Task 1

1-Difference Between Spinning Disk and Solid State Disk (SSD):

Spinning Disk (HDD):

1. Uses magnetic storage with spinning platters for data storage.
2. Slower speed due to mechanical movement of the read/write head and rotational delay.
3. Prone to mechanical failure because of moving parts.

Solid State Disk (SSD):

1. Uses flash memory with no moving parts.
2. Faster performance as it has no mechanical delay.
3. More durable as it is not affected by wear from moving parts.

2-Logical Block Addressing (LBA):

LBA is a method of addressing sectors on a hard drive as a linear list of blocks, ignoring the physical geometry of the disk (cylinders, heads, sectors).

- **Maximum Disk Size with 24-bit LBA**:
  2*24×512 bytes=8 GB
- **Maximum Disk Size with 28-bit LBA**:
  2*28×512 bytes=128 GB= 128

3-Hard Disk Interface and Features:

A hard disk interface is the connection between the hard disk and the computer system for data transfer. Examples include:

1. **IDE (Integrated Drive Electronics):**
   - Parallel data transfer.
   - Legacy interface.
2. **SATA (Serial ATA):**
   - High speed (up to 6 Gbps).
   - Supports hot swapping.
3. **SCSI (Small Computer System Interface):**
   - Used in servers.
   - Allows multiple devices on one bus.
4. **NVMe (Non-Volatile Memory Express):**
   - Extremely high speeds for SSDs.
   - Direct connection to PCIe lanes.

4-Reading and Writing on CHS Disk:

- **Reading/Writing Process:**
  - **CHS Addressing:** Disk is accessed based on the Cylinder, Head, and Sector number.
  - **Steps:**

1. Seek to the specified cylinder.
2. Move to the head.
3. Wait for the sector to rotate under the read/write head.

- **Seek Time vs. Rotational Delay:**
  - **Seek Time:** Time to position the read/write head to the correct track.
  - **Rotational Delay:** Time for the disk to rotate the desired sector under the head.
- **Mapping CHS to LBA:** LBA reduces seek time by treating sectors as a sequential array, eliminating the complexity of CHS calculations.

Task 2

1-Advantages of Partitioning a Hard Disk:

1. Better organization of data (e.g., OS, applications, personal files).
2. Easier backups and recovery.
3. Multiple operating system installations.
4. Improved performance by separating swap space.
5. Enhanced security by isolating critical data.

2-Primary Partition vs. Logical Partition:

Feature	Primary Partition	Logical Partition
Definition	Main partitions (up to 4 per disk)	Subdivisions of an extended partition
Bootable	Can store bootable OS	Cannot directly boot
Limit	Maximum of 4 (or 3 + 1 extended)	Unlimited within the extended partition

3-Partition Table:

A partition table is a data structure stored on the disk that contains information about the partitions.

Schematic View of Partition Table:

plaintext

Copy code

Partition Table:

Offset | Size | Description

-------|--------|--

0x01BE | 16 bytes | Partition 1 (status, type, start, size)

0x01CE | 16 bytes | Partition 2

0x01DE | 16 bytes | Partition 3

0x01EE | 16 bytes | Partition 4

0x01FE | 2 bytes | Boot Signature (0x55AA)

4-Shell Commands:

1. **Boot Signature of Hard Disk:**

   sudo dd if=/dev/sdX bs=512 count=1 | hexdump -C | grep 55 aa

2. Stage 1 Boot Loader Program:

sudo dd if=/dev/sdX bs=446 count=1 | hexdump -C

3.Partition Type of First Partition:

sudo fdisk -l /dev/sdX

Partition Types and Numbers:

1. **NTFS**: 7
2. **FAT32**: b
3. **Linux Filesystem**: 83
4. **Swap**: 82
5. **EFI System Partition**: ef

Create Partitions with fdisk:

sudo fdisk /dev/sdX

Task 3

File System and Journaling File System:

- **File System:** Organizes and manages data on a storage device (e.g., ext4, NTFS).

- **Journaling File System:** Logs changes before committing them to the main file system, ensuring data integrity.

Features of a Good File System:

1. Efficient storage allocation.
2. Data security and integrity.
3. File indexing and metadata management.
4. Scalability.
5. Error recovery.

Commands:

List Loaded File System Drivers:

cat /proc/filesystems

Maximum File and Partition Size:

File System	Max File Size	Max Partition Size
ext3	2 TB	16 TB
ext4	16 TB	1 EB
vfat	4 GB	2 TB
ntfs	16 EB	16 EB
zfs	16 EB	256 ZB

Display Disk Information:

lsblk -o NAME,SIZE,FSTYPE,PARTTYPE,MODE

Assign Label:

sudo e2label /dev/sdX pucit9

Undo Label:

sudo e2label /dev/sdX ""

Format Partition to NTFS:

sudo mkfs.ntfs /dev/sdX2

Confirm NTFS Partition:

sudo blkid /dev/sdX2