T3

Hardware

CHAPTER ASSIGNMENT · 75 MARKS

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from *Cambridge IGCSE and O Level Computer Science*, 2nd edition, David Watson and Helen Williams (Hodder Education), for classroom use.

Activities from the chapter

3.1

(1) Name three buses used in the von Neumann architecture.

(a)

(b) Describe the function of each named bus.

(c) Describe how bus width and clock speed can affect computer performance.

(2) Complete the following paragraph by using terms from this chapter: The CPU ..... data and instructions required for an application and temporarily stores them in the ..... until they can be processed. The ..... is used to hold the address of the next instruction to be executed. This address is copied to the ..... using the ..... The contents at this address are stored in the ..... Each instruction is then ..... and finally ..... by sending out ..... using the ..... Any calculations carried out are done using the ..... During any calculations, data is temporarily held in a special purpose register known as the .....

3.2

(1) (a) Explain how it is possible to increase the performance of a CPU/ microprocessor. In your explanation, include some of the risks associated with your suggestions to improve performance.

(b) What is meant by the term **instruction set**?

(2) A car is fitted with the latest GPS navigation system. This device is controlled by an embedded system in the form of a microcontroller.

(a) Describe the inputs needed by the embedded system and describe which outputs you would expect it to produce.

(b) Since updates to the GPS device are required every six months, explain how the device is updated without the need to take the car to the garage every six months.

3.3

(1) Using the data in Figure 3.14, design the barcodes for:

(a) 900340 (3 digits on the left; 3 digits on the right)

(b) 12576648 (4 digits on the left; 4 digits on the right)

(c) 0588902918 (5 digits on the left; 5 digits on the right)

(2) **(a)** Describe one advantage of using QR codes rather than traditional bar codes. Explain how barcodes bring the advantage you have described.

(b) A square QR code contains 40 × 40 tiny squares (pixels) where each tiny square represents a 0 or a 1. Calculate how many bytes of data can be stored on the QR code.

(c) Describe the purpose of the three large squares at the corners of the QR code.

(d) Describe one disadvantage of using QR codes.

3.4

(a) **(1)** Explain the main differences in operation of a laser printer compared to an inkjet printer.

(b)

(i) Name one application of a laser printer and one application of an inkjet printer.

(ii) For each of your named applications in b i, give a reason why the chosen printer is the most suitable.

(2) The nine stages in printing a page using an inkjet printer are shown below. The nine stages are NOT in the correct order. By writing the letters **A** to **I**, put each of the stages into the correct order. **A** – the data is then sent to the printer and it is stored in a temporary memory known as a printer buffer **B** – as the sheet of paper is fed through the printer, the print head moves from side to side across the paper printing the text or image; the four ink colours are sprayed in their exact amounts to produce the desired final colour **C** – the data from the document is sent to a printer driver **D** – once the printer buffer is empty, the printer sends an interrupt to the CPU in the computer; this is a request for more data to be sent to the printer; the whole process continues until the whole of the document has been printed **E** – the printer driver ensures that the data is in a format that the chosen printer can understand **F** – at the end of each full pass of the print head, the paper is advanced very slightly to allow the next line to be printed; this continues until the whole page has been printed **G** – a check is made by the printer driver to ensure that the chosen printer is available to print (e.g. is it busy, is it off-line, is it out of ink, and so on) **H** – if there is more data in the printer buffer, then the whole process from stage 5 is repeated until the buffer is finally empty **I** – a sheet of paper is then fed into the main body of the printer; a sensor detects whether paper is available in the paper feed tray – if it is out of paper (or the paper is jammed) then an error message is sent back to the computer

(3) Explain the difference between LED screens and LCD-LED backlit screens.

(a)

(b) Modern LCD screens use blue-white LEDs as backlighting. Cold cathode ray (fluorescent) tubes were used. Give three advantages of using LEDs.

(4) Filipe has music stored on his computer's backing store. He wishes to listen to his music through a pair of loudspeakers. Describe how the music, which is digitally stored can be played through his two analogue loudspeakers.

