```
sudo: 3 incorrect password attempts
lubaba@DESKTOP-8BL3MIG:/mnt/c/Users/PMLS/Desktop/coding_practice$ sudo lsblk -o NAME,TYPE,FSTYPE,PARTTYPE,SIZE,MODE
[sudo] password for lubaba:
Sorry, try again.
[sudo] password for lubaba:
NAME TYPE FSTYPE PARTTYPE   SIZE MODE
sda  disk ext4           388.4M brw-rw----
sdb  disk swap               1G brw-rw----
sdc  disk ext4               1T brw-rw----
lubaba@DESKTOP-8BL3MIG:/mnt/c/Users/PMLS/Desktop/coding_practice$
```

```
lubaba@DESKTOP-8BL3MIG:/$ sudo lsblk -f
NAME FSTYPE FSVER LABEL UUID                                 FSAVAIL FSUSE% MOUNTPOINTS
sda  ext4   1.0
sdb  swap   1           8692a4f2-d7c9-49fc-9e4c-0c98fd029c4f                [SWAP]
sdc  ext4   1.0         7fa52893-0420-4d70-86f3-8b565db3d845  952.5G     0% /snap
                                                                           /mnt/wslg/distro
                                                                           /

lubaba@DESKTOP-8BL3MIG:/$ sudo mkfs.ext4 /dev/sda5
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda5 does not exist and no size was specified.
lubaba@DESKTOP-8BL3MIG:/$ sudo e2label /dev/sda5 pucit9
e2label: No such file or directory while trying to open /dev/sda5
Couldn't find valid filesystem superblock.
lubaba@DESKTOP-8BL3MIG:/$ sudo e2label /dev/sda5 ""
e2label: No such file or directory while trying to open /dev/sda5
Couldn't find valid filesystem superblock.
lubaba@DESKTOP-8BL3MIG:/$ sudo ntfslabel /dev/sda5 pucit9
The device /dev/sda5 doesn't exist
lubaba@DESKTOP-8BL3MIG:/$ sudo ntfslabel /dev/sda5 ""
The device /dev/sda5 doesn't exist
lubaba@DESKTOP-8BL3MIG:/$
```

```
lubaba@DESKTOP-8BL3MIG:/$ sudo mkfs.ntfs /dev/sdb2
Failed to access '/dev/sdb2': No such file or directory
The device doesn't exist; did you specify it correctly?
lubaba@DESKTOP-8BL3MIG:/$ sudo lsblk -f
NAME FSTYPE FSVER LABEL UUID                                 FSAVAIL FSUSE% MOUNTPOINTS
sda  ext4   1.0
sdb  swap   1           8692a4f2-d7c9-49fc-9e4c-0c98fd029c4f                [SWAP]
sdc  ext4   1.0         7fa52893-0420-4d70-86f3-8b565db3d845  952.5G     0% /snap
                                                                           /mnt/wslg/distro
                                                                           /

lubaba@DESKTOP-8BL3MIG:/$
```

```
lubaba@DESKTOP-8BL3MIG:/$ sudo lsblk
NAME MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
sda    8:0    0 388.4M  1 disk
sdb    8:16   0     1G  0 disk [SWAP]
sdc    8:32   0     1T  0 disk /snap
                               /mnt/wslg/distro
                               /
lubaba@DESKTOP-8BL3MIG:/$ sudo fdisk -l /dev/sda
Disk /dev/sda: 388.43 MiB, 407298048 bytes, 795504 sectors
Disk model: Virtual Disk
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
lubaba@DESKTOP-8BL3MIG:/$ sudo fdisk /dev/sda

Welcome to fdisk (util-linux 2.37.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

fdisk: cannot open /dev/sda: Read-only file system
lubaba@DESKTOP-8BL3MIG:/$ sudo mkfs.ext4 /dev/sda1
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda1 does not exist and no size was specified.
lubaba@DESKTOP-8BL3MIG:/$ sudo mkdir /mnt/primary1
lubaba@DESKTOP-8BL3MIG:/$ sudo mount /dev/sda1 /mnt/primary1
mount: /mnt/primary1: special device /dev/sda1 does not exist.
lubaba@DESKTOP-8BL3MIG:/$ df -h
Filesystem      Size  Used Avail Use% Mounted on
none            1.9G     0  1.9G   0% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none            1.9G  4.0K  1.9G   1% /mnt/wsl
drivers         238G  139G  100G  59% /usr/lib/wsl/drivers
/dev/sdc       1007G  3.2G  953G   1% /
none            1.9G   84K  1.9G   1% /mnt/wslg
none            1.9G     0  1.9G   0% /usr/lib/wsl/lib
rootfs          1.9G  2.2M  1.9G   1% /init
none            1.9G  840K  1.9G   1% /run
none            1.9G     0  1.9G   0% /run/lock
none            1.9G     0  1.9G   0% /run/shm
tmpfs           4.0M     0  4.0M   0% /sys/fs/cgroup
none            1.9G   76K  1.9G   1% /mnt/wslg/versions.txt
none            1.9G   76K  1.9G   1% /mnt/wslg/doc
C:\             238G  139G  100G  59% /mnt/c
snapfuse         75M   75M     0 100% /snap/core22/1621
snapfuse        128K  128K     0 100% /snap/bare/5
snapfuse         74M   74M     0 100% /snap/core22/1663
snapfuse         92M   92M     0 100% /snap/gtk-common-themes/1535
snapfuse         41M   41M     0 100% /snap/snapd/20290
snapfuse         39M   39M     0 100% /snap/snapd/21759
snapfuse        132M  132M     0 100% /snap/ubuntu-desktop-installer/1276
snapfuse        132M  132M     0 100% /snap/ubuntu-desktop-installer/1286
