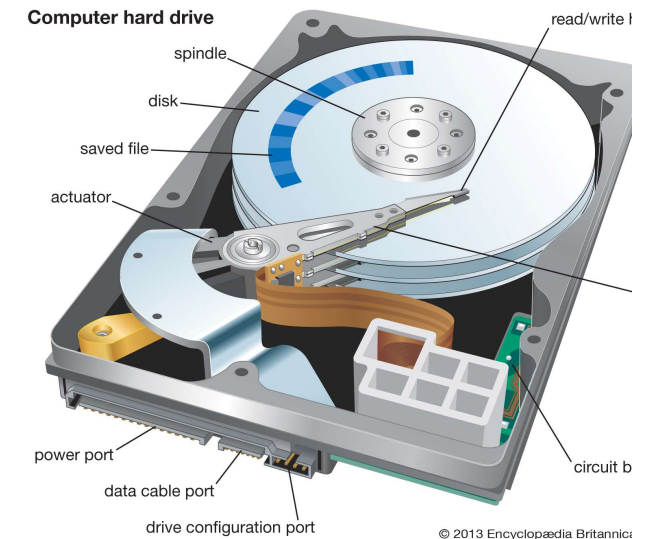


SECONDARY MEMORY

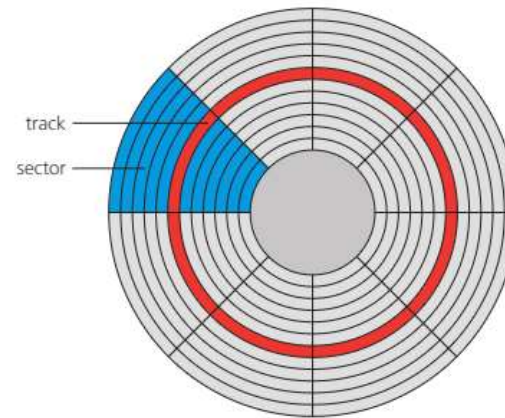
- ❖ Hard Disk Drives (HDD)
- ❖ magnetic memory
- ❖ non-volatile memory
- ❖ data is stored on the surface in sectors and tracks
- ❖ large memory storage
- ❖ cost per unit memory is cheap
- ❖ slow when compare with RAM



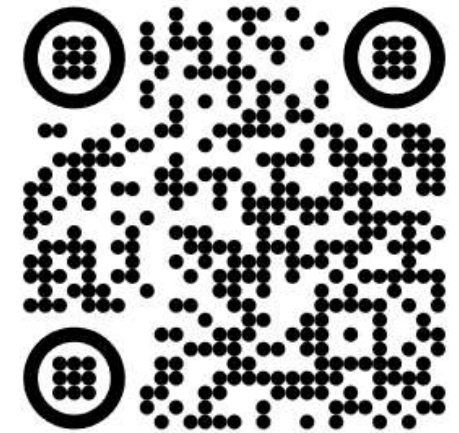
SECONDARY MEMORY

❖ How does an HDD operate?

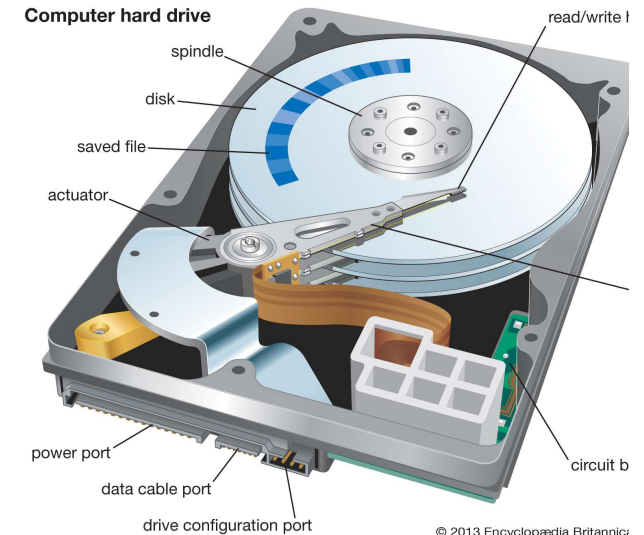
- ❖ HDD consists of several platters
- ❖ Each platter consists of several tracks
- ❖ A track has several sectors
- ❖ Motor spins the disks at very high speed (7,200 RPM)
- ❖ Read/write head moves across the disk to read/write
 - ❖ Write process
 - ❖ The write head move to the desired track and wait until the target sector comes under the head then it magnetizes substance on the platter to be south-north or north-south representing 0 and 1
 - ❖ Read process
 - ❖ The read head move to the desired track and wait until the target sector comes under the head then it reads the magnetic field and translate to 0 or 1
- ❖ most common storage in computer systems



