AQA

Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

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I declare this is my own work.

AS

COMPUTER SCIENCE

Paper 2

7516/2

Tuesday 21 May 2024 **Afternoon**

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]

JUN247516201

MATERIALS

For this paper you must have:

- **a calculator**
- **an insert.**

INSTRUCTIONS

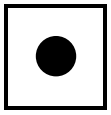
- **Use black ink or black ball-point pen.**
- **Answer ALL questions.**
- **You must answer the questions in the spaces provided. Do not write on blank pages.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**

INFORMATION

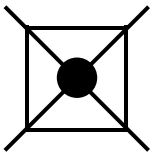
- **The marks for questions are shown in brackets.**
- **The maximum mark for this paper is 75.**

ADVICE

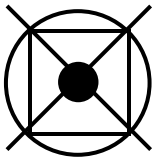
- **In some questions you are required to indicate your answer by completely shading a lozenge alongside the appropriate answer as shown.**



- **If you want to change your answer you must cross out your original answer as shown.**



- **If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown.**



DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

0 1 . 1

Describe the set of real numbers. [1 mark]

0 1 . 2

The number 5 can be written as $\frac{15}{3}$

Shade TWO lozenges to indicate which of the following statements are true. [2 marks]

○ **A 15 and 3 are NOT integers**

○ **B 15 and 3 are irrational numbers**

○ **C 5 is an irrational number**

○ **D 5 is a natural number**

○ **E 5 is a rational number**

[Turn over]

0 1 . 3

Shade ONE lozenge to indicate which of the symbols below represents the set of rational numbers. [1 mark]

○ **A** $\mathbb{C}$

○ **B** $\mathbb{N}$

○ **C** $\mathbb{Q}$

○ **D** $\mathbb{R}$

○ **E** $\mathbb{Z}$

4

0 2 . 1

Convert the bit pattern `10001010` **to hexadecimal.**
[1 mark]

0 2 . 2

Represent the decimal number 139 as an 8-BIT UNSIGNED BINARY INTEGER. [1 mark]

[Turn over]

0 2 . 3

Show how the UNSIGNED BINARY NUMBER 00100011 **can be added to the UNSIGNED BINARY NUMBER** 00101011 **without converting the numbers into decimal.**

You MUST show all your working in binary. [2 marks]

```
  0 0 1 0 0 0 1 1
+ 0 0 1 0 1 0 1 1
```

0 2 . 4

Show how the 8-BIT TWO'S COMPLEMENT BINARY INTEGER 00011100 **can be subtracted from the 8-BIT TWO'S COMPLEMENT BINARY INTEGER** 00111011 **without converting the numbers to decimal.**

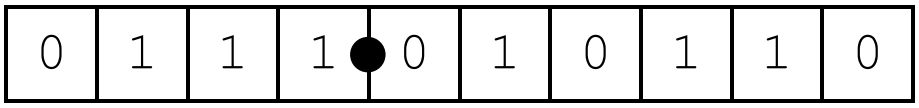
You MUST show all your working in binary. [2 marks]

[Turn over]

0 2 . 5

The bit pattern in FIGURE 1 represents a 10-BIT UNSIGNED FIXED POINT BINARY NUMBER with four bits before and six bits after the binary point.

FIGURE 1



Convert the bit pattern in FIGURE 1 to decimal.
[2 marks]

8

0 3 . 1

State the name of the component on a sound card that transforms the continuous signal received from a microphone to a form that can be stored by a computer. [1 mark]

_____

_____

_____

_____

[Turn over]

0 3 . 2

A bitmap image is 52 pixels in height and 26 pixels in width. The bitmap representation of the image requires 845 bytes.

Calculate the maximum number of colours that could be used in the bitmap image.

You should show all your working. [2 marks]

0 3 . 3

When a bitmap image is stored in a file, additional information is stored as well as the colours of the pixels. For example, the bitmap file might contain information on the date of creation, image width and height.