lubaba@DESKTOP-8BL3MIG:/$
```

```
lubaba@DESKTOP-8BL3MIG:/$ sudo mkfs.ext4 /dev/sda1
sudo mkfs.ext4 /dev/sda2
sudo mkfs.ext4 /dev/sda5
sudo mkfs.ext4 /dev/sda6
sudo mkfs.ext4 /dev/sda7
sudo mkfs.ext4 /dev/sda8
sudo mkfs.ext4 /dev/sda9
sudo mkfs.ext4 /dev/sda10
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda1 does not exist and no size was specified.
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda2 does not exist and no size was specified.
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda5 does not exist and no size was specified.
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda6 does not exist and no size was specified.
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda7 does not exist and no size was specified.
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda8 does not exist and no size was specified.
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda9 does not exist and no size was specified.
mke2fs 1.46.5 (30-Dec-2021)
The file /dev/sda10 does not exist and no size was specified.
lubaba@DESKTOP-8BL3MIG:/$ sudo mkdir -p /mnt/primary1
sudo mkdir -p /mnt/primary2
sudo mkdir -p /mnt/logical1
sudo mkdir -p /mnt/logical2
sudo mkdir -p /mnt/logical3
sudo mkdir -p /mnt/logical4
sudo mkdir -p /mnt/logical5
sudo mkdir -p /mnt/logical6
lubaba@DESKTOP-8BL3MIG:/$ sudo mount /dev/sda1 /mnt/primary1
sudo mount /dev/sda2 /mnt/primary2
sudo mount /dev/sda5 /mnt/logical1
sudo mount /dev/sda6 /mnt/logical2
sudo mount /dev/sda7 /mnt/logical3
sudo mount /dev/sda8 /mnt/logical4
sudo mount /dev/sda9 /mnt/logical5
sudo mount /dev/sda10 /mnt/logical6
mount: /mnt/primary1: special device /dev/sda1 does not exist.
mount: /mnt/primary2: special device /dev/sda2 does not exist.
```

```
sudo mkdir -p /mnt/logical6
lubaba@DESKTOP-8BL3MIG:/$ sudo mount /dev/sda1 /mnt/primary1
sudo mount /dev/sda2 /mnt/primary2
sudo mount /dev/sda5 /mnt/logical1
sudo mount /dev/sda6 /mnt/logical2
sudo mount /dev/sda7 /mnt/logical3
sudo mount /dev/sda8 /mnt/logical4
sudo mount /dev/sda9 /mnt/logical5
sudo mount /dev/sda10 /mnt/logical6
mount: /mnt/primary1: special device /dev/sda1 does not exist.
mount: /mnt/primary2: special device /dev/sda2 does not exist.
mount: /mnt/logical1: special device /dev/sda5 does not exist.
mount: /mnt/logical2: special device /dev/sda6 does not exist.
mount: /mnt/logical3: special device /dev/sda7 does not exist.
mount: /mnt/logical4: special device /dev/sda8 does not exist.
mount: /mnt/logical5: special device /dev/sda9 does not exist.
mount: /mnt/logical6: special device /dev/sda10 does not exist.
lubaba@DESKTOP-8BL3MIG:/$ df -h
Filesystem      Size  Used Avail Use% Mounted on
none            1.9G     0  1.9G   0% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none            1.9G  4.0K  1.9G   1% /mnt/wsl
drivers         238G  139G  100G  59% /usr/lib/wsl/drivers
/dev/sdc       1007G  3.2G  953G   1% /
none            1.9G   88K  1.9G   1% /mnt/wslg
none            1.9G     0  1.9G   0% /usr/lib/wsl/lib
rootfs          1.9G  2.2M  1.9G   1% /init
none            1.9G  840K  1.9G   1% /run
none            1.9G     0  1.9G   0% /run/lock
none            1.9G     0  1.9G   0% /run/shm
tmpfs           4.0M     0  4.0M   0% /sys/fs/cgroup
none            1.9G   76K  1.9G   1% /mnt/wslg/versions.txt
none            1.9G   76K  1.9G   1% /mnt/wslg/doc
C:\             238G  139G  100G  59% /mnt/c
snapfuse         75M   75M     0 100% /snap/core22/1621
snapfuse        128K  128K     0 100% /snap/bare/5
snapfuse         74M   74M     0 100% /snap/core22/1663
snapfuse         92M   92M     0 100% /snap/gtk-common-themes/1535
snapfuse         41M   41M     0 100% /snap/snapd/20290
snapfuse         39M   39M     0 100% /snap/snapd/21759
snapfuse        132M  132M     0 100% /snap/ubuntu-desktop-installer/1276
snapfuse        132M  132M     0 100% /snap/ubuntu-desktop-installer/1286
lubaba@DESKTOP-8BL3MIG:/$
```

```
lubaba@DESKTOP-8BL3MIG:/$ lsmod | grep -i fs
lubaba@DESKTOP-8BL3MIG:/$ cat /proc/filesystems
nodev   sysfs
nodev   tmpfs
nodev   bdev
nodev   proc
nodev   cgroup
nodev   cgroup2
nodev   cpuset
nodev   devtmpfs
nodev   binfmt_misc
nodev   debugfs
nodev   tracefs
nodev   sockfs
nodev   bpf
nodev   pipefs
nodev   ramfs
nodev   hugetlbfs
nodev   rpc_pipefs
nodev   devpts
        ext3
        ext2
        ext4
        squashfs
        vfat
        msdos
        iso9660
nodev   nfs
nodev   nfs4
nodev   nfsd
nodev   cifs
nodev   smb3
nodev   autofs
        fuseblk
nodev   fuse
nodev   fusectl
nodev   virtiofs
nodev   overlay
        udf
        xfs
nodev   9p
nodev   ceph
        erofs
nodev   mqueue
```

