

Exercise walk-through

3.3

Data storage

IGCSE Computer Science

Input devices



keyboard



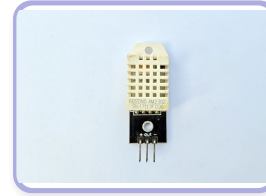
mouse



touch screen



microphone



sensor



barcode scanner

An **input** device sends data *into* the computer. A **sensor** is the one that needs no person: it measures a physical quantity and sends it as data.

The three kinds of touch screen

touch screen

detects **where** your finger touches the screen

resistive

two layers are **pressed together** where you touch – cheap, works with a glove or stylus, but less durable and no multi-touch

capacitive

senses the tiny **electric charge** of your finger – bright, durable, multi-touch, but bare skin only

infrared

your finger **breaks a grid** of light beams – works with any object and at large sizes, but sunlight interferes

Match the type to the use: capacitive for a phone, resistive for a factory where operators wear gloves, infrared for a large interactive whiteboard.

A digital camera: a lens focuses light



A flatbed scanner: it shines light across a page to copy it into the computer

A digital camera: a lens focuses light onto a sensor that records the pixels

Output devices



monitor



laser printer



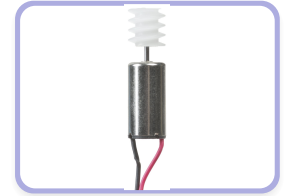
inkjet printer



3D printer



speaker



actuator

An **output** device sends data *out*. An **actuator** turns the signal into **movement** – which is how a computer acts on the world.

The output devices, by how each makes its image

LCD/LED screen

shows images using a grid of tiny coloured dots

projector

shines an **enlarged** image onto a wall or screen

**inkjet
printer**

sprays tiny drops of ink onto paper – cheap to buy, good photos, slow for long runs

laser printer

a laser and powder (**toner**) fixed onto the paper by **heat** – fast and cheap per page in bulk

3D printer

builds a **solid object** layer by layer

speaker and actuator

turn a signal into sound, or into movement in a control system

Choose the printer by **volume**: inkjet for a few high-quality pages, laser for many. That is the comparison the exam asks for.

Exercises 2.1-2.3

2.1 State whether RAM is volatile or non-volatile.

[1]

2.2 Name the three types of secondary storage.

[3]

2.3 Give one difference between RAM and ROM.

[2]

Exercises 2.1-2.3

2.1 State whether RAM is volatile or non-volatile.

[1]

2.1

- RAM loses its contents when the power is off
- it is **volatile**

2.2 Name the three types of secondary storage.

[3]

2.2

- three types of secondary storage
- **magnetic, optical, solid state**

2.3 Give one difference between RAM and ROM.

[2]

2.3

- RAM is **volatile**; ROM is **non-volatile**
- RAM holds programs and data in use; ROM holds the **start-up instructions**

Exercises 2.4-2.5

2.4 Describe how data is stored on an optical disc.

[2]

2.5 Explain what virtual memory is and why it is used.

[3]

Exercises 2.4-2.5

2.4 Describe how data is stored on an optical disc.

[2]

2.4

- a laser burns **pits** into a reflective layer along a spiral track, leaving **lands**
 - a laser reads the disc; the change between a pit and a land is the **binary data**
-

2.5 Explain what virtual memory is and why it is used.

[3]

2.5

- virtual memory is an area of **secondary storage used as though it were RAM**
- when RAM is full, unused pages are moved out to it
- more or larger programs can then run than RAM alone could hold

Exercise 3.1

3.1 ROM is used to store:

[1]

☐

A programs in use now

B the start-up instructions

C files permanently

D virtual memory

Exercise 3.1

3.1 ROM is used to store:

[1]

☐

A programs in use now

B the start-up instructions

C files permanently

D virtual memory

3.1 B

- ROM stores the **start-up (boot) instructions**
- A is RAM; C is secondary storage; D is on the hard disk

Exercise 3.2 (a)

3.2 A computer uses virtual memory.

(a) Explain what virtual memory is.

[2]

Exercise 3.2 (a)

3.2 A computer uses virtual memory.

(a) Explain what virtual memory is.

[2]

(a)

- part of secondary storage used as extra (pretend) RAM
- unused data is moved there to free RAM, so **more programs can run**

Exercise 3.2 (b)

3.2 A computer uses virtual memory.

(b) State one disadvantage of using virtual memory.

[1]

Exercise 3.2 (b)

3.2 A computer uses virtual memory.

(b) State one disadvantage of using virtual memory.

[1]

(b)

- it is **slower** (secondary storage is slower than RAM)

Exercise 3.3

3.3 State one difference between an SSD and an HDD.

[1]

Exercise 3.3

3.3 State one difference between an SSD and an HDD. [1]

3.3

- an SSD has **no moving parts** / is **faster** (an HDD uses spinning magnetic disks)

Exercise 3.4 (a)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(a) Describe how a magnetic hard disc drive stores data.

[2]

Exercise 3.4 (a)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(a) Describe how a magnetic hard disc drive stores data.

[2]

(a)

- tracks and sectors on spinning platters
- a read-write head magnetises tiny areas; the direction is a **1** or a **0**

Exercise 3.4 (b)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(b) Describe how a solid-state drive stores data.

[2]

Exercise 3.4 (b)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(b) Describe how a solid-state drive stores data.

[2]

(b)

- NAND flash with **no moving parts**
- electrons trapped in or released from cells; the state is a **1 or a 0**

Exercise 3.4 (c)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(c) Give three benefits of the solid-state drives for laptops that students carry between classes. [3]

Exercise 3.4 (c)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(c) Give three benefits of the solid-state drives for laptops that students carry between classes. [3]

(c)

- any **three** of: faster start-up and loading / no moving parts so it survives knocks / silent / lighter / uses less power so the battery lasts longer

Exercise 3.4 (d)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(d) Give one drawback of solid-state storage compared with a magnetic hard disc. [1]

Exercise 3.4 (d)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(d) Give one drawback of solid-state storage compared with a magnetic hard disc. [1]

(d)

- **costs more per gigabyte** (or each cell has a limited number of write cycles)

Exercise 3.4 (e)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(e) The laptops have 4 GB of RAM. Explain how virtual memory allows a student to open more programs than the RAM can hold, and describe what the student would notice if many programs were open.

[4]

Exercise 3.4 (e)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(e) The laptops have 4 GB of RAM. Explain how virtual memory allows a student to open more programs than the RAM can hold, and describe what the student would notice if many programs were open. [4]

(e)

- when RAM is full, unused pages are moved out to virtual memory on the drive
- that frees RAM for the program in use
- pages are moved back when needed
- the drive is much slower than RAM, so the laptop **slows down** if too many programs are open

Exercise 3.4 (f)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(f) The school also stores the students' work in cloud storage. Give two benefits and one drawback of this. [3]

Exercise 3.4 (f)

3.4 A school replaces the hard disc drives in its laptops with solid-state drives.

(f) The school also stores the students' work in cloud storage. Give two benefits and one drawback of this. [3]

(f)

- any **two** benefits: work from any device with internet / automatic backup / easy to share / school does not maintain the storage
- one drawback: needs internet / security depends on the provider / subscription cost