

A



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]



JUN 22 7517 201

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.

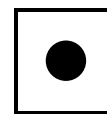
INFORMATION

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.

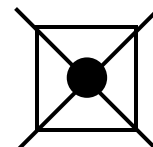


ADVICE

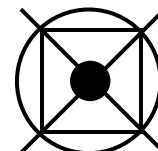
- In some questions you are required to indicate your answer by completely shading a lozenge alongside the appropriate answer as shown.



- 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]



02.3

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]

0	2	.	5
---	---	---	---

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

[Turn over]

6



03.1

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

FIGURE 1

A	B	$A + B$	\bar{A}	\bar{B}	$\bar{A} \cdot \bar{B}$	$\overline{\bar{A} \cdot \bar{B}}$
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]

6



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



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 _____



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[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 below.

You should show your working. [3 marks]



Answer

●							
---	--	--	--	--	--	--	--

Mantissa

--	--	--	--

Exponent

[Turn over]

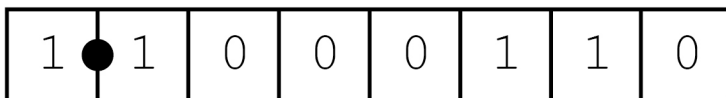


Questions 05.3, 05.4 and 05.5 use a **NORMALISED** floating point representation with an 8-bit mantissa and a 4-bit exponent, both stored using **TWO'S COMPLEMENT**.

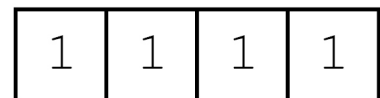
05.5

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

FIGURE 4



Mantissa



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]



[illegible]

[Turn over]



[illegible]

[illegible]

[Turn over]





[Turn over]

12



0	7
---	---

The information for Question 7 and FIGURE 5 are on pages 2 to 3 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]

<input type="radio"/>

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

<input type="radio"/>

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.

<input type="radio"/>

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

<input type="radio"/>

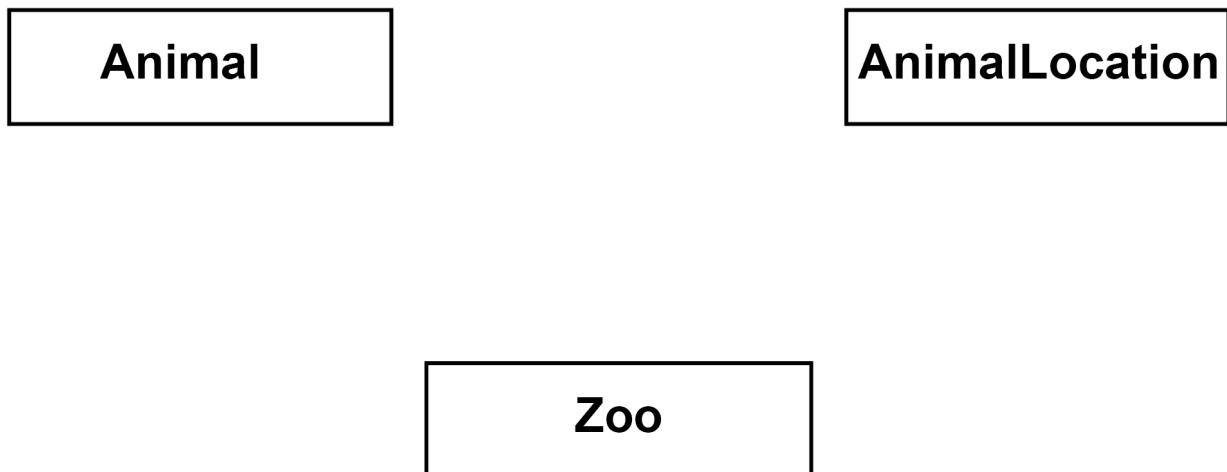
D There are no repeating groups (or equivalently each attribute is atomic).

07.2

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



[Turn over]



0	7	.	3
---	---	---	---

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

```
CREATE TABLE Animal (

```



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]

[Turn over]





[Turn over]



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]

[illegible]

[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]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

[Turn over]

<hr/> <p>9</p>



**TABLE 1 is provided on pages 4 to 7 of the insert.
TABLE 1 is included so that you can answer Questions
09.1 and 09.2.**

09

**FIGURE 7, provided on page 8 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 4 to 7 of the insert.**

09.1

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

09.2

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

Complete the trace table 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 _____

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]

[Turn over]

10



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]

<hr/>
6



1	1
---	---

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

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[Turn over]

<hr/>
3



1	2
---	---

The information for Question 12 and FIGURE 8 are on pages 10 and 11 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]

<input type="radio"/>

A f_u

<input type="radio"/>

B f_v

<input type="radio"/>

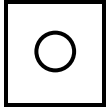
C f_x

<input type="radio"/>

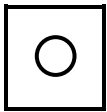
D f_y

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

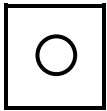
Shade TWO lozenges to indicate which of the listed functions from FIGURE 8 use recursion in their definitions. [1 mark]



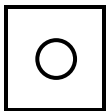
A f_u



B f_v



C f_w



D f_x

[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 f_z . [1 mark]

1 2 . 5

It is proposed that the definition of the function f_z is changed to:

$$f_z(d) = f_u(f_y(d))$$

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

[Turn over]

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



1	3	.	2
---	---	---	---

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

[Turn over]



$$\boxed{1} \boxed{3} . \boxed{3}$$

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

**Describe the principles of operation of an SSD.
[4 marks]**

[illegible]

END OF QUESTIONS

<hr/>
7



Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

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For Examiner's Use	
Question	Mark
1	
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TOTAL	

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