

LEVEL 4 ASSESSMENT



Module Name: *Computer Architecture and Operating Systems*



Module Code : *ACCA4022*



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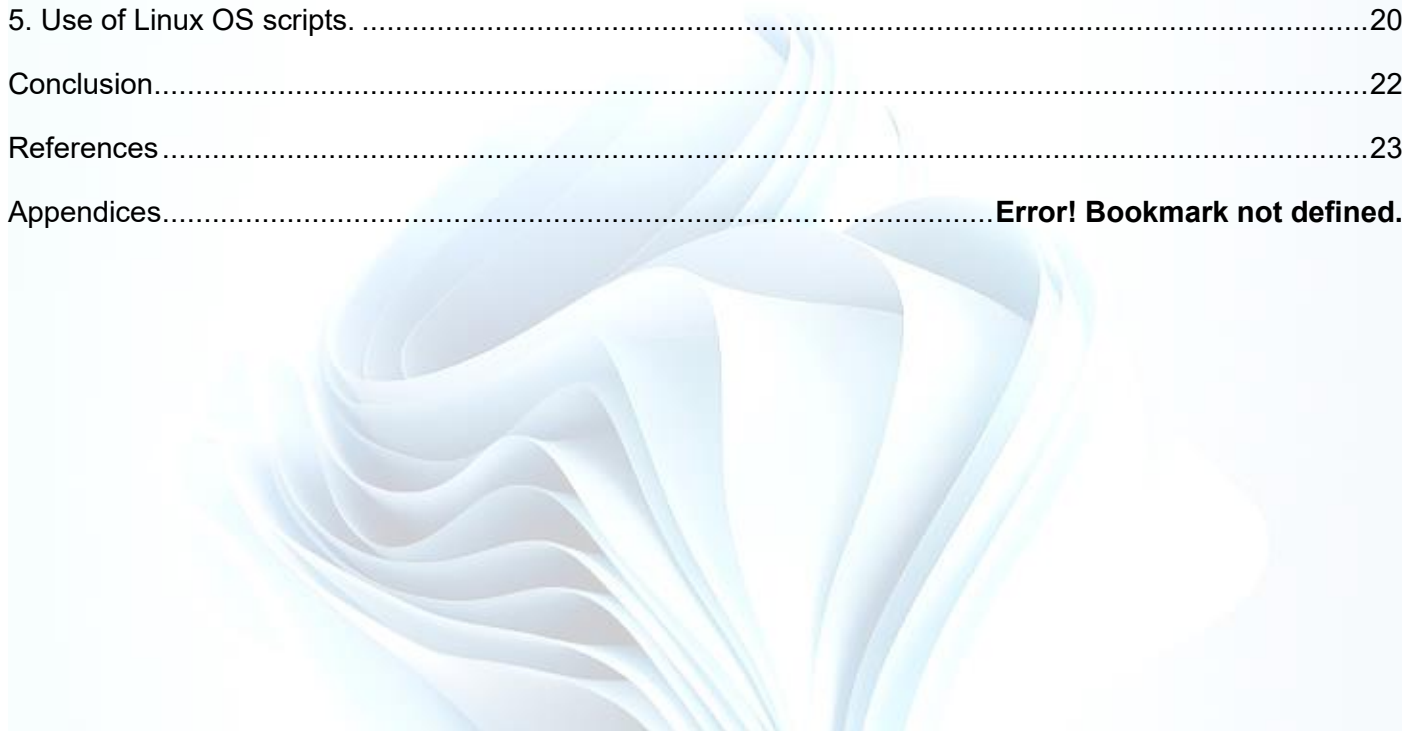
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Introduction

Computer architecture is like the design of a computer's parts, such as the processor, memory , and storage. It's how all the physical components are built and work together to make the computer function. The operating system is the software that helps the computer's hardware do its job. It acts like a manager, making sure the programs you use can run properly, managing memory, and organizing files . In simple terms, computer architecture is the " hardware blueprint ," and the operating system makes sure everything works fine together so a person can use your computer easily. The operating system are of varouus types such as linux , mac, windows os etc.

1. Key functions of general Operating Systems

An operating system helps a computer run smoothly by taking care of its main tasks in the background. It manages the computer's hardware , makes sure multiple programs can run at the same time , organizes files, and keeps the system secure. It also provides an easy way for users to interact with the computer, such as through a screen or commands. [1]

1.1 Process and Processor Management

A **process** is an active state of a program. When a program is loaded into memory and executed, it becomes a process which performs all the tasks mentioned in the program.

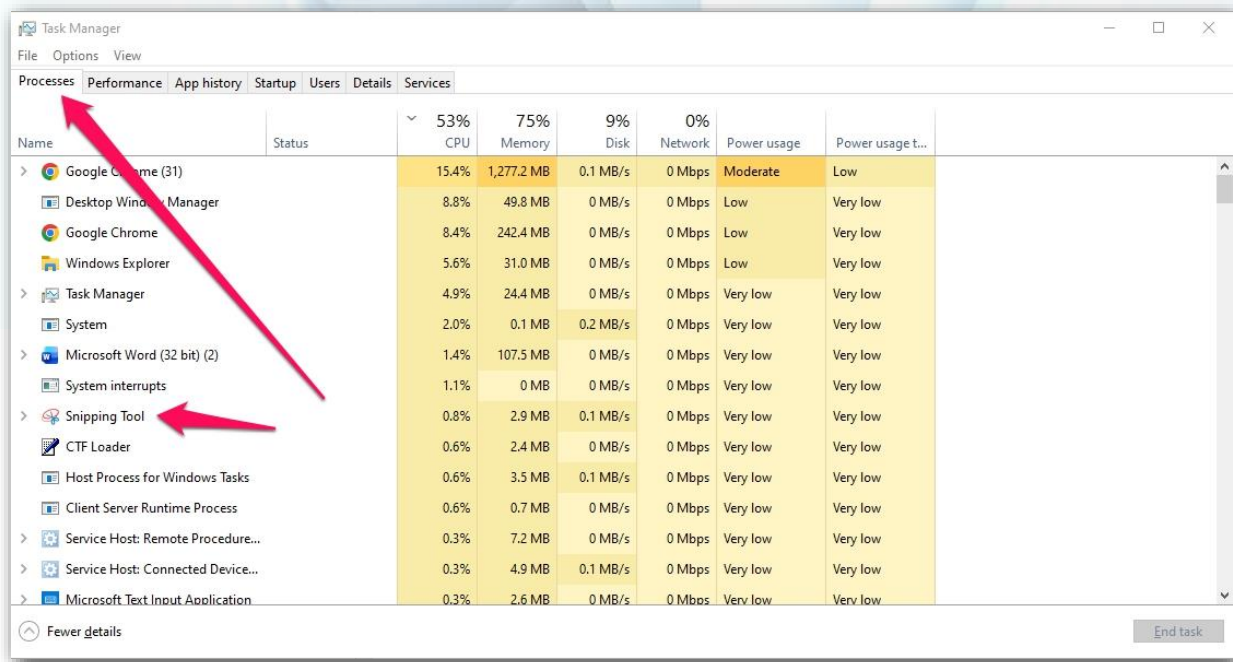


Fig1.1 a

Fig1.1 shows the **process** percentage utilized by the CPU, Memory and even the disk space percentage used, for example when I used the snipping tool to take the screen shot it also showed the process of the application and its properties.

Process management is a function performed by the operating system to manage these processes effectively. it helps managing full time of these processes, including creating and deleting them, allocating them access to the CPU, controlling their states, which can include ready state, executing state, and waiting state. Process management enables different programs to operate without errors when they are executed simultaneously . [1]

1.2 Memory Management

It involves the granting, tracking, and rescinding of system RAM to different processes. Virtual memory is one of the methods used by operating systems to increase the amount of memory available beyond that which is physically supported by RAM, by leveraging disk storage as additional memory space. This enables applications to operate as if they have large blocks of memory, even when physical memory is actually fragmented . Windows implements memory management using both paging and segmentation, detailed information on memory usage patterns , page faults, and cache performance is therefore obtainable through the Performance Monitor. [2]

Fig 1.2 below shows the Task Manager Performance tab showing Memory section with usage graph, committed memory, cached memory etc. as seen below.

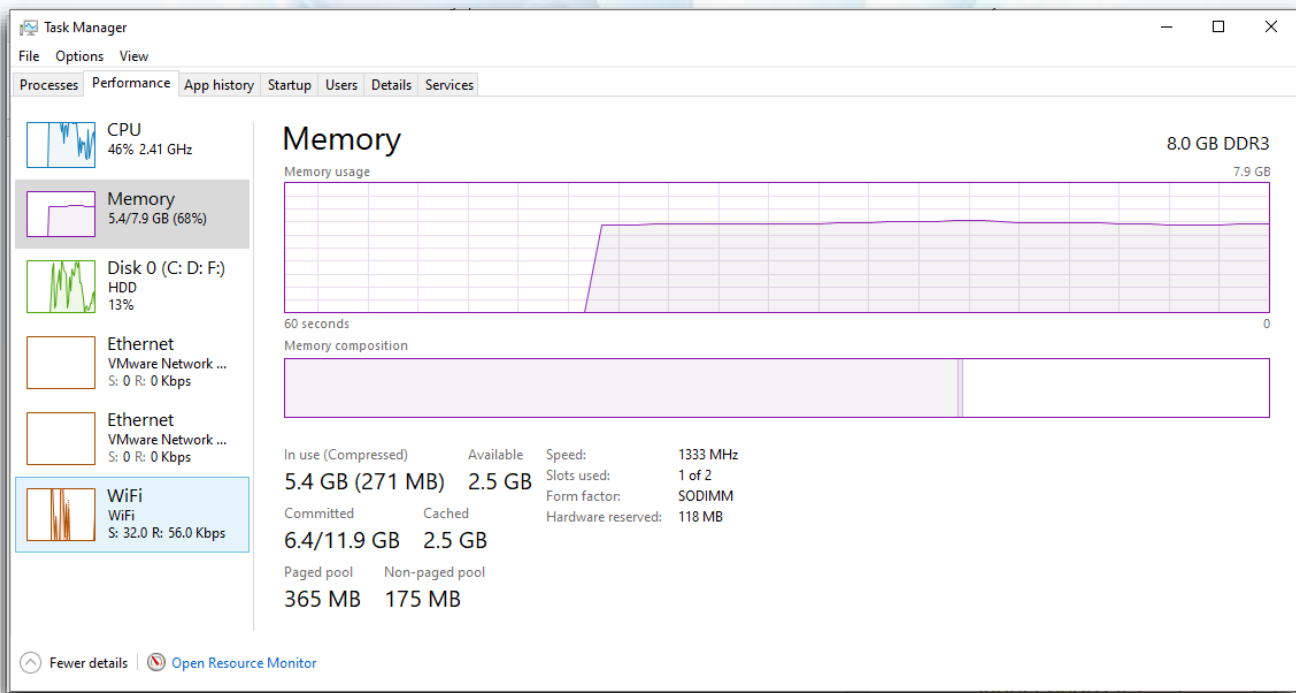


Fig1.2

1.3 File System Management

The file system defines the structuring applied to store and retrieve data on storage devices. Operating systems operate with hierarchical directory structures, which enable logical grouping of related files while maintaining metadata consisting of creation dates, permissions, and ownership information [3]. Windows relies heavily on the NTFS, enabling advanced features such as file compression, encryption, disk quotas, and journaling for data integrity. File Explorer is the graphical interface to deal with the file system, while it also gives access to file properties and security settings.

Fig 1.3 below shows screenshot of File Explorer showing folder hierarchy in the left navigation pane , with file properties dialog open displaying Security tab and permissions.

