Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

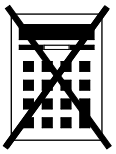
Candidate signature _____

I declare this is my own work.

GCSE
COMPUTER SCIENCE

Paper 2 Computing Concepts

Time allowed: 1 hour 45 minutes



Materials
- There are no additional materials required for this paper.
- You must **not** use a calculator.

Instructions
- Use black ink or black ball-point pen. Use pencil only for drawing.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
- 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 total number of marks available for this paper is 90.

Advice

For Examiner's Use	
Question	Mark
1–2	
3	
4–5	
6–7	
8–11	
12–13	
14	
15–16	
17	
18	
TOTAL	

For the multiple-choice questions, completely fill in the lozenge alongside the appropriate answer.

CORRECT METHOD  WRONG METHODS 

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. 

Answer **all** questions.

Do not write outside the box

0 1 . 1 Convert the binary number `11010100` into decimal.

[1 mark]

0 1 . 2 Convert the binary number `10111001` into hexadecimal.

You should show your working.

[2 marks]

0 1 . 3 State the largest decimal number that can be represented using 6 bits.

[1 mark]

0 2 . 1 Add together the following three binary numbers and give your answer in binary.

[2 marks]

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

Do not write outside the box

0 2 . 2 Apply a binary shift three places to the right on the bit pattern `10101000`

Give the result using 8 bits.

[1 mark]

The arithmetic effect of applying a left binary shift of two to a binary number is to multiply that number by four.

0 2 . 3 State the arithmetic effect of applying a left binary shift of four to a binary number.

[1 mark]

0 2 . 4 State the arithmetic effect of applying a left binary shift of three followed by a right binary shift of five to a binary number.

[1 mark]

9

Turn over for the next question

Do not write outside the box

0 3 . 1 Complete the truth table for the XOR logic gate.

[1 mark]

A	B	A XOR B
0	0	
0	1	
1	0	
1	1	

0 3 . 2 A game uses three sensors.

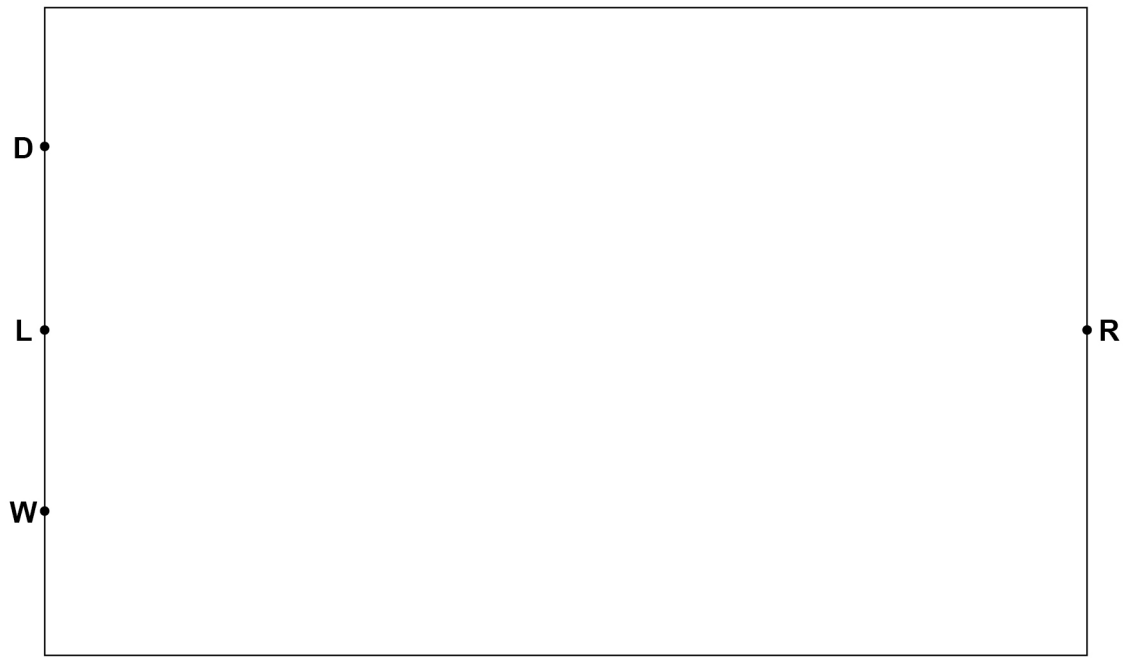
A red light (**R**) in the game switches on if **all** of the following conditions are true:

- sensor **D** is off
- sensor **L** is on
- sensor **W** is on.

