

Week 5 – Operating Systems

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Assignment 5.1: Unix-like

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

UNIX is an officially certified operating system that meets the Single UNIX Specification and is a registered trademark.

Unix-like operating systems are not certified but are designed to behave like UNIX and follow the same principles. Also they are mostly open-source.

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-creator of UNIX at Bell Labs. He also created the B programming language and helped define core UNIX concepts like the file system and process model.

Dennis Ritchie

Co-creator of UNIX alongside Ken Thompson. He created the C programming language, which made UNIX portable and influenced almost all modern programming languages.

Bill Joy

Key developer of BSD (Berkeley Software Distribution). He created important UNIX tools like vi and contributed to TCP/IP networking. Co-founder of Sun Microsystems.

Richard Stallman

Founder of the GNU Project and the Free Software Movement. He created essential tools like GCC and GNU utilities, promoting free and open-source software used in Unix-like systems.

Linus Torvalds

Creator of the Linux kernel. His work enabled fully free Unix-like operating systems and powers most servers, Android devices, and supercomputers today.

What is the philosophy of the GNU movement?

The philosophy of the GNU movement is that software should be **free**, meaning users must have the freedom to run, study, modify, and share software. It promotes user control over technology through open source code and opposes proprietary restrictions on software.

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

Yes, Ubuntu mostly conforms to the GNU philosophy. It is based on the Linux kernel and GNU tools and is free to use, study, modify, and share. However, Ubuntu sometimes includes optional proprietary software and drivers for convenience, which slightly compromises strict GNU principles but does not violate them since these components are optional.

Find out what is the Windows Subsystem for Linux?

The Windows Subsystem for Linux (WSL) is a feature of Microsoft Windows that allows users to run a Linux environment directly on Windows without using a traditional virtual machine

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

Android belongs to the **Linux / Unix-like** operating system family.

iOS belongs to the **UNIX / Unix-like** operating system family.

ChromeOS belongs to the **Linux / Unix-like** operating system family.

Assignment 5.2: Supercomputers and gameconsoles

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 solve problems that require massive computational speed and processing capacity—far beyond what ordinary PCs can handle. They are used mainly in **scientific research, engineering, and complex simulations** that involve huge amounts of data and calculations. Typical uses include **weather forecasting, climate modeling, aerospace and automotive design, drug discovery and molecular modeling, nuclear research and national security simulations, astrophysics and cosmology studies, and other advanced scientific investigations**. Over time their use has expanded from primarily government and research labs to industry and AI-related research as well.

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 PlayStation 3 consoles connected together to function as a parallel computing system. Using the Cell Broadband Engine CPU, which was based on technology from IBM's Roadrunner supercomputer, these clusters were used for low-cost high-performance computing. Universities and research institutions used PS3 clusters for scientific research such as physics simulations, protein folding, astrophysics calculations, cryptography, and image processing, until Linux support on the PS3 was discontinued.

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** runs **Oracle Linux** (specifically **Oracle Autonomous Linux / Oracle Linux for ARM**) on the Raspberry Pi nodes.

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/>

Oracle's Raspberry Pi supercomputer does **not** appear in the Top500 list of the world's fastest supercomputers because the ranking is based on raw computational performance, measured in FLOPS. Raspberry Pi clusters, while useful for experimentation and education, do not provide anywhere near the processing power of the specialized high-performance systems used in the Top500, making it logically impossible for them to qualify.

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 **x86-64 (AMD Zen 2) CPU architecture**.

The PlayStation 5 runs a **custom Sony operating system based on FreeBSD (Unix-like)**, while the Xbox Series X runs a **custom Microsoft Windows-based operating system**.

Modern game consoles use the same CPU architecture as PCs, which makes development easier and more efficient, but they still run highly specialized operating systems optimized for gaming rather than general-purpose use.