State the name given to this additional information when storing a bitmap image. [1 mark]

_____

_____

_____

_____

[Turn over]

0 3 . 4

A sound is recorded with a sample rate of 96 000 Hz and a sample resolution of 24 bits. The file size of the recording is 12 096 kilobytes.

A sample rate of 1 Hz means that one sample has been taken every second.

Calculate the duration of the sound recording.

You should show all your working. [3 marks]

0 3 . 5

A sample resolution of 16 bits is commonly used in audio recordings.

Explain why increasing the sample resolution from 16 bits to 24 bits can improve the quality of an audio recording. [1 mark]

[Turn over]

0 3 . 6

MIDI does not use sampling to represent music.

Describe how music is represented using MIDI.
[2 marks]

0 3 . 7

Explain ONE advantage of using MIDI instead of sampled sound to represent music. [1 mark]

11

0 4 . 1

A message is encrypted using a Caesar cipher that operates with a shift value of four. For example, the letter A **in plaintext would be represented by** E **in ciphertext.**

The ciphertext for the message is WSSDI**.**

What is the plaintext for the message? [1 mark]

0 4 . 2

Explain TWO reasons why Caesar ciphers are vulnerable to being cracked. [2 marks]

3

0 5 . 1

Shade ONE lozenge to indicate which of the following is an example of system software. [1 mark]

- ○ **A Computer game**
- ○ **B Image editor**
- ○ **C Programming language translator**
- ○ **D Video conferencing software**
- ○ **E Word processor**

0 5 . 2

An operating system manages hardware resources, for example the I/O devices associated with a computer system.

State TWO other examples of hardware resources that an operating system is responsible for managing.
[2 marks]

3

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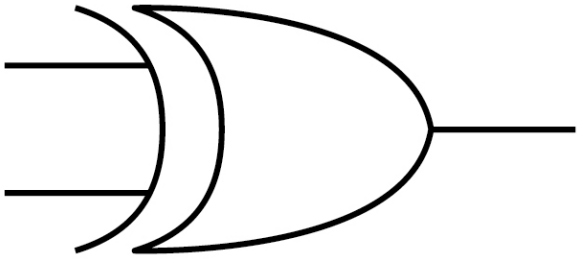
0 6 . 1

FIGURE 2 shows the symbol for a logic gate.

FIGURE 2



State the name of the logic gate shown in FIGURE 2.
[1 mark]

_____

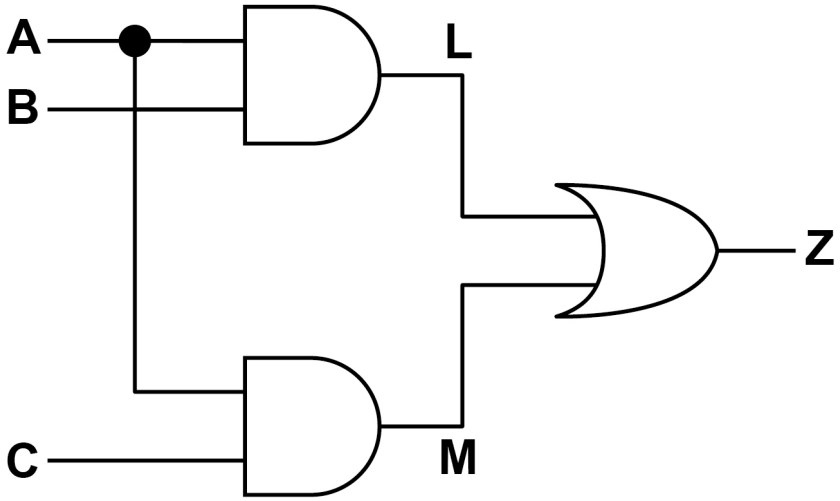
_____

[Turn over]

0 6 . 2

FIGURE 3 shows a logic circuit.

