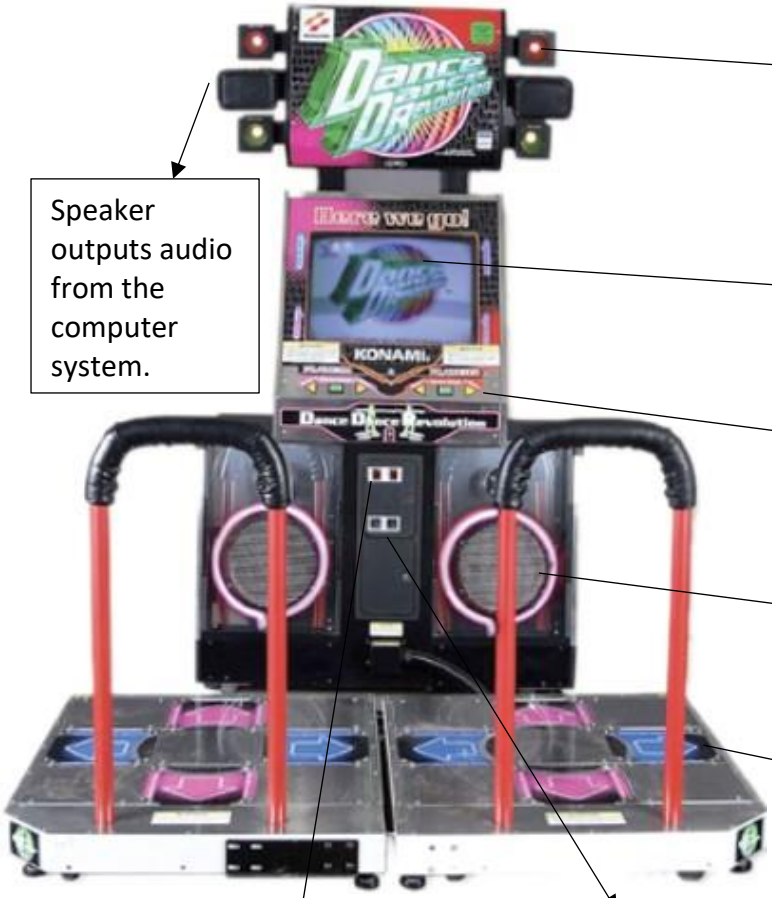
Input and Output devices



Bulbs emit a colour.
This is a form of output from the computer system.

Speaker outputs audio from the computer system.

LCD screen outputs messages, data and graphics from the computer system.

Buttons input signals into the system.

Speaker outputs sound/audio form the computer system.

Floor buttons input signals to the system.

Refund button inputs signal to the computer system.

Coins can be placed into the machine. A coin counter within the system will count these and so input data to the computer system.

Seven segment display outputs price of tickets.

LCD screen outputs data from system.

LCD screen outputs data from system.

Buttons sued to input signals into system.

Nots are dispensed from the computer system output)

LEDs output signal from computer system at note slot.

Refund button inputs signal to system.

Lottery tickets dispensed in tray (output).

Input devices: are hardware peripherals that are used to provide control signals and pass data into a system from the outside world.

Output devices: are hardware peripherals that are used to send data or signals out of a computer system to another system or user.

Storage Devices

Storage capacity:

The amount of data and instructions that can be stored in a system is measured in bytes.

- 1 bit is a single binary digit (1 or 0)
- 1 byte is comprised of 8 bits.
- ½ a byte is called a nibble. This is 4 bits.
- 1 KB = Assumed as 1000 bytes but in reality, it is 1024B
- MB = Assumed as 1000 kB but in reality is 1024 KB
- GB = Assumed as 1000MB but is actually 1024MB
- TB = 1000 GB but is actually 1024 GB

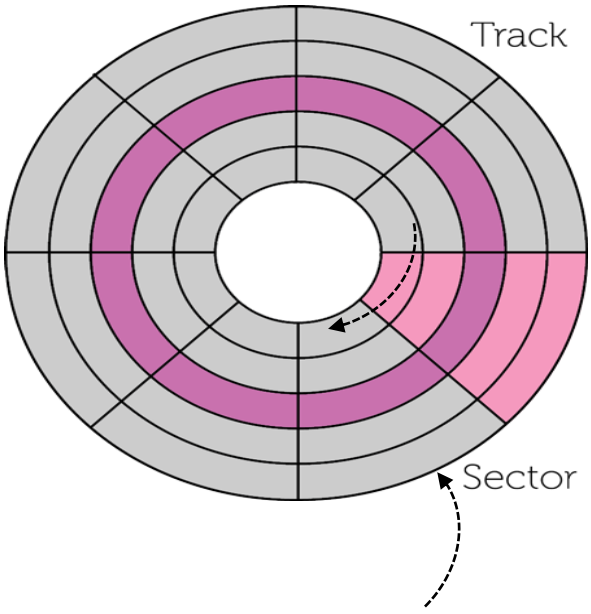
Magnetic disk:

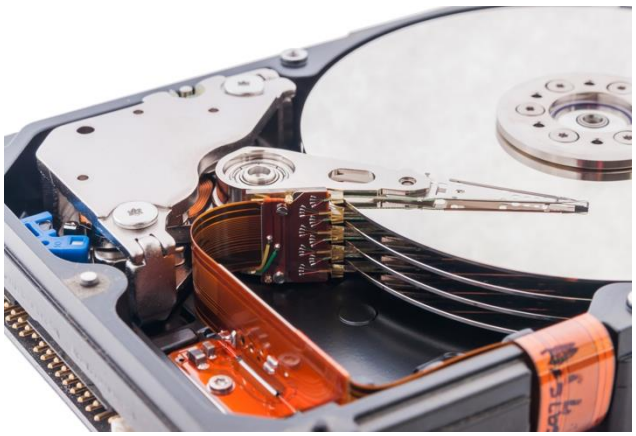
Magnetic disk: A storage device that is coated with a magnetic surface (material is called platter). Mechanical parts move over the disk surface to read and write data magnetically.