Assignment 5.3: Working with Windows

Take relevant screenshots of the assignments below

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

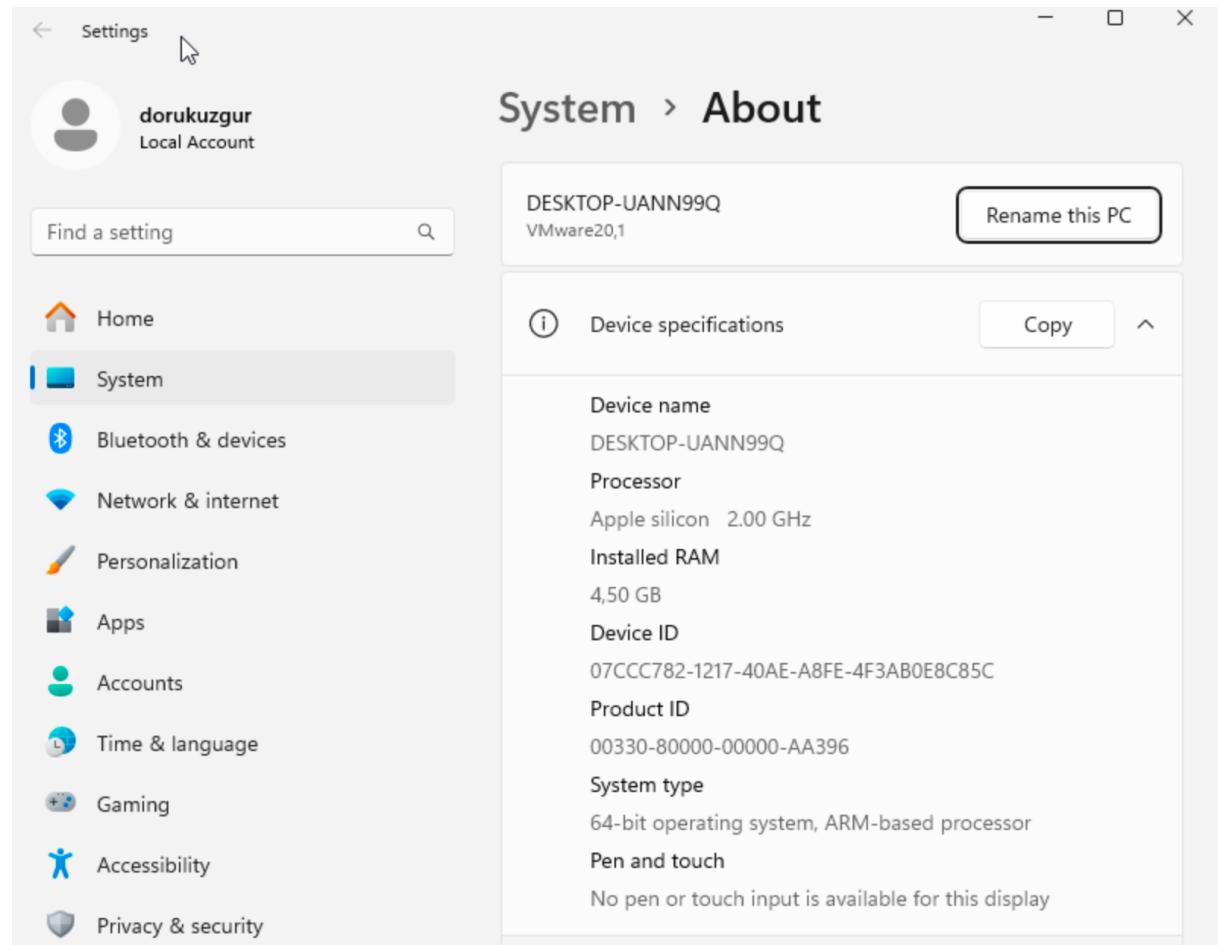
These shortcuts opened different system screens such as **File Explorer, Settings, Task View, Desktop, Run dialog, and the power user menu**, allowing faster navigation without using the mouse.

