

Exercise walk-through

3.4

Network hardware

IGCSE Computer Science

What we will cover

- 1 The CPU & buses
- 2 The fetch–execute cycle
- 3 Input & output devices
- 4 RAM, ROM & storage
- 5 Virtual memory
- 6 Network hardware



Virtual memory, and the two kinds of address

**virtual mem-
ory**

when RAM fills, the computer uses part of **secondary storage** as extra, pretend RAM

the cost

secondary storage is far slower, so heavy use makes the machine crawl

**MAC ad-
dress MAC**

a **permanent** hardware address, set by the manufacturer, unique to the network card

IP address IP

assigned by the network, and it **changes** when the device moves

IPv4

32-bit, four denary numbers 0–255, for example 192.168.0.1

IPv6

128-bit, eight groups of hexadecimal – far more addresses, because IPv4 ran out

MAC identifies the **device**; IP identifies **where it is on the network**. A letter needs both the person and the address.

Two more devices, and where they sit

Network interface card A **network interface card** (NIC) gives a device its physical connection and its MAC address – wired or wireless.

Sensors **Sensors** are input devices that read a physical quantity continuously – temperature, light, pressure, motion – and feed an embedded system.

QR code scanner A **QR code scanner** photographs the pattern and decodes the data stored in it – a camera plus software, not a new kind of hardware.

Sort any device by what it does to data: brings it in, sends it out, stores it, or moves it between machines.

Exercises 2.1-2.3

2.1 State the function of a network interface card (NIC). [1]

2.2 State the function of a router. [1]

2.3 Identify a suitable sensor for each: an automatic door, a greenhouse watering system, a burglar alarm. [3]

Exercises 2.1-2.3

2.1 State the function of a network interface card (NIC). [1]

2.1

- a NIC is the network hardware in a device
- it lets the device **join a network and send/receive data**

2.2 State the function of a router. [1]

2.2

- a router **connects different networks** and forwards packets towards the right one

2.3 Identify a suitable sensor for each: an automatic door, a greenhouse watering system, a burglar alarm. [3]

2.3

- automatic door: **infrared / motion / pressure** sensor
- greenhouse watering: **moisture / humidity** sensor
- burglar alarm: **infrared / pressure / motion** sensor

Exercises 2.4-2.5

2.4 State the purpose of an analogue-to-digital converter in a monitoring system. [1]

2.5 Explain the difference between a monitoring system and a control system. [2]

Exercises 2.4-2.5

2.4 State the purpose of an analogue-to-digital converter in a monitoring system. [1]

2.4

- sensors give analogue readings; the microprocessor needs binary
 - the ADC **converts analogue readings into digital values**
-

2.5 Explain the difference between a monitoring system and a control system. [2]

2.5

- a **monitoring** system only records readings or gives a warning
- a **control** system also sends signals that **change the process**

Exercise 3.1

3.1 A MAC address is best described as:

[1]

☐

A given by the network and changeable

B a unique number set by the maker, identifying a device

C the same as a packet number

D a web address

Exercise 3.1

3.1 A MAC address is best described as:

[1]

☐

A given by the network and changeable

B a unique number set by the maker, identifying a device

C the same as a packet number

D a web address

3.1 B

- a MAC address is a **unique number set by the maker**
- A is an IP address; C is packet numbering; D is a URL

Exercise 3.2 (a)

3.2 A device connects to a network.

(a) State two differences between a MAC address and an IP address.

[2]

Exercise 3.2 (a)

3.2 A device connects to a network.

(a) State two differences between a MAC address and an IP address.

[2]

(a)

- MAC: set by the maker and does **not** change
- IP: given by the network and **can change**

Exercise 3.2 (b)

3.2 A device connects to a network.

(b) Explain how a router uses the IP address in a packet.

[2]

Exercise 3.2 (b)

3.2 A device connects to a network.

(b) Explain how a router uses the IP address in a packet.

[2]

(b)

- the router reads the receiver's IP address in the packet header
- it **forwards the packet towards that network**

Exercise 3.3 (a)

3.3 A car park uses a computer system to manage its spaces.

(a) Identify a suitable sensor to detect a car arriving at the barrier, and a suitable input device to read the driver's ticket. [2]

Exercise 3.3 (a)

3.3 A car park uses a computer system to manage its spaces.

(a) Identify a suitable sensor to detect a car arriving at the barrier, and a suitable input device to read the driver's ticket. [2]

(a)

- arriving car: **pressure** sensor in the road, or **infrared** across the entrance
- ticket: **barcode** / **magnetic-stripe reader**, or a keypad

Exercise 3.3 (b)

3.3 A car park uses a computer system to manage its spaces.

(b) Identify a suitable output device to tell drivers how many spaces are free. [1]

Exercise 3.3 (b)

3.3 A car park uses a computer system to manage its spaces.

(b) Identify a suitable output device to tell drivers how many spaces are free. [1]

(b)

- an **LED display** (or monitor/screen) showing free spaces

Exercise 3.3 (c)

3.3 A car park uses a computer system to manage its spaces.

(c) Describe how the microprocessor uses the sensor readings to decide whether to raise the barrier. [4]

Exercise 3.3 (c)

3.3 A car park uses a computer system to manage its spaces.

(c) Describe how the microprocessor uses the sensor readings to decide whether to raise the barrier. [4]

(c)

- the sensor sends readings continuously to the microprocessor
- the ADC converts them to digital
- the microprocessor compares the reading with "a car is waiting" and checks that free spaces > 0
- if both are true it signals the actuator to **raise the barrier** and subtracts one from the count

Exercise 3.3 (d)

3.3 A car park uses a computer system to manage its spaces.

(d) Explain why the system needs an analogue-to-digital converter.

[2]

Exercise 3.3 (d)

3.3 A car park uses a computer system to manage its spaces.

(d) Explain why the system needs an analogue-to-digital converter.

[2]

(d)

- the sensor produces a continuously varying **analogue** signal
- the microprocessor can only work with **digital** values, so the signal must be converted

Exercise 3.3 (e)

3.3 A car park uses a computer system to manage its spaces.

(e) State whether this is a monitoring system or a control system, and justify your answer. [2]

Exercise 3.3 (e)

3.3 A car park uses a computer system to manage its spaces.

(e) State whether this is a monitoring system or a control system, and justify your answer. [2]

(e)

- **control** system
- it does not only record data: it operates the barrier and **changes what happens**

Exercise 3.3 (f)

3.3 A car park uses a computer system to manage its spaces.

(f) The car park adds a camera that reads number plates. Give the name of this technology and describe one benefit for the car park. [2]

Exercise 3.3 (f)

3.3 A car park uses a computer system to manage its spaces.

(f) The car park adds a camera that reads number plates. Give the name of this technology and describe one benefit for the car park. [2]

(f)

- **ANPR** (automatic number plate recognition), a form of OCR
- benefit: no ticket so entry is faster / automatic charging / detect a stolen car