Complete the logic circuit for this game.

You **must** use the correct symbols for the logic gates.

[3 marks]



Do not write outside the box

0 3 . 3 Another circuit in the game will output True if any two sensors are activated or if all three sensors are activated. This has been represented as the Boolean expression:

$$(W \,.\, D) + (D \,.\, L) \,.\, (W \,.\, L)$$

The expression contains an error.

Shade **one** lozenge that shows the expression with the error corrected.

[1 mark]

A $(W \,.\, D) \,.\, (D \,.\, L) \,.\, (W \,.\, L)$ ⬭

B $\left(\overline{W} \,.\, D\right) \,.\, (D \,.\, L) + (W \,.\, L)$ ⬭

C $(W \,.\, D) + (D \,.\, L) + (W \,.\, L)$ ⬭

D $\left(\overline{W} \,.\, D\right) + (D + L) \,.\, (W \,.\, L)$ ⬭

0 3 . 4 A green light (**G**) in the game switches on if **all** of the following conditions are true:

- sensor **D** is off
- sensor **L** is off
- sensor **W** is on.

Write a Boolean expression for this logic circuit.

You **must** use Boolean expression operators in your answer.

[3 marks]

G = _____

_____

—
8

Turn over for the next question

Do not write outside the box

0 4 . 1 Describe what is meant by the terms system software and application software.

[2 marks]

System software _____

_____

_____

Application software _____

_____

_____

0 4 . 2 State **four** functions of an operating system.

[4 marks]

1 _____

_____

2 _____

_____

3 _____

_____

4 _____

_____

Do not write outside the box

0 5 An autonomous vehicle is controlled by a computer system, senses its environment and requires no input from a human driver.

Discuss the legal and ethical impacts that need to be considered when replacing manual, human-driven vehicles with autonomous vehicles.

[6 marks]

12

Do not write outside the box

0 6 Programming languages can be classified as low-level or high-level.

Shade **two** lozenges to show the statements that are true about code written using a low-level language instead of a high-level language.

[2 marks]

A The code more closely resembles English. ⬭

B The code is easier to write. ⬭

C The code is not translated using a compiler. ⬭

D The code is quicker to write. ⬭

E The code can directly manipulate computer registers. ⬭

F The code never needs to be translated before being executed. ⬭

Do not write outside the box

0 7 Assemblers and interpreters are two types of program translator.

0 7 . 1 State the purpose of an assembler.

[1 mark]

0 7 . 2 Explain how an interpreter works.

[4 marks]

7

Turn over for the next question

Do not write outside the box

0 8 State **two** reasons why computers have more RAM than cache memory.

[2 marks]

1 _____

_____

2 _____

_____

0 9 . 1 Data is increasingly being stored 'in the cloud'.

State **two** advantages of using cloud storage instead of local storage.

[2 marks]

1 _____

_____

2 _____

_____

0 9 . 2 Many new computers use solid-state storage for secondary storage rather than magnetic storage.

Explain why solid-state storage is **not** fitted to every new computer.

[2 marks]

_____

_____

_____

_____

Do not write outside the box

1 0 How many bits are there in two kilobytes?

Show your working.

[2 marks]

Answer _____ bits

1 1 The ASCII value for the character x is the decimal number 120

Complete **Table 1** with the missing ASCII and Unicode values.