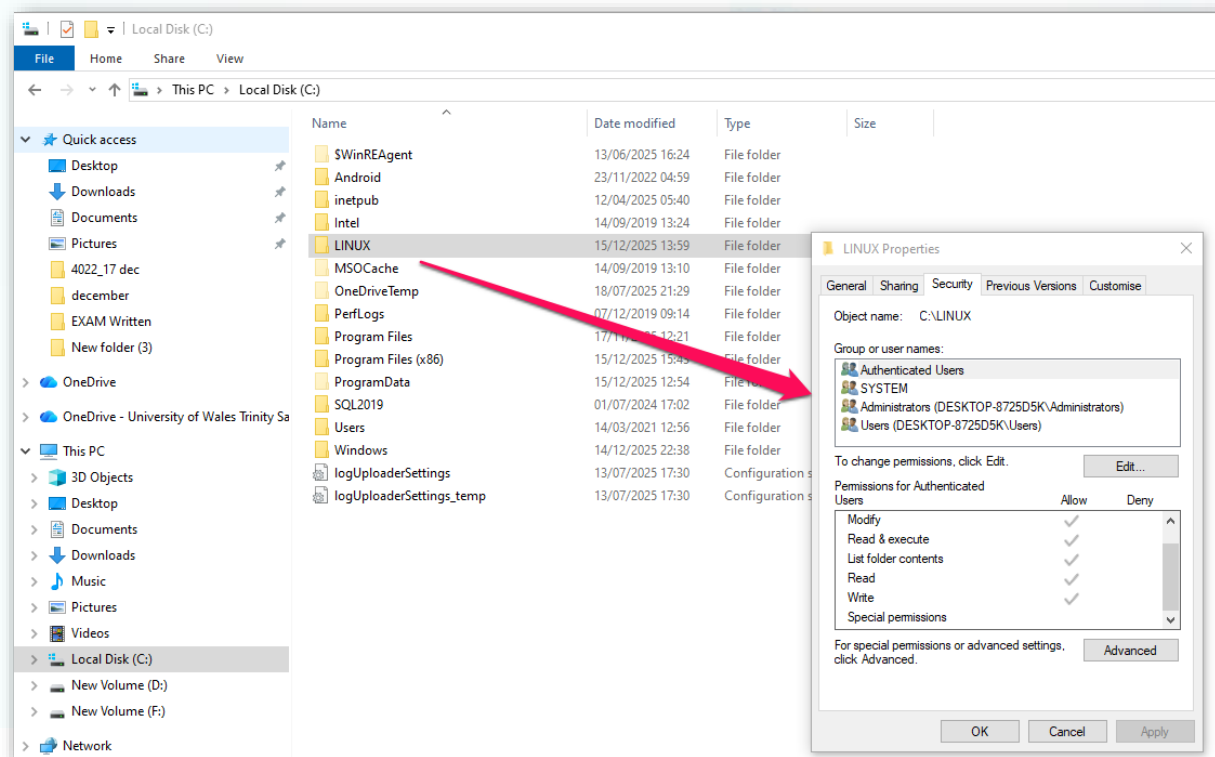


Fig 1.3

1.4 Security and Protection

Cybersecurity functions provide protection for system resources against illegal access and malware. The operating system supports user authentication, access control lists, and encryption functions to ensure data protection [4] . The Windows Security (formerly Windows Defender) offers end-to-end protection against virus attacks, malware, and network attacks. The User Account Control prevents illegal system changes by asking admin permission for certain system actions. The Local Security Policy editor enables the admin to set up password policies, auditing policies, and user rights management.

Fig 1.4 below shows screenshot of Windows Security dashboard pointing protection areas ,Virus & threat protection, Firewall, App & browser control and their current status on the right pane.

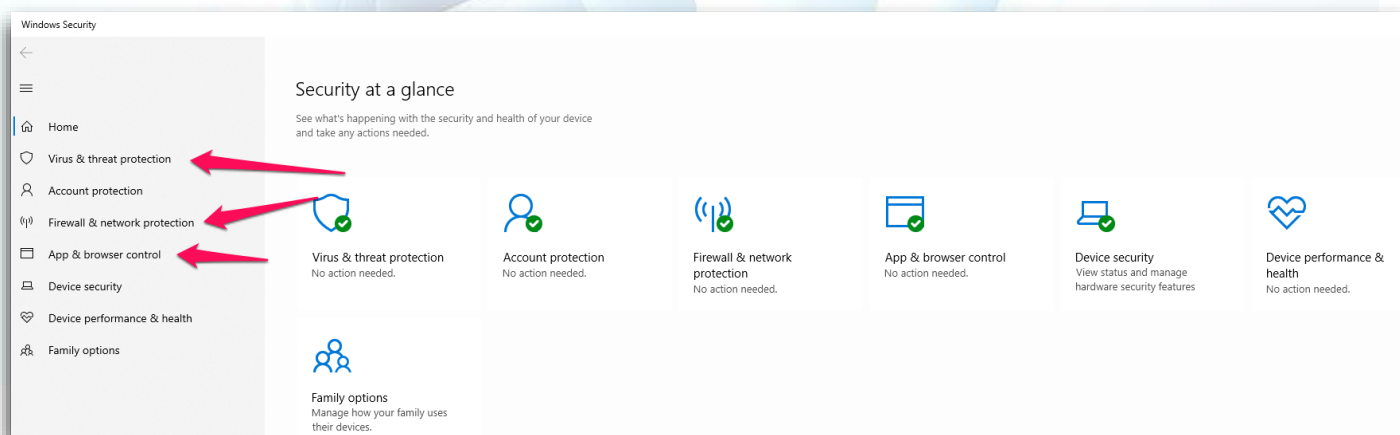


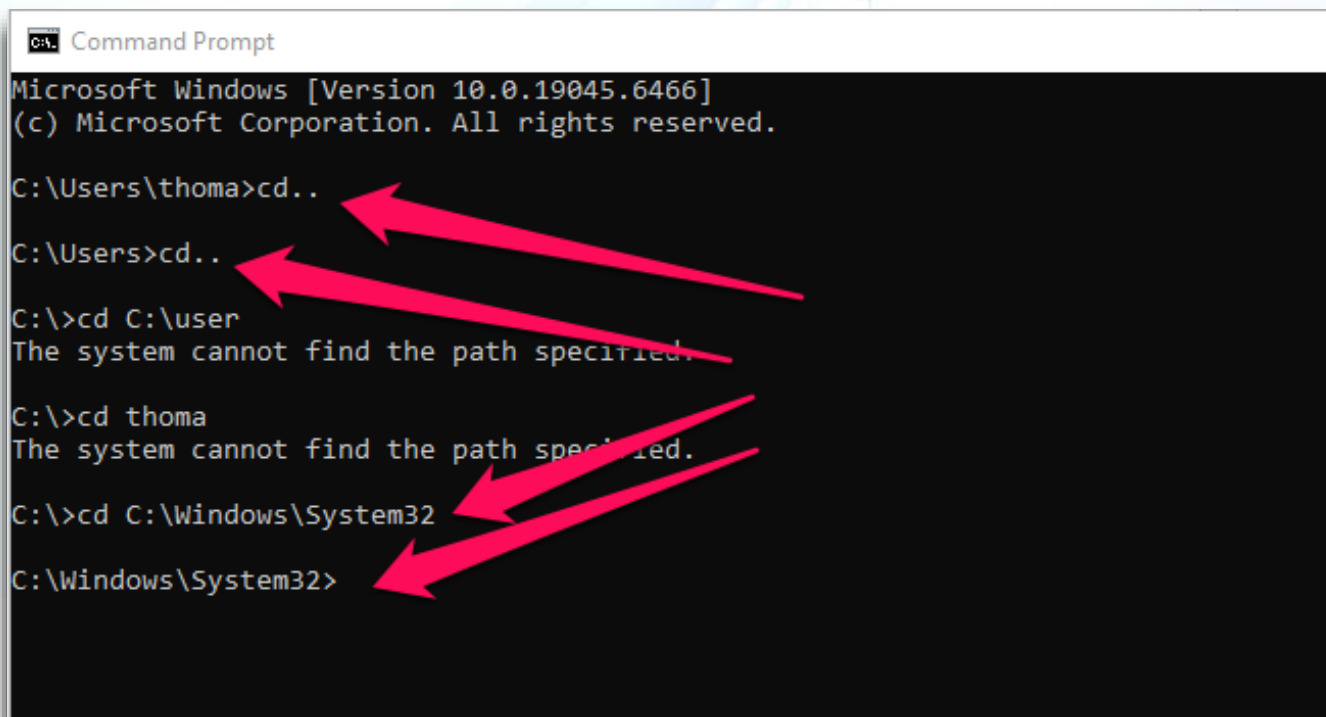
Fig 1.4

2. Use of Windows OS CLI commands.

The Windows Command Prompt and PowerShell offer very efficient command-line utilities for managing systems. These tools will enable system administrators to carry out duties more efficiently compared to graphical user interfaces when dealing with multiple systems and repetitive tasks [5]. Below are ten critical commands that can be applied practically: -

2.1 Directory and Navigation System

Cd command known as Change Directory: This command navigates between folders in the file system. Using **cd..** moves up one directory level, while **cd 'file name'** navigates to an absolute path. This command forms the basis of command-line navigation [6]. **Fig 2.1** below shows both examples using Cmd in the windows search to bring up the command prompt window. **Fig 2.1a** shows the **dir** command line that shows the directory in the path you run this command e.g. C:\.

A screenshot of the Windows Command Prompt window. The title bar reads 'C:\> Command Prompt'. The window content shows the following text: 'Microsoft Windows [Version 10.0.19045.6466] (c) Microsoft Corporation. All rights reserved. C:\Users\thoma>cd.. C:\Users>cd.. C:\>cd C:\user The system cannot find the path specified. C:\>cd thoma The system cannot find the path specified. C:\>cd C:\Windows\System32 C:\Windows\System32>'. Four red arrows point from the right side of the image to the 'cd..' commands and the 'cd C:\Windows\System32' command.

```
C:\> Command Prompt
Microsoft Windows [Version 10.0.19045.6466]
(c) Microsoft Corporation. All rights reserved.

C:\Users\thoma>cd..
C:\Users>cd..
C:\>cd C:\user
The system cannot find the path specified.

C:\>cd thoma
The system cannot find the path specified.

C:\>cd C:\Windows\System32
C:\Windows\System32>
```

Fig 2.1

```
Command Prompt
Microsoft Windows [Version 10.0.19045.6466]
(c) Microsoft Corporation. All rights reserved.

C:\Users\thoma>dir
Volume in drive C has no label.
Volume Serial Number is 8C60-5CB6

Directory of C:\Users\thoma

15/12/2025  21:23    <DIR>        .
15/12/2025  21:23    <DIR>        ..
26/09/2021  10:36    <DIR>        .android
09/03/2021  16:28    <DIR>        .idlerc
04/07/2022  01:33    <DIR>        .ms-ad
22/11/2025  21:07    <DIR>        .VirtualBox
18/08/2022  10:20    <DIR>        .vscode
12/11/2020  11:14    <DIR>        3D Objects
12/11/2020  11:14    <DIR>        Contacts
15/12/2025  12:26    <DIR>        Desktop
15/12/2025  14:01    <DIR>        Documents
15/12/2025  21:49    <DIR>        Downloads
12/11/2020  11:14    <DIR>        Favorites
12/11/2020  11:14    <DIR>        Links
12/11/2020  11:14    <DIR>        Music
18/07/2025  20:29    <DIR>        OneDrive
31/08/2025  17:09    <DIR>        OneDrive - University of Wales Trinity Saint David
15/12/2025  23:50    <DIR>        Pictures
20/01/2021  18:54    <DIR>        PycharmProjects
12/11/2020  11:14    <DIR>        Saved Games
06/10/2021  22:39    <DIR>        Searches
26/08/2025  11:05    <DIR>        Videos
17/11/2025  14:44    <DIR>        VirtualBox VMs
               0 File(s)                0 bytes
               23 Dir(s)  429,379,760 bytes free
```

