A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

A-level

COMPUTER SCIENCE

Paper 2

7517/2

Time allowed: 2 hours 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]

BLANK PAGE

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.**
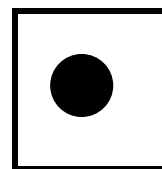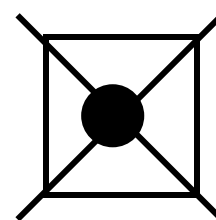
[Turn over]

INFORMATION

- **The marks for questions are shown in brackets.**

- **The maximum mark for this paper is 100.**

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.**
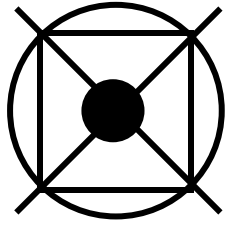
DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions.

| 0 | 1 | . | 1 |

Describe how a 12-bit unsigned binary integer such as `010010101110` **can be converted directly into hexadecimal.**

The method you describe must NOT involve converting into decimal.
[2 marks]

_____

_____

_____

_____

_____

_____

_____

_____

0 1 . 2

State ONE reason why hexadecimal is often used in preference to binary.
[1 mark]

_____

_____

_____

_____

[Turn over]

3

| 0 | 2 | . | 1 |

A data communications system uses parallel data transmission.

Describe how parallel data transmission works. [2 marks]

_____

_____

_____

_____

_____

_____

_____

0 2 . 2

State ONE advantage of serial data transmission over parallel data transmission. [1 mark]

_____

_____

_____

_____

[Turn over]

0 2 . 3

Shade ONE lozenge to indicate which of these statements about data communications systems is FALSE.
[1 mark]

○ **A For a particular communications channel, the bit rate can be higher than the baud rate.**
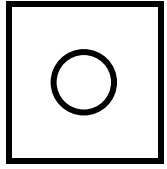
○ **B Latency is the rate at which signals on a wire or line can change.**

○ **C The bandwidth of a transmission medium is the range of signal frequencies that the medium can transmit without a significant reduction in signal strength.**

○ **D** **The greater the bandwidth of a transmission medium the higher the bit rate that can be achieved by a communication system using it.**

0 2 . 4

State the purpose of the START BIT in asynchronous serial transmission.
[1 mark]

_____

_____

_____

_____

[Turn over]

0 2 . 5

State the purpose of the STOP BIT in asynchronous serial transmission.
[1 mark]

_____

_____

_____

_____

6

BLANK PAGE

[Turn over]

| 0 | 3 | . | 1 |

Complete the truth table in FIGURE 1 for the inputs A and B. [1 mark]

FIGURE 1

A	B	$A + B$	$\overline{A}$	$\overline{B}$	$\overline{A} \cdot \overline{B}$	$\overline{\overline{A} \cdot \overline{B}}$
0	0					
0	1					
1	0					
1	1					

0	3	.	2

The truth table in FIGURE 1 demonstrates the correctness of an important law in Boolean algebra.

State the name of the law. [1 mark]

_____

_____

_____

_____

[Turn over]

0	3	.	3

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

$$\overline{\overline{A} + B \cdot C + B \cdot \overline{C}} + C \cdot (A + \overline{A} \cdot (B + 1))$$

You MUST show your working. [4 marks]

Working _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____

[Turn over]

$$\boxed{\begin{array}{c} \\ \hline 6 \end{array}}$$

0 4 . 1

Define the term 'system software'.
[1 mark]

_____

_____

_____

_____

0 4 . 2

The list below contains five types of software. Four of the types are examples of system software.

Shade ONE lozenge to indicate which type of software is NOT system software. [1 mark]

◯ **A Assemblers**

◯ **B Bitmap image editors**

◯ **C Interpreters**

◯ **D Libraries**

◯ **E Utility programs**

[Turn over]

0 4 . 3

Describe TWO functions of an operating system. [2 marks]

Function 1_____

_____

_____

_____

Function 2_____

_____

_____

_____

4

BLANK PAGE

[Turn over]

0 5 . 1

FIGURE 2 shows a number stored using a FIXED POINT representation and TWO'S COMPLEMENT, with six bits before and four bits after the binary point.

FIGURE 2

| 1 | 0 | 1 | 1 | 0 | 0 ● 1 | 0 | 1 | 1 |

Convert the number in FIGURE 2 to decimal.

You should show your working.
[2 marks]

_____

_____

_____

_____

_____

_____

_____

Answer _____

[Turn over]

0 5 . 2

**State TWO reasons why values stored using a FLOATING POINT representation are usually stored in normalised form.
[2 marks]**

Reason 1 _____

_____

_____

_____

Reason 2 _____

_____

_____

_____

BLANK PAGE

[Turn over]

Questions 05.3, 05.4 and 05.5 use a NORMALISED floating point representation with an 8-bit mantissa and a 4-bit exponent, both stored using TWO'S COMPLEMENT.

| 0 | 5 | . | 3 |

FIGURE 3 shows a floating point representation of a number.

FIGURE 3

0●1	1	0	1	1	0	0

Mantissa

1	0	0	1

Exponent

Calculate the decimal equivalent of the number.

