
Creator of the **Linux kernel** in 1991. When combined with GNU tools, it formed **GNU/Linux**, the most widely used Unix-like OS today

c) What is the philosophy of the GNU movement?

a. The GNU movement is based on the idea that software should be free—not in price, but in freedom.
b. It promotes the user's rights to run, study, modify, and share software.

c. Its goal is to ensure that computing is controlled by users, not by companies or restrictive licenses.

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

Ubuntu supports the GNU ideas but is not completely free software because it includes some non-free components.

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

WSL is a Windows feature that allows users to run a **Linux environment inside Windows** without using a virtual machine. It lets you run Linux commands, tools, and even graphical apps directly on Windows.

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

Android → Unix-like (built on the Linux kernel)

iOS → Unix-like (based on Darwin/BSD)

ChromeOS → Unix-like (also built on the Linux kernel)

So all three belong to the Unix-like 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

Supercomputers are extremely powerful computers designed to do a huge number of calculations very quickly. They are used for tasks that normal computers cannot handle. According to the Computer History Museum website, supercomputers are mainly used for things like **weather prediction, scientific research, and complex simulations**. Scientists use them to model climate change, study molecules, or simulate physics problems. Supercomputers are also used in engineering, for example to test car designs by running virtual crash or stress simulations. In addition, they have been used in areas like national security and cryptography because of their high processing power. Overall, supercomputers help solve very large and complex problems that require massive computing speed.

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 group of many PlayStation 3 (PS3) consoles connected together so they work like one powerful computer. The PS3 used the Cell processor, which was originally related to the same technology used in IBM's Roadrunner supercomputer. Because the PS3 had a strong CPU for its time, researchers discovered they could link hundreds of PS3s to create a low-cost supercomputer.

These PS3 clusters were used for scientific research, such as physics simulations, image processing, and military research. One famous example is the U.S. Air Force, which built a cluster of over 1,700 PS3 consoles to create a very powerful and cheap supercomputer. Universities also used PS3 clusters for experiments in parallel computing and for running complex calculations.

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?

The Raspberry Pi cluster built by Oracle uses the operating system **Oracle Linux**. This is a Linux-based operating system that Oracle often uses for servers and large computing projects. So even though the cluster is made from small Raspberry Pi devices, it still runs a full Linux system designed for high-performance and enterprise workloads.

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, Oracle's Raspberry Pi supercomputer does not appear in the TOP500 list. The TOP500 list contains the fastest supercomputers in the world, and they use very powerful CPUs and GPUs. A Raspberry Pi cluster is made from many small, low-power devices, so even with many of them combined, the performance is far too low to compete with real supercomputers. Because of that, it is logical that Oracle's Raspberry Pi cluster is not included in the TOP500.

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?

CPU architecture:
Both the PlayStation 5 and the Xbox Series X use AMD x86-64 CPU architecture.
This is the same architecture used in most modern desktop and laptop PCs.

• Operating systems:

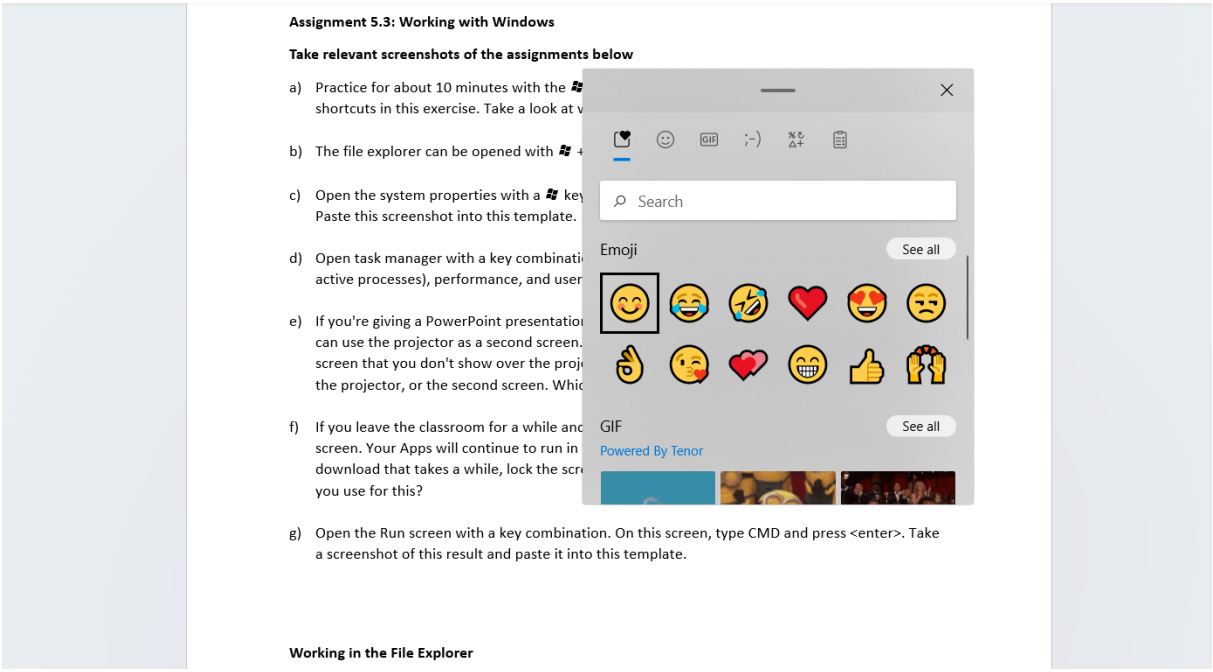
- PlayStation 5: Runs a customized Orbis OS, which is based on FreeBSD (a Unix-like operating system).
- Xbox Series X: Runs a customized Windows-based OS, part of the Xbox OS family, built on the Windows NT kernel.

• Conclusion:
Even though these consoles are gaming devices, they use the same CPU architecture as regular PCs (x86-64) and run operating systems that are closely related to Unix-like systems (PS5) or Windows (Xbox).
This shows that modern consoles are basically specialized computers, not very different from normal PCs in terms of hardware and OS design.

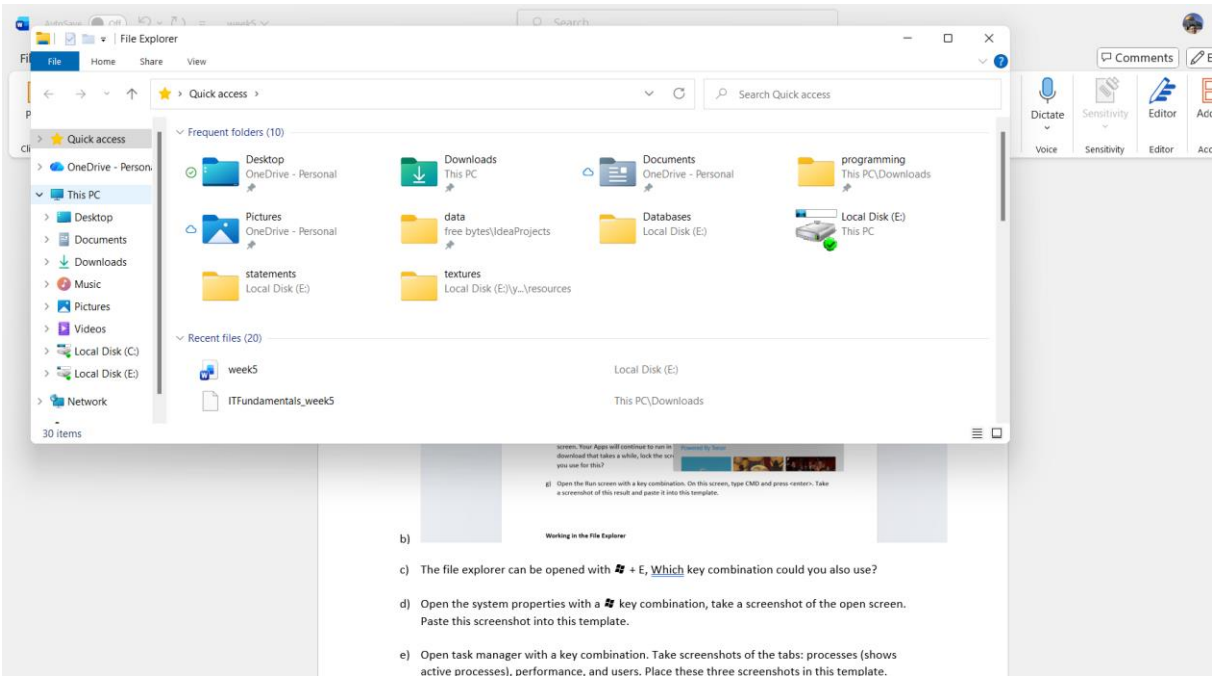
Assignment 5.3: Working with Windows

Take relevant screenshots of the assignments below

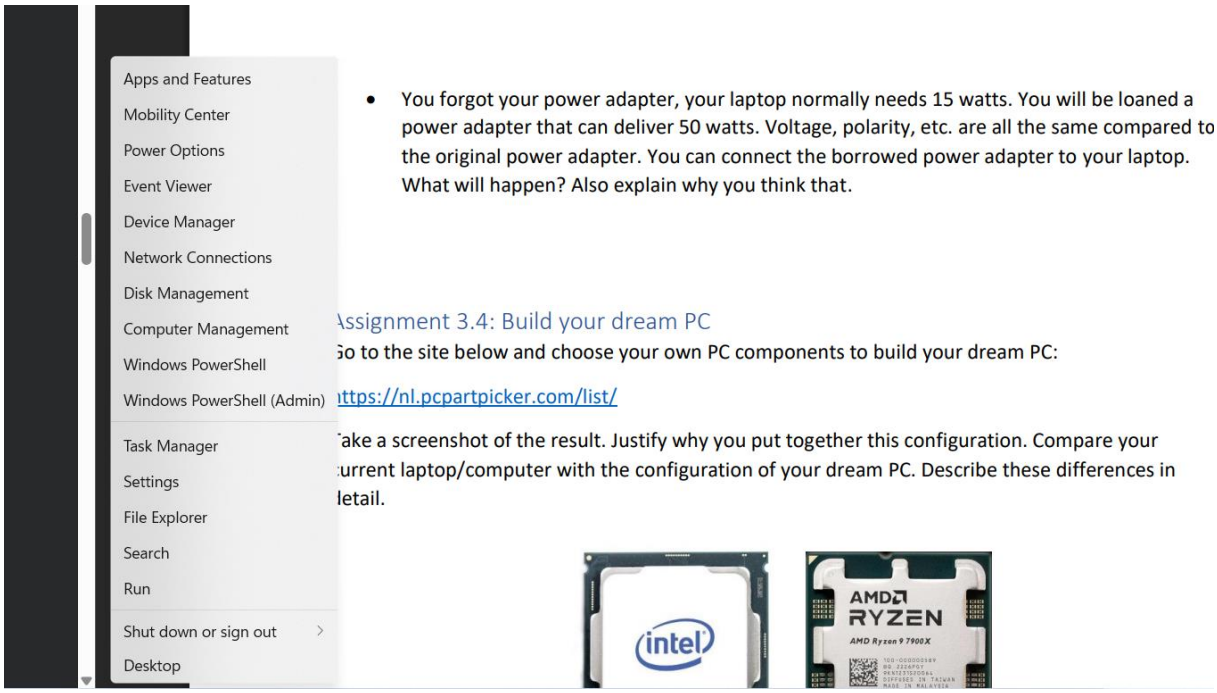
a) Practice for about 10 minutes with the ⊞ keyboard shortcuts combinations, skip the general shortcuts in this exercise. Take a look at which screens are opened.