Fig 2.1a

2.2 File operations

Fig 2.2 below shows 2 command lines copy and delete , it shows that the user navigates into FOLDER 1 using the "cd" command and then verifies that temp.txt is indeed in the location. It is then copied into FOLDER 2 using the copy command, where the message that appears shows that the copy was successful. The final command used is the del command to delete temp.txt from FOLDER 1. This shows how to copy and then delete a file using the Command Prompt.

```
Command Prompt
Microsoft Windows [Version 10.0.19045.6466]
(c) Microsoft Corporation. All rights reserved.

C:\Users\thoma>cd FOLDER 1
C:\Users\thoma\FOLDER 1>dir
Volume in drive C has no label.
Volume Serial Number is 8C60-5CB6

Directory of C:\Users\thoma\FOLDER 1

16/12/2025  00:35    <DIR>        .
16/12/2025  00:35    <DIR>        ..
16/12/2025  00:35             0 temp.txt
               1 File(s)                0 bytes
               2 Dir(s)  429,388,464 bytes free

C:\Users\thoma\FOLDER 1>copy temp.txt C:\user\thoma\FOLDER 2\
The syntax of the command is incorrect.

C:\Users\thoma\FOLDER 1>copy temp.txt "C:\Users\thoma\FOLDER 2\"
1 file(s) copied.

C:\Users\thoma\FOLDER 1>cd "C:\Users\thoma\FOLDER 2"
C:\Users\thoma\FOLDER 2>dir
Volume in drive C has no label.
Volume Serial Number is 8C60-5CB6

Directory of C:\Users\thoma\FOLDER 2

16/12/2025  00:42    <DIR>        .
16/12/2025  00:42    <DIR>        ..
16/12/2025  00:35             0 temp.txt
               1 File(s)                0 bytes
               2 Dir(s)  429,386,919,936 bytes free

C:\Users\thoma\FOLDER 2>del temp.txt
C:\Users\thoma\FOLDER 2>dir
Volume in drive C has no label.
Volume Serial Number is 8C60-5CB6

Directory of C:\Users\thoma\FOLDER 2

16/12/2025  00:44    <DIR>        .
16/12/2025  00:44    <DIR>        ..
               0 File(s)                0 bytes
               2 Dir(s)  429,386,657,792 bytes free

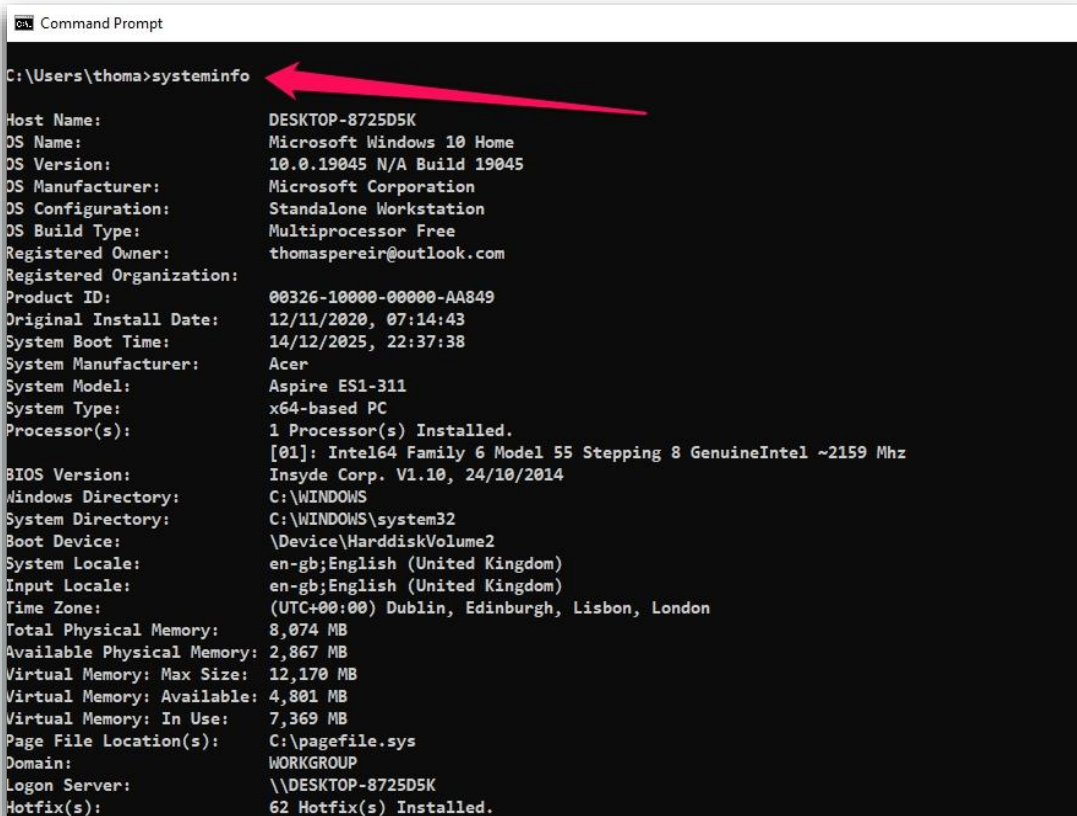
C:\Users\thoma\FOLDER 2>
```

Fig 2.2

2.3 System information

systeminfo: This tool displays detailed information regarding the OS version, hardware properties, network settings, and applies hot fixes. this tool helps while preparing documentation or while troubleshooting. check **Fig 2.3a , 2.3b**

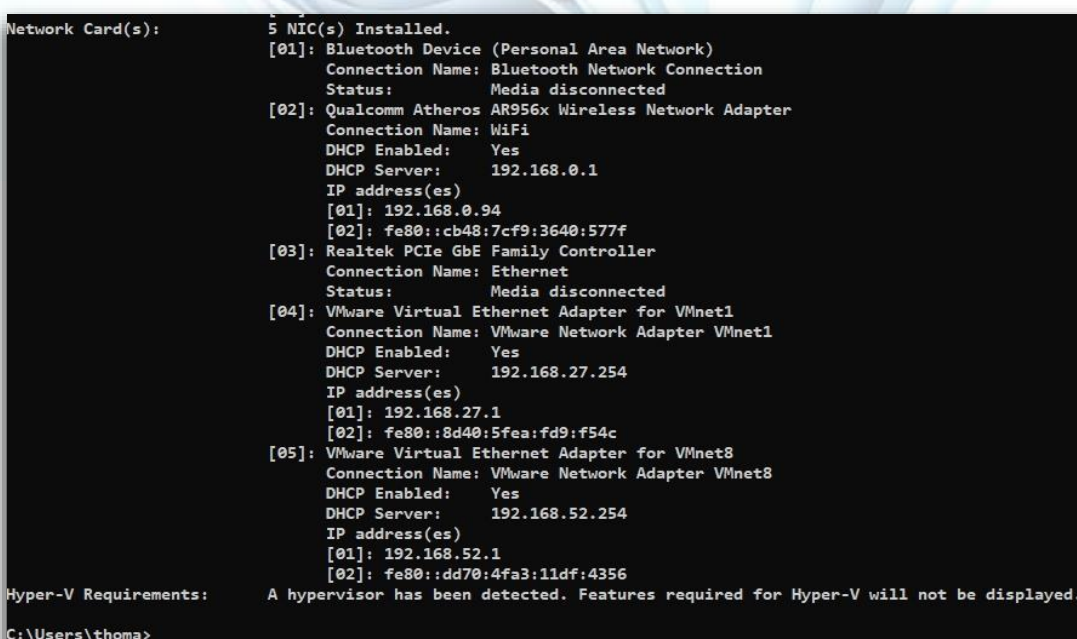
tasklist: It lists all processes that are currently running, displaying Process ID (PID), session name, memory usage, and status. '/v' switch option displays detail of processes showing status and CPU time consumption. [7]. check **Fig 2.3c**



```
Command Prompt
C:\Users\thoma>systeminfo

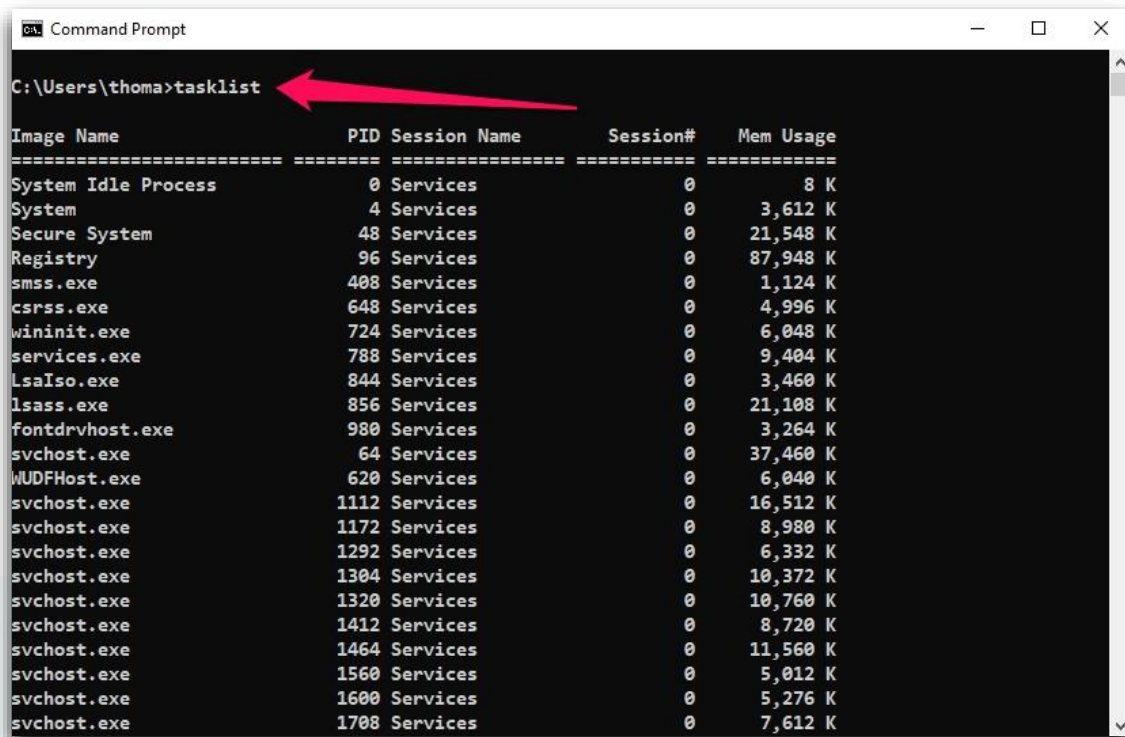
Host Name:                DESKTOP-8725D5K
OS Name:                  Microsoft Windows 10 Home
OS Version:               10.0.19045 N/A Build 19045
OS Manufacturer:         Microsoft Corporation
OS Configuration:        Standalone Workstation
OS Build Type:             Multiprocessor Free
Registered Owner:         thomaspereir@outlook.com
Registered Organization:
Product ID:               00326-10000-00000-AA849
Original Install Date:    12/11/2020, 07:14:43
System Boot Time:         14/12/2025, 22:37:38
System Manufacturer:      Acer
System Model:              Aspire ES1-311
System Type:               x64-based PC
Processor(s):              1 Processor(s) Installed.
                           [01]: Intel64 Family 6 Model 55 Stepping 8 GenuineIntel ~2159 Mhz
BIOS Version:              Insyde Corp. V1.10, 24/10/2014
Windows Directory:        C:\WINDOWS
System Directory:          C:\WINDOWS\system32
Boot Device:               \Device\HarddiskVolume2
System Locale:              en-gb;English (United Kingdom)
Input Locale:              en-gb;English (United Kingdom)
Time Zone:                 (UTC+00:00) Dublin, Edinburgh, Lisbon, London
Total Physical Memory:     8,074 MB
Available Physical Memory: 2,867 MB
Virtual Memory: Max Size:  12,170 MB
Virtual Memory: Available: 4,801 MB
Virtual Memory: In Use:    7,369 MB
Page File Location(s):     C:\pagefile.sys
Domain:                    WORKGROUP
Logon Server:              \\DESKTOP-8725D5K
Hotfix(s):                 62 Hotfix(s) Installed.
```

Fig 2.3a



```
Network Card(s):          5 NIC(s) Installed.
                           [01]: Bluetooth Device (Personal Area Network)
                               Connection Name: Bluetooth Network Connection
                               Status:          Media disconnected
                           [02]: Qualcomm Atheros AR956x Wireless Network Adapter
                               Connection Name: WiFi
                               DHCP Enabled:    Yes
                               DHCP Server:     192.168.0.1
                               IP address(es)
                               [01]: 192.168.0.94
                               [02]: fe80::cb48:7cf9:3640:577f
                           [03]: Realtek PCIe GbE Family Controller
                               Connection Name: Ethernet
                               Status:          Media disconnected
                           [04]: VMware Virtual Ethernet Adapter for VMnet1
                               Connection Name: VMware Network Adapter VMnet1
                               DHCP Enabled:    Yes
                               DHCP Server:     192.168.27.254
                               IP address(es)
                               [01]: 192.168.27.1
                               [02]: fe80::8d40:5fea:fd9:f54c
                           [05]: VMware Virtual Ethernet Adapter for VMnet8
                               Connection Name: VMware Network Adapter VMnet8
                               DHCP Enabled:    Yes
                               DHCP Server:     192.168.52.254
                               IP address(es)
                               [01]: 192.168.52.1
                               [02]: fe80::dd70:4fa3:11df:4356
Hyper-V Requirements:     A hypervisor has been detected. Features required for Hyper-V will not be displayed.
C:\Users\thoma>
```