Express your answer as a fraction or to 4 decimal places.

You should show your working.
[2 marks]

_____

_____

_____

_____

_____

_____

_____

Answer _____

[Turn over]

Questions 05.3, 05.4 and 05.5 use a NORMALISED floating point representation with an 8-bit mantissa and a 4-bit exponent, both stored using TWO'S COMPLEMENT.

| 0 | 5 | . | 4 |

Write the normalised floating point representation of the decimal value –23.25 in the boxes on the opposite page.

You should show your working.
[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer

	•						

Mantissa

Exponent

[Turn over]

Questions 05.3, 05.4 and 05.5 use a NORMALISED floating point representation with an 8-bit mantissa and a 4-bit exponent, both stored using TWO'S COMPLEMENT.

| 0 | 5 | . | 5 |

FIGURE 4 shows the closest possible representation of the decimal number –0.22558594 in this floating point system.

FIGURE 4

| 1 •1 | 0 | 0 | 0 | 1 | 1 | 0 |
Mantissa
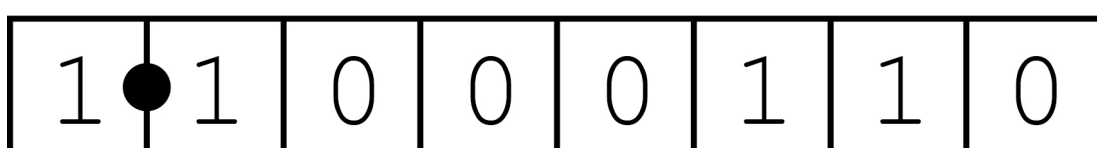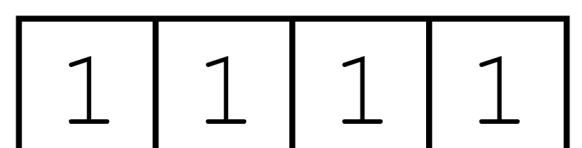
| 1 | 1 | 1 | 1 |
Exponent

By converting this number back to decimal it can be seen that the actual value stored is –0.2265625

Calculate the RELATIVE ERROR that has occurred when representing –0.22558594

You should show your working.

Express your answer as a percentage to 2 decimal places. [2 marks]

_____

_____

_____

_____

_____

_____

Answer _____

[Turn over]

11

0	6

Supermarkets often gather information about their customers and the purchases that they make. This information can be analysed by the supermarket and other companies for a range of purposes.

Some of the information is collected at the checkout, where the identity of the person is read from a loyalty or payment card using RFID (radio-frequency identification) and a barcode reader is used to identify the products being purchased.

By analysing the purchases that a shopper has made, it might be possible to identify such things as whether the shopper has children, is pregnant, or lives in a house with a garden. Other types of analysis might include the amount of money a customer spends, the times that they choose to shop at

and the differences in shopping habits of different groups of shoppers.

Describe the principles of operation of the hardware used to collect the information AND discuss some of the ethical and legal issues that might arise as a result of the capture and processing of this data.

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

0	7

The information for Question 7 and FIGURE 5 are on pages 2 to 4 of the insert. Read this information before answering the question.

0 7 . 1

Shade ONE lozenge to identify which of the properties below DOES NOT HAVE TO BE TRUE for a fully normalised database. [1 mark]

○ **A Each attribute in a relation is dependent on the primary key.**

○ **B Each attribute in a relation is dependent only on the primary key; it is not also dependent on any other attribute in the relation.**

○ **C The primary key in each relation consists of only one attribute.**

○ **D There are no repeating groups (or equivalently each attribute is atomic).**

[Turn over]

| 0 | 7 | . | 2 |

FIGURE 6 is an incomplete entity-relationship diagram for part of the database shown in FIGURE 5.

Draw lines on FIGURE 6 to indicate the degree of the TWO relationships between the three entities shown in the entity-relationship diagram.   [2 marks]
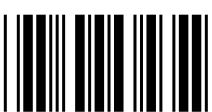
FIGURE 6

| Animal | | AnimalLocation |

| Zoo |

BLANK PAGE

[Turn over]

0 7 . 3

Complete the following SQL statement to create the Animal relation, including the key field. [3 marks]

```
CREATE TABLE Animal (_____
```

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____)

[Turn over]

| 0 | 7 | . | 4 |

There is a requirement to identify all of the red pandas that were present at the zoo called 'Ashdale Park' at any time between 01/04/2020 and 31/05/2020, inclusive.

The animals might still be at the zoo or may have moved to another zoo.

Write a query that will list all the red pandas that were at the zoo on any day between these dates.
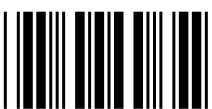
For each red panda on the list, the animal's individual name and the date that the animal arrived at the zoo, and no other fields, should be listed. [7 marks]

_____

_____

_____

BLANK PAGE

| 0 | 7 | . | 5 |

It is proposed that an additional attribute, ZooName, is added to the Animal relation. This will store the name of the zoo that currently has the animal. No other changes would be made to the database.