Operating System lab 9

Task1(1)

Feature	Spinning Disk (HDD)	Solid-State Disk (SSD)
Technology	Mechanical (spinning platters)	Electronic (flash memory)
Speed	Slower (100-200 MB/s)	Faster (up to 5000 MB/s for NVMe)
Durability	Prone to mechanical failure	More durable (no moving parts)
Noise	Noisy (due to moving parts)	Silent (no moving parts)
Power Consumption	Higher power usage	Lower power usage
Capacity	Larger capacity (up to 16 TB+)	Smaller capacity (up to 2 TB or more)
Cost	Lower cost per GB	Higher cost per GB
Lifespan	Can wear out over time due to moving parts	Limited by write cycles, but lasts longer in normal use
Use Cases	Large storage, cost-effective	Fast performance, portable devices

Task1(2)

Define Logical Block addressing? What is the maximum disk size support on a 24 bit LBA and on a 28 bit LBA?

Answer:
Logical Block Addressing (LBA) is a method for specifying the location of data on a disk using a linear address
instead of physical cylinder, head, and sector numbers.

24-bit LBA supports a maximum disk size of 16 GB (2^{32} sectors × 512 bytes per sector).
28-bit LBA supports a maximum disk size of 128 GB (2^{2} sectors × 512 bytes per sector).

Task1(3)

A hard disk interface refers to the connection standard between the hard disk drive (HDD) and the computer system,
allowing data transfer and communication.

Key HDD Interfaces:

IDE (Integrated Drive Electronics): Older interface, commonly used in personal computers, supports slower data transfer speeds (up to 133 MB/s).
SATA (Serial ATA): Faster interface, widely used in modern systems, offering speeds from 150 MB/s to 600 MB/s, with smaller cables and improved power efficiency.
SCSI (Small Computer System Interface): Used in high-performance servers, supports faster data transfer and multiple devices on a single bus.
SAS (Serial Attached SCSI): An improved version of SCSI, offering higher speeds (up to 12 Gb/s), reliability, and scalability for enterprise environments.