Fig 2.3b



```
C:\Users\thoma>tasklist

Image Name                      PID Session Name        Session#    Mem Usage
=====
System Idle Process             0 Services              0             8 K
System                          4 Services              0          3,612 K
Secure System                   48 Services              0         21,548 K
Registry                       96 Services              0         87,948 K
smss.exe                       408 Services              0          1,124 K
csrss.exe                      648 Services              0          4,996 K
wininit.exe                    724 Services              0          6,048 K
services.exe                   788 Services              0          9,404 K
LsaIso.exe                     844 Services              0          3,460 K
lsass.exe                      856 Services              0         21,108 K
fontdrvhost.exe               980 Services              0          3,264 K
svchost.exe                     64 Services              0         37,460 K
WUDFHost.exe                  620 Services              0          6,040 K
svchost.exe                   1112 Services              0         16,512 K
svchost.exe                   1172 Services              0          8,980 K
svchost.exe                   1292 Services              0          6,332 K
svchost.exe                   1304 Services              0         10,372 K
svchost.exe                   1320 Services              0         10,760 K
svchost.exe                   1412 Services              0          8,720 K
svchost.exe                   1464 Services              0         11,560 K
svchost.exe                   1560 Services              0          5,012 K
svchost.exe                   1600 Services              0          5,276 K
svchost.exe                   1708 Services              0          7,612 K
```

Fig 2.3c

2.4 Network Commands

ipconfig: Displays network adapter configuration including IP addresses, subnet masks, and default gateways. Also The 'ipconfig/all' command provides detailed information including MAC addresses, DHCP status, and DNS servers [7] . Check **Fig 2.4a**

ping: Tests network connectivity by sending ICMP echo requests to a specified host. The response times indicate network latency, whilst packet loss suggests connectivity issues. The '-t' switch enables continuous pinging until manually stopped [7]. Check **Fig 2.4b**

```
Command Prompt

C:\Users\thoma>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 9:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 10:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Ethernet adapter VMware Network Adapter VMnet1:

    Connection-specific DNS Suffix  . :
    Link-local IPv6 Address . . . . . : fe80::8d40:5fea:fd9:f4c%4
    IPv4 Address. . . . . : 192.168.27.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . :

Ethernet adapter VMware Network Adapter VMnet8:

    Connection-specific DNS Suffix  . :
    Link-local IPv6 Address . . . . . : fe80::dd70:4fa3:11df:4356%20
    IPv4 Address. . . . . : 192.168.52.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . :
```

Fig 2.4 b

```
Command Prompt

C:\Users\thoma>ping google.com

Pinging google.com [142.250.151.139] with 32 bytes of data:
Reply from 142.250.151.139: bytes=32 time=14ms TTL=11
Reply from 142.250.151.139: bytes=32 time=12ms TTL=12
Reply from 142.250.151.139: bytes=32 time=11ms TTL=12
Reply from 142.250.151.139: bytes=32 time=13ms TTL=12

Ping statistics for 142.250.151.139:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 11ms, Maximum = 14ms, Average = 12ms

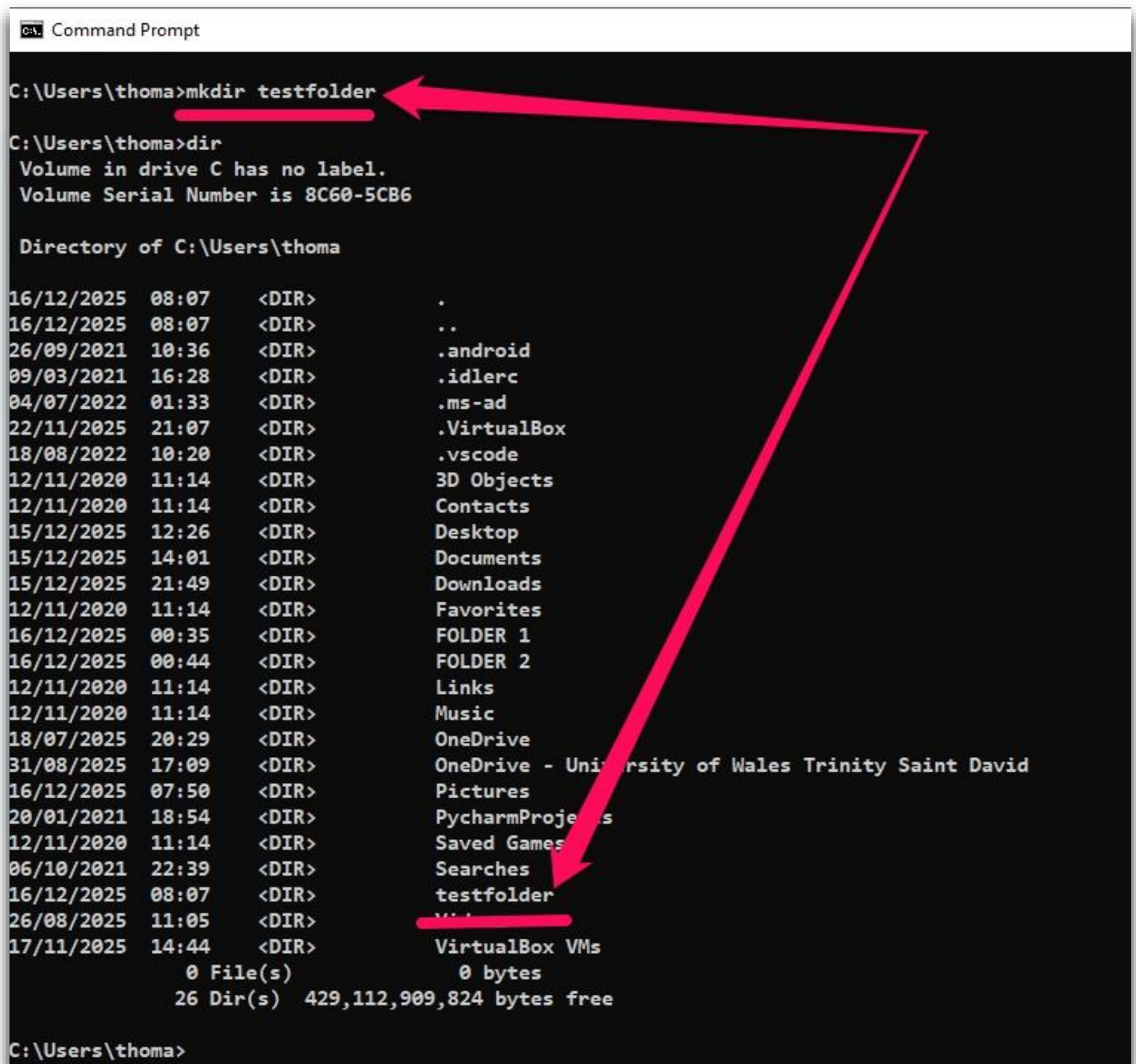
C:\Users\thoma>
```

Fig 2.4 b

2.5 Directory Management

Mkdir : Creates new directories within the file system. check image below where I created a test folder and then checked the output using the **dir** command where we see the test folder being available now. Check Fig 2.5

Cls : Cls will just clear the screen and will bring to the initial command prompt with a blank screen below



The screenshot shows a Windows Command Prompt window titled "Command Prompt". The user has entered the command `C:\Users\thoma>mkdir testfolder`, which is underlined in red. A red arrow points from this command to the output of the `dir` command. The user then enters `C:\Users\thoma>dir`. The output shows the directory listing for `C:\Users\thoma`, including various system folders and files. The newly created `testfolder` is listed at the bottom of the directory listing, underlined in red. A red arrow points from the `mkdir` command to this entry. The output also shows the volume information for drive C and the free space available.

```
Command Prompt

C:\Users\thoma>mkdir testfolder
C:\Users\thoma>dir
Volume in drive C has no label.
Volume Serial Number is 8C60-5CB6

Directory of C:\Users\thoma

16/12/2025  08:07    <DIR>          .
16/12/2025  08:07    <DIR>          ..
26/09/2021  10:36    <DIR>          .android
09/03/2021  16:28    <DIR>          .idlerc
04/07/2022  01:33    <DIR>          .ms-ad
22/11/2025  21:07    <DIR>          .VirtualBox
18/08/2022  10:20    <DIR>          .vscode
12/11/2020  11:14    <DIR>          3D Objects
12/11/2020  11:14    <DIR>          Contacts
15/12/2025  12:26    <DIR>          Desktop
15/12/2025  14:01    <DIR>          Documents
15/12/2025  21:49    <DIR>          Downloads
12/11/2020  11:14    <DIR>          Favorites
16/12/2025  00:35    <DIR>          FOLDER 1
16/12/2025  00:44    <DIR>          FOLDER 2
12/11/2020  11:14    <DIR>          Links
12/11/2020  11:14    <DIR>          Music
18/07/2025  20:29    <DIR>          OneDrive
31/08/2025  17:09    <DIR>          OneDrive - University of Wales Trinity Saint David
16/12/2025  07:50    <DIR>          Pictures
20/01/2021  18:54    <DIR>          PycharmProjects
12/11/2020  11:14    <DIR>          Saved Games
06/10/2021  22:39    <DIR>          Searches
16/12/2025  08:07    <DIR>          testfolder
26/08/2025  11:05    <DIR>          VirtualBox VMs
17/11/2025  14:44    <DIR>          VirtualBox VMs

0 File(s)                0 bytes
26 Dir(s)  429,112,909,824 bytes free

C:\Users\thoma>
```

Fig 2.5

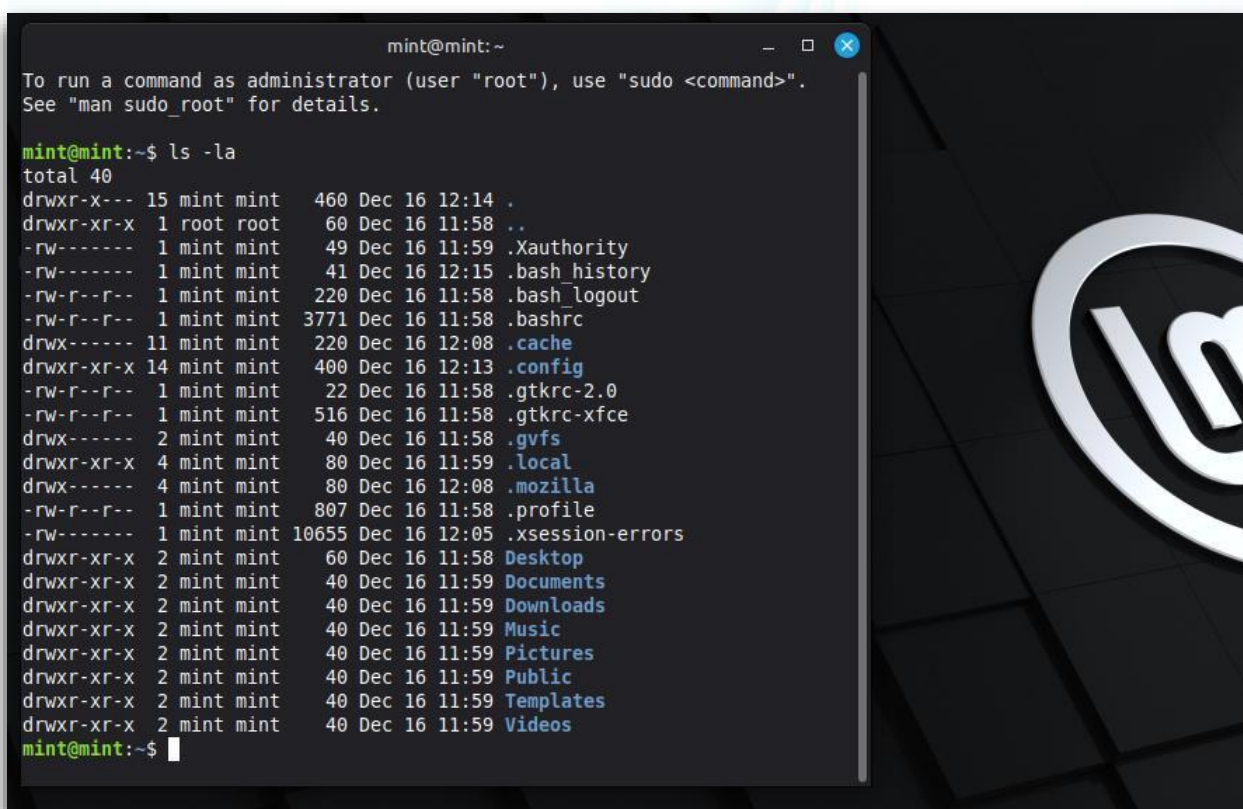
3. Use of Linux OS CLI commands.

