

# OCR Computer Science A Level

## 1.1.3 Input, Output and Storage

### Intermediate Notes



**Specification:**

**1.1.3 a)**

- How different input, output and storage devices can be applied to the solution of different problems.

**1.1.3 b)**

- The uses of magnetic, flash and optical storage devices.

**1.1.3 c)**

- RAM and ROM.

**1.1.3 d)**

- Virtual storage.



## Input, Output and Storage Devices

An input device is one which can be used to put data and information into a computer. Likewise, an output device is one which can be used to send information from the computer.

Examples of input devices include:

### **Keyboard**

Used to enter text into a computer

### **Webcam**

A camera used by a computer to take photos and record videos

### **Microphone**

Used to record sound in digital format

Examples of output devices include:

### **Speakers**

Used to output sound from a computer

### **Printers**

Used to output information from a computer onto paper

Important things to consider when purchasing an input device include the speed and accuracy of input. Different devices will be able to transfer data at **faster rates** or to record information in greater detail.



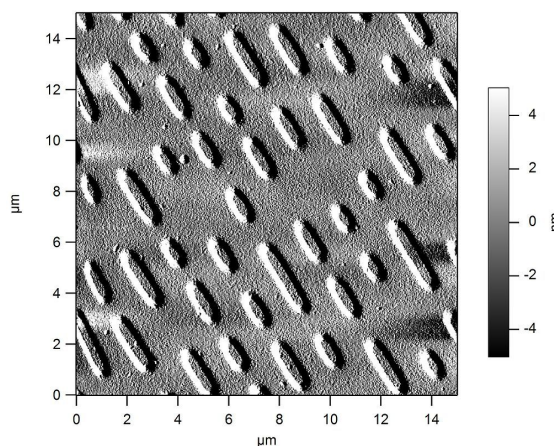
## The Use of Storage

There are a **variety of different methods** of storing information, each of which is suited to a particular type of information.

### Optical

Optical devices are read from and written to using **lasers**. Information is represented by portions of the disc which either **reflect** or **scatter** the incident laser light written in spiral tracks on the disc's surface.

A microscopic view of the surface of a CD. The portions which are recessed scatter light whereas the flat portions reflect light.



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### CDs

CD stands for **compact disc**. They use optical technology to store **small quantities** of information. Most commonly used for **audio files**, CDs are small, thin and light which makes them very portable.

Their disadvantages include being **easily damaged** by scratches, their **limited storage capacity** and **relatively slow transfer speeds**.

### DVDs

DVD stands for **digital versatile disc** or **digital video disc**. Similar to CDs, DVDs are also optical devices which have a **higher storage capacity than CDs**, making them suited to storing digital videos which require more storage space than audio files or photos.

### Blu-Ray

An advancement over DVDs, blu-ray discs have **more than five times as much storage** than traditional DVDs, making them useful for storing high-resolution films.



## Magnetic

Devices which store information magnetically represent binary information using **two magnetic states** which represent 1 and 0, allowing any information to be represented in binary form.

The most common type of magnetic storage is **hard disk drives**. However, magnetic tape (including cassette tapes) also stores information magnetically.

### Hard Disk Drives

Sometimes abbreviated to HDD, hard disk drives typically have **high capacities** of between 500GB and 5TB. They work by rotating magnetic platters at high speeds under a read/write head on an actuating arm which allows the read/write head to access any part of the platter.

Disadvantages of HDDs include their somewhat **slow data transfer speeds** and their tendency to become damaged by movement. The combination of brittle platters and moving parts results in a delicate device.

### Magnetic Tape

First used to record computer data in the 1950s, magnetic tape was a popular storage medium right through to the 1980s. Wound onto reels, long stretches of tape were passed through readers which would check the polarity of the tape and read off a binary value. Tape was a **bulky** way to store data and the technology was superseded by more modern technology.

### Floppy Disks

A floppy disk comprises a **thin magnetic disk** (which would have originally been flexible, hence the name) enclosed in plastic to protect the disk from dust and dirt. They were incredibly portable, thanks to their thin size and low weight, so became popular for exchanging small amounts of data - in a similar way to how USB flash drives are used today. Floppy disks had a typical storage capacity of 1MB.



## Flash

Flash storage is **fast and compact**. The technology makes use of silicon **semiconductors** forming the logic gates NAND and NOR to store electrical charge in one of two states: high or low. These two states represent the binary values True and False, which can be used to represent information.

### Synoptic Link

Logic gates and circuits are covered in the notes for **1.4.3 Boolean Algebra**

The preferred logic gate used for storing small quantities of data, such as code to be executed, is NOR. For larger files, like photos and videos, NAND is the preferred technology.

Flash memory can be erased and reprogrammed **electronically**, and is **non-volatile**, meaning it stores its data even when power is lost. These features make SSDs a good replacement for HDDs as they have the same functionality but improved performance.

As a general rule, flash memory is more expensive per gigabyte than other methods of data storage, like magnetic and optical.

## Solid State Drives

Often referred to as SSDs, solid state drives are currently one of the most popular forms of data storage. They are extremely **light and portable**, while having no moving parts - this makes them much more resistant to damage from movement than hard disk drives, which are packed with moving parts. Furthermore, SSDs are renowned for their high data transfer rates. The primary disadvantage of SSDs is their **cost**, which continues to decrease as they become more common.



## RAM and ROM

So far, we've seen [secondary storage devices](#), used to store user data like images and videos. RAM and ROM are two types of primary storage, used by the computer's operating system to run the computer. They store information like code instructions to execute and files which are required by running programs.

### RAM

Random access memory is a type of [fast](#) main memory used to store data and programs that the computer is currently using. This speeds up the computer's execution as RAM has higher access speeds than even flash memory. RAM is [more expensive per gigabyte](#) than secondary storage devices, so computers often have only 4 or 8 GB of RAM compared to 100s or 1000s of GB of secondary storage.

RAM is volatile, meaning that it loses its information when power is lost.

### ROM

Read only memory, as the name suggests, [cannot be modified](#). Once programmed, the state of the memory cells inside does not change. ROM is non-volatile, so it retains its data even when the computer is powered off.

## Virtual Storage

Virtual storage is the name given to storing information [remotely](#) so that it can be accessed by any computer with access to the same system, for example over the Internet. Examples of virtual storage include [cloud storage services](#) like Google Drive and Microsoft OneDrive as well as networked storage used in offices and schools.

As internet speeds increase, virtual storage is becoming a more popular method of storage thanks to the convenience of files being available "in the cloud" on any device connected to the Internet.

While virtual storage is [convenient](#) to access and share, its disadvantages include limitations of a user's network speed and [high costs](#).