FIGURE 3



Complete the truth table for the logic circuit in FIGURE 3. [2 marks]

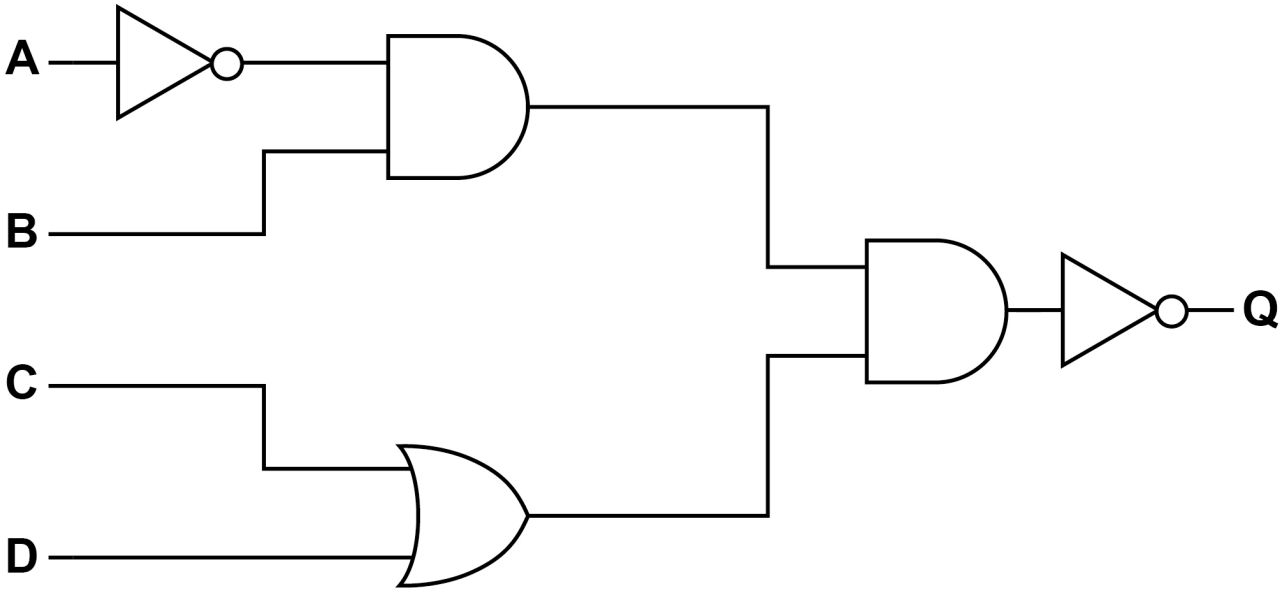
A	B	C	L	M	Z
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

[Turn over]

0 6 . 3

FIGURE 4 shows a logic circuit.

FIGURE 4



Write a Boolean expression for Q. [3 marks]

0 6 . 4

Using the rules of Boolean algebra, simplify the following expression.

$$\overline{W} \cdot X \cdot Z + W \cdot Z + X \cdot Y \cdot \overline{Z} + \overline{W} \cdot X \cdot Y \cdot 1$$

You MUST show your working. [4 marks]

Final answer _____

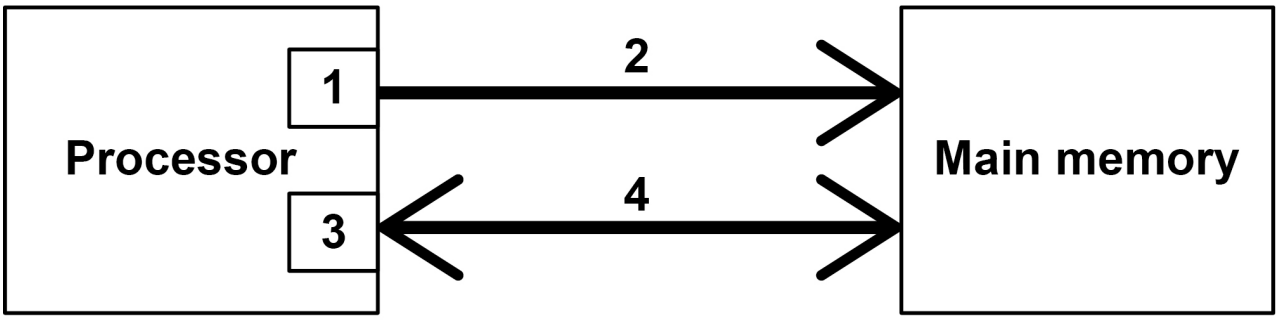
[Turn over]