[2 marks]

Table 1

Character	ASCII value	Unicode value
w		
x	120	
y		
z		

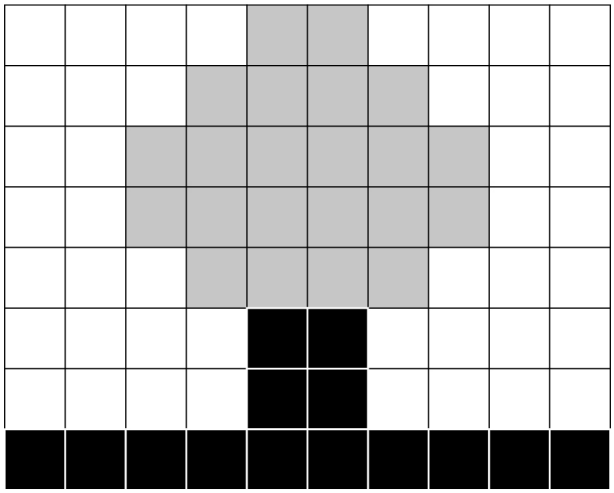
10

Turn over for the next question

Do not write outside the box

1 2 **Figure 1** shows a 10 x 8 bitmap image that uses three colours.

Figure 1



Calculate the minimum file size that would be required to store the bitmap image in **Figure 1**.

Give your answer in **bytes**.

Show your working.

[3 marks]

Answer _____ bytes

Do not write outside the box

1 3 Analogue sound must be converted to a digital form for storage and processing in a computer.

1 3 . 1 Define the term **sample resolution**.

[1 mark]

1 3 . 2 State **one** disadvantage of a high sample resolution.

[1 mark]

1 3 . 3 A 50-second sound has been recorded at a sample rate of 40 000 Hz.
Two bytes have been used to store each sample of the sound.

Calculate the file size of the sound file in **megabytes**.

Show your working.

[2 marks]

Answer _____ megabytes

7

Turn over for the next question

Do not write outside the box

1 4 Computer networks can be installed using wired or wireless technology.

1 4 . 1 State **one** wireless method used to connect devices on a Personal Area Network (PAN).

[1 mark]

1 4 . 2 Describe **two** differences between a Local Area Network (LAN) and a Wide Area Network (WAN).

[2 marks]

1

2

1 4 . 3 Give **three** advantages of using a wireless network instead of a wired network.

[3 marks]

1

2

3

Do not write outside the box

1 4 . 4 Shade **one** lozenge to indicate the application layer protocol used for sending emails from a client device to a mail server.

[1 mark]

A FTP ⬭

B HTTP ⬭

C SMTP ⬭

D UDP ⬭

1 4 . 5 Explain the purpose of the HTTPS protocol.

[2 marks]

_____

_____

_____

_____

9

Turn over for the next question

Do not write outside the box

1 5 . 1 State **two** issues with only using usernames and passwords in an authentication system.

[2 marks]

1 _____

_____

2 _____

_____

1 5 . 2 Describe **one** security measure that could be used, in addition to a password, to make sure that a user is who they are claiming to be.

[2 marks]

_____

_____

_____

_____

1 5 . 3 State **two** reasons why automatic software updates provide better security than manual software updates.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Do not write outside the box

1 6 . 1 Explain what penetration testing is.

[2 marks]

1 6 . 2 Describe the aim of a white-box penetration test.

[2 marks]

10

Turn over for the next question

Do not write outside the box

1 7 . 1 State **two** reasons why data are compressed.

[2 marks]

1 _____

_____

2 _____

_____

1 7 . 2 **Figure 2** shows a string.

Figure 2

MISSISSIPPI

One method for compressing data is run length encoding (RLE).

When using RLE, the data in **Figure 2** become:

1M 1I 2S 1I 2S 1I 2P 1I

Explain why RLE is **not** a suitable method for compressing the data in **Figure 2**.

[2 marks]

_____

_____

_____

_____

_____

Do not write outside the box

1 7 . 3 Another method for compressing data is Huffman coding. In Huffman coding, the codes for the characters can be created based on their position in a tree.

