AQA

Please write clearly in block capitals.

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

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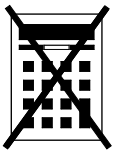
I declare this is my own work.

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]

128 64 32 16 8 4 2 1
1 1 0 1 0 1 0 0

128 + 64 + 16 + 4 = 212

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

You should show your working.

[2 marks]

10111001

binary 1011 1001

decimal (11) (9)

hexadecimal B 9

=B9

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

[1 mark]

111111

= 32 + 16 + 8 + 4 + 2 +1 = 63

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

[2 marks]

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

If two 1's , put 0 and carry the 1

If three 1's, put 1 and carry the 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.

shift to right -> delete right bits and add 0's from the left

[1 mark]

0	0	0	1	0	1	0	1

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]

shift by 1 = x2^1

shift by 2 = x2^2

shift by 4 = x2^4 = x16

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]

$\times 2^3 \div 2^5 = \times 2^{-2} = \div 2^2 = \div 4$

9

Turn over for the next question

either one or the other, not both

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
0	1	1
1	0	1
1	1	0

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:

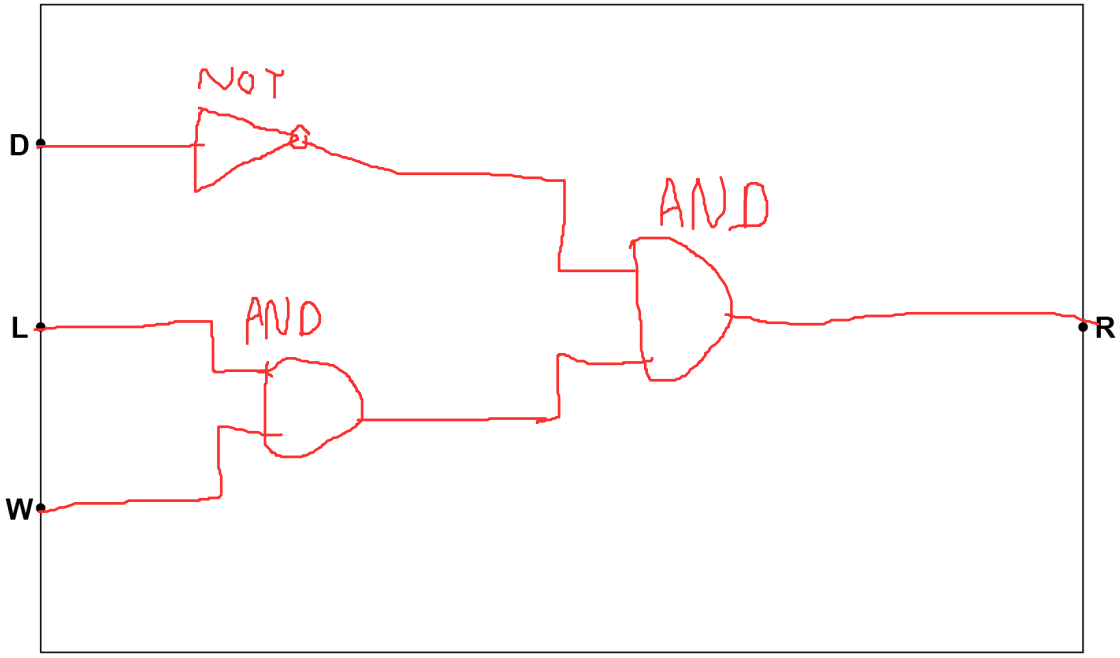
- sensor **D** is off
- sensor **L** is on
- sensor **W** is on.

NOT
AND
AND

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:

A.B is AND

A+B is OR

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

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

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

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

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.

NOT D AND L

AND W

Write a Boolean expression for this logic circuit.

