AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS
COMPUTER SCIENCE

Paper 2

Friday 9 June 2017 Morning Time allowed: 1 hour 30 minutes

Materials
You will need no other materials.
You may use a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- 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. ⊗

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Answer **all** questions in the spaces provided.

0 1

0 1 . 1 Shade in **one** lozenge to indicate which of the symbols represents the set of rational numbers.

[1 mark]

ℚ ⬭ ℝ ⬭ ℤ ⬭ ℕ ⬭

0 1 . 2 Shade in **one** lozenge to indicate which of the symbols represents the set of numbers that does **not** include **all** of the numbers -3, 4 and 9.

[1 mark]

ℚ ⬭ ℝ ⬭ ℤ ⬭ ℕ ⬭

0 1 . 3 Shade in **one** lozenge to indicate which of the symbols represents the set of numbers that is most suitable for measuring the circumference of a ball.

[1 mark]

ℚ ⬭ ℝ ⬭ ℤ ⬭ ℕ ⬭

3

Turn over for the next question

0 2 **Figure 1a** and **Figure 1b** show two bit patterns.

Figure 1a

0	0	0	1	0	1	1	1

Figure 1b

0	0	0	0	0	1	1	0

0 2 . 1 Explain how unsigned binary integers can be converted to hexadecimal.

You should illustrate in your explanation how the bit pattern in **Figure 1a** would be converted.

[2 marks]

0 2 . 2 If **Figure 1a** and **Figure 1b** both represent unsigned binary integers, what is the **binary result** of adding the two numbers together?

[1 mark]

Answer: _____

0 2 . 3 If **Figure 1a** and **Figure 1b** both represent unsigned binary integers, what is the **binary result** of multiplying the two numbers?

You **must** show your working.

[2 marks]

Answer: _____

0 2 . 4 Indicate clearly on **Figure 2** where the binary point must be placed so that the value 19.375 is represented.

[1 mark]

Figure 2

1	0	0	1	1	0	1	1

0 2 . 5 **Figure 3** is a 7-bit ASCII character to be transmitted across a network. The system uses odd parity with the parity bit being transmitted in the MSB (Most Significant Bit).

Calculate the parity bit and write it in the empty cell in **Figure 3**.

[1 mark]

Figure 3

	0	1	0	1	0	1	1

Turn over ►

0 2 . 6 When transmitting data across a network some systems use majority voting rather than a parity bit.

State **one** advantage of using majority voting over a parity bit **and** explain how this advantage is achieved.

[2 marks]

9

0 3 A band is recording and digitising a song to make available as a download from their website.

0 3 . 1 The song lasts 3 minutes. The sample resolution is 16 bits and a sample rate of 44 kHz has been used.

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

Calculate the minimum amount of storage space, in megabytes (MB), needed to store the song in an uncompressed format.

You **must** show your working.

[3 marks]

Answer: _____

0 3 . 2 The song is being recorded using a microphone plugged into the sound card of the computer. The sound card contains an analogue to digital converter (ADC).

Describe the steps the ADC goes through in this process.

[3 marks]

0 3 . 3 The band have been advised to save their song using lossless compression.

Explain why it might be appropriate for the band to save the song using lossless compression rather than using lossy compression.

[2 marks]

8

0 4

0 4 . 1 Explain the differences between an interpreter and a compiler.

[4 marks]

0 4 . 2 A company is using a newly-developed processor in its latest microwave oven. A software developer is writing the program to control the oven.

The developer chose to use **assembly language** rather than a high-level language to write the program.

Explain why the developer may have made this decision.

[3 marks]

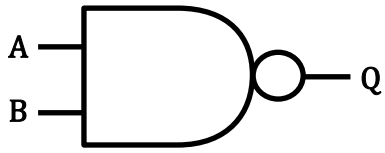
7

Turn over for the next question

0 5

Figure 4

A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0



0 5 . 1 What is the name of the logic gate represented by the truth table and symbol shown in **Figure 4**?

[1 mark]

0 5 . 2 Complete the truth table below to prove that $\mathbf{A} + \overline{\mathbf{B}}$ is equivalent to $\overline{\overline{\mathbf{A}} \cdot \mathbf{B}}$

[3 marks]

A	B					
0	0					
0	1					
1	0					
1	1					

0 5 . 3 Using the laws of Boolean algebra, simplify the following Boolean expression.

$$(\mathbf{X} + \mathbf{Y}) \cdot (\mathbf{X} + \overline{\mathbf{Y}})$$

You **must** show your working.

[4 marks]

Answer: _____

8

Turn over for the next question

0 6 The two most common computer architectures are **Harvard** and **von Neumann**.

0 6 . 1 Describe **one** difference between the way the Harvard and von Neumann architectures operate.

[2 marks]

0 6 . 2 Shade **one** lozenge to indicate the type of computer architecture that is typically used for digital signal processing.