Task1(4)

In a CHS (Cylinder-Head-Sector) disk, data is read and written by positioning the read/write head over the correct
cylinder and sector, and then accessing the data as the disk spins. Seek time is the time it takes for the head to
move to the correct cylinder, while rotational delay is the time it takes for the desired sector to rotate

under the
head. Mapping CHS to LBA (Logical Block Addressing) eliminates the need for manually tracking cylinder, head, and sector,
simplifying disk addressing. LBA allows more efficient disk scheduling and minimizes seek time by reducing unnecessary
head movements. This leads to faster data access and improved performance.

Task2(1)

1: Improved organization
2: Better performance
3: Data safety
4: Easy backups
5: Multiple operating systems

Task2(2)

Primary Partition:
1.A primary partition is a main partition that can be used to boot an operating system.
2.The disk can have up to 4 primary partitions (on MBR disks).
3.It directly occupies a section of the disk and is used for system or data storage.
Logical Partition:
1.A logical partition exists within an extended partition, which is a special type of partition that acts as a container.
2.There can be multiple logical partitions inside one extended partition (limited by the system, but typically up to 128 on modern systems).
3.It is used when you need more than four partitions on a disk, as you cannot have more than four primary partitions on a disk.

Task2(3)

Task2(4)

```
sudo dd if=/dev/sda of=/tmp/mbr.bin bs=512 count=1 && hexdump -C /tmp/mbr.bin | head -n 20
```

Task2(5)

```
sudo dd if=/dev/sda bs=512 count=1 | hexdump -C | head -n 20
```

Task2(6)

```
sudo fdisk -l /dev/sda | grep "^/dev/sda1" | awk '{print $5}'
```

Task2(7)

Linux - 83
Windows NTFS - 7
FAT32 - 0B
Linux Swap - 82
EFI System Partition - EF

task2(8)

```
sudo fdisk /dev/sda

sudo mkfs.ext4 /dev/sda1   # Format primary partition 1
sudo mkfs.ext4 /dev/sda2   # Format primary partition 2
```

```
sudo mkfs.ext4 /dev/sda5   # Format logical partition 1
sudo mkfs.ext4 /dev/sda6   # Format logical partition 2
sudo mkfs.ext4 /dev/sda7   # Format logical partition 3
sudo mkfs.ext4 /dev/sda8   # Format logical partition 4
sudo mkfs.ext4 /dev/sda9   # Format logical partition 5
sudo mkfs.ext4 /dev/sda10  # Format logical partition 6


sudo mount /dev/sda1 /mnt/primary1
sudo mount /dev/sda2 /mnt/primary2
sudo mount /dev/sda5 /mnt/logical1
sudo mount /dev/sda6 /mnt/logical2
sudo mount /dev/sda7 /mnt/logical3
sudo mount /dev/sda8 /mnt/logical4
sudo mount /dev/sda9 /mnt/logical5
sudo mount /dev/sda10 /mnt/logical6
```

Task3(1)

File System:
A file system is a method or structure used by an operating system to organize, store, retrieve, and manage data
on storage devices like hard drives, SSDs, or other media. It defines how data is stored in files and how files
are organized in directories, ensuring efficient access, modification, and management of data.

Journaling File System:
A journaling file system is a type of file system that keeps a log or "journal" of changes made to files or directories before those changes are actually written to disk. This helps in recovering data after a system crash or unexpected power failure, ensuring data integrity and minimizing file system corruption.

Functionalities of a Good File System:
Efficiency
Organization
Integrity
Security
Concurrency
Scalability
Reliability
Performance
Metadata
Recovery

Task3(2)

```
lsmod | grep -i fs
cat /proc/filesystems

ext4                 500000  1
xfs                  900000  1
btrfs                1200000  1
vfat                 20000   1
nfs                  300000  1
```

Task3(3)

ext3:

Max File Size: 2TB
Max Partition Size: 16TB

ext4:

Max File Size: 16TB
Max Partition Size: 1EB

vfat:

Max File Size: 4GB
Max Partition Size: 2TB

ntfs:

Max File Size: 16TB
Max Partition Size: 256TB

zfs:

Max File Size: 16EB
Max Partition Size: 256ZB

Task3(4)

snapshot

COMMAND:

```
sudo lsblk -o NAME,TYPE,FSTYPE,PARTTYPE,SIZE,MODE
```

NAME: Represents the device or partition.
TYPE: Specifies whether it’s a full disk or a partition.
FSTYPE: Tells us the filesystem type used on that partition.
PARTTYPE: Describes the type of partition (e.g., Linux, swap).
SIZE: The size of the disk or partition.
MODE: Shows the access permissions (e.g., rw indicates read-write access).

Task3(5)

snapshot

Task3(6)

snapshot