▲ Figure 3.63 Tracks and sectors



how HDD works



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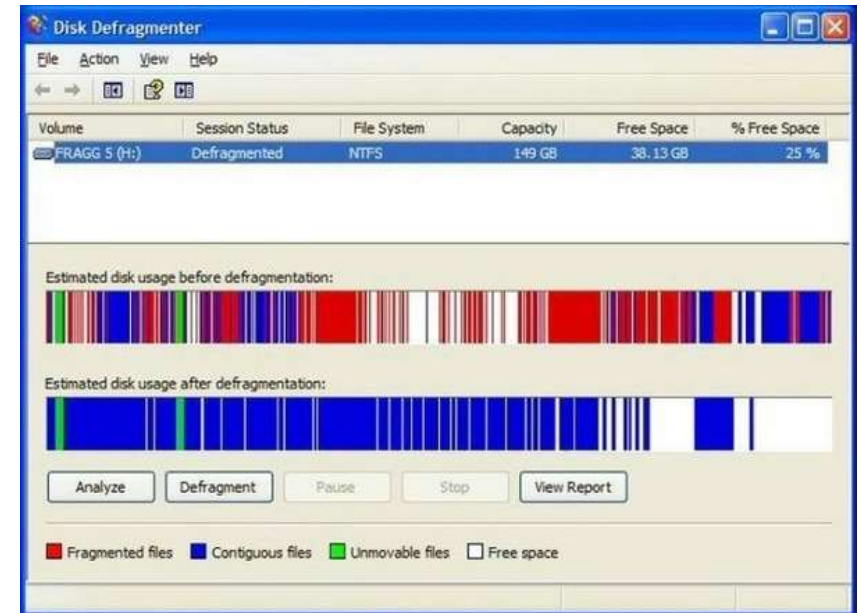
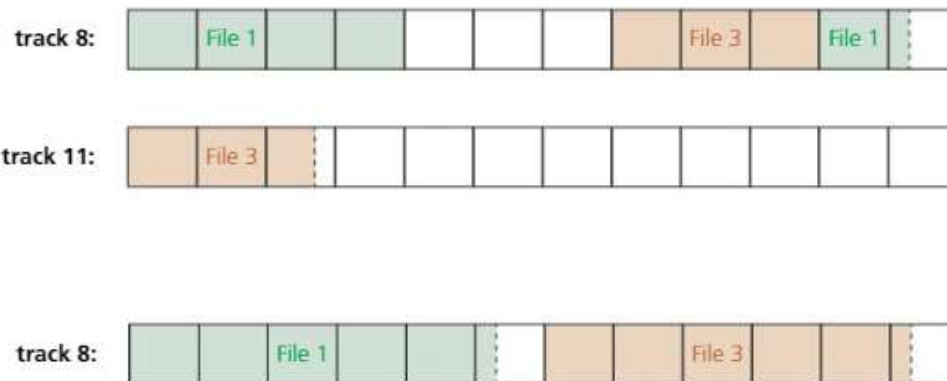
SECONDARY MEMORY

- Since HDD has much capacity, lower price and it is also non-volatile, why computers still need RAM which has low capacity, pricy and it is volatile?