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

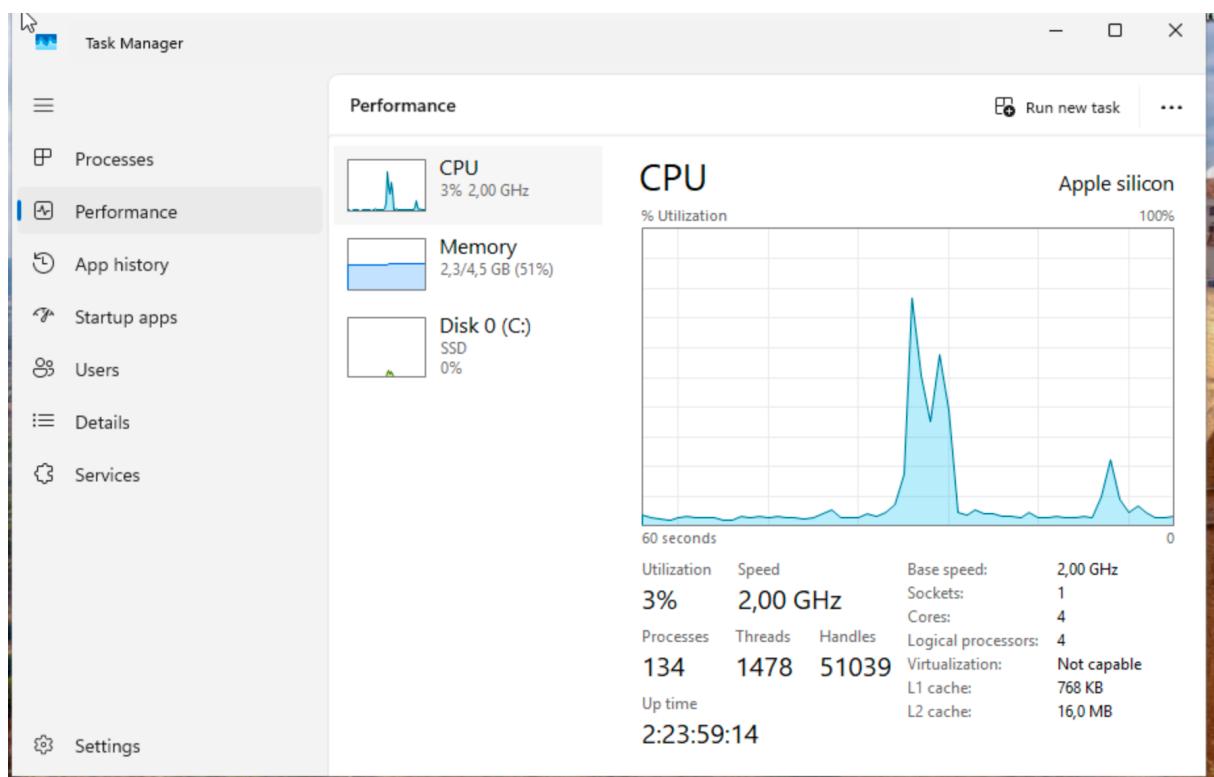
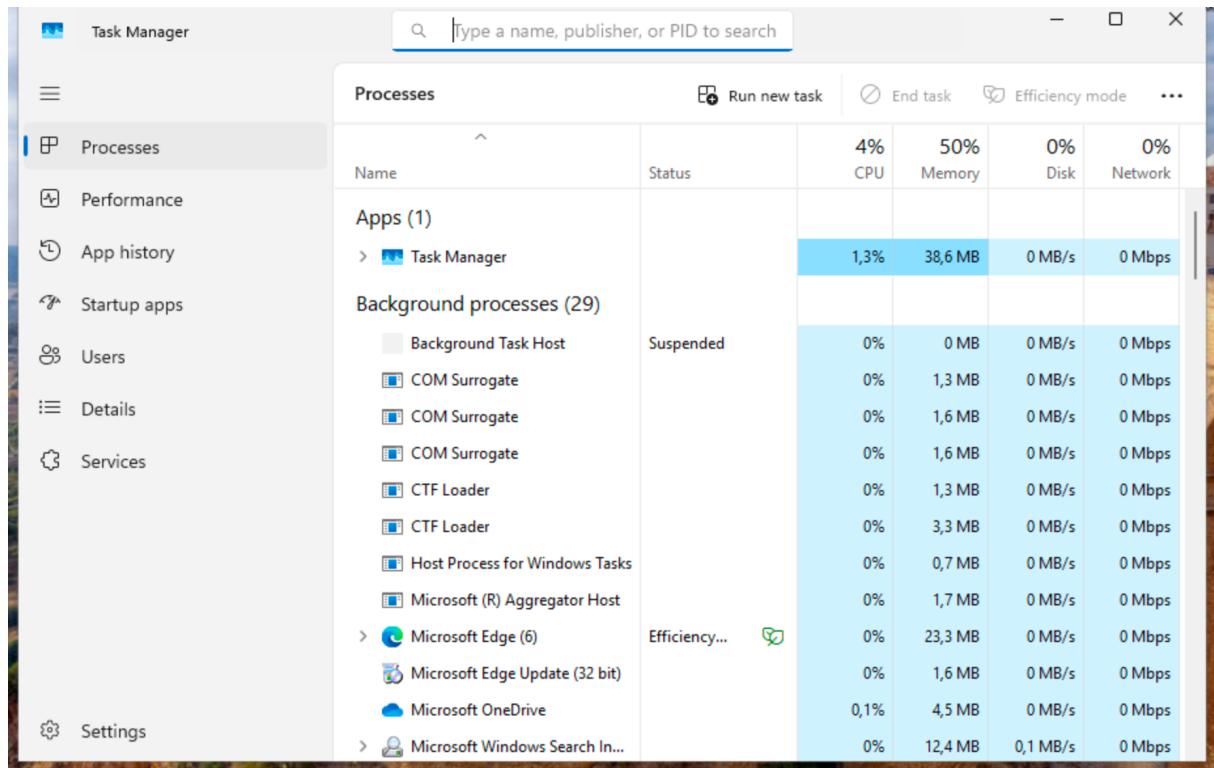
Win + X → File Explorer