Disks **contain concentric circles called tracks** which are **split into sectors**. Disk heads mounted on **mechanical arms** read and write data.

For a **magnetic hard disk**, **the material is called a platter**. On the **magnetic surface,** there are **billions of regions** which can be **independently magnetised** to store a **1 or demagnetized** to store a **0.**
Since the regions stay in the magnetised/demagnetised state after the power is switched off, data can be stored even without power. This memory is **non-volatile**.

Examples: a floppy disk, a hard disk, or a removable cartridge.





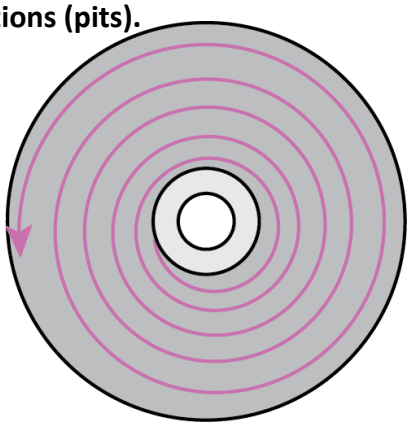
Advantages	Disadvantages
Cheap per unit capacity	Mechanical/moving parts are subject to failure on shock/damage so less portable
Available in large capacities	Larger power consumption (spinning disk)
Fast read/write speeds	Slower data access/write speeds compared to Flash/SSD
Data can be recovered by specialists even when the disk had failed	Relatively large sealed unit (disk platter/disk head)
Capacity:	500 to 3TB or more
Uses	
Personal computers, storage of vast quantities of data	

Optical Storage (disc):

Optical Disk: Data recorded onto optical discs, laser reads and writes onto disk, highly portable.

Data is stored on an optical device such as a CD/DVD using a **pattern of dots.**

Pits and lands (binary 0/binary 1) are burnt into a tight spiral track circulating outwards from the centre.
A laser beam is directed onto a spinning optical disk. The reflection beam is measured for changes. From the signal, 0s and 1s can be derived from reflections (lands) or no/poor reflections (pits).



The dots and so data remains stored on the media without any power (it is **non-volatile**).

Advantages	Disadvantages
Cheap (highly distributable)	Less storage capacity compared to other types
Very portable (light and small)	Easily scratched and corrupted by sunlight or magnets
Little physical space	Must have the appropriate reader device
Relatively durable/ not prone to shock damage	Less environmentally friendly & uneconomical for large amounts of storage
Temporary storage solution	Slow read/write speeds
	Usually ROM (Read-Only-Memory), few RW
Capacity:	CD: <720 Mb DVD: <8.4 GB, Blu-Ray <50GB
Uses	
Distributing software, songs, videos, multimedia storage, backup and archiving	

Dots can be created on a disc using a laser that marks the surface of the device. This process is called burning a disc. A DVD and a blue-ray disc are the same physical size yet the blue-ray disc holds much more data. This owes to the development in shorter wavelength lasers. They create much smaller pits, enabling a greater number to fit

on the same space so the track created can be much narrower, tighter and spiralled as a longer length.

Recordable discs use a reflective layer with a transparent dye coating that becomes less reflective when a spot laser “burns” a spot onto the track (a pit).

Rewriteable compact discs (RW) use a laser and a magnet in order to heat a spot on the disc and then set its state to become a 1 or 0 before it cools down again.
A DVD-RW uses a phase change alloy that can change between amorphous and crystalline states by changing the power/intensity of the laser beam.

Solid state storage:

Solid state disks are a form non-volatile flash memory. Data is recorded onto flash chips, no moving parts, very fast read and write speeds.

They are composed of millions of NAND flash memory cells along with a controller to manage pages and blocks of memory.
They use a special type of RAM that can retain its state once power has been disconnected. It is known as EEPROM or electronically erasable programmable read-only memory
An array of semiconductor memory is arranged on an integrated circuit within a drive. There are no moving parts as these are not needed to seek memory locations.

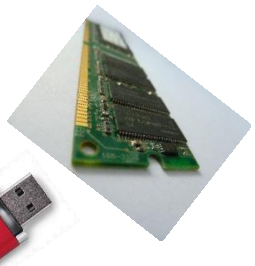
This memory has high speeds (read/write); data is physically close and easy to recover.

Advantages	Disadvantages
Extremely fast read/write	Less storage capacity compared magnetic disks due to expense
Very portable (light and small & no moving parts); prone to shock damage	Expensive at present
No noise (no moving parts)	Shorter lifespan than mechanical hard disks; limited write cycle
Uses less energy; saves battery life	
More compact/small than mechanical storage	
More durable	
Capacity:	CD: 30GB to 750GB or more
Uses	
Personal computers, laptops, portable devices (phones), PDAs (personal handheld computers), Military usage	

It is more expensive so is usually only available in smaller capacities. It is more energy efficient, reliable and compact than magnetic devices.

Note: Disc is for optical media; disk refers to disk drives like HDD/SSD

Flash memory



This uses the same technology as solid state. However, more widely available so have lower costs and are extremely portable.

Flash memory chips made up of semiconductor material within an integrated circuit. There are no moving parts.

Used in: USBS, phones, portable computers, motherboards (CMOS/BIOS), cameras, SD cards etc.