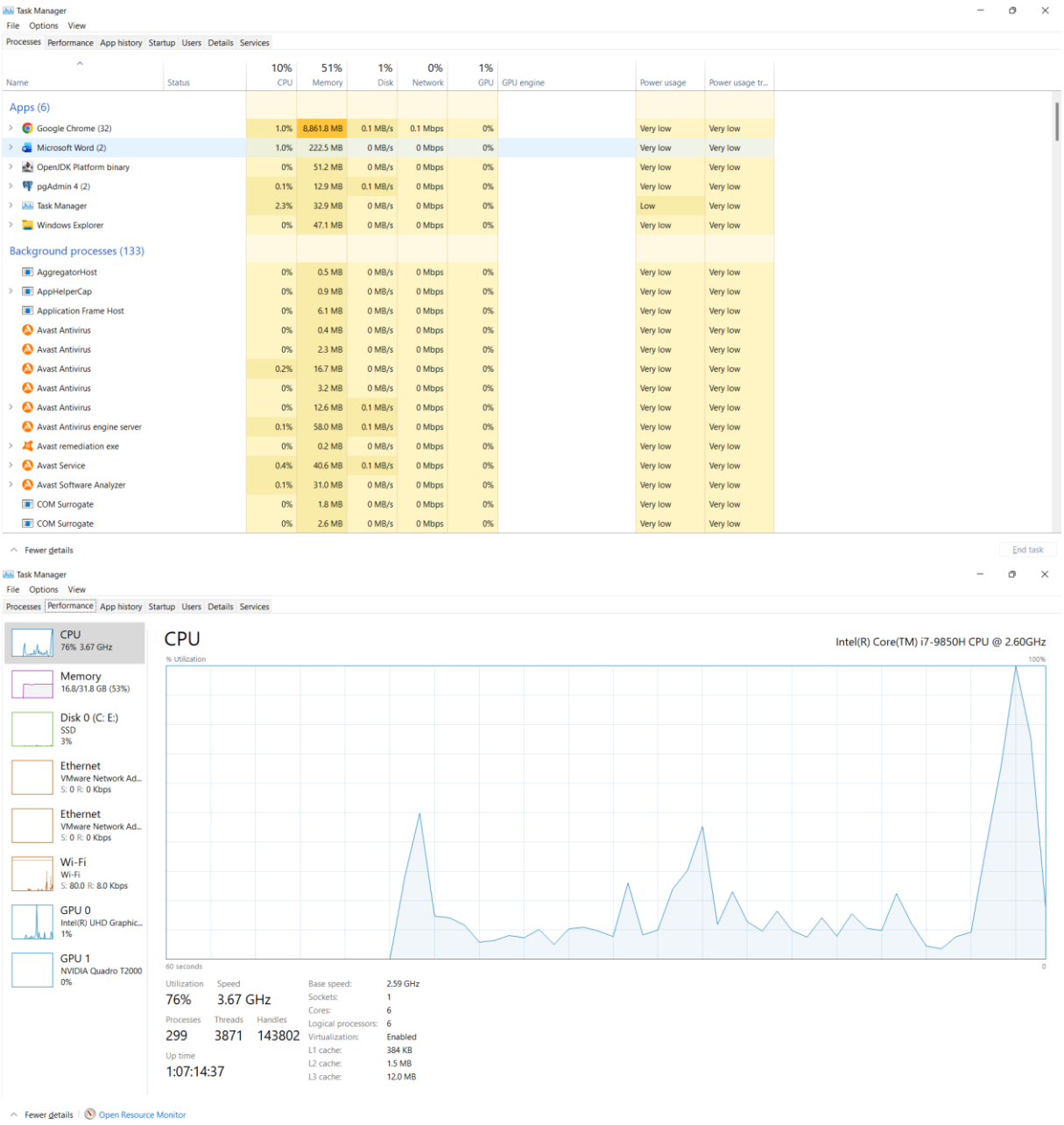
b) The file explorer can be opened with ⊞ + E, Which key combination could you also use?

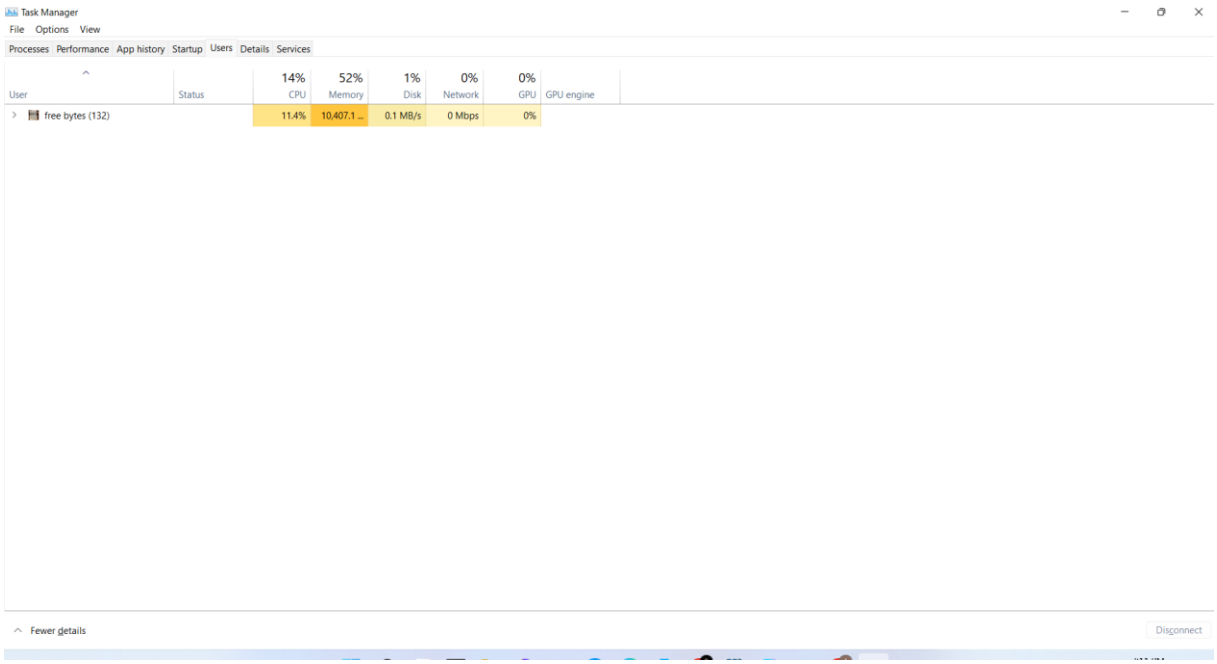


c) Open the system properties with a ⊞ key combination, take a screenshot of the open screen. Paste this screenshot into this template.



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.

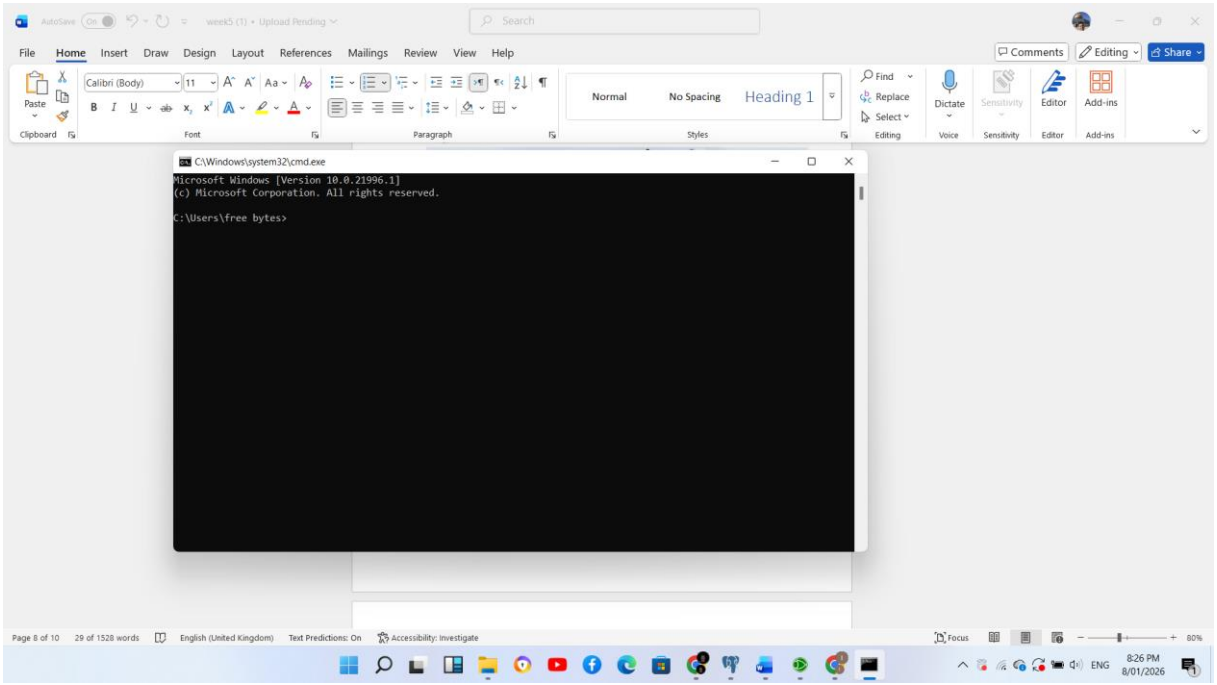

Task Manager
File Options View
Processes Performance App history Startup Users Details Services
Name Status 10% CPU 51% Memory 1% Disk 0% Network 1% GPU GPU engine Power usage Power usage tr...
Apps (6)
Google Chrome (32) 1.0% 8,861.8 MB 0.1 MB/s 0.1 Mbps 0% Very low Very low
Microsoft Word (2) 1.0% 222.5 MB 0 MB/s 0 Mbps 0% Very low Very low
OpenJDK Platform binary 0% 51.2 MB 0 MB/s 0 Mbps 0% Very low Very low
pgAdmin 4 (2) 0.1% 12.9 MB 0.1 MB/s 0 Mbps 0% Very low Very low
Task Manager 2.3% 32.9 MB 0 MB/s 0 Mbps 0% Low Very low
Windows Explorer 0% 47.1 MB 0 MB/s 0 Mbps 0% Very low Very low
Background processes (133)
AggregatorHost 0% 0.5 MB 0 MB/s 0 Mbps 0% Very low Very low
AppHelperCap 0% 0.9 MB 0 MB/s 0 Mbps 0% Very low Very low
Application Frame Host 0% 6.1 MB 0 MB/s 0 Mbps 0% Very low Very low
Avast Antivirus 0% 0.4 MB 0 MB/s 0 Mbps 0% Very low Very low
Avast Antivirus 0% 2.3 MB 0 MB/s 0 Mbps 0% Very low Very low
Avast Antivirus 0.2% 16.7 MB 0 MB/s 0 Mbps 0% Very low Very low
Avast Antivirus 0% 3.2 MB 0 MB/s 0 Mbps 0% Very low Very low
Avast Antivirus 0% 12.6 MB 0.1 MB/s 0 Mbps 0% Very low Very low
Avast Antivirus engine server 0.1% 58.0 MB 0.1 MB/s 0 Mbps 0% Very low Very low
Avast remediation exe 0% 0.2 MB 0 MB/s 0 Mbps 0% Very low Very low
Avast Service 0.4% 40.6 MB 0.1 MB/s 0 Mbps 0% Very low Very low
Avast Software Analyzer 0.1% 31.0 MB 0 MB/s 0 Mbps 0% Very low Very low
COM Surrogate 0% 1.8 MB 0 MB/s 0 Mbps 0% Very low Very low
COM Surrogate 0% 2.6 MB 0 MB/s 0 Mbps 0% Very low Very low
Fewer details
End task
Task Manager
File Options View
Processes Performance App history Startup Users Details Services
CPU 76% 3.67 GHz
Memory 16.8/31.8 GB (53%)
Disk 0 (C: E:) SSD 3%
Ethernet VMware Network Ad... S: 0 R: 0 Kbps
Ethernet VMware Network Ad... S: 0 R: 0 Kbps
Wi-Fi Wi-Fi S: 80.0 R: 8.0 Kbps
GPU 0 Intel(R) UHD Graphic... 1%
GPU 1 NVIDIA Quadro T2000 0%
CPU
Intel(R) Core(TM) i7-9850H CPU @ 2.60GHz
% Utilization
100%
60 seconds
0
Utilization 76%
Speed 3.67 GHz
Processes 299
Threads 3871
Handles 143802
Up time 1:07:14:37
Base speed: 2.59 GHz
Sockets: 1
Cores: 6
Logical processors: 6
Virtualization: Enabled
L1 cache: 384 KB
L2 cache: 1.5 MB
L3 cache: 12.0 MB
Fewer details
Open Resource Monitor

