

## Exercise L12 I/O and External storage

1. Of programmed I/O, interrupt-driven I/O, DMA, or channel I/O, which is not suitable for processing the I/O of a:

- a) Mouse
- b) Gamecontroller
- c) CD
- d) Thumbdriveormemorystick

Explain your answers.

Ans

Character movement based = programmed I/O, interrupt-driven I/O

Block movement based = DMA, channel I/O

- a) DMA, channel I/O not suitable for [a]
- b) DMA, channel I/O not suitable for [b]
- c) programmed I/O, interrupt-driven I/O not suitable for [c]
- d) programmed I/O, interrupt-driven I/O not suitable for [d]

2. If an address bus needs to be able to address eight devices, how many conductors will be required? What if each of those devices also needs to be able to talk back to the I/O control device?

Ans

Address eight devices

$$8 = 2^3$$

3 conductors

3. Suppose a disk drive has the following characteristics:

- 4 surfaces
- 1024 tracks per surface
- 128 sectors per track
- 512 bytes/sector
- Track-to-track seek time of 5 milliseconds
- Rotational speed of 5000 RPM.

1. a) What is the capacity of the drive?
2. b) What is the access time?

Ans

4 surfaces = 2 disks

**Capacity** = (Surfaces \* Tracks per surface \* Sectors per track \* Bytes/Sector)/MB

$$= (4 * 1024 * 128 * 512) / 2^{20}$$

$$= 256 \text{ MB}$$

**Rotation delay** = ((60 seconds/5000) \* (1000 ms[1 sec]/second))/2

$$= ((60 \text{ seconds}/5000) * (1000 \text{ ms}[1 \text{ sec}]/\text{second}))/2$$

$$= ((60/5000) * 1000 \text{ ms}[1 \text{ sec}])/2$$

$$= 6 \text{ ms}$$

**Access time** = Seek time + Rotational Delay

$$= 5 \text{ ms} + 6 \text{ ms}$$

$$= 11 \text{ ms}$$

a) **Capacity of the drive** = 256 MB

b) **Access time** = 11 ms

4. How does the organization of an SSD differ from a magnetic disc? How are they similar to a disk?

Ans

4.1) SSD different from a magnetic disk at

- 1] **Speed** (access time and transfer rates) of SSD is typically 100 times faster than magnetic disk.
- 2] **Lifetime** (reliability) of SSD is longer than magnetic disk because magnetic disk use mechanical system to access file. That cause the lifetime is shorter.
- 3] **Size** of Magnetic disk is bigger than SSD (In same price).
- 4] **The way to access** of SSD is direct access while magnetic disk is not direct access.

4.2) They are similar to a disk at

- 1] External storage (R/W)
- 2] Move in block

5. a) Which of the RAID systems described in this chapter cannot tolerate a single disk failure?  
b) Which can tolerate more than one simultaneous disk failure?

Ans

- a) Raid 0
- b) Raid 1 and Raid 6