SECONDARY MEMORY

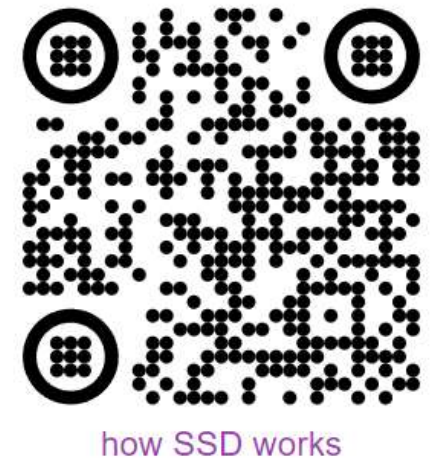
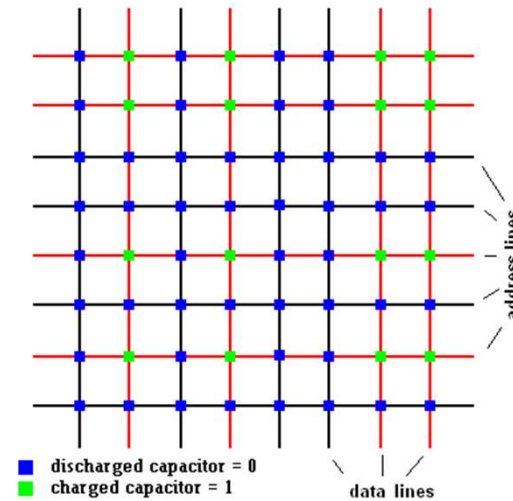
❖ Fragmentation in HDD

- ❖ Through time, the HDD will undergo numerous deletions and editing which leads to sectors becoming increasingly fragmented
- ❖ it results in a gradual deterioration of the HDD performance (in other words, it takes longer and longer to access data)



SECONDARY MEMORY

- ❖ Solid State Drives (SSD)
 - ❖ it consists several NAND flash memory
 - ❖ inside NAND flash memory, There is a grid of millions of tiny transistors
 - ❖ each transistor can capture electron (charged transistor = 1, discharged transistor = 0)



SECONDARY MEMORY

❖ Solid State Drives (SSD)

❖ The main benefits of this newer solid state technology over hard disk drives are:

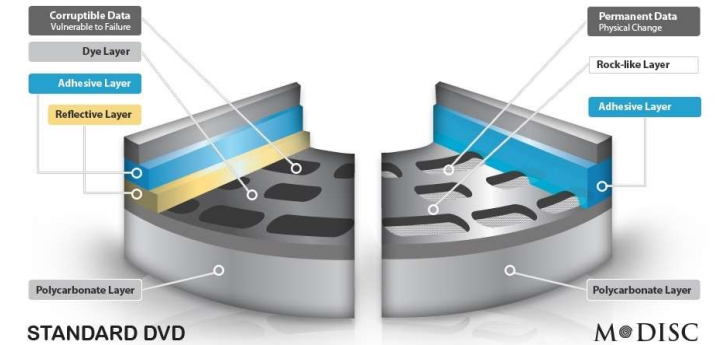
- ❖ they are more reliable (no moving parts to go wrong) (shock resistance)
- ❖ they are considerably lighter (which makes them suitable for laptops, drones)
- ❖ they have a lower power consumption
- ❖ they run much cooler than HDDs (both these points again make them very suitable for laptop computers)
- ❖ because of no moving parts, they are very thin
- ❖ data access is considerably faster than HDD.

❖ Disadvantage of SSD

- ❖ lower capacity than HDD
- ❖ more expensive than HDD
- ❖ the longevity of the technology. Most solid state storage devices are projected to read and write at only 20 GB of write operations per day over a three year period