Linux systems heavily utilize the Bash shell for administration tasks, mostly due to its powerful command-line functionality, which often goes beyond graphical methods in terms of flexibility and efficiency [8]. Some important Bash commands are presented here that are commonly used in file manipulation and system monitoring applications. [9]

1. **ls -la** - List all files with details, including hidden files

Steps:

First Open the terminal, Navigate to the directory you want to inspect (use `cd` if needed), run the command: `ls -la` . check results in the figure below 3.1



```
mint@mint: ~  
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.  
  
mint@mint:~$ ls -la  
total 40  
drwxr-x--- 15 mint mint 460 Dec 16 12:14 .  
drwxr-xr-x  1 root root  60 Dec 16 11:58 ..  
-rw----- 1 mint mint  49 Dec 16 11:59 .Xauthority  
-rw----- 1 mint mint  41 Dec 16 12:15 .bash_history  
-rw-r--r-- 1 mint mint 220 Dec 16 11:58 .bash_logout  
-rw-r--r-- 1 mint mint 3771 Dec 16 11:58 .bashrc  
drwx----- 11 mint mint 220 Dec 16 12:08 .cache  
drwxr-xr-x 14 mint mint 400 Dec 16 12:13 .config  
-rw-r--r-- 1 mint mint  22 Dec 16 11:58 .gtkrc-2.0  
-rw-r--r-- 1 mint mint 516 Dec 16 11:58 .gtkrc-xfce  
drwx----- 2 mint mint  40 Dec 16 11:58 .gvfs  
drwxr-xr-x  4 mint mint  80 Dec 16 11:59 .local  
drwx----- 4 mint mint  80 Dec 16 12:08 .mozilla  
-rw-r--r-- 1 mint mint 807 Dec 16 11:58 .profile  
-rw----- 1 mint mint 10655 Dec 16 12:05 .xsession-errors  
drwxr-xr-x  2 mint mint  60 Dec 16 11:58 Desktop  
drwxr-xr-x  2 mint mint  40 Dec 16 11:59 Documents  
drwxr-xr-x  2 mint mint  40 Dec 16 11:59 Downloads  
drwxr-xr-x  2 mint mint  40 Dec 16 11:59 Music  
drwxr-xr-x  2 mint mint  40 Dec 16 11:59 Pictures  
drwxr-xr-x  2 mint mint  40 Dec 16 11:59 Public  
drwxr-xr-x  2 mint mint  40 Dec 16 11:59 Templates  
drwxr-xr-x  2 mint mint  40 Dec 16 11:59 Videos  
mint@mint:~$
```

Fig 3.1

2. **pwd** – Prints current working directory path

Open the terminal and run the command **pwd**, the terminal will display the full path of your current directory as seen below in fig 3.2

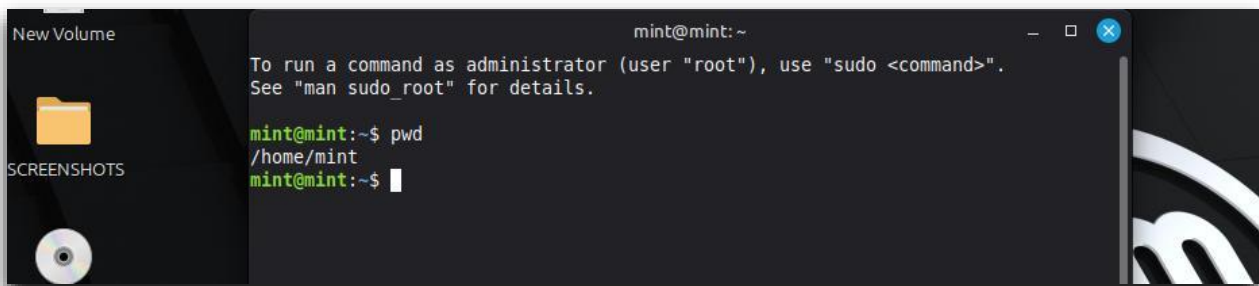


Fig 3.2

3. **cd** – Change directory

Open the terminal. To change to your home directory, simply type `cd ~` Or to change to any specific directory, type `cd /path/to/directory`. The terminal will change your current directory to the specified location. See results below in fig 3.3

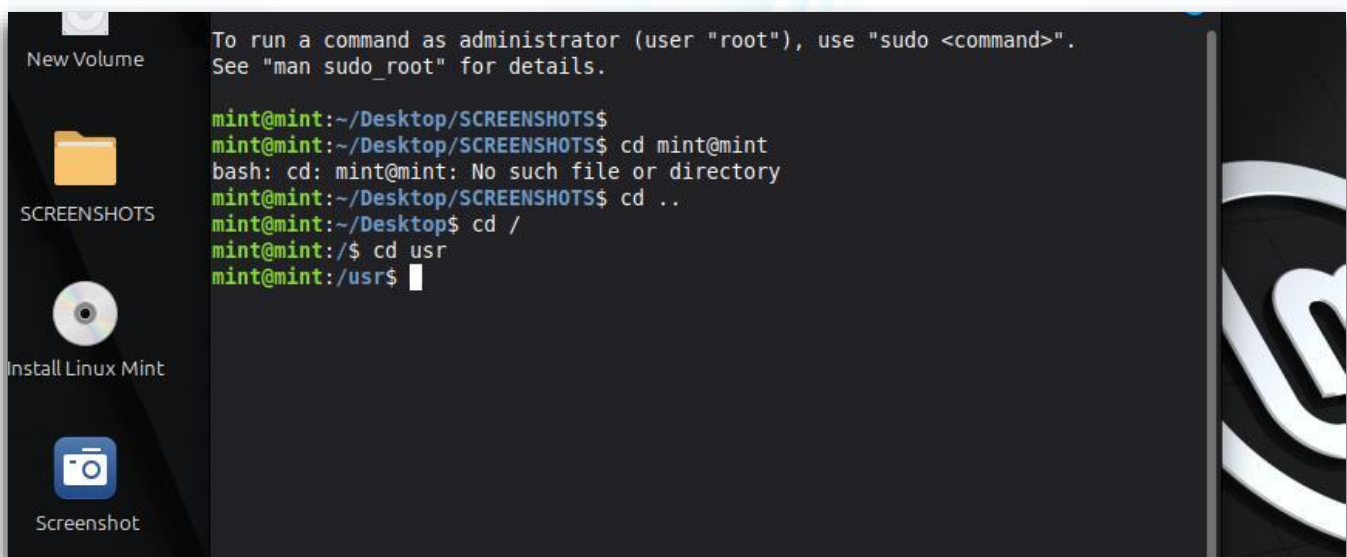


Fig 3.3

4. **mkdir** - Make a new directory

Open the terminal, Navigate to the location where you want to create a new directory (use `cd` if needed).run the command **mkdir** new_directory_name. This creates a new directory named new directory name in the current working directory. Check screen shot in **fig 3.4** below.

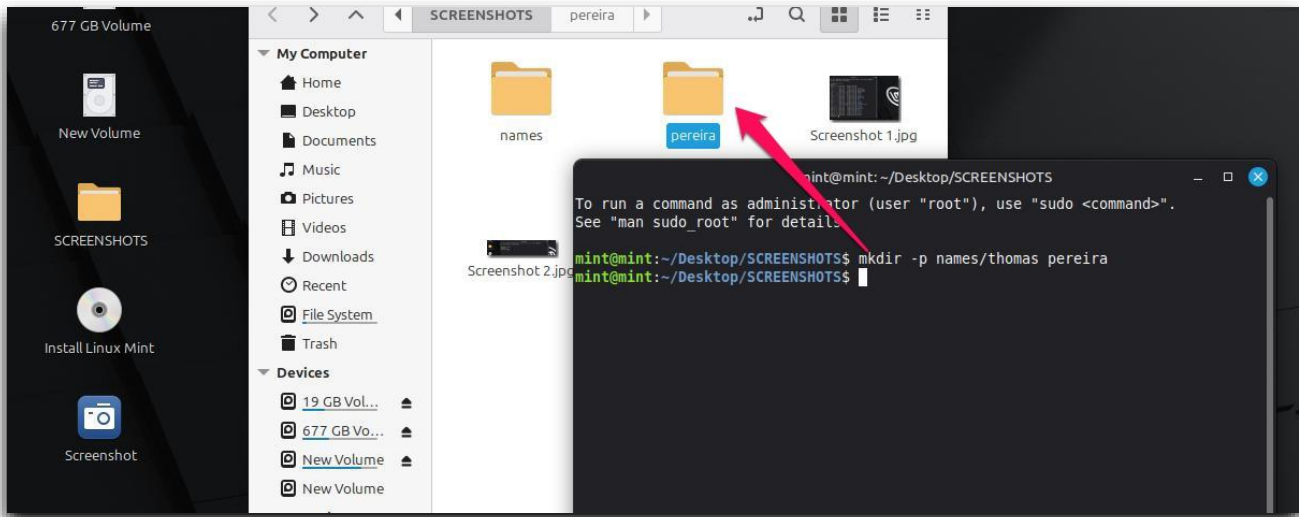


fig 3.4

5. rm Command to Remove Files

The **rm** command is used to remove files. First create a test file

In terminal, create a file using the **touch** command. This file will be used to demonstrate the **rm** command.

touch testfile.txt, this creates an empty file called **testfile.txt**. List the file using the **ls** command. We will see **testfile.txt** in the list of files, further remove the file using **rm** use **rm testfile.txt**. This removes the **testfile.txt** file. It does not confirm deletion, but I tried doing **ls** command in the same directory and the file was no more

