



Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

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AS

COMPUTER SCIENCE

Paper 2

7516/2

Friday 24 May 2019

Morning

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]



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.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**

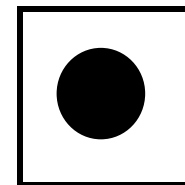
INFORMATION

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

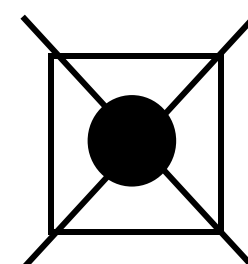


ADVICE

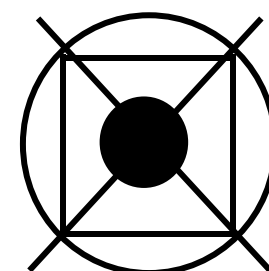
- In some questions you are required to indicate your answer by completely shading a lozenge alongside the appropriate answer as shown.



- 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

Explain the difference between the set of natural numbers and the set of integer numbers. [1 mark]

0	1	.	2
---	---	---	---

Explain the difference between rational and irrational numbers. [1 mark]

[Turn over]

—
2

0	2	.	1
---	---	---	---

Convert the bit pattern shown below into hexadecimal. [1 mark]

1	0	1	1	0	1	1	1
---	---	---	---	---	---	---	---

0	2	.	2
---	---	---	---

Explain why programmers often use hexadecimal to represent bit patterns instead of binary. [1 mark]

0 2 . 3

The bit pattern below represents an unsigned fixed-point binary number with five bits before and five bits after the binary point.

Convert the binary number into decimal. [2 marks]

1	0	0	1	1	●	1	0	0	0	1
---	---	---	---	---	---	---	---	---	---	---

[Turn over]



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0	2	.	4
---	---	---	---

Explain how the two's complement binary integer 00100111 can be subtracted from the two's complement binary integer 01001001 without converting the numbers into decimal.
[2 marks]

[Turn over]

6



0 3 . 1

The bit pattern 00111000 is the character code for the numeric character '8'

The bit pattern 00001000 represents the decimal number 8

Explain how a computer could convert the character code for '8' to the bit pattern for its corresponding decimal value. [1 mark]

03.2

ASCII and Unicode are two common information coding systems.

Explain why Unicode was introduced as an alternative to ASCII. [2 marks]

[Turn over]

3

0	4	.	1
---	---	---	---

Sampling with an 8-bit sample resolution means that each sample can be approximated to one of 256 different levels.

**If the sample resolution is increased to 10 bits, how many MORE levels are available for approximating samples?
[1 mark]**

0	4	.	2
---	---	---	---

A sound lasts 3 minutes and 20 seconds. It is sampled at a 44.1kHz sample rate with a 16-bit sample resolution.

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



Calculate the minimum amount of storage space, in megabytes (MB), needed to store the sampled sound.

**You should show your working.
[3 marks]**

Answer: _____

[Turn over]

4

0 5

A computer system can be defined as hardware and software working together.

0 5 . 1

**What is meant by the term hardware?
[1 mark]**

05.2

**What is meant by the term software?
[1 mark]**

[Turn over]

05.3

Explain the key difference between system software and application software. [2 marks]

0	5	.	4
---	---	---	---

Some of the following types of software are examples of system software.

Shade in TWO lozenges to indicate which types of software are system software. [2 marks]

Compiler

Photo editor

Spreadsheet

Computer game

Operating system

Word processor

[Turn over]

<hr/>
6



0	6	.	1
---	---	---	---

State the name of the logic gate represented by the truth table shown in FIGURE 1. [1 mark]

FIGURE 1

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

Answer: _____

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[Turn over]



06.2

A factory has a machine for filling bottles on a conveyor belt.

- **Q represents the signal to move the conveyor belt on. When Q is set to true the belt will move on.**
- **A is a sensor which outputs true if a bottle is present.**
- **B is a sensor which outputs true if a bottle is full.**
- **C is a sensor which outputs true if a bottle is correctly positioned.**
- **D is a sensor which outputs true if the next section has a bottle in it.**

The conveyor belt is able to move if both of these conditions are true:

- **a bottle is full and correctly positioned or there is no bottle present**
- **there is no bottle in the next section.**

In the box below, draw a logic circuit for the machine. [3 marks]



[Turn over]

0	6	.	3
---	---	---	---

De Morgan's laws can be applied to enable a combination of logic gates to be replaced by a single gate that produces the same output.