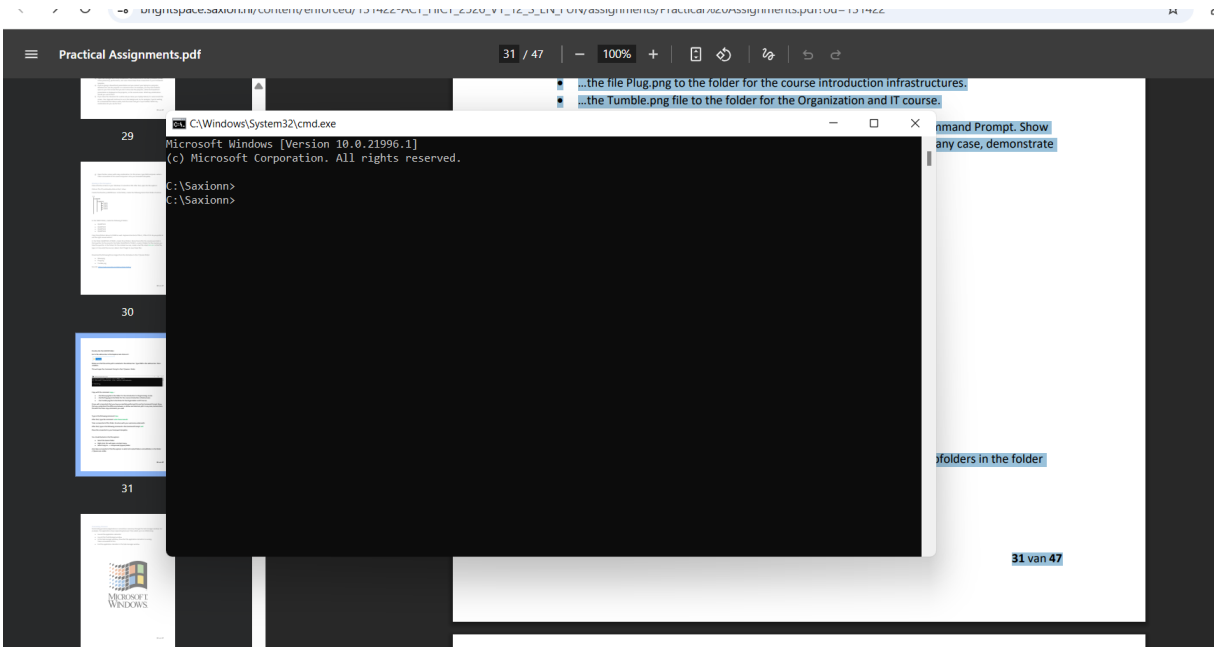


e) If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector,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

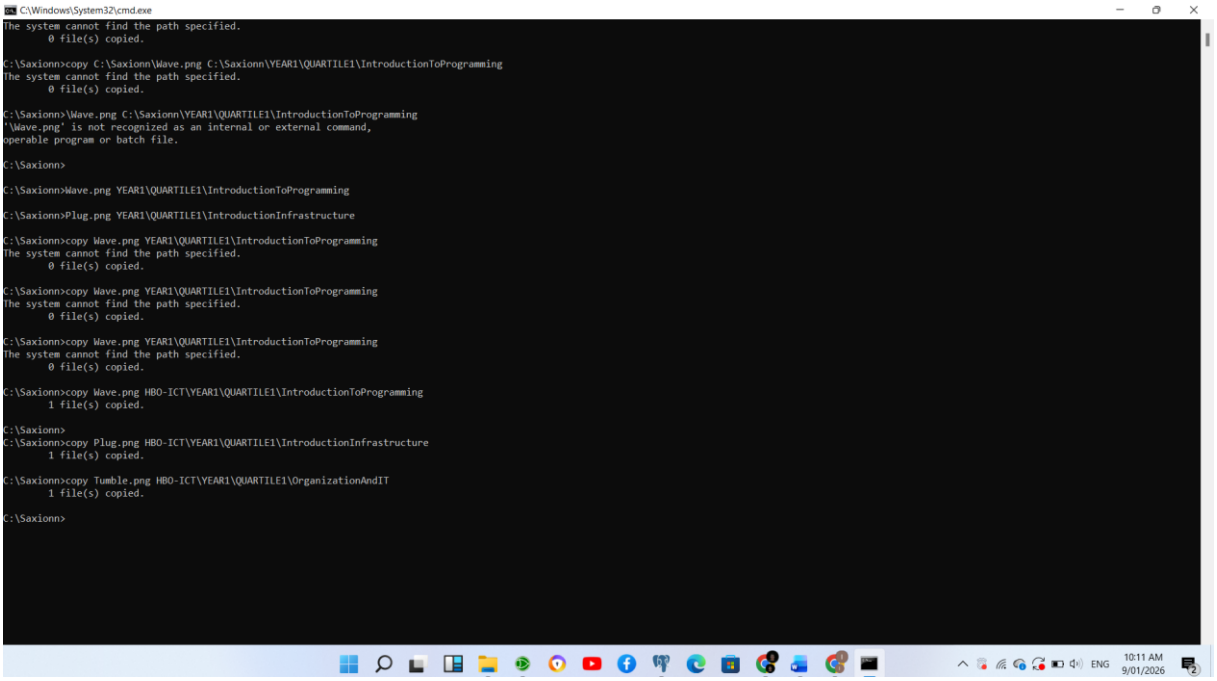
g) Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.



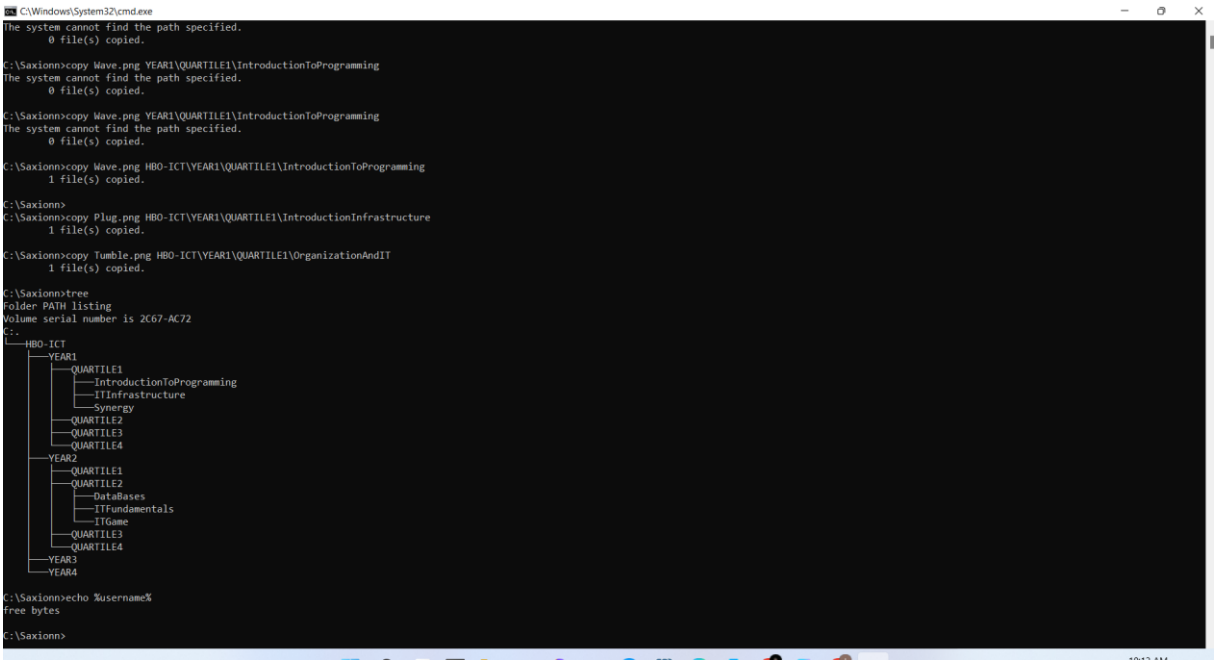


Working in the File Explorer

Relevant screenshots **copy** command:

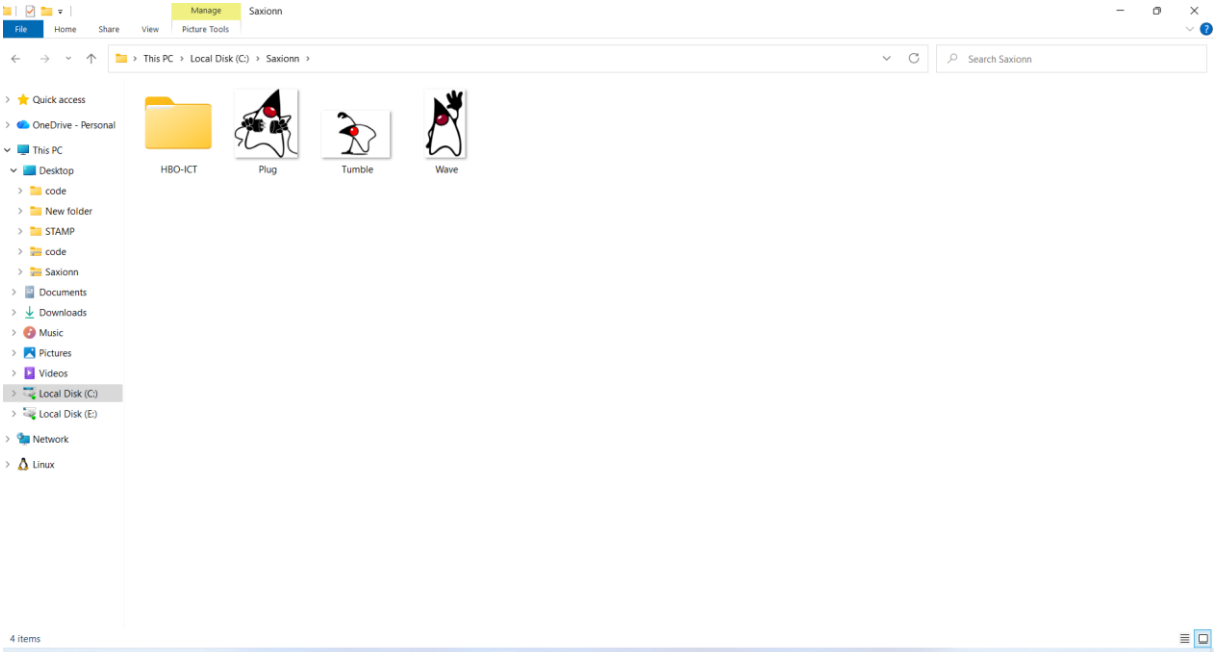


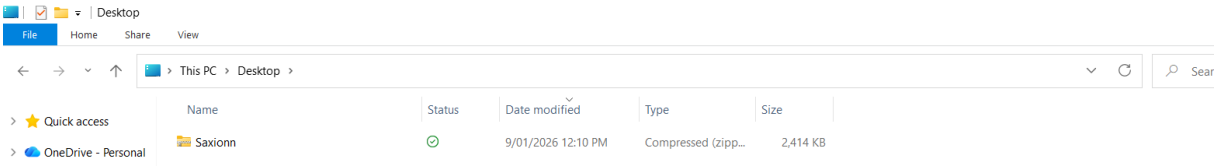
Relevant screenshots **tree** command:



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

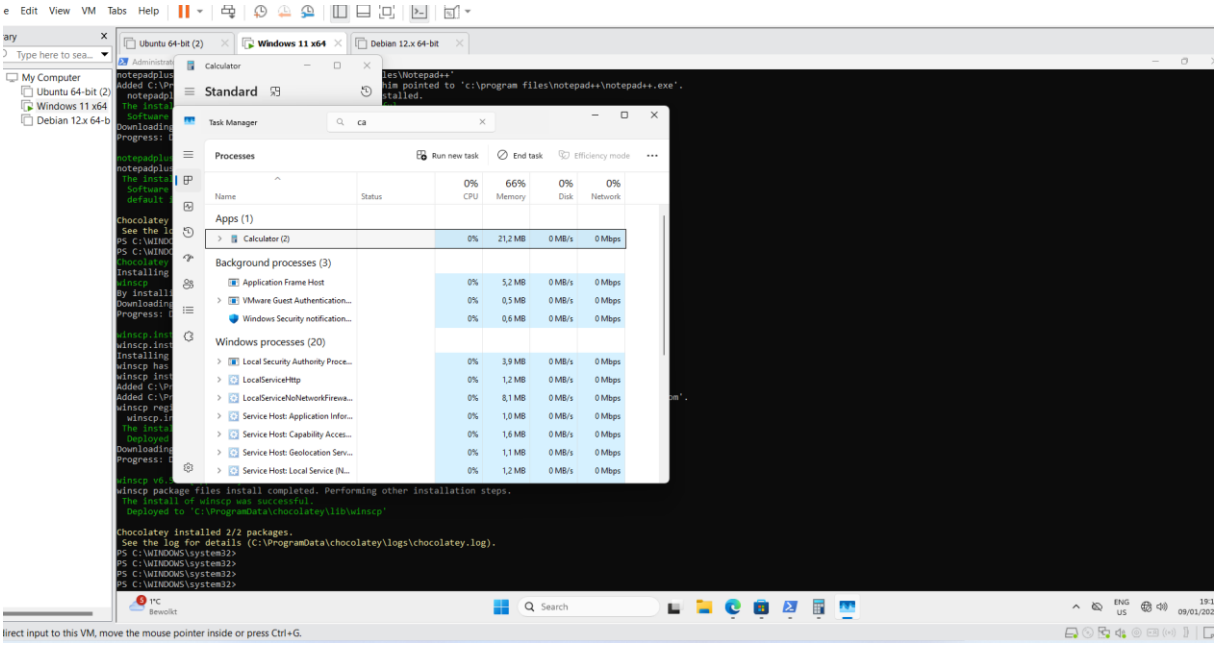
]