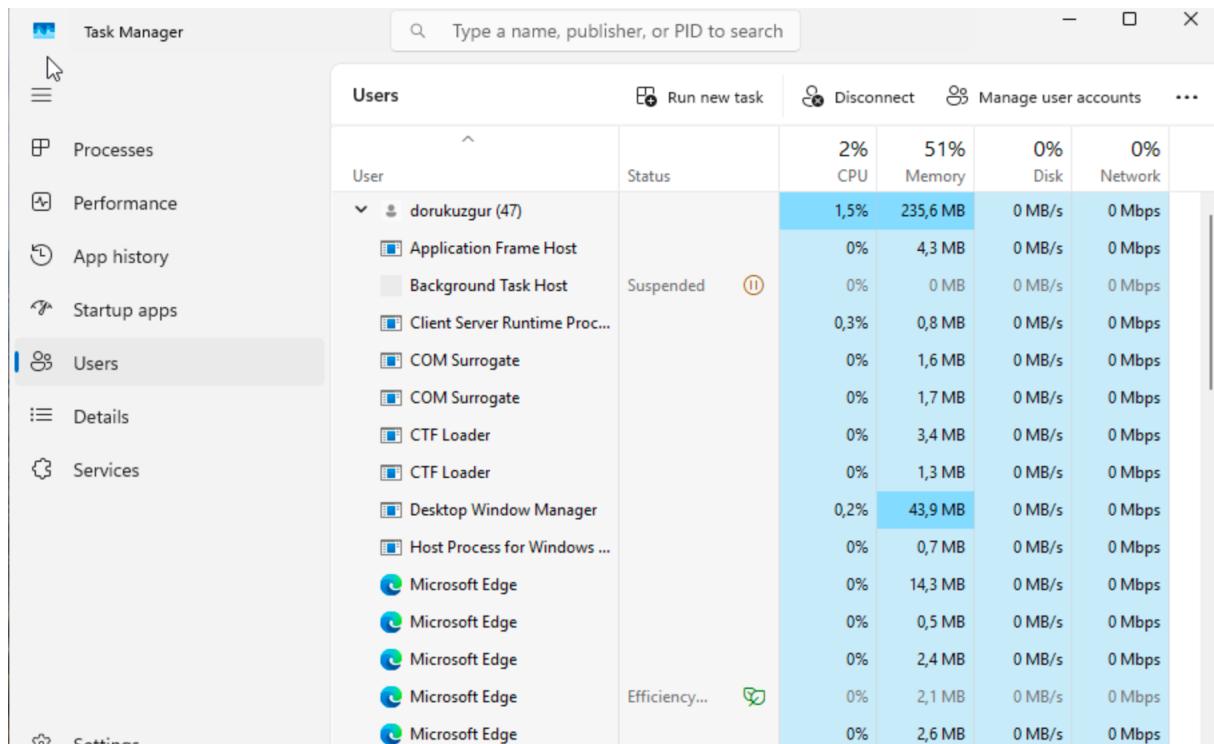
Open the system properties with a W key combination, take a screenshot of the open screen. Paste this screenshot into this template.