What single gate could replace the combination of gates in the expression $\overline{\overline{A} \cdot \overline{B}}$? [1 mark]

0 6 . 4

Using the rules and identities of Boolean Algebra, simplify the following Boolean expression.

$$A \cdot (A + C) \cdot \bar{A} + \overline{\bar{A} \cdot \bar{A} \cdot B} \quad \text{[4 marks]}$$

[Turn over]

<hr/> 9



0	7
---	---

When the processor writes data to the main memory it will make use of the address, control and data buses.

**Explain how EACH of these buses will be used during this WRITE process.
[4 marks]**

[Turn over]

<hr/>
4

0	8
---	---

Modern computers often come with hard disks and solid-state disks (SSD) but no optical disk drives.

0	8	.	1
---	---	---	---

Explain why computers often have both of these types of storage rather than just having a hard disk or just having an SSD. [2 marks]

0	8	.	2
---	---	---	---

Explain why it is faster to access data from solid state storage than from an optical disk. [2 marks]

[Turn over]

<hr/>
4



0	9
---	---

Three students share a house when they go to university and have set up a peer-to-peer network between their computers for sharing files and playing multi-user games.

0	9	.	1
---	---	---	---

**Explain why a peer-to-peer network might be a better choice for the students than a client-server network.
[2 marks]**

0 9 . 2

Define the term 'protocol'. [1 mark]

[Turn over]

09.3

Define the term 'baud rate'. [1 mark]

09.4

Define the term 'bandwidth'. [1 mark]

0 9 . 5

Discuss how encrypting data with WPA/WPA2, disabling SSID broadcasting and MAC address whitelisting could enhance the security of a WiFi network. [3 marks]

[Turn over]



0	9	.	6
---	---	---	---

When transmitting data, the wireless network uses the following systems:

- **Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) with Request to Send/Clear to Send (RTS/CTS)**
- **Majority Voting.**

Explain the process the transmitting device will go through to transmit data and what the receiving device would then do when it receives data. [8 marks]

[Turn over]



09.7

Explain an advantage that majority voting has over using parity bits when transmitting data. [1 mark]

[Turn over]

17

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

1	0	.	1
---	---	---	---

1	0
---	---

FIGURE 2, on the opposite page, shows an algorithm, written in pseudo-code, that is used to multiply two variables W and X together. The resulting answer is stored in variable Y . It can be assumed that both W and X are positive integers. Z is a temporary variable. The operation DIV performs integer division.

Line numbers are included but are not part of the algorithm.

FIGURE 2

```
1  W ← 9
2  X ← 12
3  Y ← 0
4  REPEAT
5      Z ← W LOGICAL BITWISE AND 1
6      IF Z = 1 THEN
7          Y ← Y + X
8      END IF
9      W ← W DIV 2
10     X ← X * 2
11 UNTIL W = 0
```

[Turn over]

1	0	.	1
---	---	---	---

Write a sequence of assembly language instructions that perform multiplication using the same method shown in FIGURE 2 on page 37.

Assume that registers 0, 1, 2 and 3 are used to store the values represented by variables W , X , Y and Z accordingly.

Some lines, including those equivalent to line numbers 1 to 5 in FIGURE 2, have been completed for you. [7 marks]

39

```
MOV R0, #9  
MOV R1, #12  
MOV R2, #0
```

```
startloop: AND R3, R0, #1
```

```
jump:
```

```
B startloop
```

```
endloop:
```

[Turn over]