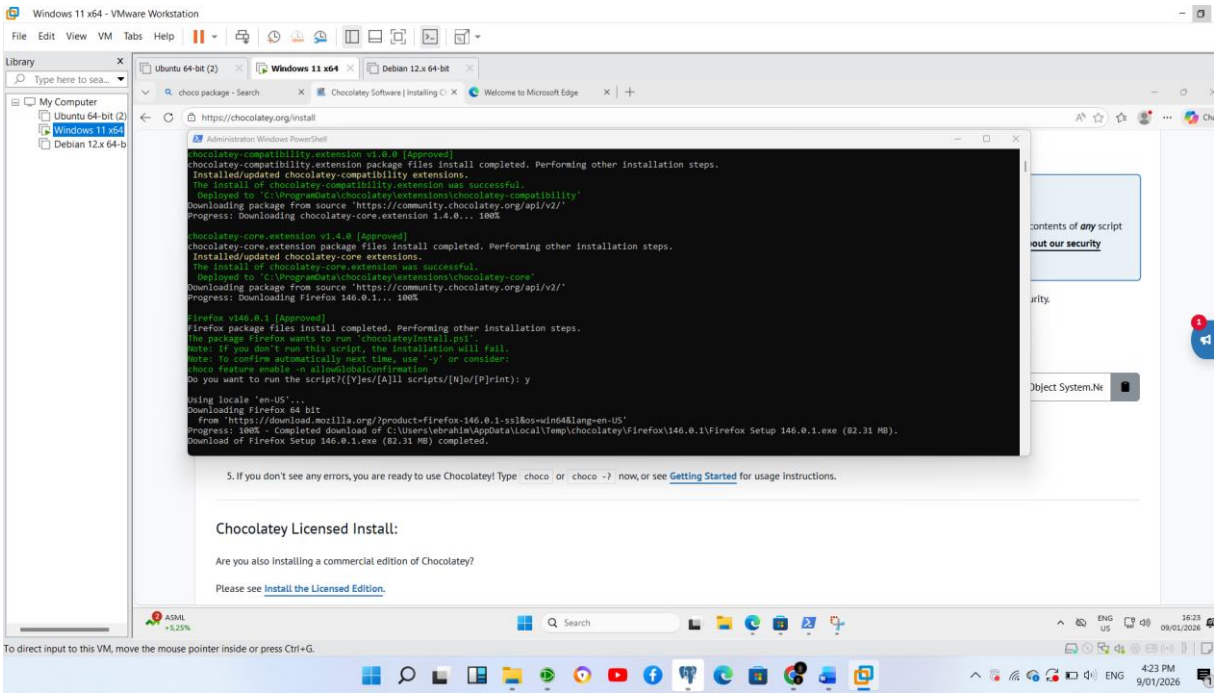




Terminating Processes

Relevant Screenshots Task Manager Window:





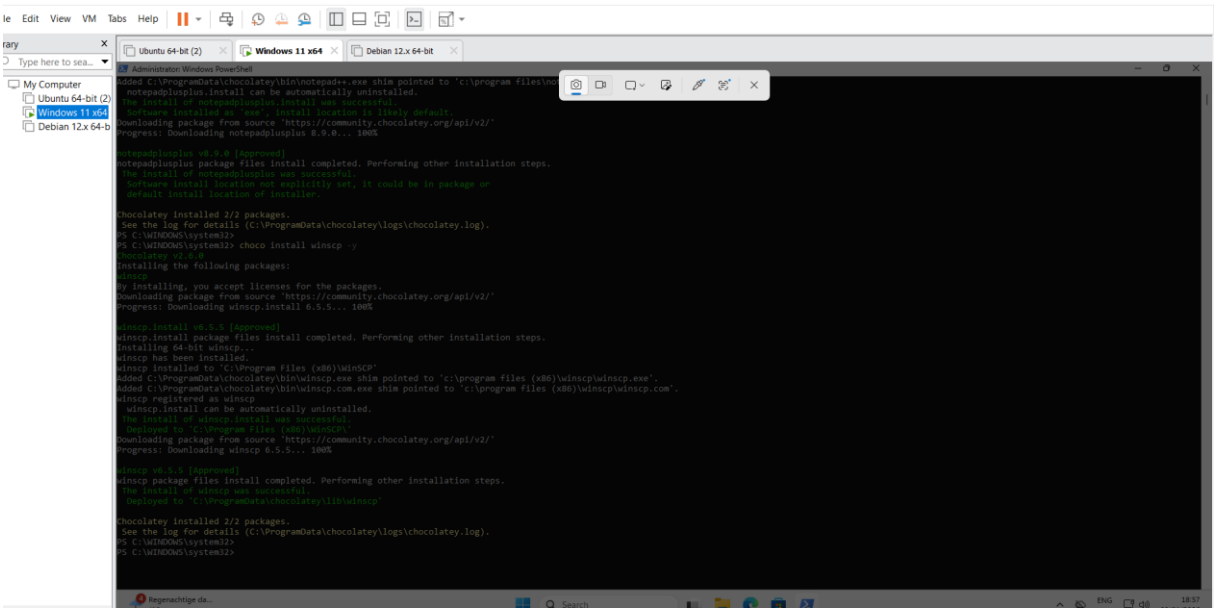
Install Software

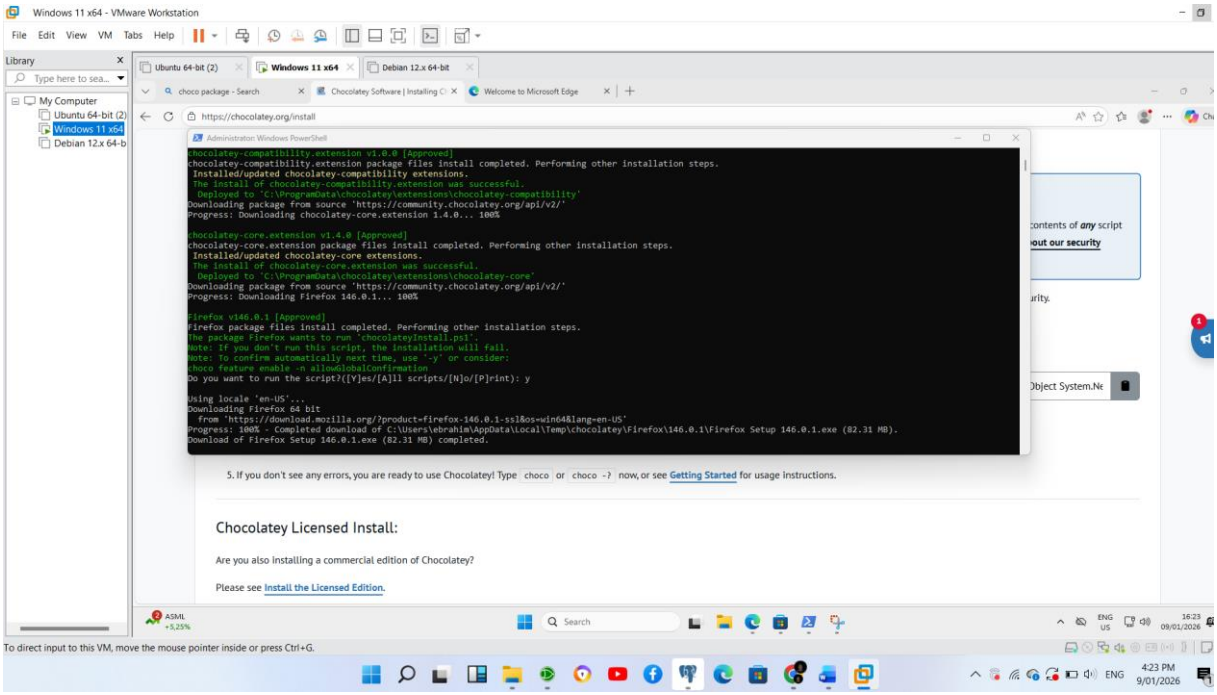
Relevant screenshots that the following software is installed with winget:

- WinSCP
- Notepad++
- 7zip

] Ubuntu 64-bit (2)
] Windows 11 x64
] Debian 12.x 64-b

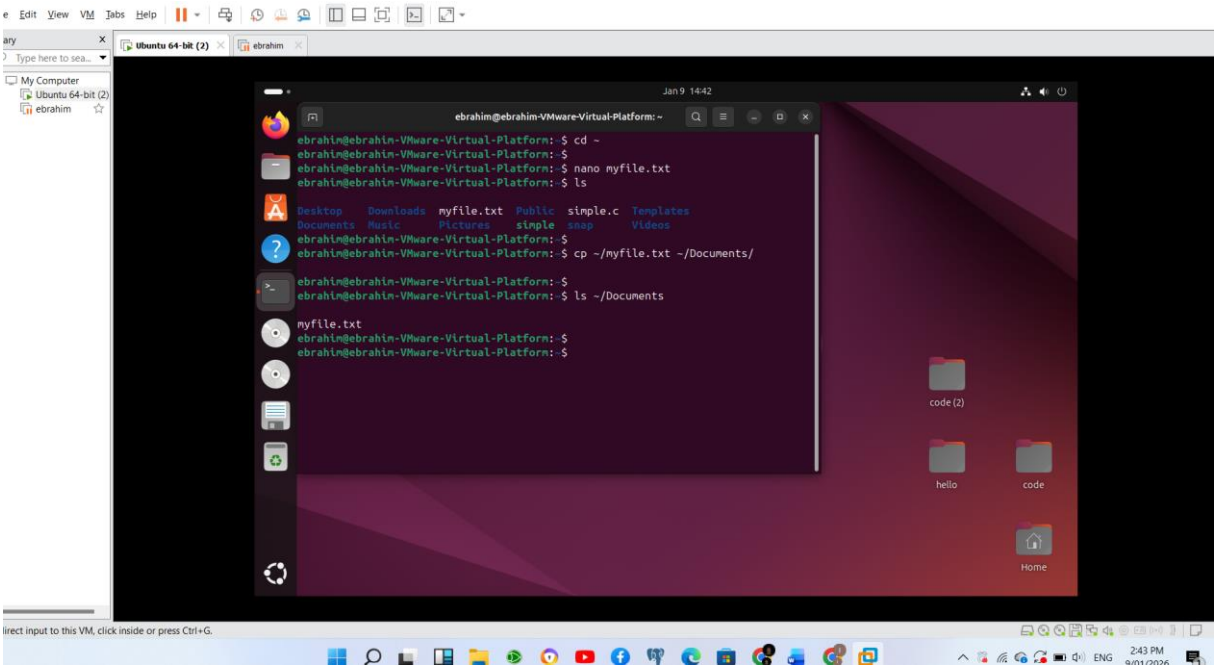
```
7zip.install has been installed.
7zip installed to 'C:\Program Files\7-Zip'
Added C:\ProgramData\chocolatey\bin\7z.exe shim pointed to 'c:\program files\7-zip\7z.exe'.
  7zip.install can be automatically uninstalled.
 The install of 7zip.install was successful.
  Deployed to 'C:\Program Files\7-Zip\'
Downloading package from source 'https://community.chocolatey.org/api/v2/'
Progress: Downloading 7zip 25.1.0... 100%

7zip v25.1.0 [Approved]
7zip package files install completed. Performing other installation steps.
 The install of 7zip was successful.
  Deployed to 'C:\ProgramData\chocolatey\lib\7zip'

Chocolatey installed 2/2 packages.
 See the log for details (C:\ProgramData\chocolatey\logs\chocolatey.log).
PS C:\WINDOWS\system32>
PS C:\WINDOWS\system32> choco install notepadplusplus -y
Chocolatey v2.6.0
Installing the following packages:
notepadplusplus
By installing, you accept licenses for the packages.
Downloading package from source 'https://community.chocolatey.org/api/v2/'
Progress: Downloading notepadplusplus.install 8.9.0... 100%

notepadplusplus.install v8.9.0 [Approved]
notepadplusplus.install package files install completed. Performing other installation steps.
Installing 64-bit notepadplusplus.install...
notepadplusplus.install has been installed.
WARNING: No registry key found based on  'Notepad\+\+*'
notepadplusplus.install installed to 'C:\Program Files\Notepad++'
Added C:\ProgramData\chocolatey\bin\notepad++.exe shim pointed to 'c:\program files\notepad++\notepad++.exe'.
  notepadplusplus.install can be automatically uninstalled.
 The install of notepadplusplus.install was successful.
  Software installed as 'exe', install location is likely default.
Downloading package from source 'https://community.chocolatey.org/api/v2/'
Progress: Downloading notepadplusplus 8.9.0... 100%

notepadplusplus v8.9.0 [Approved]
notepadplusplus package files install completed. Performing other installation steps.
 The install of notepadplusplus was successful.
  Software install location not explicitly set, it could be in package or
  default install location of installer.

Chocolatey installed 2/2 packages.
 See the log for details (C:\ProgramData\chocolatey\logs\chocolatey.log).
PS C:\WINDOWS\system32>
PS C:\WINDOWS\system32> choco install winscp -y
Chocolatey v2.6.0
```