Win + Pause/Break



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.





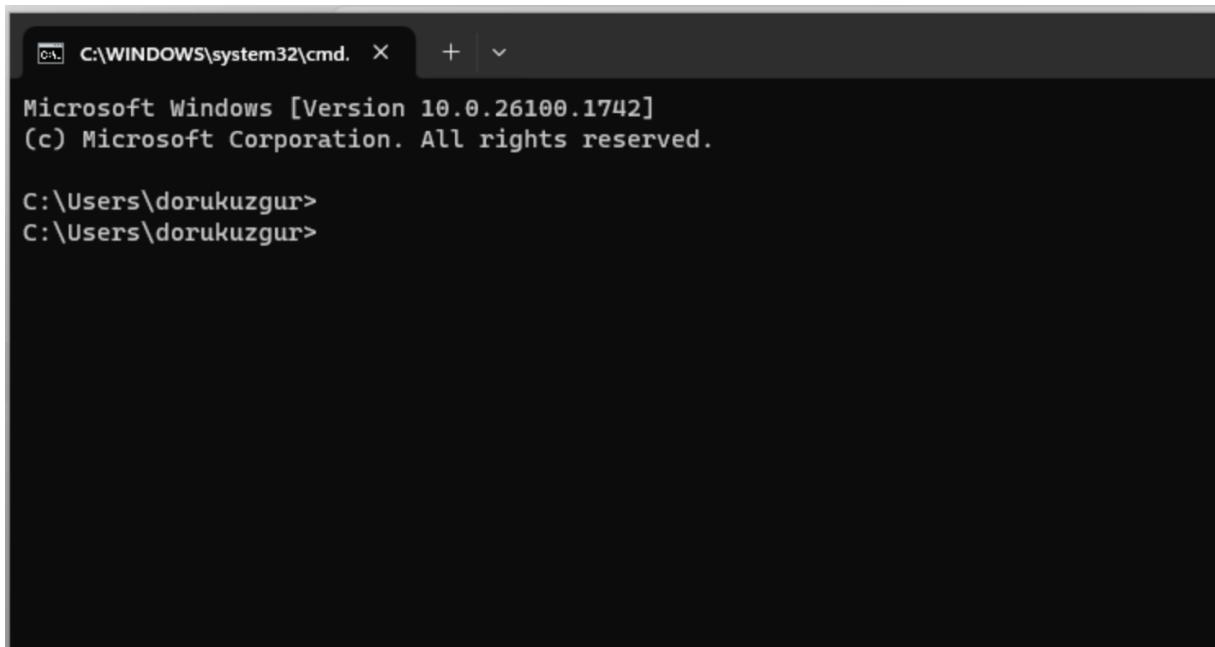
If you're giving a PowerPoint presentation and you connect your laptop to a projector, Windows can use the projector as a second screen. For example, you may have Outlook open on your first screen that you don't show over the projector, while the PowerPoint presentation is displayed on the projector,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

Win + P

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?