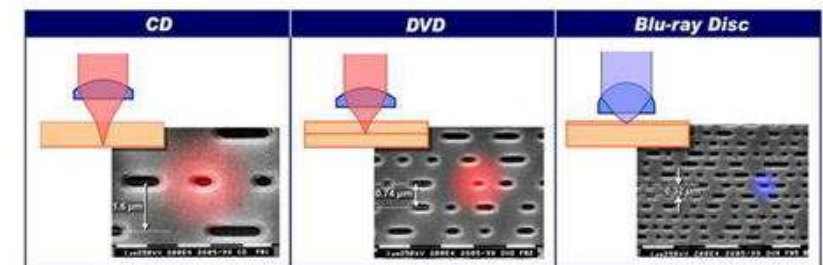
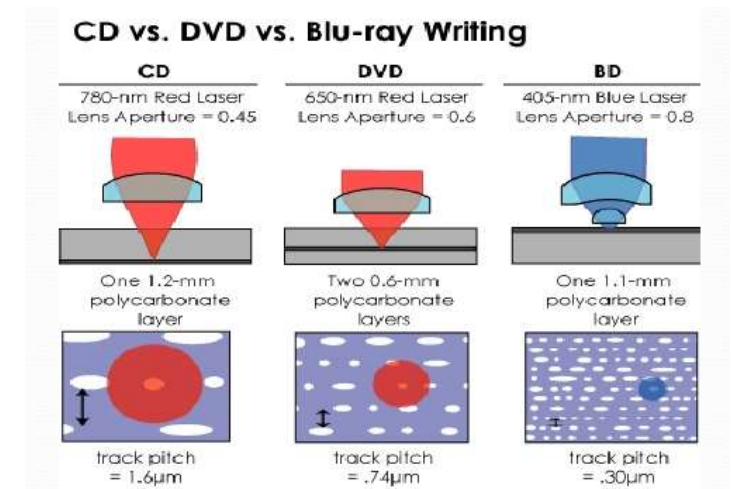
SECONDARY MEMORY— CD, DVD, BLU-RAY

- ❖ Optical media
- ❖ It uses laser(blue or red) to read and write
- ❖ How does it work?
 - ❖ Motor spins the disc
 - ❖ Write process
 - ❖ laser is used to make an area of the surface to be 'pit' and it is less reflective
 - ❖ While the area that is not the pit area is called 'land' and it more reflective than pit
 - ❖ Lands and pits are represented 0s and 1s
 - ❖ Reading process
 - ❖ Laser from the read head is used to shine on the disc, the laser is reflected differently on lands or pits, so it represents 0s and 1s



SECONDARY MEMORY— CD, DVD, BLU-RAY

- ❖ DVD technology is slightly different to that used in CDs. One of the main differences is the potential for dual-layering, which considerably increases the storage capacity
- ❖ Blu-ray uses blue laser which is smaller than red laser, so it increases number of lands and pits with the same area. As a result, it can store more data than DVD and CD



SECONDARY MEMORY— CD, DVD, BLU-RAY

▼ **Table 3.11** Comparison of CD, DVD and Blu-ray (Note: nm = 10^{-9} metres and μm = 10^{-6} metres)

Disk type	Laser colour	Wavelength of laser light	Disk construction	Track pitch (distance between tracks)
CD	Red	780 nm	single 1.2 mm polycarbonate layer	1.60 μm
DVD (dual-layer)	Red	650 nm	two 0.6 mm polycarbonate layers	0.74 μm
Blu-ray (single layer)	Blue	405 nm	single 1.2 mm polycarbonate layer	0.30 μm
Blu-ray (dual-layer)	Blue	405 nm	two 0.6 mm polycarbonate layers	0.30 μm

QUESTION

Description of storage device	Name of storage device	Category of storage		
		Primary	Secondary	Off-line
optical media which use one spiral track; red lasers are used to read and write data on the media surface; makes use of dual-layering technology to increase the storage capacity				
non-volatile memory chip; contents of the chip cannot be altered; it is often used to store the start up routines in a computer (e.g. the BIOS)				
non-volatile memory device which uses NAND flash memories (which consist of millions of transistors wired in series on single circuit boards)				
optical media which use blue laser technology to read and write data on the media surface; it uses a single 1.1 mm polycarbonate disc				

QUESTION

- ❖ Name two differences between DVDs and Blu-rays

- ❖ A security system records video footage. One minute of video requires 180 MB of storage. The recording system can store several hours of video footage. Name and describe a suitable storage device for this recording system.

QUESTION

- ❖ Complete the paragraph by choosing six correct terms from the list.
- ❖ • Optical • On-line • RAM • HDD • Primary • SSD • Secondary • ROM • Off-line
- ❖ A computer has two different types of memory. memory is not directly accessed by the CPU, but it allows a user to store data that can be accessed by softwares. Two examples of this type of memory are and The second type of memory is memory. This memory is directly accessed by the CPU. It allows the processor to access data and instructions that are stored in this memory. Two examples of this memory are and