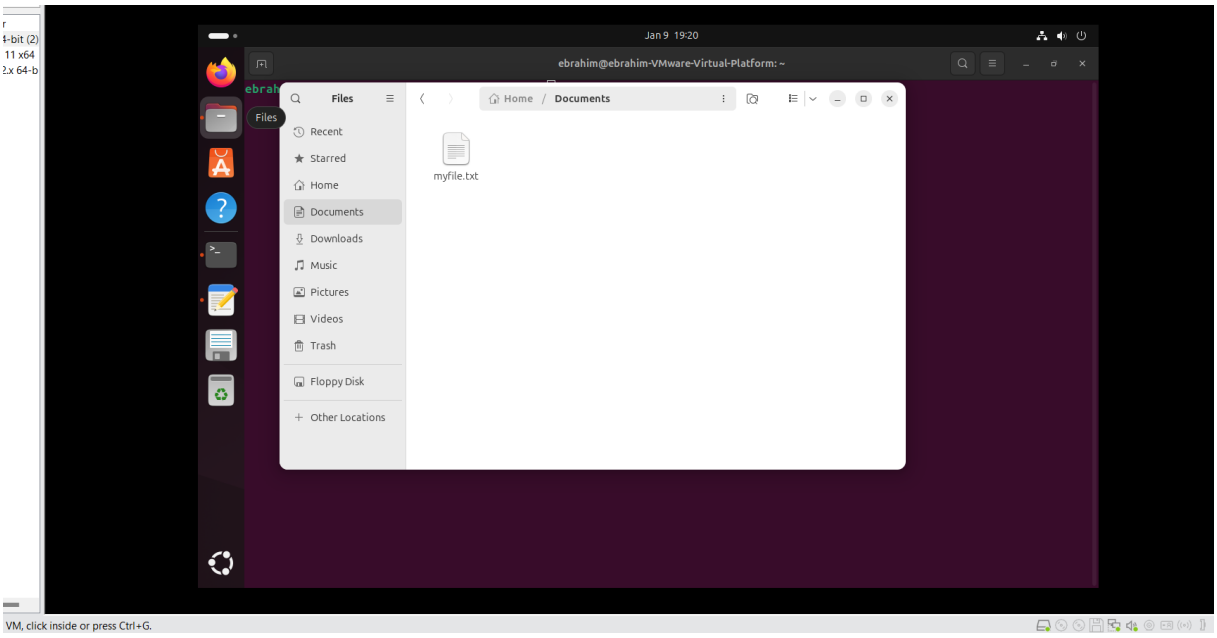


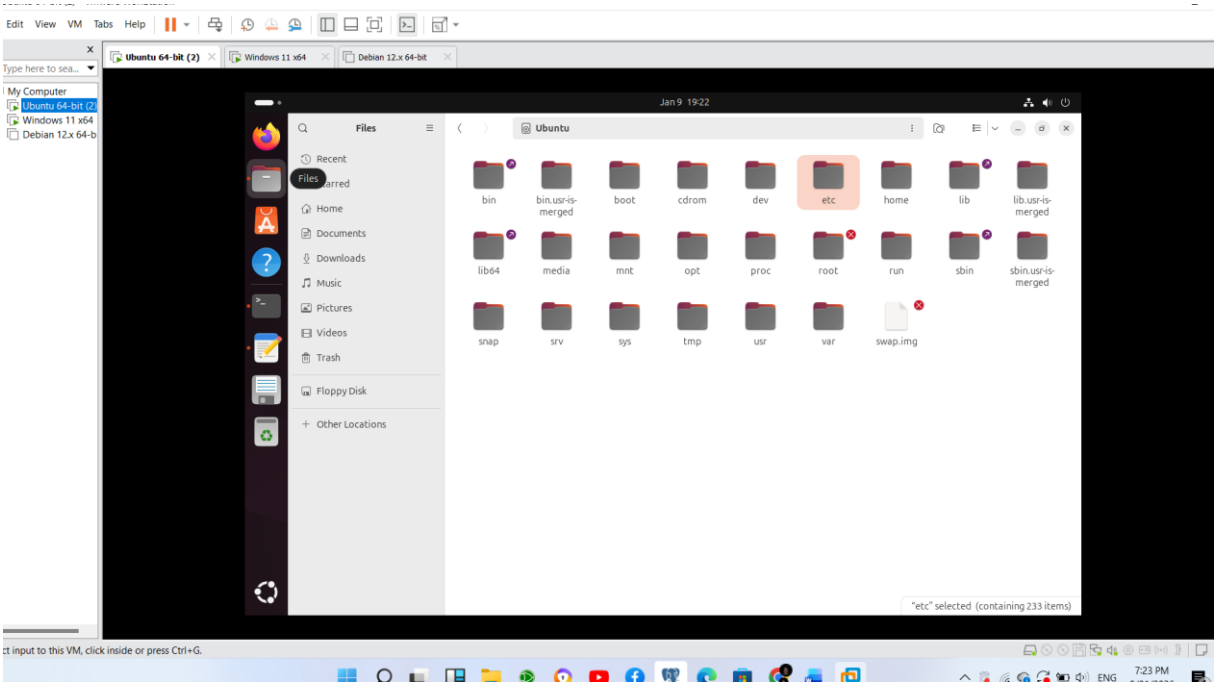


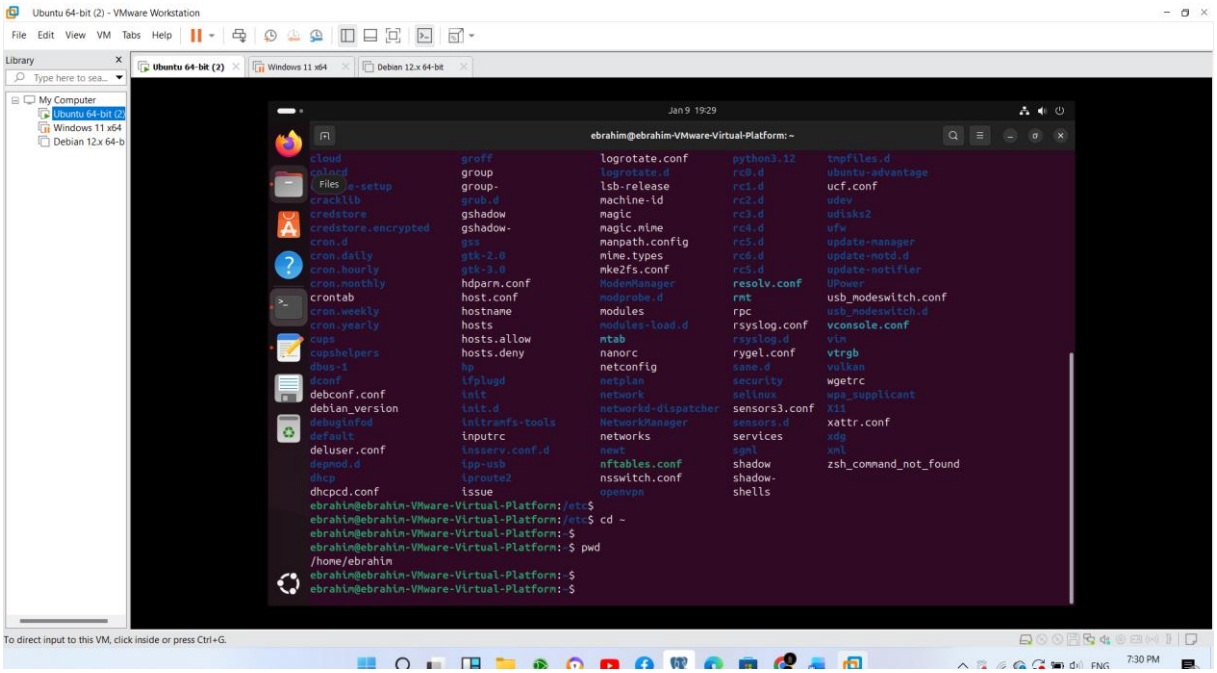
Assignment 5.4: Working with Linux

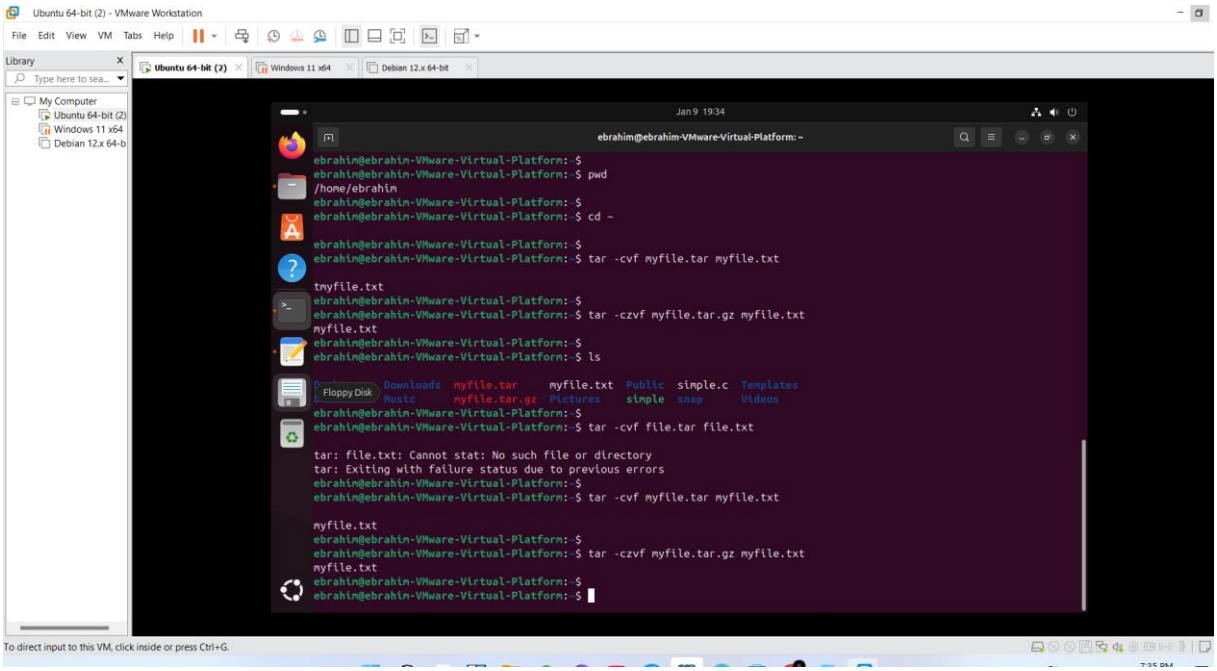
Relevant screenshots + motivation

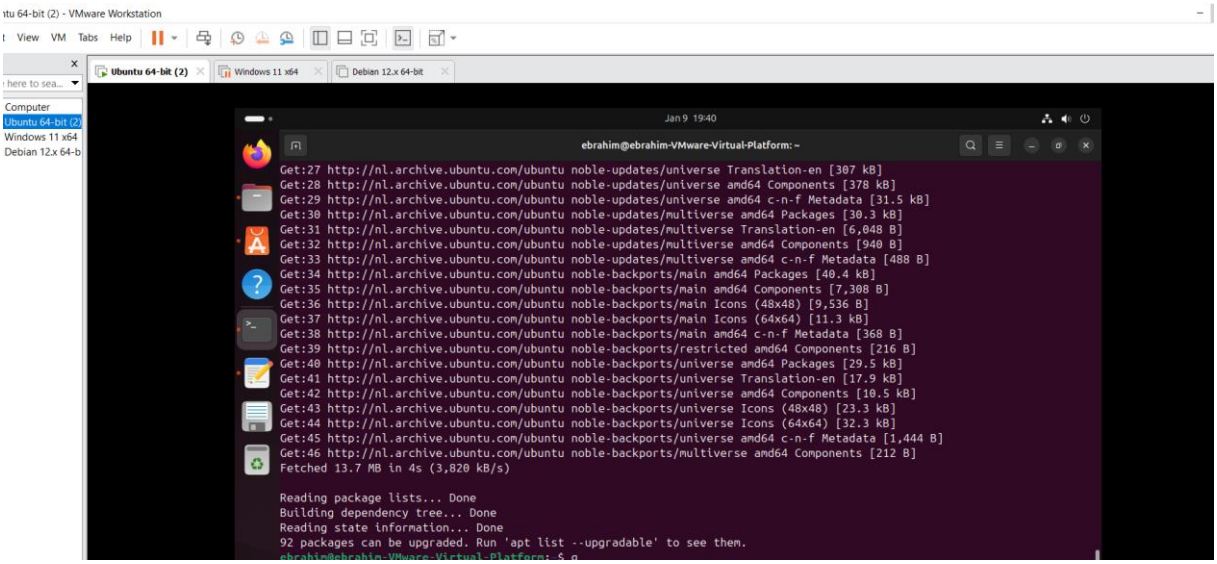

Edit View VM Tabs Help
Ubuntu 64-bit (2)
ebrahim
My Computer
Ubuntu 64-bit (2)
ebrahim
Jan 9 14:42
ebrahim@ebrahim-VMware-Virtual-Platform: ~
ebrahim@ebrahim-VMware-Virtual-Platform:~$ cd ~
ebrahim@ebrahim-VMware-Virtual-Platform:~$
ebrahim@ebrahim-VMware-Virtual-Platform:~$ nano myfile.txt
ebrahim@ebrahim-VMware-Virtual-Platform:~$ ls
Desktop Downloads myfile.txt Public simple.c Templates
Documents Music Pictures simple snap Videos
ebrahim@ebrahim-VMware-Virtual-Platform:~$
ebrahim@ebrahim-VMware-Virtual-Platform:~$ cp ~/myfile.txt ~/Documents/
ebrahim@ebrahim-VMware-Virtual-Platform:~$
ebrahim@ebrahim-VMware-Virtual-Platform:~$ ls ~/Documents
myfile.txt
ebrahim@ebrahim-VMware-Virtual-Platform:~$
ebrahim@ebrahim-VMware-Virtual-Platform:~$
code (2)
hello
code
Home
irect input to this VM, click inside or press Ctrl+G.
ENG
2:43 PM

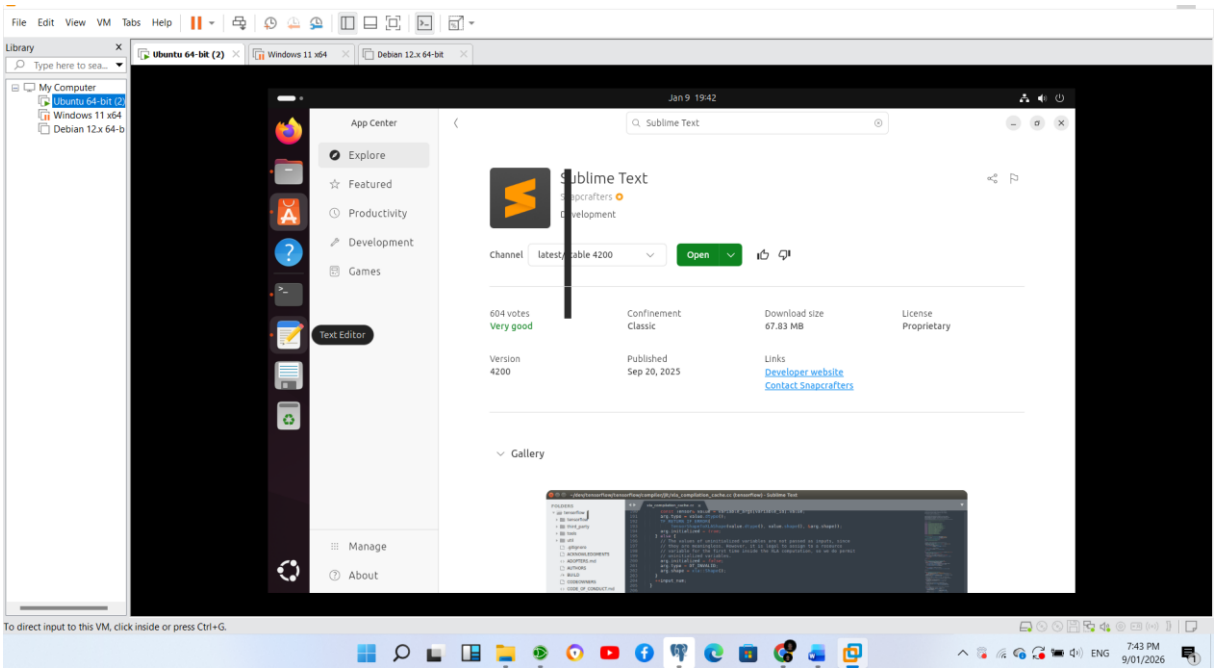

Jan 9 19:20
ebrahim@ebrahim-VMware-Virtual-Platform: ~
Files
Recent
Starred
Home
Documents
Downloads
Music
Pictures
Videos
Trash
Floppy Disk
Other Locations
Home / Documents
myfile.txt
VM, click inside or press Ctrl+G.

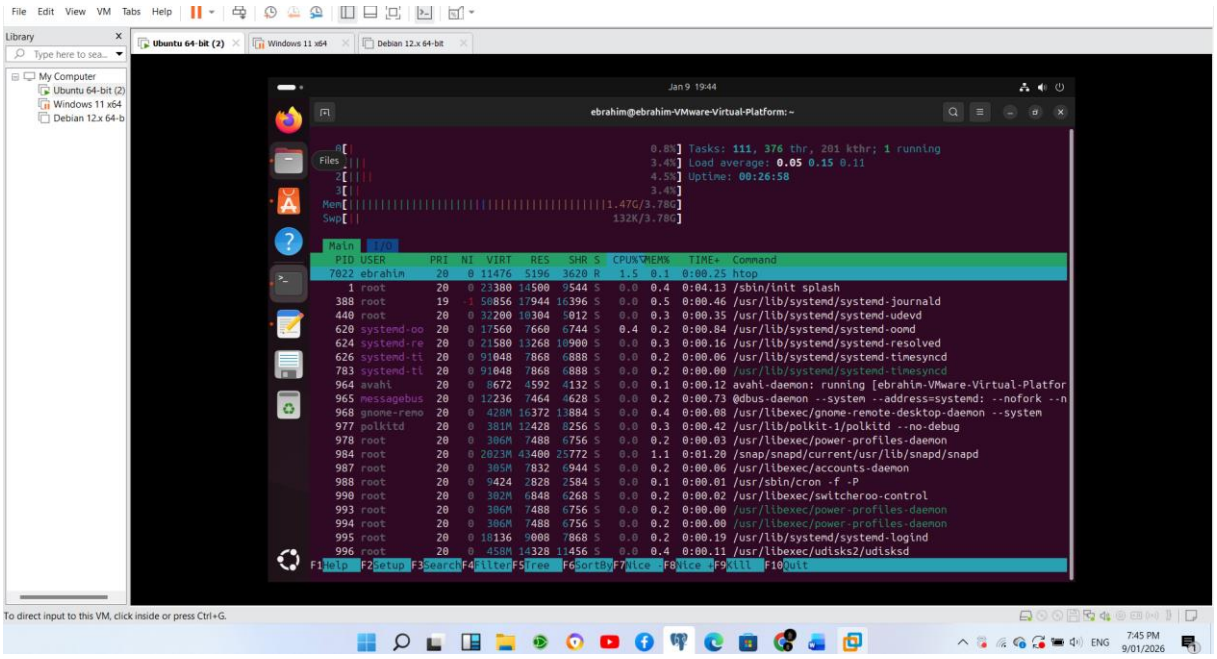

Edit View VM Tabs Help
Ubuntu 64-bit (2)
Windows 11 x64
Debian 12.x 64-bit
My Computer
Jan 9 19:22
Files
Ubuntu
Recent
Home
Documents
Downloads
Music
Pictures
Videos
Trash
Floppy Disk
Other Locations
bin
bin.usr-is-merged
boot
cdrom
dev
etc
home
lib
lib.usr-is-merged
lib64
media
mnt
opt
proc
root
run
sbin
sbin.usr-is-merged
snap
srv
sys
tmp
usr
var
swap.img
"etc" selected (containing 233 items)
To direct input to this VM, click inside or press Ctrl+G.
ENG
7:23 PM


Ubuntu 64-bit (2) - VMware Workstation
File Edit View VM Tabs Help
Library
My Computer
Ubuntu 64-bit (2)
Windows 11 x64
Debian 12.x 64-bit
Jan 9 19:29
ebrahim@ebrahim-VMware-Virtual-Platform: ~
cloud
groff
logrotate.conf
python3.12
tmpfiles.d
group
logrotate.d
rc0.d
ubuntu-advantage
group-
lsb-release
rc1.d
ucf.conf
grub.d
machine-id
rc2.d
udev
gshadow
magic
rc3.d
udisks2
gshadow-
magic.mime
rc4.d
ufw
gss
manpath.config
rc5.d
update-manager
gtk-2.0
mime.types
rc6.d
update-motd.d