Win + L

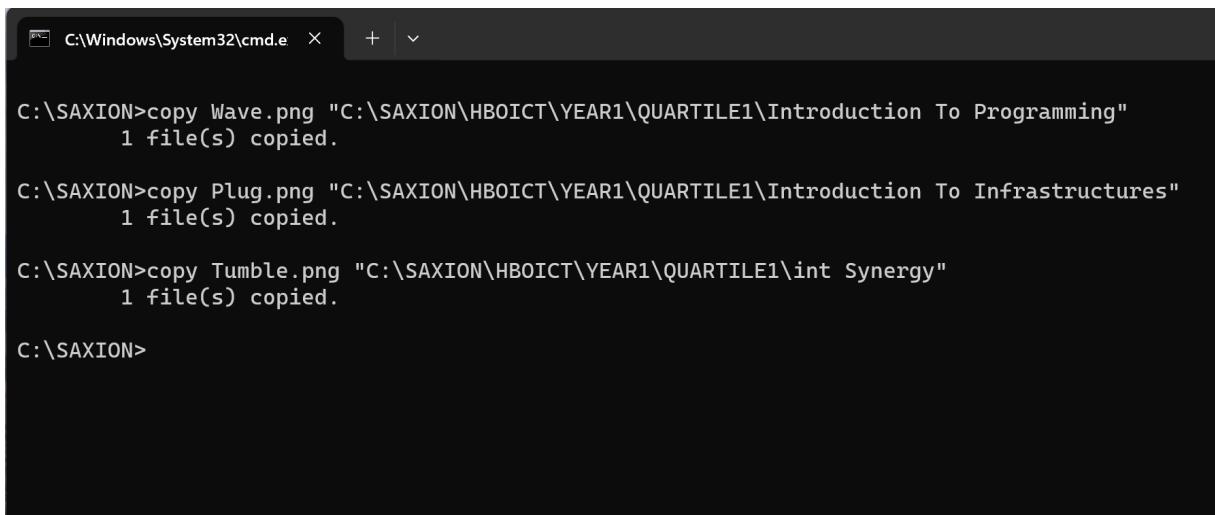
Open the Run screen with a key combination. On this screen, type CMD and press <enter>. Take a screenshot of this result and paste it into this template.



A screenshot of a Windows Command Prompt window. The title bar reads "C:\WINDOWS\system32\cmd." and the window content area is entirely black, indicating no output or a blank command line.

Working in the File Explorer

Relevant screenshots copy command:



A screenshot of a Windows Command Prompt window. The user has run three "copy" commands to move files from the current directory to a specific path: "copy Wave.png "C:\SAXION\HBOICT\YEAR1\QUARTILE1\Introduction To Programming\"", "copy Plug.png "C:\SAXION\HBOICT\YEAR1\QUARTILE1\Introduction To Infrastructures\"", and "copy Tumble.png "C:\SAXION\HBOICT\YEAR1\QUARTILE1\int Synergy\". Each command resulted in 1 file(s) being copied.

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

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

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

C:\SAXION>
```

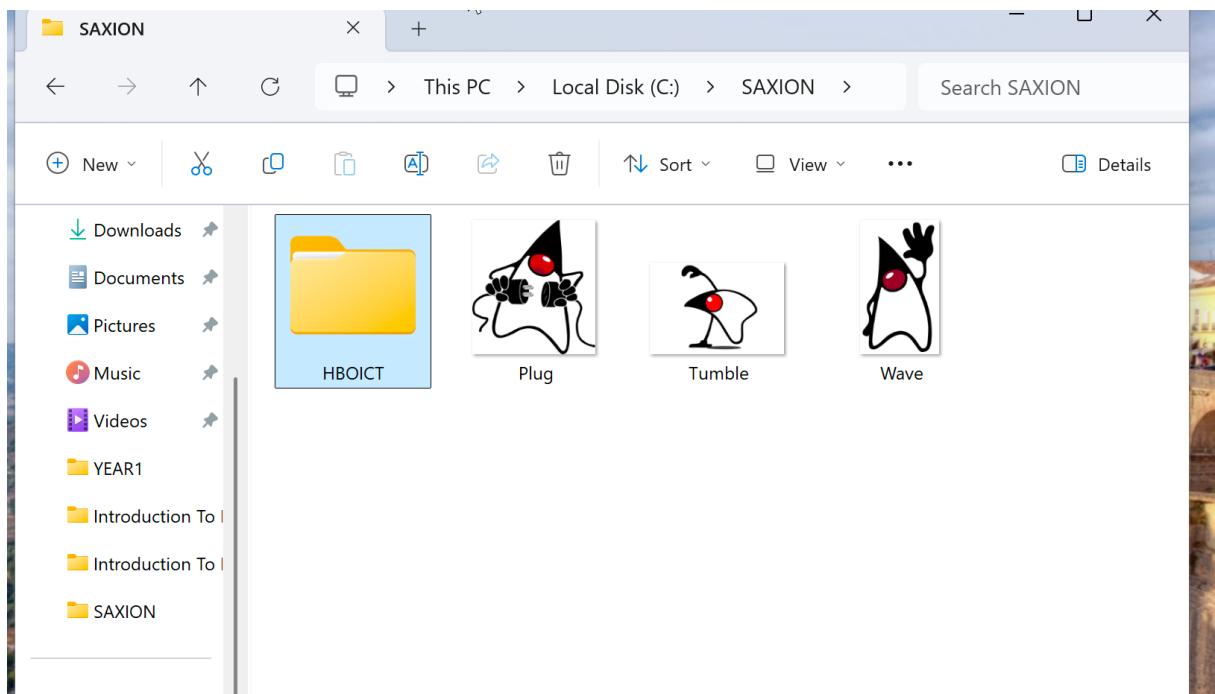
Relevant screenshots tree command:

```
C:\SAXION>tree
Folder PATH listing
Volume serial number is 00000236 28C8:DBBC
C:.
└── HBOICT
    ├── YEAR1
    │   ├── QUARTILE1
    │   │   └── int Synergy
    │   │       ├── Introduction To Infrastructures
    │   │       └── Introduction To Programming
    │   ├── QUARTILE2
    │   ├── QUARTILE3
    │   └── QUARTILE4
    ├── YEAR2
    │   ├── QUARTILE1
    │   ├── QUARTILE2
    │   ├── QUARTILE3
    │   └── QUARTILE4
    ├── YEAR3
    │   ├── QUARTILE1
    │   ├── QUARTILE2
    │   ├── QUARTILE3
    │   └── QUARTILE4
    └── YEAR4
        ├── QUARTILE1
        ├── QUARTILE2
        ├── QUARTILE3
        └── QUARTILE4

C:\SAXION>echo %username%
dorukuzgur

C:\SAXION>
```

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



Terminating Processes

Relevant Screenshots Task Manager Window:

Processes		Run new task	End task	..
Name	Status	4%	54%	
Name		CPU	Memory	
Apps (2)				
Calculator (2)	0%	21,5 MB		

Install Software

Relevant screenshots that the following software is installed with winget:

WinSCP

Notepad++

7zip

```
C:\Windows\System32>winget install -e --id 7zip.7zip --source winget
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-arm64.exe
[██████████] 1.51 MB / 1.51 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>winget install -e --id Notepad++.Notepad++ --source winget
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.Install
[██████████] 6.25 MB / 6.25 MB
Successfully verified installer hash
Starting package install...
Successfully installed

C:\Windows\System32>winget install -e --id WinSCP.WinSCP --source winget
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
[██████████] 11.6 MB / 11.6 MB
Successfully verified installer hash
Starting package install...
Successfully installed
```

Assignment 5.4: Working with Linux

Relevant screenshots + motivation

```
axi@Doruks-MacBook-Air ~ % cd ~  
touch example.txt  
  
axi@Doruks-MacBook-Air ~ % cp example.txt Documents/
```

```
axi@Doruks-MacBook-Air ~ % cd /etc  
  
axi@Doruks-MacBook-Air /etc % cd ~
```

/etc stores **system-wide configuration files** for the operating system and installed services.

Linux has **one single root directory /** for the entire system, while Windows uses **multiple drive letters** like C: and D:

Create a tar archive

```
tar -cvf example.tar example.txt
```

Extract a tar archive

```
tar -xvf example.tar
```

Compress a text file with tar and gzip

```
tar -czvf example.tar.gz example.txt
```

Real-time CPU usage per core

Memory and swap usage

Running processes

Process ownership and priorities

Ability to kill processes interactively

ASCII logo of operating system

Operating system name and version

Kernel version

Host / machine model

Uptime

- CPU model
- GPU model
- RAM usage
- Disk usage (sometimes)
- Shell and terminal in use
- Screen resolution
- Desktop environment / window manager

Assignment 5.5: Users and permissions on Linux

Relevant screenshots + motivation