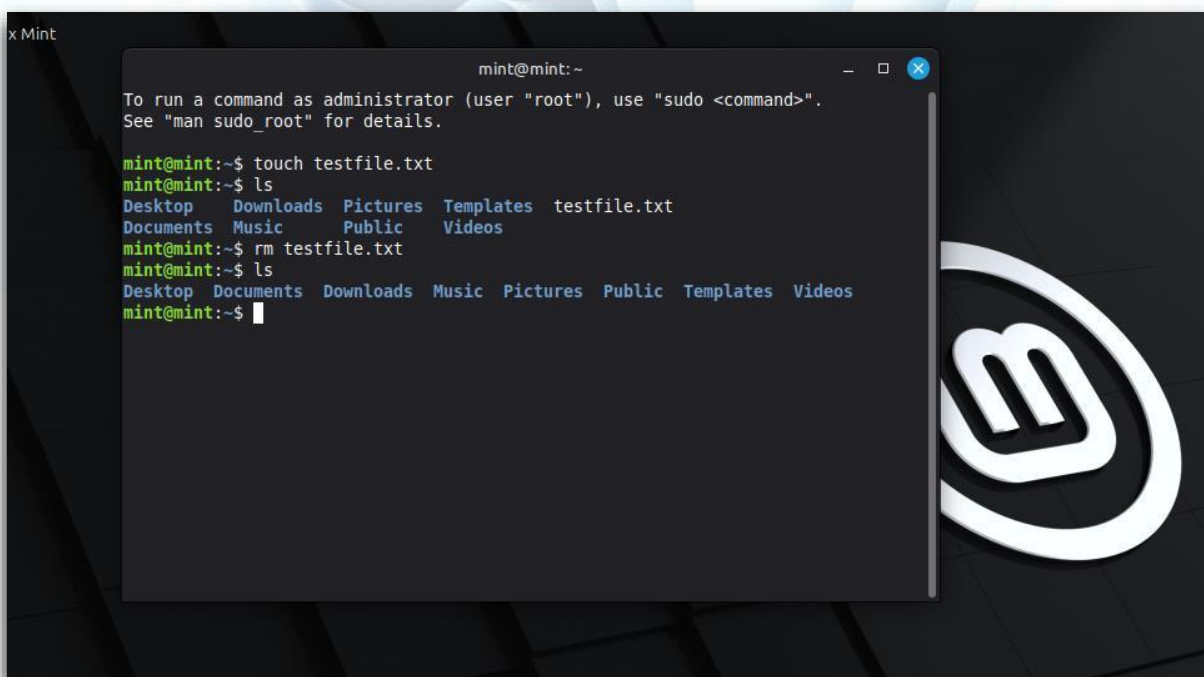
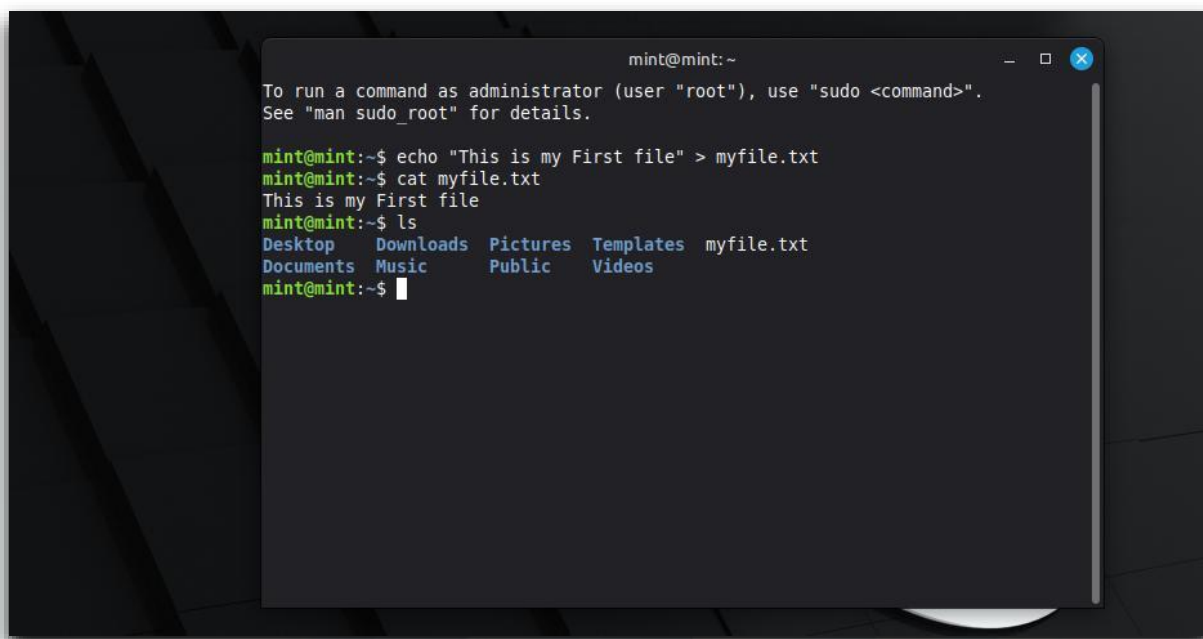


Fig 3.5

6. cat – Displays contents of a file

We can View the Content of the File with **cat**

Look in the figure below where I have used the command `cat myfile.txt` and the output shows as This is my first file!

A terminal window titled 'mint@mint:~' with standard window controls. It shows a sequence of commands and their outputs: a message about running commands as administrator, creating a file 'myfile.txt' with the text 'This is my First file', viewing the file's contents with 'cat', and listing the directory with 'ls' which shows 'myfile.txt' among other folders.

```
mint@mint:~  
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.  
  
mint@mint:~$ echo "This is my First file" > myfile.txt  
mint@mint:~$ cat myfile.txt  
This is my First file  
mint@mint:~$ ls  
Desktop  Downloads  Pictures  Templates  myfile.txt  
Documents Music      Public    Videos
```

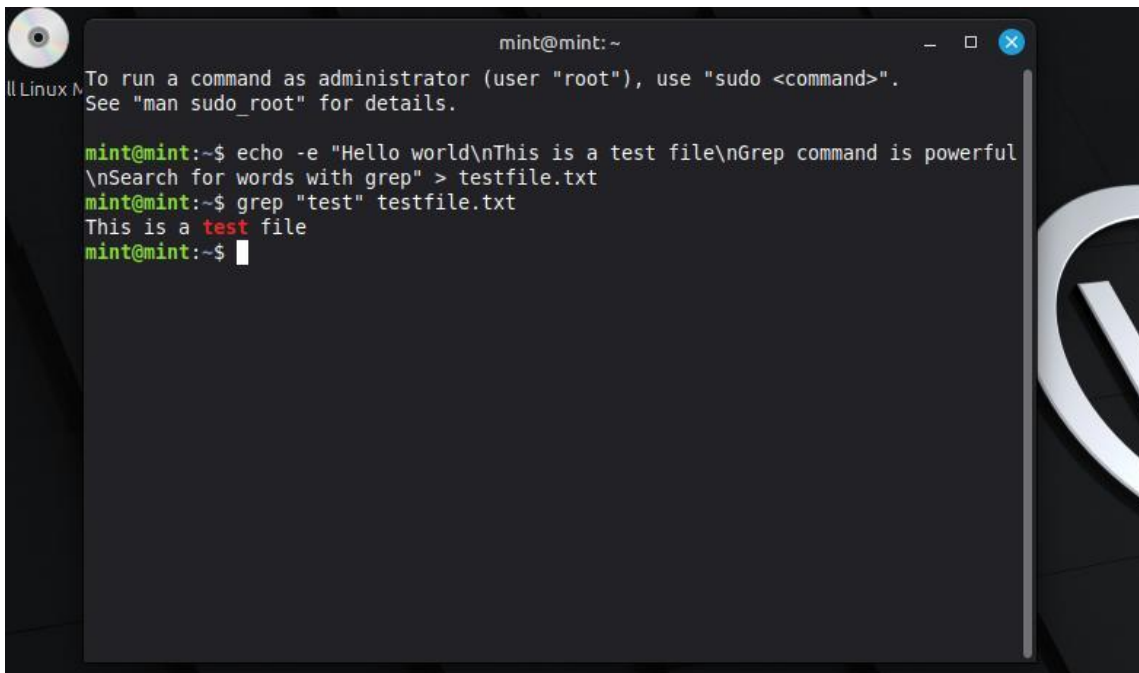
Fig 3.6

7.grep – Searches for text patterns in files, The most common use of grep is to search for a word or pattern inside a file. first I created a file with some text in it as below

```
echo -e "Hello world\nThis is a test file\nGrep command is powerful\nSearch for words with grep" > testfile.txt
```

This creates a file called testfile.txt with several lines of text. I used grep to search for a word

As "test" in testfile.txt: the command I used was `grep "test" testfile.txt`.The output shows as "This is a test file" see screenshot below in **fig 3.7**

A terminal window titled 'mint@mint: ~' with standard window controls. It displays a message about running commands as administrator. The user then runs 'echo -e "Hello world\nThis is a test file\nGrep command is powerful\nSearch for words with grep" > testfile.txt'. Next, they run 'grep "test" testfile.txt', which outputs 'This is a test file'. The prompt returns to 'mint@mint:~\$'.

```
mint@mint:~$ echo -e "Hello world\nThis is a test file\nGrep command is powerful\nSearch for words with grep" > testfile.txt
mint@mint:~$ grep "test" testfile.txt
This is a test file
mint@mint:~$
```

Fig 3.7

8.The chmod (change mode) command in Linux is used to modify the permissions of files and directories. Let's go through the basics of chmod with simple examples, along with easy steps for screenshots.

Steps: -

1.Use the echo command to create a simple test file:

```
echo "Hello, this is a test file!" > testfile.txt
```

2.Before using chmod, check the current permissions of the file:

```
ls -l testfile.txt
```

3.This will display the permissions like:

```
-rw-r--r-- 1 user user 31 Dec 17 14:00 testfile.txt
```

4.change the permissions to make the file executable by the user.

```
chmod u+x testfile.txt
```

This gives execute permission to the user.

5.Check the file permissions again to see the update:

```
ls -l testfile.txt
```

next we see

```
-rwxr--r-- 1 user user 31 Dec 17 14:00 testfile.txt
```

```
mint@mint:~  
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.  
  
mint@mint:~$ echo "Hello, this is a test file!" > testfile.txt  
mint@mint:~$ ls  
Desktop Downloads Pictures Templates myfile.txt  
Documents Music Public Videos testfile.txt  
mint@mint:~$ ls -l testfile.txt  
-rw-rw-r-- 1 mint mint 28 Dec 17 10:03 testfile.txt  
mint@mint:~$ chmod u+x testfile.txt  
mint@mint:~$ ls -l testfile.txt  
-rwxrw-r-- 1 mint mint 28 Dec 17 10:03 testfile.txt  
mint@mint:~$
```

Screenshot 8

9.ps aux –The **ps aux** command displays information about all processes running on the system, including the users, CPU usage and memory usage and much more. Check the screenshot below.

```
mint@mint:~  
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.  
  
mint@mint:~$ ps aux  
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND  
root         1  0.1  0.1 22756 13848 ?        Ss   09:12   0:06 /sbin/init sp  
root         2  0.0  0.0      0     0 ?        S    09:12   0:00 [kthreadd]  
root         3  0.0  0.0      0     0 ?        S    09:12   0:00 [pool_workque  
root         4  0.0  0.0      0     0 ?        I<   09:12   0:00 [kworker/R-rc  
root         5  0.0  0.0      0     0 ?        I<   09:12   0:00 [kworker/R-sy  
root         6  0.0  0.0      0     0 ?        I<   09:12   0:00 [kworker/R-kv  
root         7  0.0  0.0      0     0 ?        I<   09:12   0:00 [kworker/R-sl  
root         8  0.0  0.0      0     0 ?        I<   09:12   0:00 [kworker/R-ne  
root        13  0.0  0.0      0     0 ?        I<   09:12   0:00 [kworker/R-mm  
root        14  0.0  0.0      0     0 ?        I    09:12   0:00 [rcu_tasks_kt  
root        15  0.0  0.0      0     0 ?        I    09:12   0:00 [rcu_tasks_ru  
root        16  0.0  0.0      0     0 ?        I    09:12   0:00 [rcu_tasks_tr  
root        17  0.0  0.0      0     0 ?        S    09:12   0:00 [ksoftirqd/0]  
root        18  0.1  0.0      0     0 ?        I    09:12   0:04 [rcu_preempt]  
root        19  0.0  0.0      0     0 ?        S    09:12   0:00 [rcu_exp_par_  
root        20  0.0  0.0      0     0 ?        S    09:12   0:00 [rcu_exp_gp_k  
root        21  0.0  0.0      0     0 ?        S    09:12   0:00 [migration/0]  
root        22  0.0  0.0      0     0 ?        S    09:12   0:00 [idle_inject/  
root        23  0.0  0.0      0     0 ?        S    09:12   0:00 [cpuhp/0]  
root        24  0.0  0.0      0     0 ?        S    09:12   0:00 [cpuhp/1]  
root        25  0.0  0.0      0     0 ?        S    09:12   0:00 [idle_inject/  
root        26  0.0  0.0      0     0 ?        S    09:12   0:00 [migration/1]  
root        27  0.0  0.0      0     0 ?        S    09:12   0:00 [ksoftirqd/1]  
root        29  0.0  0.0      0     0 ?        I<   09:12   0:00 [kworker/1:0H  
root        30  0.0  0.0      0     0 ?        S    09:12   0:00 [kdevtmpfs]  
root        31  0.0  0.0      0     0 ?        I<   09:12   0:00 [kworker/R-in
```