3.5

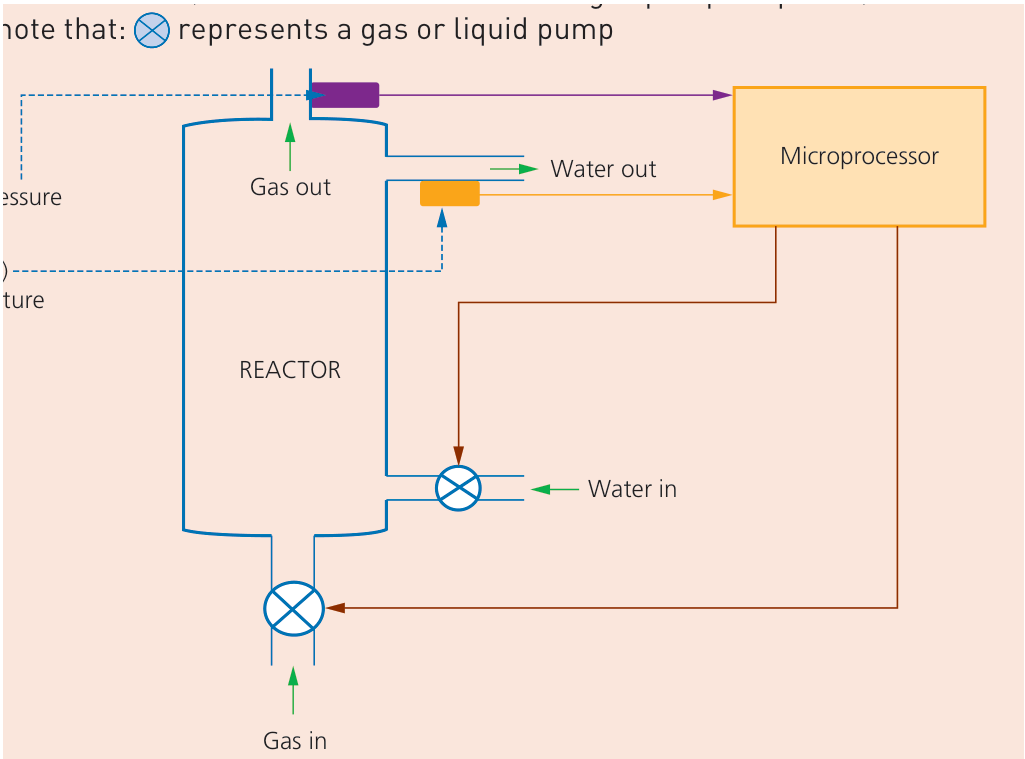
(1) An air conditioning unit in a car is being controlled by a microprocessor and a number of sensors.

(a) Describe the main differences between **control** and **monitoring** of a process.

(b) Describe how the sensors and microprocessor would be used to control the air conditioning unit in the car. Name at least two different sensors that might be used and explain the role of positive feedback in your description. You might find drawing a diagram of your intended process to be helpful.

(2) Look at Figure 3.54 and describe how the pH sensor would be used to control the acidity levels in the soil to optimise growing conditions in the greenhouse.

(3) The diagram (Figure 3.55) below shows a nuclear reactor. Two of the sensors used in the control and monitoring of the reactor are: »a temperature sensor to monitor the reactor temperature (if this exceeds 300°C then the water flow into the reactor is increased) »a pressure sensor to monitor the gas pressure of carbon dioxide circulating in the reactor (if this is less 10 bar then the gas pump is opened) »note that: (Gas) pressure sensor (Reactor) temperature sensor ▲**Figure 3.55** Describe how the sensors and microprocessor are used to maintain the correct water (reactor) temperature and gas pressure in the reactor. Name any other hardware devices you think may be needed in your description.

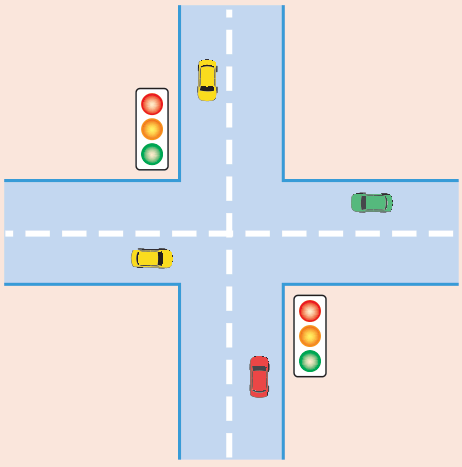


ıre 3.55

cribe how the sensors and roprocessor are used to maintain correct water (reactor) temperature gas pressure in the reactor. Name other hardware devices you think be needed in your description.

junction (Figure 3.56) is controlled raffic lights.

cribe how sensors in the road a microprocessor are used to trol the traffic at the junction. The



(4) The junction (Figure 3.56) is controlled by traffic lights. Describe how sensors in the road and a microprocessor are used to control the traffic at the junction. The microprocessor is able to change the ▲**Figure 3.56** colour sequence of the lights.

3.6

(1) Describe how ROM and RAM chips could be used in the following devices:

(a) a microwave oven

(b) a refrigerator

(c) a remote-controlled model aeroplane; the movement of the aeroplane is controlled by a hand-held device.

3.7

(1) Name two types of memory used in a mobile phone. For each named memory, describe its purpose in the mobile phone.

(2) Explain what is meant by **virtual memory**.

(a)

(b) Five programs are currently being run in a computer. Program 1 is using 10 GiB of RAM, program 2 is using 5 GiB of RAM, program 3 is using 12 GiB of RAM and program 4 is using 4 GiB of RAM. The programs are at the stage where program 5 now needs to access RAM, but RAM is presently full (RAM has a 32 GiB maximum capacity). Explain how virtual memory could be used to allow program 5 to access RAM without any of the data from the other four programs being lost.