[1 mark]

Harvard	⬭	**von Neumann**	⬭

0 6 . 3 Describe, using full sentences, the steps involved in the Fetch-Execute cycle for the von Neumann architecture. Your description should cover the fetch, decode and execute stages **and** must clearly state which of the three sections each step falls in.

[6 marks]

Turn over for the next question

9

0 7 **Table 1 – standard AQA assembly language instruction set**. This should be used to answer question parts **0 7 . 1** and **0 7 . 2**

`LDR Rd, <memory ref>`	Load the value stored in the memory location specified by `<memory ref>` into register `d`.
`STR Rd, <memory ref>`	Store the value that is in register `d` into the memory location specified by `<memory ref>`.
`ADD Rd, Rn, <operand2>`	Add the value specified in `<operand2>` to the value in register `n` and store the result in register `d`.
`SUB Rd, Rn, <operand2>`	Subtract the value specified by `<operand2>` from the value in register `n` and store the result in register `d`.
`MOV Rd, <operand2>`	Copy the value specified by `<operand2>` into register `d`.
`CMP Rn, <operand2>`	Compare the value stored in register `n` with the value specified by `<operand2>`.
`B <label>`	Always branch to the instruction at position `<label>` in the program.
`B<condition> <label>`	Branch to the instruction at position `<label>` if the last comparison met the criterion specified by `<condition>`. Possible values for `<condition>` and their meanings are: `EQ`: equal to `NE`: not equal to `GT`: greater than `LT`: less than
`AND Rd, Rn, <operand2>`	Perform a bitwise logical AND operation between the value in register `n` and the value specified by `<operand2>` and store the result in register `d`.
`ORR Rd, Rn, <operand2>`	Perform a bitwise logical OR operation between the value in register `n` and the value specified by `<operand2>` and store the result in register `d`.
`EOR Rd, Rn, <operand2>`	Perform a bitwise logical XOR (exclusive or) operation between the value in register `n` and the value specified by `<operand2>` and store the result in register `d`.
`MVN Rd, <operand2>`	Perform a bitwise logical NOT operation on the value specified by `<operand2>` and store the result in register `d`.
`LSL Rd, Rn, <operand2>`	Logically shift left the value stored in register `n` by the number of bits specified by `<operand2>` and store the result in register `d`.
`LSR Rd, Rn, <operand2>`	Logically shift right the value stored in register `n` by the number of bits specified by `<operand2>` and store the result in register `d`.
`HALT`	Stops the execution of the program.

Labels: A label is placed in the code by writing an identifier followed by a colon (:). To refer to a label the identifier of the label is placed after the branch instruction.

Interpretation of `<operand2>`

`<operand2>` can be interpreted in two different ways, depending on whether the first character is a # or an R:

- `#` – use the decimal value specified after the `#`, eg `#25` means use the decimal value 25.
- `Rm` – use the value stored in register `m`, eg `R6` means use the value stored in register 6.

The available general purpose registers that the programmer can use are numbered 0 to 12.

0 7 . 1 **Figure 5** shows an incomplete assembly language program. The intended purpose of the code is to count from 1 to 10 inclusive, writing the values to memory location 17, which is used to control a motor.

Complete the code in **Figure 5**. You may not need to use all four lines for your solution and you should not write more than one instruction per line.

[4 marks]

Figure 5

```
            MOV R0, #1
startloop:

            STR R0, 17

            _____________________

            _____________________

            _____________________

            _____________________

endloop:

            HALT
```

0 7 . 2 `R1` contains the decimal value 7. What value will be contained in `R1` after the instruction below is executed?

```
LSL R1, R1, #2
```

[1 mark]

0 7 . 3 Explain the difference between direct addressing and immediate addressing.

[1 mark]

6

Turn over ►

0 8 Devices can communicate using either parallel or serial transmission.

Parallel transmission sends many bits at the same time whilst serial transmission only sends one bit at a time.

0 8 . 1 Describe **two** reasons why serial transmission might be preferred to parallel transmission.

[4 marks]

0 8 . 2 In the context of networking, define the following terms.

[2 marks]

Bit rate:

Latency:

0 8 . 3 Explain how disabling SSID (Service Set Identifier) broadcasting can increase the security of a wireless network.

[2 marks]

0 8 . 4 Explain how the use of a MAC (Media Access Control) address white list can increase the security of a wireless network.

[2 marks]

10

Turn over for the next question

0 9 Google have a service called Street View which allows a user to view surroundings from street-level. Google have extended their Street View service to cover the inside of buildings such as museums and sports stadiums.

Discuss a range of ethical, legal and cultural issues that Google may have needed to deal with when extending the service.

[9 marks]

Turn over for the next question

9

1 0 A laser printer has a representation of an image stored in its memory.

Describe how it prints this image on to a piece of paper.

[6 marks]

6

END OF QUESTIONS