gtk-3.0
mke2fs.conf
rcS.d
update-notifier
hdparm.conf
ModemManager
resolv.conf
UPower
host.conf
modprobe.d
rmt
usb_modeswitch.conf
hostname
modules
rpc
usb_modeswitch.d
hosts
modules-load.d
rsyslog.conf
vconsole.conf
hosts.allow
mtab
rsyslog.d
vim
hosts.deny
nanorc
rygel.conf
vtrgb
hp
netconfig
sane.d
vulkan
ifplugd
netplan
security
wgetrc
init
network
selinux
wpa_supplicant
init.d
networkd-dispatcher
sensors3.conf
X11
initramfs-tools
NetworkManager
sensors.d
xattr.conf
inputrc
networks
services
xdg
insserv.conf.d
newt
sgml
xml
ipp-usb
nftables.conf
shadow
zsh_command_not_found
iproute2
nsswitch.conf
shadow-
issue
openvpn
shells
debconf.conf
debian_version
deluser.conf
dhcpcd.conf
ebrahim@ebrahim-VMware-Virtual-Platform:/etc$
ebrahim@ebrahim-VMware-Virtual-Platform:/etc$ cd ~
ebrahim@ebrahim-VMware-Virtual-Platform:~$
ebrahim@ebrahim-VMware-Virtual-Platform:~$ pwd
/home/ebrahim
ebrahim@ebrahim-VMware-Virtual-Platform:~$
ebrahim@ebrahim-VMware-Virtual-Platform:~$
To direct input to this VM, click inside or press Ctrl+G.
ENG
7:30 PM


Ubuntu 64-bit (2) - VMware Workstation
File Edit View VM Tabs Help
Library
Type here to sea...
My Computer
Ubuntu 64-bit (2)
Windows 11 x64
Debian 12.x 64-b
Ubuntu 64-bit (2)
Windows 11 x64
Debian 12.x 64-bit
Jan 9 19:34
ebrahim@ebrahim-VMware-Virtual-Platform: ~
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$ pwd
/home/ebrahim
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$ cd ~
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$ tar -cvf myfile.tar myfile.txt
tmyfile.txt
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$ tar -czvf myfile.tar.gz myfile.txt
myfile.txt
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$ ls
Floppy Disk
Downloads myfile.tar myfile.txt Public simple.c Templates
Music myfile.tar.gz Pictures simple snap Videos
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$ tar -cvf file.tar file.txt
tar: file.txt: Cannot stat: No such file or directory
tar: Exiting with failure status due to previous errors
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$ tar -cvf myfile.tar myfile.txt
myfile.txt
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$ tar -czvf myfile.tar.gz myfile.txt
myfile.txt
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
ebrahim@ebrahim-VMware-Virtual-Platform: ~$
To direct input to this VM, click inside or press Ctrl+G.