(3) Five descriptions of computer terms are shown on the left and five terms are shown on the right. Draw lines to connect each description to the correct computer term.

storage environment where the client and remote storage provider are different companies	thrashing
high rate of HDD read/write operations causing large amount of head movement	swap space
space on HDD or SSD reserved for data used in virtual memory management	cloud storage
situation where a HDD is so busy doing read/write operations that execution of a process is halted	thrash point
method of data storage where the data is stored on hundreds of off-site servers	public cloud

(4) Give four differences between RAM and ROM chips.

(a)

(b) Give an example of the use of each type of memory.

(5) Use the following words to complete the paragraph below which describes how solid state
(a) memories work (each word may be used once, more than once or not at all). Word list: control gate NAND electrons negative floating gate positive intersection transistor matrix volatile Solid state devices control the movement of ..... within a ..... chip. The device is made up of a .....and at each ..... there is a ..... and a ..... transistor. ..... are attracted towards ..... when a voltage is applied.

(b) Give three advantages of using SSD, rather than HDD, which make SSD technology particularly suitable for use in laptop computers.

(c) Describe one disadvantage of solid state technology.

3.8

(1) Explain each of the following terms:

(a) Network interface card (NIC)

(b) MAC address

(c) IP address

(d) Router

(e) DHCP server.

(2) Give two features of dynamic IP addresses.

(a)

(b) Give two features of static IP addresses.

(c) Explain why we need both types of IP address.

(3) Describe three differences between MAC addresses and IP addresses.

Exam-style questions

1

(a) Many mobile phone and tablet manufacturers are moving to OLED screen technology. Give **three** reasons why this is happening. [3]

(b) A television manufacturer makes the following advertising claim: "Our OLED screens allow the user to enjoy over 1 million vivid colours in true-to-life vision" Comment on the validity of this claim by the manufacturer. [4]

2

(a) A company is developing a new games console. The console games will be stored on a ROM chip once the program to run the new game has been fully tested and developed.

(i) Give **two** advantages of putting the game's program on a ROM chip.

(ii) The manufacturers are also using RAM chips on the internal circuit board. Why have they done this?

(iii) The games console will have four USB ports. Apart from the need to attach games controllers, give reasons why USB ports are incorporated. [8]

(b) During development of the games console the plastic parts are being made by a 3D printer. Give **two** reasons why the manufacturer would use 3D printers. [2]

3 An air conditioning unit in a car is being controlled by a microprocessor and a number of sensors.

(a) Describe the main differences between **control** and **monitoring** of a process. [2]

(b) Describe how the sensors and microprocessor would be used to control the air conditioning unit in the car. Name at least **two** different sensors that might be used and explain the role of positive feedback in your description. You might find drawing a diagram of your intended process to be helpful. [6]

4

(a) Describe the differences between a static IP address and a dynamic IP address. Include in your explanation, why both types of IP addressing are used. [4]

(b) What is meant by a MAC address? Describe the **two** different types of MAC address. [4]

5

(a) Five statements about two types of RAM memory (DRAM and SRAM) are shown below. By drawing lines, link each statement to the correct type of RAM. [5]

the data has to be refreshed constantly in order to retain data	DRAM
this type has the more complex circuitry	
it does not need to be refreshed as long as the power supply is still on	SRAM
it requires higher power consumption which is significant when installed in battery-powered devices, such as a laptop	
it is mostly used in the cache memory of the CPU where operational speed is important	

(b) Describe **three** of the differences between RAM and ROM. [3]

(c) Compare the two optical storage devices: DVD and Blu-ray. Your answer should include: »technology differences »capacity differences »other features of the two types of storage. [6]

6

(a) Name **two** types of touchscreen technology used on mobile phones. For each named technology, describe how the position of where a finger touched the screen can be identified. [6]

(b) Organic LED (OLED) screens are now becoming increasingly common.

(i) Briefly describe the technology behind OLED screens.

(ii) Give **three** advantages of OLED screens when compared to LED/LCD screens. [3]

7 A zoo has an information point. »Visitors use a menu to select information about animals. »The menu includes 500 different animals. »The information is provided only using high definition video with an audio track.

(a) State **one** input device that could be used for the information point. [1]

(b) The output is shown on a monitor. State **one** other output device that could be used for the information point. [1]

(c) The video files are stored at the information point. State **one** secondary storage device that could be used. [1]

(d) The zoo decides to introduce Quick Response codes in different places in the zoo. These provide further information about the animals. Describe how customers obtain the information from the Quick Response codes. [4]

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8 Anna has a farm that grows fruit. She has a system that monitors the conditions for growing the fruit. Sensors are used in this system.

(a) Explain what is meant by the term **sensor**. [2]

(b) State **two** sensors that could be used in this system and describe how they could be used. [6]

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9 The diagram shows **five** output devices and **five** descriptions. Draw a line between each output device and its description. **Output device Description** [4]

Output device	Description
Inkjet printer	Flat panel display that uses the light modulating properties of liquid crystals.
LCD screen	Flat panel display that uses an array of light emitting diodes as pixels.
2D cutter	Droplets of ink are propelled onto paper.
LED screen	Electrically charged powdered ink is transferred onto paper.
Laser printer	2D High-powered laser that uses the X-Y plane. cutter

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End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/computer-science/o-level/hardware/