Describe ONE ADVANTAGE and ONE DISADVANTAGE of adding this new attribute to the relation. [2 marks]

Advantage _____

_____

_____

_____

_____

_____

_____

Disadvantage _____

_____

_____

_____

_____

_____

_____

[Turn over]

15

0 8

A student is setting up a small computer network in their house. The network will link together the laptops, desktop computers and mobile devices that belong to the people who live in the house.

0 8 . 1

Compare how peer-to-peer networking and client-server networking work.
[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

0 8 . 2

**Explain why a peer-to-peer system would be most appropriate to use in the house.
[3 marks]**

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

0 8 . 3

When a person in the house uses the network to load a webpage it is likely that the Domain Name Server (DNS) system will be used.

Describe the main purpose of the DNS system AND how it works. [3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

9

TABLE 1 is provided on pages 6 to 13 of the insert. TABLE 1 is included so that you can answer Questions 09.1 and 09.2.

| 0 | 9 |

FIGURE 7, provided on page 14 of the insert, shows an assembly language program that has been written using the AQA Assembly Language Instruction Set, which is given in TABLE 1 on pages 6 to 13 of the insert.

| 0 | 9 | . | 1 |

State the name of the addressing mode used in the instruction `ADD R3, R3, R0`   **[1 mark]**

_____

_____

BLANK PAGE

[Turn over]

0 9 . 2

Memory location 120 contains the value 23 and memory location 121 contains the value 5.

Complete the trace table, on the opposite page, to show how the contents of the memory locations and registers change when the program in FIGURE 7 is executed. [5 marks]

MEMORY LOCATIONS			REGISTERS			
120	**121**	**122**	**R0**	**R1**	**R2**	**R3**
23	5					

[Turn over]

0 9 . 3

State the purpose of the program in FIGURE 7. [1 mark]

_____

_____

_____

_____

| 0 | 9 | . | 4 |

The program in FIGURE 7 has been written using assembly language.

State TWO reasons why the programmer may have chosen to write this program in assembly language rather than in a high-level programming language.
[2 marks]

Reason 1 _____

_____

_____

_____

Reason 2 _____

_____

_____

_____

[Turn over]

0 9 . 5

The program in FIGURE 7 will be translated into machine code.

Explain the relationship between an assembly language instruction and a machine code instruction. [1 mark]

_____

_____

_____

_____

10

BLANK PAGE

[Turn over]

1 0 . 1

A digital recording was made using a sampling rate of 44 100 Hz with a 16-bit sample resolution.

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

The file, which stores only the recording, is 17.199 megabytes in size.

Calculate the duration of the recording in seconds.

You should show your working.
[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____ **seconds**

[Turn over]

1 0 . 2

MIDI is a system that can be used to enable musical devices to communicate and to represent music on a computer.

Describe the advantages of using MIDI to represent music instead of using sampled sound. [3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

6

1 1

Compare the hardware requirements of thin-client and thick-client computing systems. [3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

$\dfrac{}{3}$

| 1 | 2 |

The information for Question 12 and FIGURE 8 are on pages 16 and 17 of the insert. Read this information before answering the question.

| 1 | 2 | . | 1 |

Shade ONE lozenge to indicate which of the listed functions from FIGURE 8 includes a higher-order function in its definition.   [1 mark]

○ **A** `fu`

○ **B** `fv`

○ **C** `fx`

○ **D** `fy`

1 2 . 2

Shade TWO lozenges to indicate which of the listed functions from FIGURE 8 use recursion in their definitions.
[1 mark]

| ○ | **A** `fu` |

| ○ | **B** `fv` |

| ○ | **C** `fw` |

| ○ | **D** `fx` |

[Turn over]

1 2 . 3

Calculate the results of making the function calls listed in TABLE 2, using the functions and list in FIGURE 8 as appropriate.   [4 marks]

TABLE 2

FUNCTION CALL	RESULT
fu 50	
fv temps	
fw temps	
fz temps	

1 2 . 4

Explain the purpose of the function `fz`.
[1 mark]

_____

_____

_____

_____

[Turn over]

1 2 . **5**

It is proposed that the definition of the function `fz` **is changed to:**

```
fz d = fu (fy (d))
```

Explain why this new definition of `fz` **could be considered to be an improvement over the definition of** `fz` **in FIGURE 8. [1 mark]**

_____

_____

_____

_____

8

1 3 . 1

Below is a definition of a term relating to the architecture of a computer system:

Machine code instructions stored in main memory are fetched and executed serially by a processor that performs arithmetic and logical operations.

Shade ONE lozenge to indicate which term this defines. [1 mark]

○ **A The Harvard architecture**

○ **B The processor instruction set**

○ **C The stored program concept**

○ **D The von Neumann architecture**

[Turn over]

1 3 . 2

Explain why desktop computers usually have secondary storage devices.
[2 marks]

_____

_____

_____

_____

_____

_____

_____

13.3

A computer is fitted with a solid-state disk (SSD).

Describe the principles of operation of an SSD. [4 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.
Write the question numbers in the
left-hand margin.

BLANK PAGE