```
axi@Doruks-MacBook-Air hello % sudo cd ~/hello
[./hello.sh
zsh: permission denied: ./hello.sh
```

```
axi@Doruks-MacBook-Air hello % chmod 744 hello.sh
axi@Doruks-MacBook-Air hello % ./hello.sh
Hello Doruk, 578776!
axi@Doruks-MacBook-Air hello %
```

Assignment 5.6: View the contents of files

Relevant screenshots + motivation

cat

Displays the full contents of a file in the terminal.

wc

Counts lines, words, and characters in a file.

less

Opens a file in an interactive viewer where you can scroll and search.

head

Shows the first part of a file (default: first 10 lines).

tail

Shows the last part of a file (default: last 10 lines).

grep

Searches for a specific word or pattern inside a file.

Lines: 12,306

Words: 107,562

Characters: 607,504

The word "kingdom" appears on:

Line 490

Line 1124

Assignment 5.7: Digital forensics

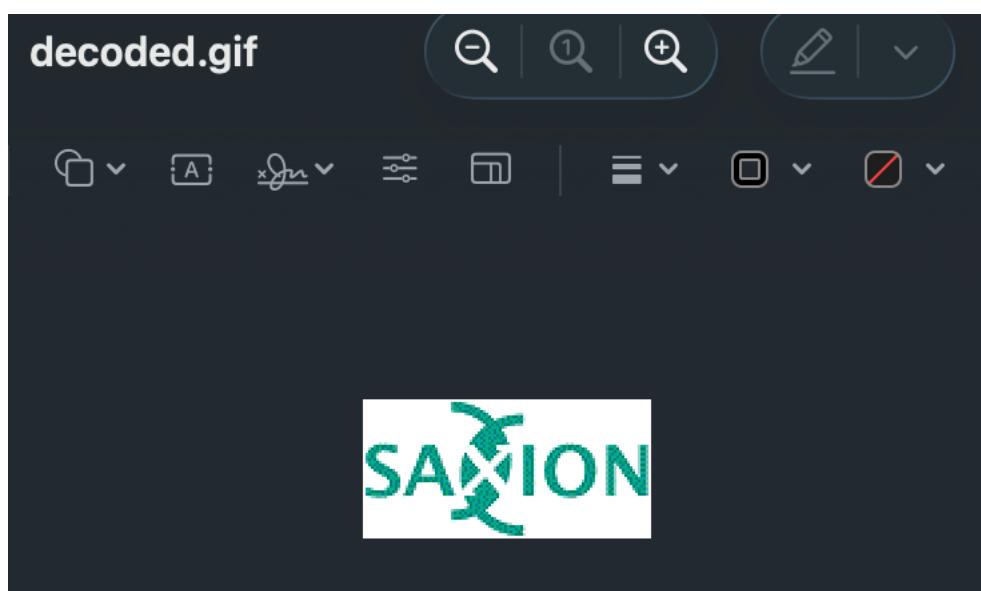
Relevant screenshots + motivation

Motorolla

Moto g(6) play

Groningen

still recognizes the file as a **JPEG image**



Assignment 5.8: Steganography

Relevant screenshots + motivation

```
axiserver@game:~/wowo$ steghide extract -sf apple2.jpg
Enter passphrase:
wrote extracted data to "message.txt".
axiserver@game:~/wowo$ cat message.txt
Hello class.
You have almost completed Week 5.

axiserver@game:~/wowo$ doruk uzgur 578776
```

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.

```
doruk@debian-server:~$ ls -lh /srv/images
total 6.5G
-rw-rw-r-- 1 doruk doruk 6.5G Dec 28 17:44 ubuntu2404_vm.img.gz
doruk@debian-server:~$
```

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

```
ubuntu@ubuntu:~$ ssh doruk@192.168.17.130 "cat /srv/images/ubuntu2404_vm.img.gz"
| gzip -d | sudo dd of=/dev/nvme0n1 bs=4M status=progress
doruk@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 successful booted Ubuntu vm after restoring

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