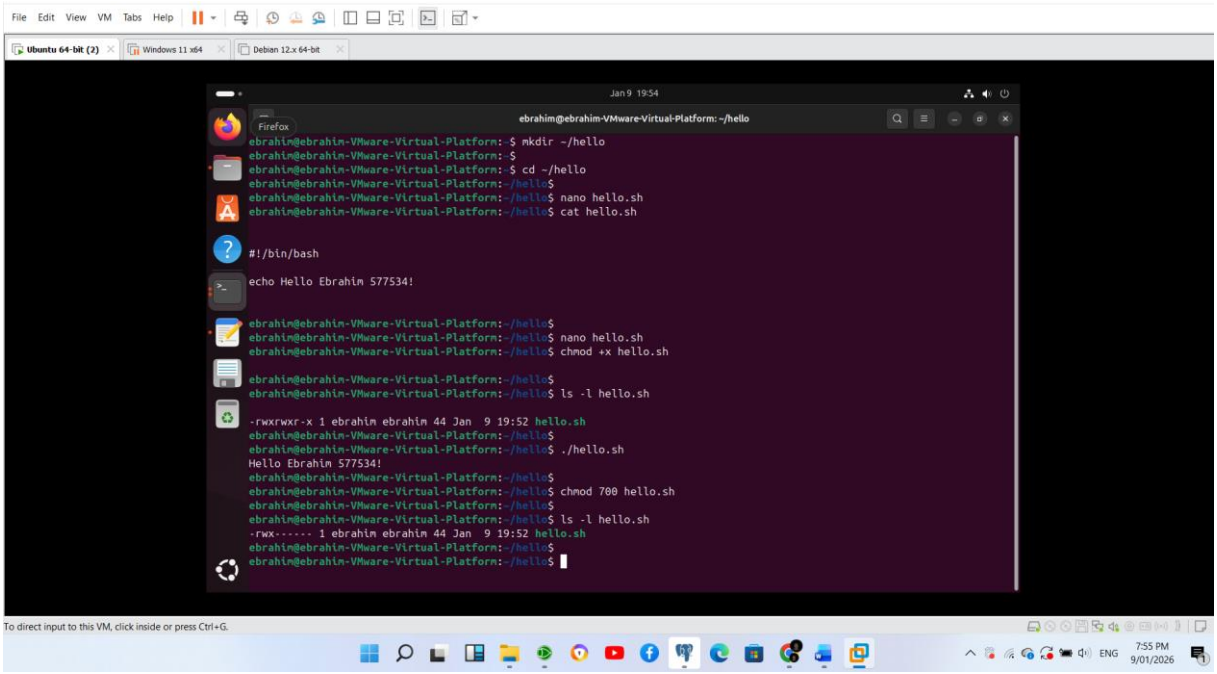

tu 64-bit (2) - VMware Workstation
View VM Tabs Help
here to sea...
Computer
Ubuntu 64-bit (2)
Windows 11 x64
Debian 12.x 64-b
Ubuntu 64-bit (2)
Windows 11 x64
Debian 12.x 64-bit
Jan 9 19:40
ebrahim@ebrahim-VMware-Virtual-Platform: ~
Get:27 http://nl.archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [307 kB]
Get:28 http://nl.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [378 kB]
Get:29 http://nl.archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [31.5 kB]
Get:30 http://nl.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [30.3 kB]
Get:31 http://nl.archive.ubuntu.com/ubuntu noble-updates/multiverse Translation-en [6,048 B]
Get:32 http://nl.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
Get:33 http://nl.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 c-n-f Metadata [488 B]
Get:34 http://nl.archive.ubuntu.com/ubuntu noble-backports/main amd64 Packages [40.4 kB]
Get:35 http://nl.archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [7,308 B]
Get:36 http://nl.archive.ubuntu.com/ubuntu noble-backports/main Icons (48x48) [9,536 B]
Get:37 http://nl.archive.ubuntu.com/ubuntu noble-backports/main Icons (64x64) [11.3 kB]
Get:38 http://nl.archive.ubuntu.com/ubuntu noble-backports/main amd64 c-n-f Metadata [368 B]
Get:39 http://nl.archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [216 B]
Get:40 http://nl.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Packages [29.5 kB]
Get:41 http://nl.archive.ubuntu.com/ubuntu noble-backports/universe Translation-en [17.9 kB]
Get:42 http://nl.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [10.5 kB]
Get:43 http://nl.archive.ubuntu.com/ubuntu noble-backports/universe Icons (48x48) [23.3 kB]
Get:44 http://nl.archive.ubuntu.com/ubuntu noble-backports/universe Icons (64x64) [32.3 kB]
Get:45 http://nl.archive.ubuntu.com/ubuntu noble-backports/universe amd64 c-n-f Metadata [1,444 B]
Get:46 http://nl.archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Fetched 13.7 MB in 4s (3,820 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
92 packages can be upgraded. Run 'apt list --upgradable' to see them.





Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation



I created a bash script in ~/hello and made it executable using chmod.
I executed the script using ./hello.sh.
Using numeric chmod (700), only the logged-in user has execute permissions.

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

cat → Displays the full contents of a file.

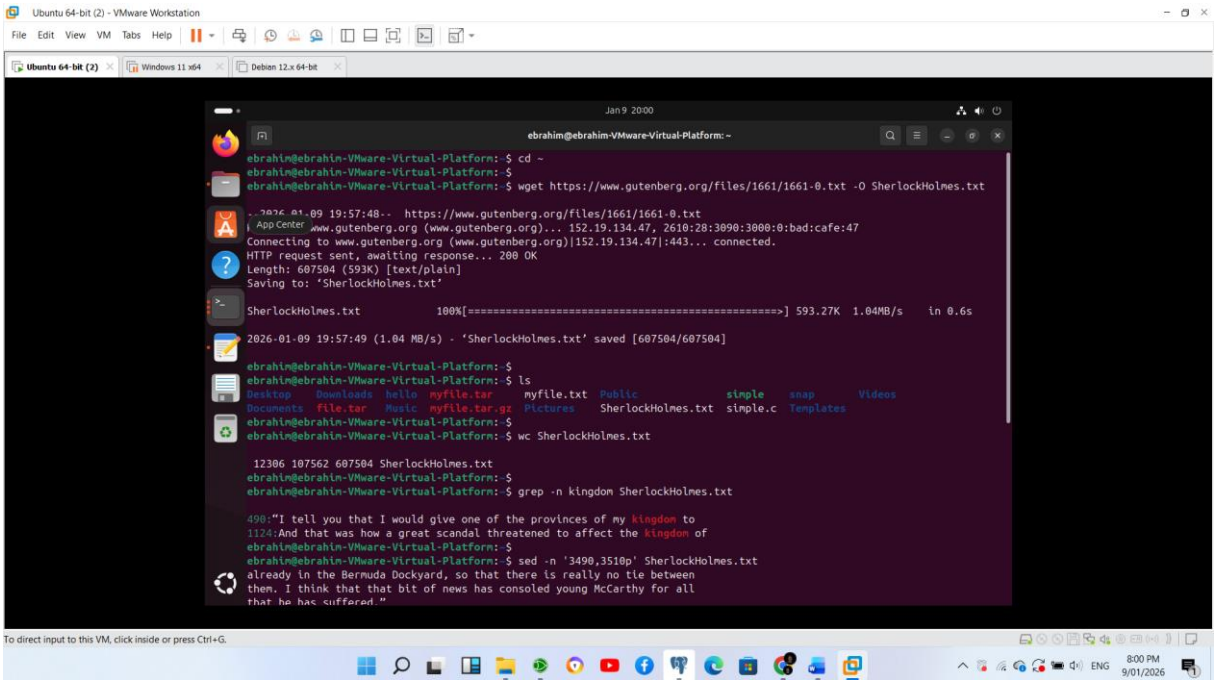
wc → Counts lines, words, and characters in a file.

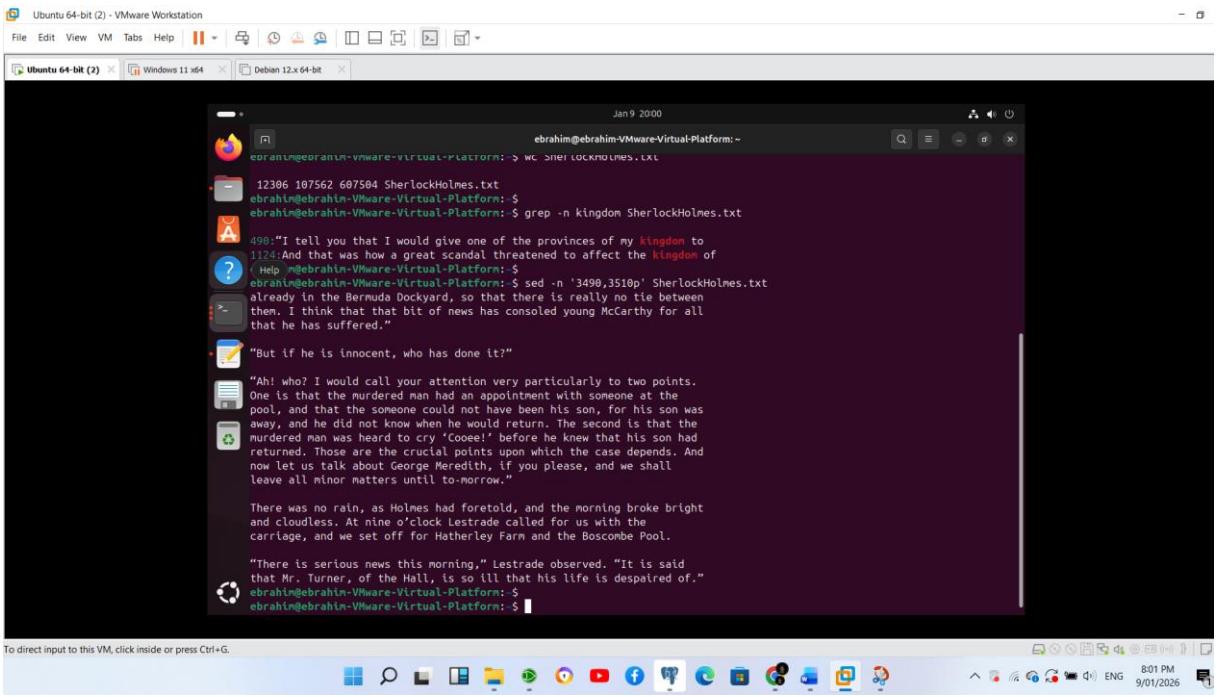
less → Opens a file for scrolling and reading page by page.

head → Shows the first lines of a file.

tail → Shows the last lines of a file.

grep → Searches for text inside a file.