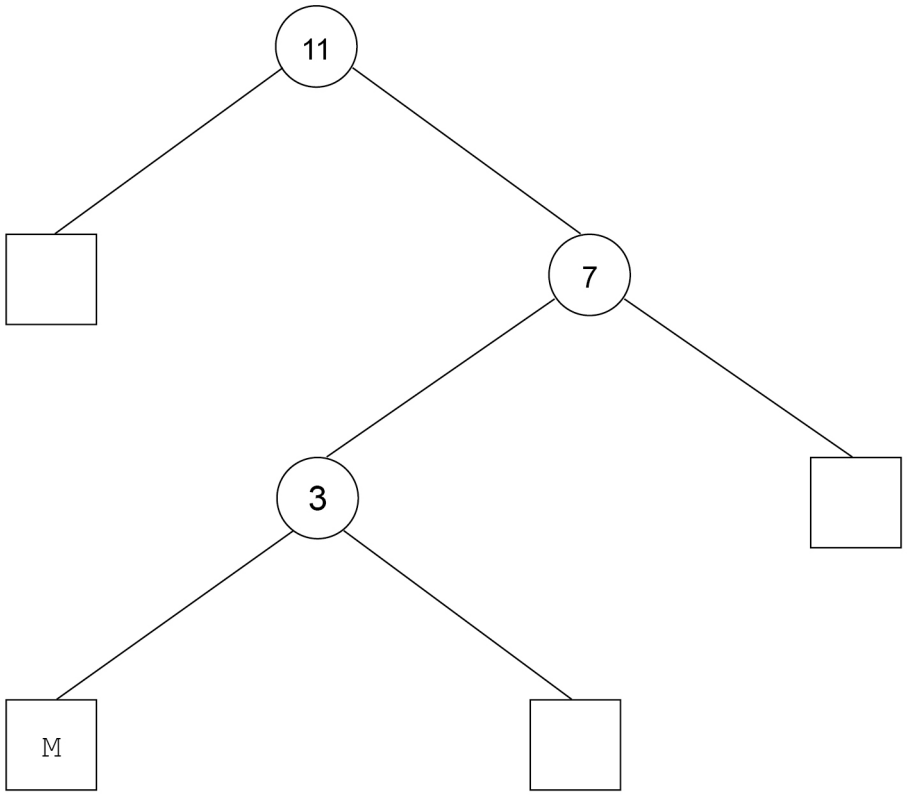
Figure 3 shows a Huffman code for each different character in the string in **Figure 2**.

Figure 3

Character	Binary code
M	100
I	0
S	11
P	101

Complete the Huffman tree below to show the position of the characters I, S and P using the codes from **Figure 3**.

[1 mark]



5

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1 8 A relational database has been developed for a youth club to store information about their members and the awards they are given.

The database contains two tables: **Member** and **Award**

Figure 4 shows some data from the tables.

Figure 4

Member

MemberID	FirstName	LastName	DateJoined
1	Zarah	Tariq	2020-01-05
2	Penny	Hill	2020-01-05
3	Peter	Boyes	2020-02-14
4	Reuben	Bailey	2020-10-20

Award

AwardID	MemberID	DatePresented	AwardName
1	1	2020-09-10	Teamwork
2	1	2020-10-13	Outdoors
3	3	2020-06-19	Challenge
4	2	2020-11-11	Leader

1 8 . 1 Define the term **relational database**.

[2 marks]

Do not write outside the box

1 8 . 2 State **one** benefit of using relational databases.

[1 mark]

1 8 . 3 State the name of the field from the **Member** table that is the most suitable to use as the primary key.

[1 mark]

1 8 . 4 State the name of the field from the **Award** table that is a foreign key.

[1 mark]

Question 18 continues on the next page

Figure 4 has been included again below.

Figure 4

Member

MemberID	FirstName	LastName	DateJoined
1	Zarah	Tariq	2020-01-05
2	Penny	Hill	2020-01-05
3	Peter	Boyes	2020-02-14
4	Reuben	Bailey	2020-10-20

Award

AwardID	MemberID	DatePresented	AwardName
1	1	2020-09-10	Teamwork
2	1	2020-10-13	Outdoors
3	3	2020-06-19	Challenge
4	2	2020-11-11	Leader

Do not write outside the box

1 8 . 5 The youth club needs to produce a report listing the members who have been given the Leader award. The report must include both names of each member and the date the award was presented.

Write an SQL query that could be used to find this information. The results must be in order of the date the awards were presented, starting with the earliest.

[6 marks]

1 8 . 6 A new member joins the youth club. The following SQL is run to add their details to the database:

```
INSERT INTO A
B(5, 'Alina', 'Ahmed', '2020-11-30')
```

Some of the SQL has been replaced by labels.

State the SQL that should have been written in place of the labels **A** and **B**.

[2 marks]

A _____

B _____

13

END OF QUESTIONS

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