Fig 3.9

10. top – The `top` command in Linux provides a, real-time view of the system's running processes. It shows information like CPU , memory usage, and the processes using the resources. Check the screenshot below.

```

top - 10:16:43 up 1:03, 1 user, load average: 1.36, 1.07, 0.92
Tasks: 210 total, 2 running, 208 sleeping, 0 stopped, 0 zombie
%Cpu(s): 34.8 us, 18.2 sy, 0.0 ni, 40.9 id, 4.8 wa, 0.0 hi, 1.4 si, 0.0 st
MiB Mem : 7824.5 total, 1141.9 free, 2683.1 used, 4930.6 buff/cache
MiB Swap: 0.0 total, 0.0 free, 0.0 used. 5141.5 avail Mem

  PID USER      PR  NI   VIRT   RES   SHR  S  %CPU  %MEM    TIME+  COMMAND
 5596 root        20   0 546476 103508 24400 R   36.3   1.3   0:03.34 fwupd
 5587 fwupd-r+   20   0 671456 29736 17400 S   29.4   0.4   0:01.05 fwupdmgr
 2168 mint       20   0 3829328 206600 121816 S   20.1   2.6   6:03.73 cinnamon
 1648 root        20   0 1061192 179376 106752 S    5.9   2.2   6:56.95 Xorg
 4937 root        20   0      0      0      0  I    1.0   0.0   0:01.31 kworker/u8:2-events_unbound
 1379 message+  20   0  11120   6756   4684 S    0.7   0.1   0:03.78 dbus-daemon
 1414 root        20   0 258812 14924 12652 S    0.7   0.2   0:14.99 touchegg
 4745 root        20   0      0      0      0  I    0.7   0.0   0:02.11 kworker/u8:1-events_unbound
 5564 mint       20   0 20552   5744   3568 R    0.7   0.1   0:00.80 top
   17 root        20   0      0      0      0  S    0.3   0.0   0:01.07 ksoftirqd/0
   18 root        20   0      0      0      0  I    0.3   0.0   0:05.39 rcu_preempt
   46 root         0 -20      0      0      0  I    0.3   0.0   0:05.20 kworker/u9:0-i915_flip
  898 root        20   0  30364   8136   4704 S    0.3   0.1   0:02.01 systemd-udev
 1375 avahi       20   0   8748   4676   4180 S    0.3   0.1   0:04.79 avahi-daemon
 1404 polkitd     20   0 311168 11140   7880 S    0.3   0.1   0:00.92 polkitd
 1975 mint       20   0 456932 26372 20264 S    0.3   0.3   0:01.84 csd-power
 2921 mint       20   0 456492 25480 18984 S    0.3   0.3   0:01.19 xdg-desktop-por
 4261 mint       20   0 2435692 69876 55464 S    0.3   0.9   0:05.79 Web Content
 5531 root        20   0      0      0      0  I    0.3   0.0   0:00.24 kworker/0:0-events
 5546 mint       20   0 549808 44904 33568 S    0.3   0.6   0:01.93 gnome-terminal-
    1 root        20   0 22756  13848   9604 S    0.0   0.2   0:06.60 systemd
    2 root        20   0      0      0      0  S    0.0   0.0   0:00.01 kthreadd
    3 root        20   0      0      0      0  S    0.0   0.0   0:00.00 pool_workqueue_release
    4 root         0 -20      0      0      0  I    0.0   0.0   0:00.00 kworker/R-rcu_gp
    5 root         0 -20      0      0      0  I    0.0   0.0   0:00.00 kworker/R-sync_wq
    6 root         0 -20      0      0      0  I    0.0   0.0   0:00.00 kworker/R-kvfree_rcu_reclaim
    7 root         0 -20      0      0      0  I    0.0   0.0   0:00.00 kworker/R-slub_flushwq
  
```

Fig 3.10

4. Use of Windows OS scripts.

4.1 Variables and User Input

Set command: First Open Notepad to Create a Script, Press Windows + R, type notepad and enter. then write a simple batch script by typing in notepad:

```
@echo off
set /p username=Enter your name:
echo Hello %username%
pause
```

Save the Script and name the file as userinput.bat and save it to desktop. now run the script by going to the desktop and double-click userinput.bat, then enter user input the script will ask to enter your name, then type your name and press enter. The **View Output** shows the Command prompt which displays- Hello Thomas

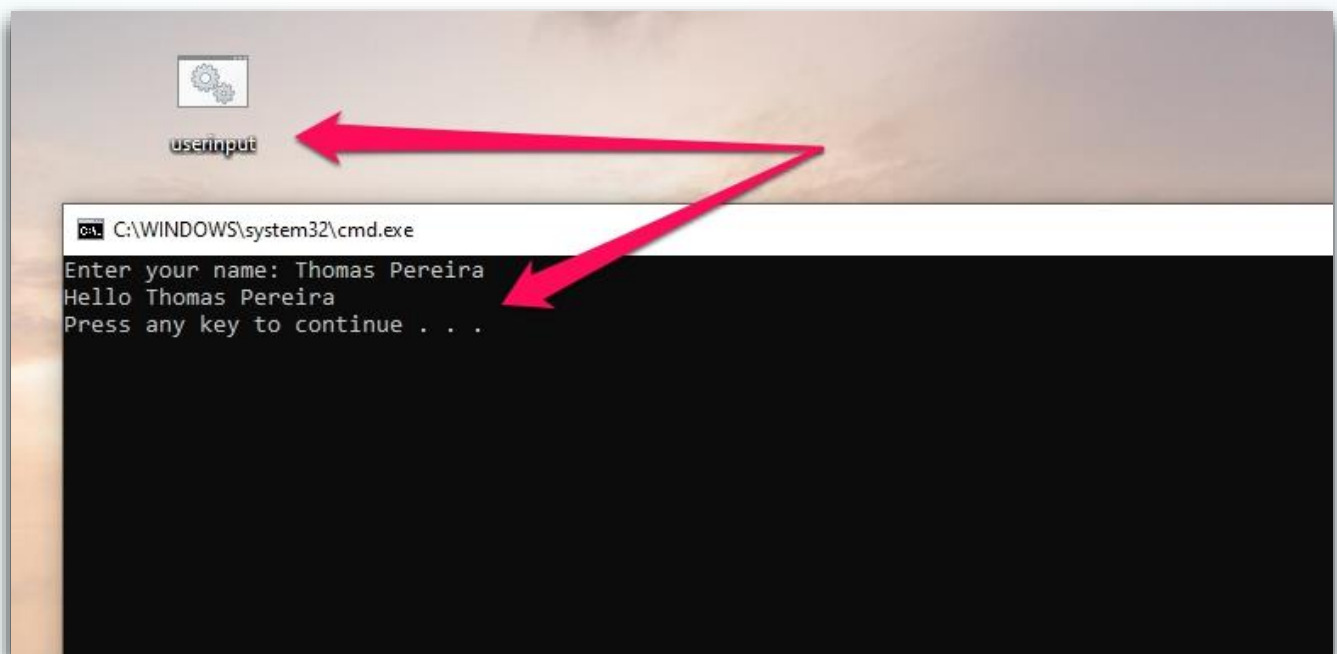


Fig 4.1

4.2 Loops and Iteration:

Loops enable repetitive execution of code blocks. Batch supports **FOR** loops for iterating through file sets, directory contents, or numeric ranges. The following script processes all text files in a directory [5]

As seen earlier in 4.1, use the same steps to create a batch file as seen in the figure below, I created a test folder with 3 text files and saved the processfile.bat in the same folder after running the file it gives the output as below fig 4.2

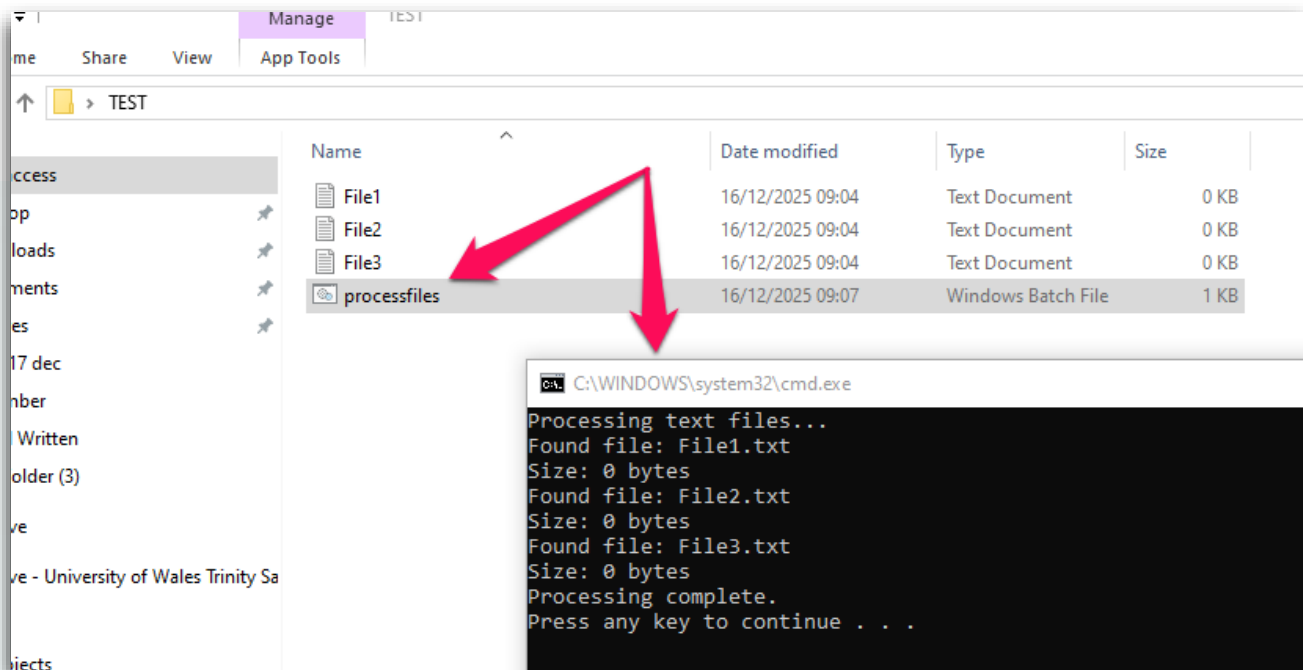


Fig 4.2

4.3 PowerShell System Administration:

PowerShell is great at sysadmin tasks thanks to cmdlets, these are specialized commands in the format Verb-Noun. The following PowerShell script will fetch system information and export it to a CSV file: [10]

first open windows powershell, click start, type PowerShell, right-click windows powershell, select run as administrator, open notepad, press windows + r, type notepad, press enter, type the powershell script as below .save the script, save to all files in a desktop folder, name the file, as systemreport.ps1 and save . check script in the screenshot below.

```
# System Information Report Script
$computerInfo = Get-ComputerInfo
Select-Object CsName, WindowsVersion, OsArchitecture $processes = Get-Process | Sort-Object CPU -Descending | Select-Object -First 5 Name, CPU, WorkingSet
Write-Host "Computer: $($computerInfo.CsName)" -ForegroundColor Green
Write-Host "Windows Version: $($computerInfo.WindowsVersion)"
Write-Host "`nTop 5 CPU-consuming processes:" $processes | Format-Table -AutoSize
# Export to CSV
$processes | Export-Csv -Path "TopProcesses.csv" -NoTypeInformation
Write-Host "Report exported to TopProcesses.csv" -ForegroundColor Yellow
```