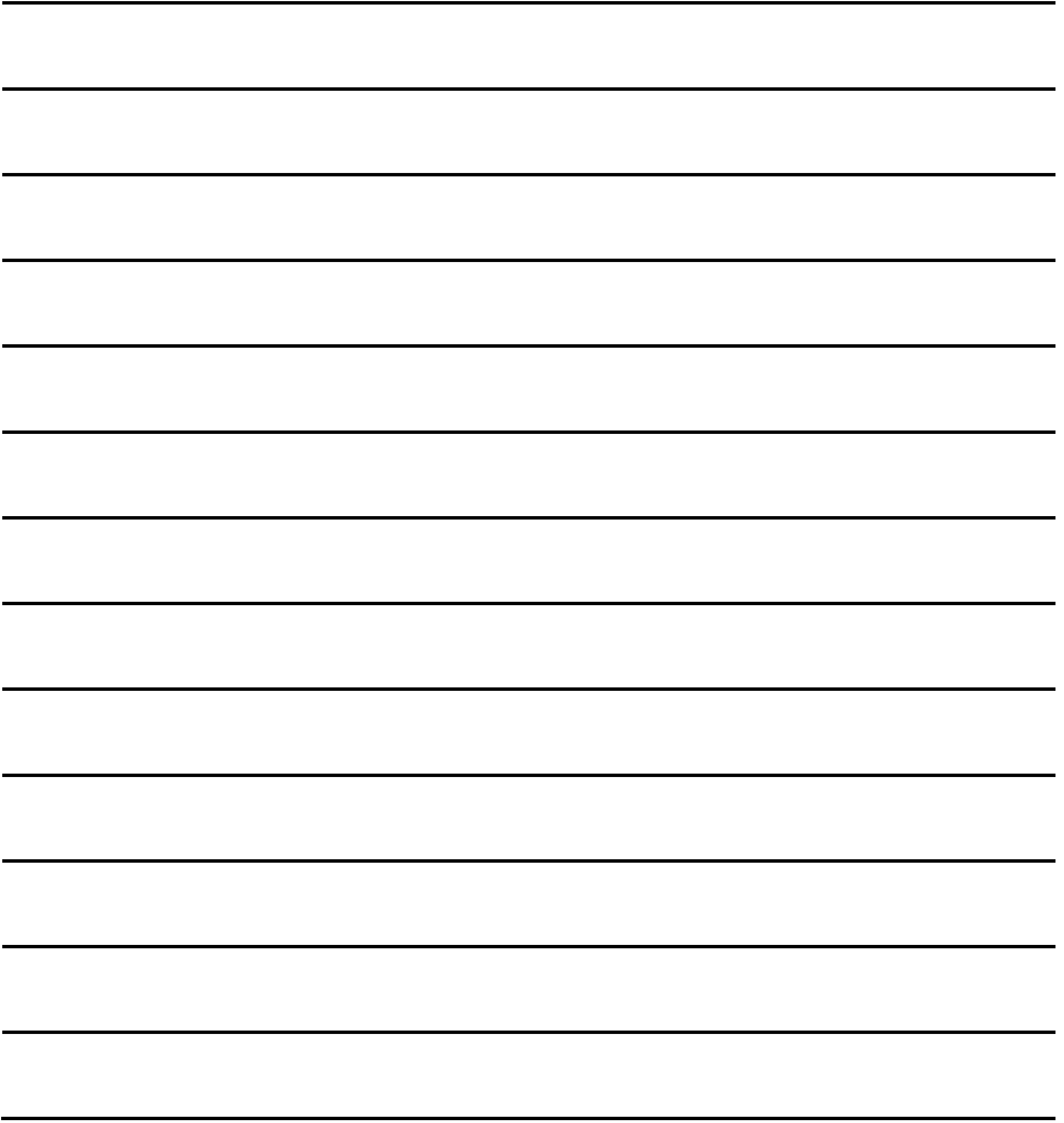
10.2

**Describe TWO differences between machine code and assembly language.
[2 marks]**

10.3

Assemblers and compilers are two different types of translator.

**Describe ONE similarity and ONE difference between the role of an assembler and the role of a compiler.
[2 marks]**



[Turn over]

11

1	1
---	---

There have been some cases where law enforcement officers have requested a phone manufacturer to bypass access restrictions on a phone that they believe contains evidence of criminal activity. The manufacturers frequently refuse to do so.

Discuss a range of ethical and legal issues raised by the manufacturer agreeing or refusing to bypass access restrictions to the contents of the phone.

In your answer you will be assessed on your ability to follow a line of reasoning to produce a coherent, relevant and structured response. [9 marks]

[Turn over]



END OF QUESTIONS

9



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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
TOTAL	

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