10

0 7 . 1

FIGURE 5 shows some of the processor registers and buses that are used during the fetch stage of the fetch-execute cycle, together with the main memory.

FIGURE 5



State the name of the components that are labelled in FIGURE 5 with the numbers 1 to 4. In the case of register names, the full names MUST be stated.
[2 marks]

1	
2	
3	
4	

0 7 . 2

Describe the stored program concept. [2 marks]

[Turn over]

0 7 . 3

In a particular processor instruction set, each instruction consists of an opcode and an operand. An operand could be an immediate value to be used by a program.

State TWO other types of value that can be stored in an operand. [2 marks]

0 7 . 4

Computer A and Computer B both have a processor with a clock speed of 2.8 GHz but Computer A performs tasks much faster than Computer B. Computer A has a larger cache and greater word length than Computer B.

Explain why the larger cache and greater word length are possible factors for the performance difference between Computer A and Computer B. [2 marks]

Larger cache _____

_____

_____

_____

Greater word length _____

_____

_____

_____

[Turn over]

8

TABLE 1, provided in the separate insert, shows the standard AQA assembly language instruction set that should be used to answer question 0 8

0 8

Registers `R1` **and** `R3` **each store a different positive number.**

Write a program using the standard AQA assembly language in TABLE 1, provided in the separate insert, that will:

- **store the greater of these two numbers in** `R1`
- **store** `1` **in** `R2` **if the value originally in** `R1` **is greater than the value in** `R3`**, storing** `3` **in** `R2` **otherwise.**

[4 marks]

[Turn over]

4

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[Turn over]

0 9 . 1

RFID tags can be read by an RFID reader.

Describe how data is read from an RFID tag. [3 marks]

0 9 . 2

An RFID tag can be active or passive. A passive tag must be moved within a few centimetres of an RFID reader to be read. An active tag will have its own power source, which allows it to be read from a greater distance.

It is decided that RFID tags will be used in passports to store personal information.

Explain why passive tags are likely to be a more appropriate choice than active tags for use in passports. [2 marks]

[Turn over]

5

1 0

A smartphone company has designed a device that can be put into items such as luggage to help locate these items if they are lost. The device works by sending an encrypted signal containing its current location to nearby smartphones. The smartphones relay the signal to the company's servers via the Internet, allowing a user to see the device's exact location using a mobile phone app.

The company expects to sell hundreds of millions of devices. The data collected from each device will be permanently kept in secondary storage on the company's servers. The company is planning to use solid-state drives in the servers that will hold device location data but is unsure whether using solid-state drives is a good idea.

Discuss a range of moral, ethical, legal and cultural issues raised by the new device AND explain the properties of solid-state drives that the company should consider when deciding on a secondary storage technology.

In your answer you will be assessed on your ability to follow a line of reasoning to produce a coherent, relevant and structured response. [12 marks]

[Turn over]

[Turn over]

12

1 1 . 1

Describe the difference between baud rate and bit rate. [2 marks]

1 1 . 2

A photographer wants to create a large file sharing network to allow thousands of photographers to share their photos with each other for free.

State TWO reasons why the photographer may choose to use a peer-to-peer network rather than a client-server network. [2 marks]

1 1 . 3

Explain the purpose of a Service Set Identifier (SSID). [1 mark]

_____

_____

_____

_____

[Turn over]

1 1 . 4

Explain how disabling SSID broadcasting can increase the security of a wireless network. [2 marks]

END OF QUESTIONS

7

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

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For Examiner's Use	
Question	Mark
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