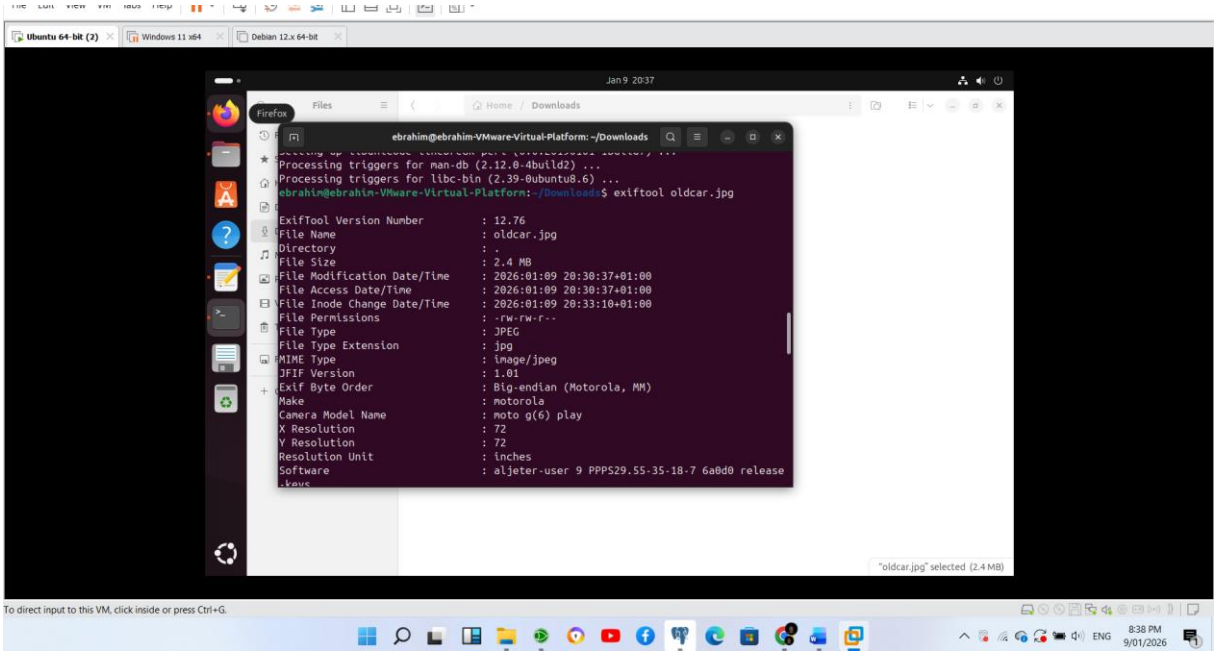


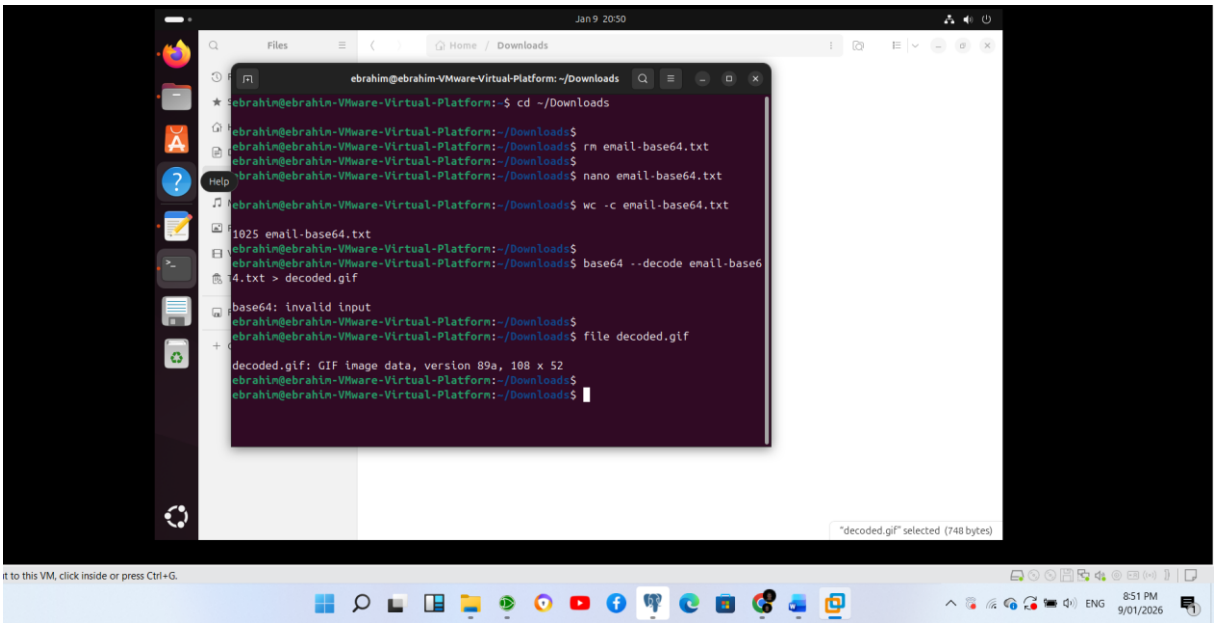


I used the wc command to count the number of lines, words, and characters in the file.
I used grep -n to find the word "kingdom" and display the line numbers.
Using text viewing commands, I displayed the lines around the word "kingdom".

Assignment 5.7: Digital forensics

Relevant screenshots + motivation

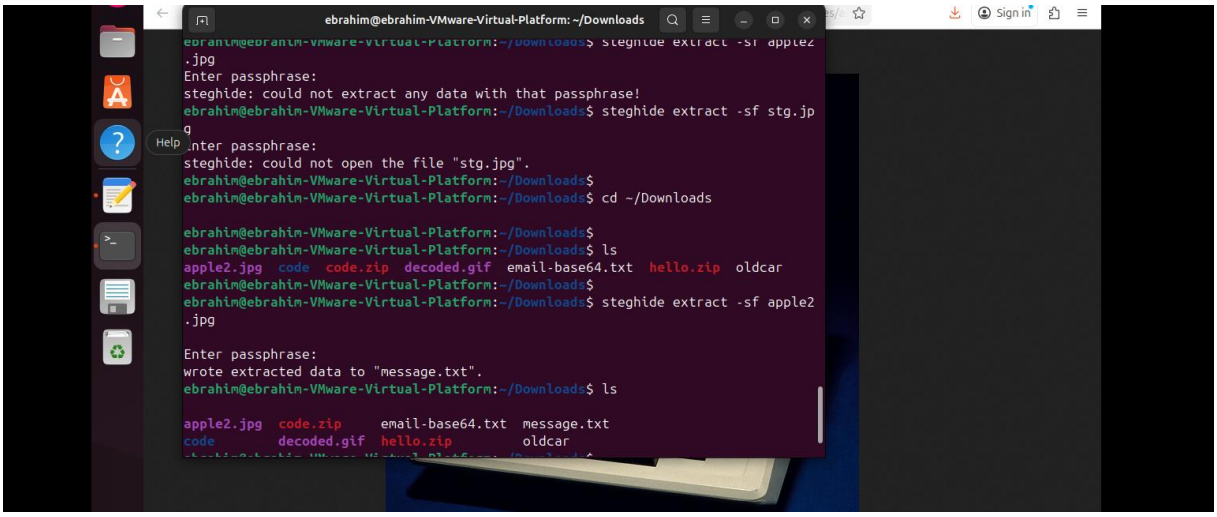


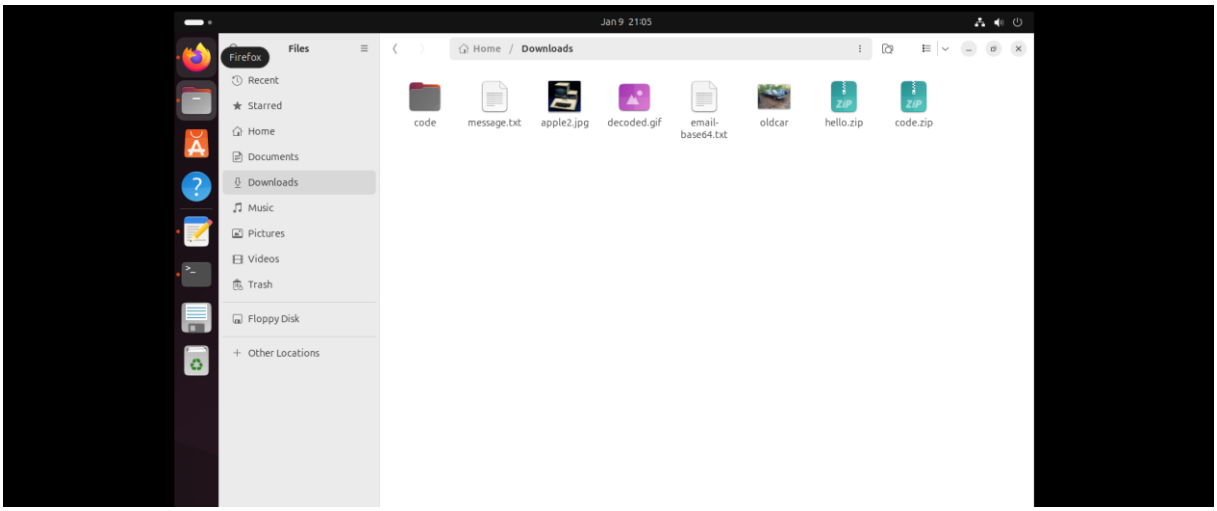


Copying the BASE64 data directly from Brightspace truncated the input.
I reconstructed the full BASE64 content manually to ensure correct decodin

Assignment 5.8: Steganography

Relevant screenshots + motivation

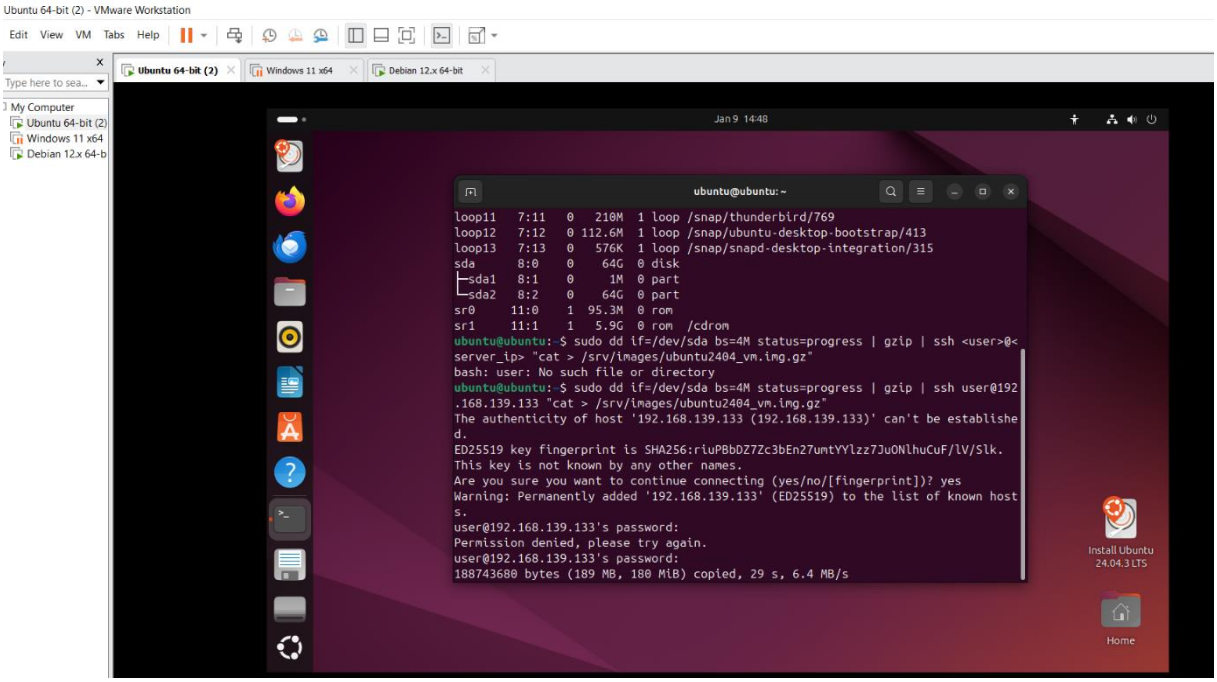


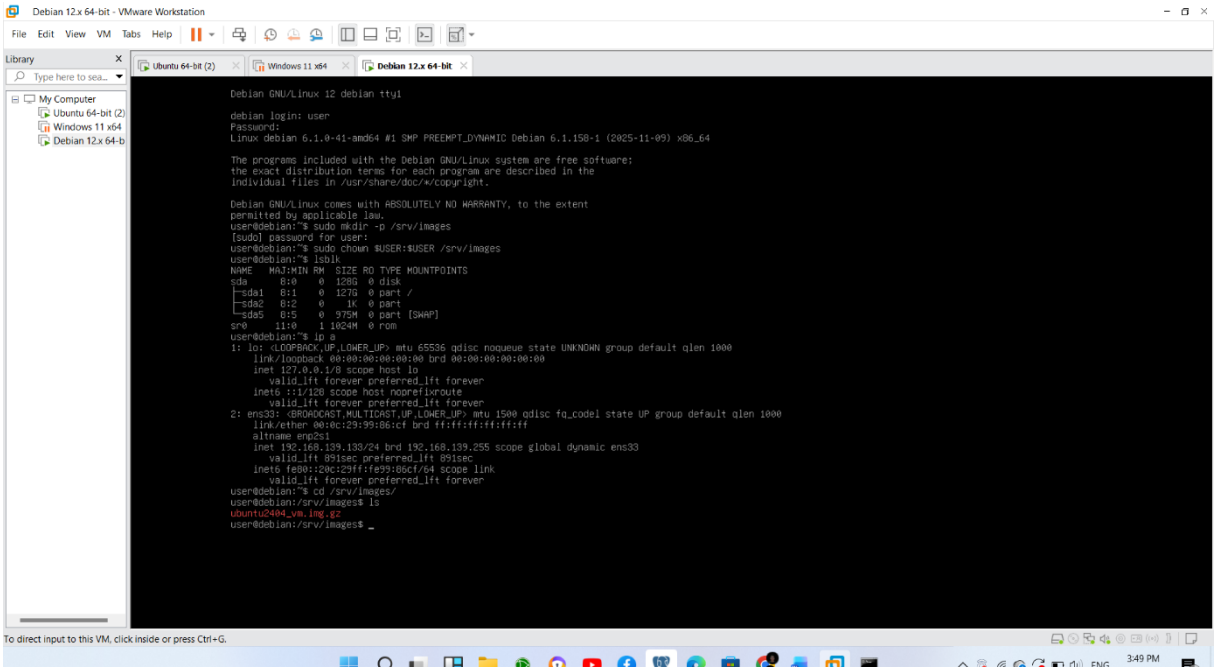


Assignment 5.9: Capture disk images

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.





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