Fig 4.3a

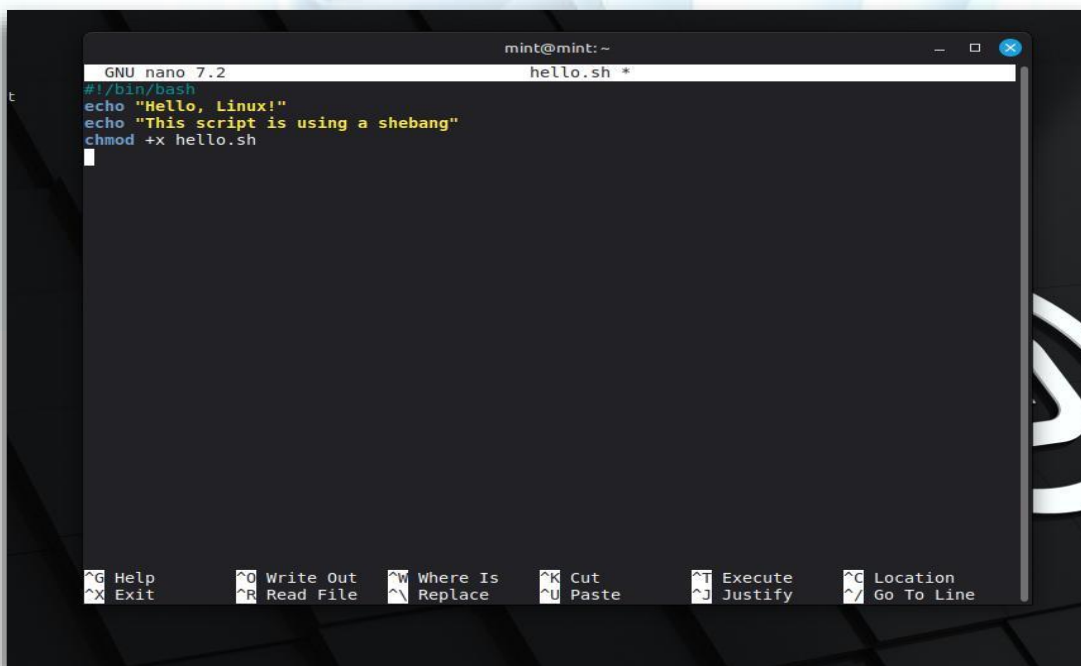
To execute the PowerShell script, type a dot and a backslash to represent the current directory; then add SystemReport.ps1 and press Enter. So, PowerShell will display the computer name, Windows version, and the top five CPU processes with message stating that the CSV file is generated. To analyze the results, the generated file TopProcesses.csv in the PowerShell script directory needs to be opened with Microsoft Excel or Notepad software

5. Use of Linux OS scripts.

Linux OS scripts are small programs that assist the computer in performing some tasks on its own.

Scripts can be employed for time purposes, say doing repeated chores that entail backing up, upgrading, and managing files. Scripts minimize errors since the same process is repeated every time. Hence they make system work easier, faster, and more reliable. Below are a few examples. [11], [9]

1. **shebang** :- Open Linux terminal and create a file using the command nano hello.sh. The code to be written in this file will be `#!/bin/bash` followed by another command, which could be `echo "Hello Linux"`. You would then create the file and exit the editor by pressing the key combination 'Ctrl+X'. The newly created file would then be made executable by the command `chmod +x hello.sh`. The last command to be used would be `./hello.sh` to execute the script. The first command used to create the script, which is `#!/bin/bash`, specifies the interpreter for the Linux operating system to use when running the script.



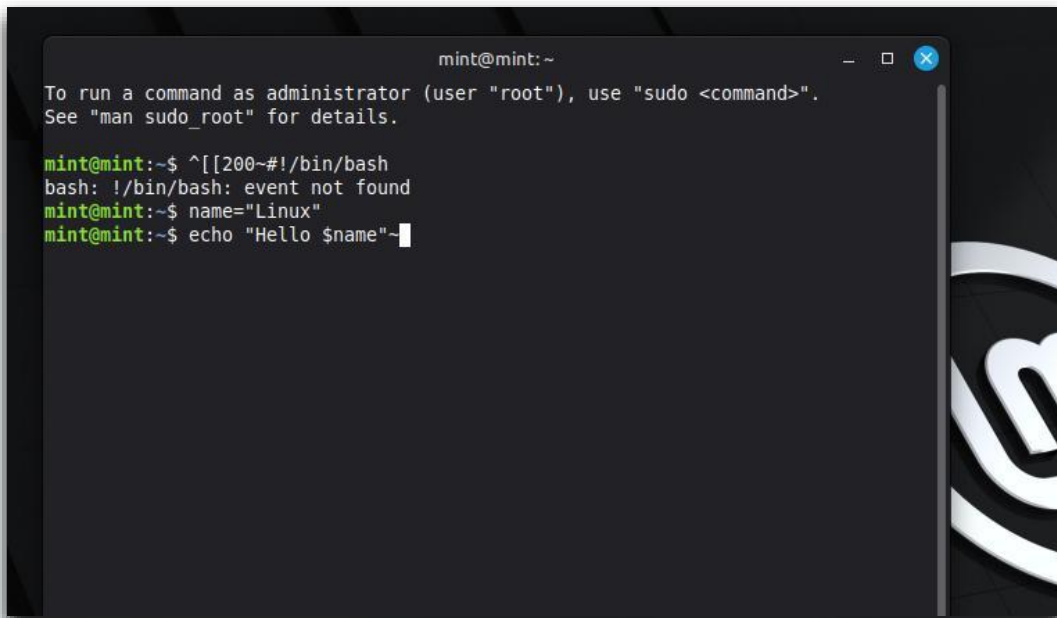
```
mint@mint: ~  
GNU nano 7.2 hello.sh *  
#!/bin/bash  
echo "Hello, Linux!"  
echo "This script is using a shebang"  
chmod +x hello.sh  
^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location  
^X Exit      ^R Read File  ^N Replace    ^U Paste      ^J Justify    ^V Go To Line
```

Fig 5.1

2.Variables :- A variable stores a value (text or number) that you can use later.

create a variable by writing `name=value` (no spaces). To use the variable, add `$` before the name like `$name`.

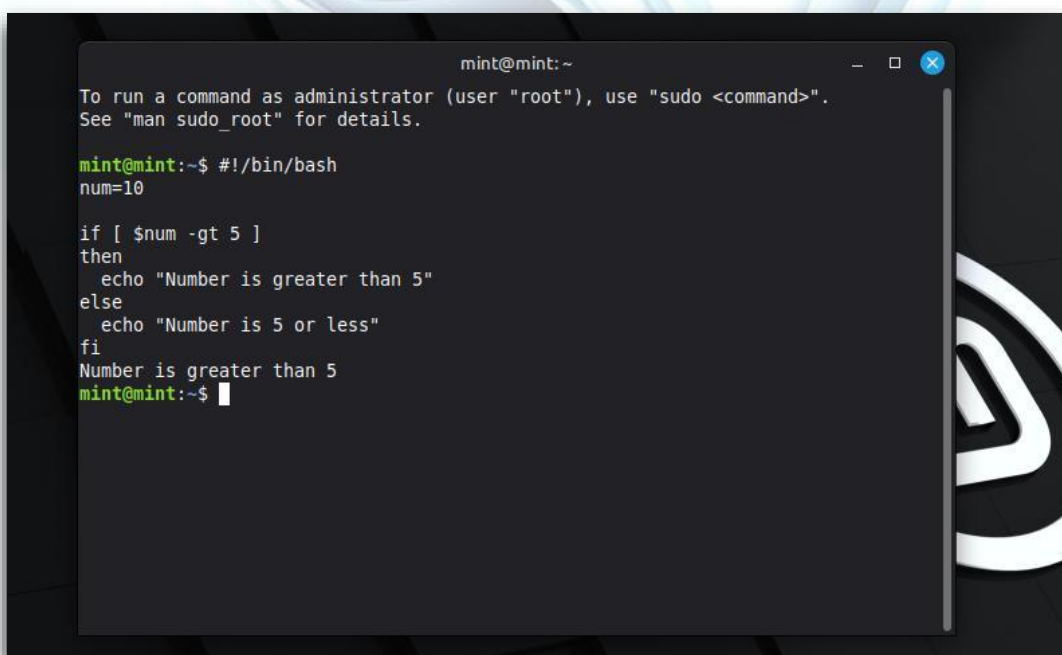
When you run the script, the shell replaces the variable with its value. Check image below.

A terminal window titled 'mint@mint: ~' with standard window controls. It displays a message about running commands as administrator. The user enters a prompt character, then `name="Linux"`, and finally `echo "Hello $name"`, which outputs "Hello Linux".

```
mint@mint: ~  
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.  
  
mint@mint:~$ ^[[200~#!/bin/bash  
bash: !/bin/bash: event not found  
mint@mint:~$ name="Linux"  
mint@mint:~$ echo "Hello $name"~
```

Fig 5.2

3.conditional:-The script checks a condition using `if`. If the condition is true, it runs the first command. If it is false, it runs the `else` part. `fi` ends the conditional. It is used to **make decisions** in a script

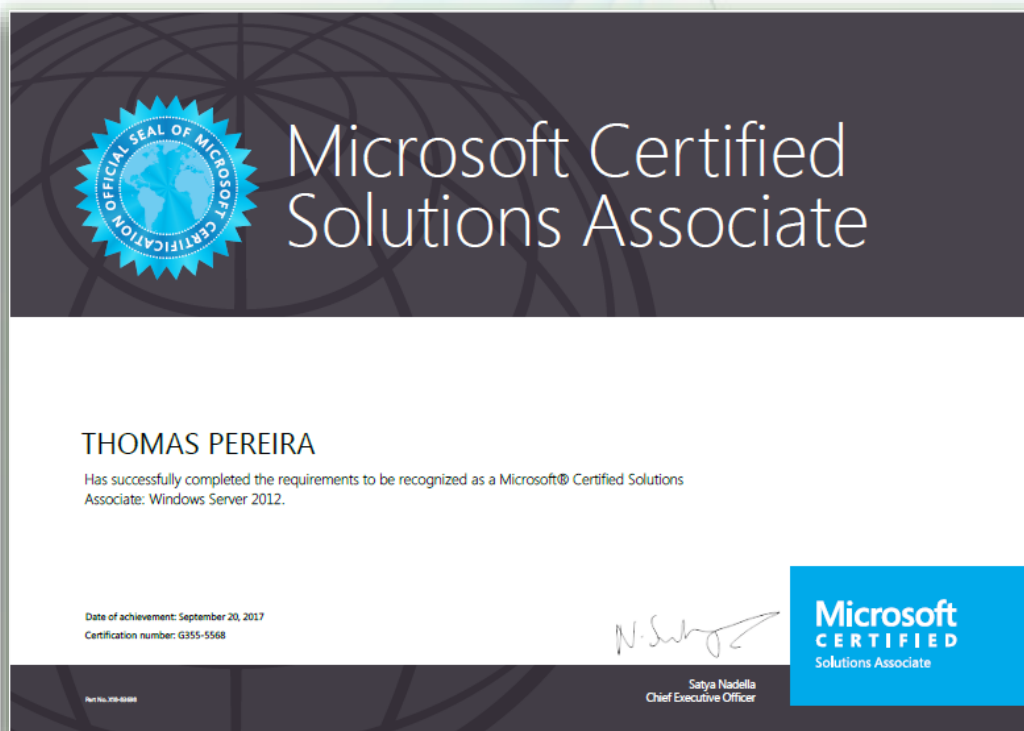
A terminal window titled 'mint@mint: ~' with standard window controls. It displays a message about running commands as administrator. The user enters a prompt character, then `num=10`, followed by an `if` statement that checks if `num` is greater than 5. Since the condition is true, it outputs "Number is greater than 5".

```
mint@mint: ~  
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.  
  
mint@mint:~$ #!/bin/bash  
num=10  
  
if [ $num -gt 5 ]  
then  
    echo "Number is greater than 5"  
else  
    echo "Number is 5 or less"  
fi  
Number is greater than 5  
mint@mint:~$
```

Fig 5.3

Conclusion

The topics highlighted in this report include the functions of the operating systems, which include the management of processes, memory, file systems, and security. Additionally, the use of command line operations in Windows and Linux to perform other functions was also highlighted in the study. Finally, the use of scripts in Windows operating systems, which involve the use of batch files and PowerShell, as well as the use of bash in Linux operating systems, to automate other functions was highlighted in the study. All these topics are useful in the effective management of computer systems. I faced difficulties due to an old, outdated laptop but plan to buy a new one in 2026. I had to install Linux on a usb (bootable) that would boot separately from windows , had to save the screen shot of Linux task and save via Linux directories and access in windows after restart , which consumed a lot of time Also due to time constraints and other obligations , I was unable to do a certificate fresh course , but I do have a self-example of a certificate that I attained a while ago , by self study and online video tutorials that helped me attain a certificate as below , I had studied for over 6-7 months and finally passed my certification **(MCSA)**.



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