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

[3 marks]

G = W . D . L

—
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 Manages operations in a computer system

Sets a platform for application software

Application software Is for END USER tasks such as sending emails

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

[4 marks]

1 Network Management

2 Security Management

3 Process Management

4 File Management

Application Management

Input/Output device Management

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]

ETHICAL:

Autonomous driving vehicles can be safer by always keeping safe distances + speeds

They must make decisions such as the trolley problem, with ethical complication

Less jobs as no need for taximen

Disabled passengers will have higher accessability as will not have to operate car

May be data collection issues such as passengers having their location recorded at all times

LEGAL:

May become vulnerable to be hijacked

If accident occurs, may be unclear who or what is at fault

As less/no human input, car insurance may have to change

New driving laws will have to be enforced

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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]

Translates assembly code into machine code

0 7 . 2 Explain how an interpreter works.

[4 marks]

Translate lines one at a time + executes, rather than all at once

If a RUNTIME ERROR is found, translation halts

They do not produce executable file, so the program needs to be re-translated every time it is executed

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 RAM cheaper than cache

2 Cache memory capacity is not large enough to store PROGRAMS

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 Allows for easier collaberation with other people

2 Allows for easy access on multiple devices

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]

High cost per gigabyte of storage

Typically (but not always) have lower capacity than magnetic storage

Do not write outside the box

1 0 How many bits are there in two kilobytes?

Show your working.

[2 marks]

8 bits in a byte

16 kilobits

16,000 bits

Answer 16,000 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]

'a' = 61

Table 1

Character	ASCII value	Unicode value
w	119	77
x	120	78
y	121	79
z	122	80

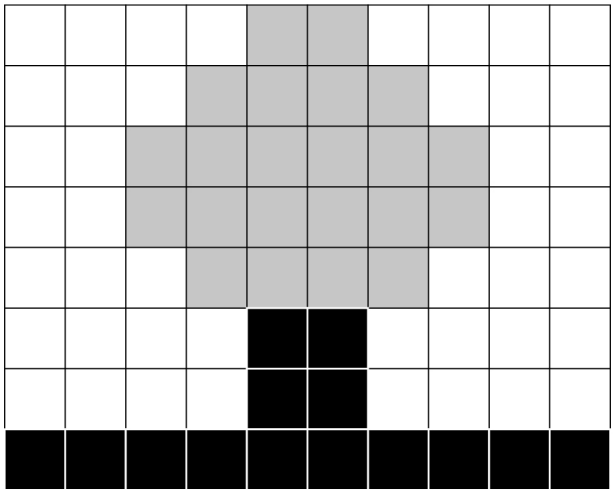
10

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]

3 colours represented by 2 bits -> colour depth of 2 bit

resolution = 10 x 8 = 80

80 x 2 = 160 bits

160 / 8 = 20 bytes

Answer 20 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]

Number of bits per sample

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

[1 mark]

Large file size

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]

50 x 40000 x 2 = 4,000,000 bytes

4,000,000 / 1,000 = 4,000 KB

4,000 / 1,000 = 4MB

Answer 4 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]

Bluetooth

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

[2 marks]

1 LAN over small geographical area

WAN over large geographical area

2 LAN owned by single person usually, WAN owned by collection of organisations

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

[3 marks]

1 Mobility

2 No risk of tripping on wires

3 Easier installation

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]

file

hypertext

MAIL

datagram

A FTP ⬭

B HTTP ⬭

C SMTP ⬭

D UDP ⬭

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

[2 marks]

Sends hypertext web pages using an ENCRYPTED (safe) connection.

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 Weak passwords can easily be cracked by algorithms

2 Can't verify identity of person entering details

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]

Two factor authentication, asks a personal question that only the intended user will know

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

[2 marks]

1 user might forget to update

2 protected quicker - installed as soon as available

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1 6 . 1 Explain what penetration testing is.

[2 marks]

Testing a network to gain access in order to find weaknesses that someone with malicious intent could exploit

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

[2 marks]

Simulation of a malicious attack who has basic knowledge of the system

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 reduce storage needed for a file

2 faster data transmission rate

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]

Low frequency of CONSECUTIVE repeated characters, so the compressed data will be longer than the plain data

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**.

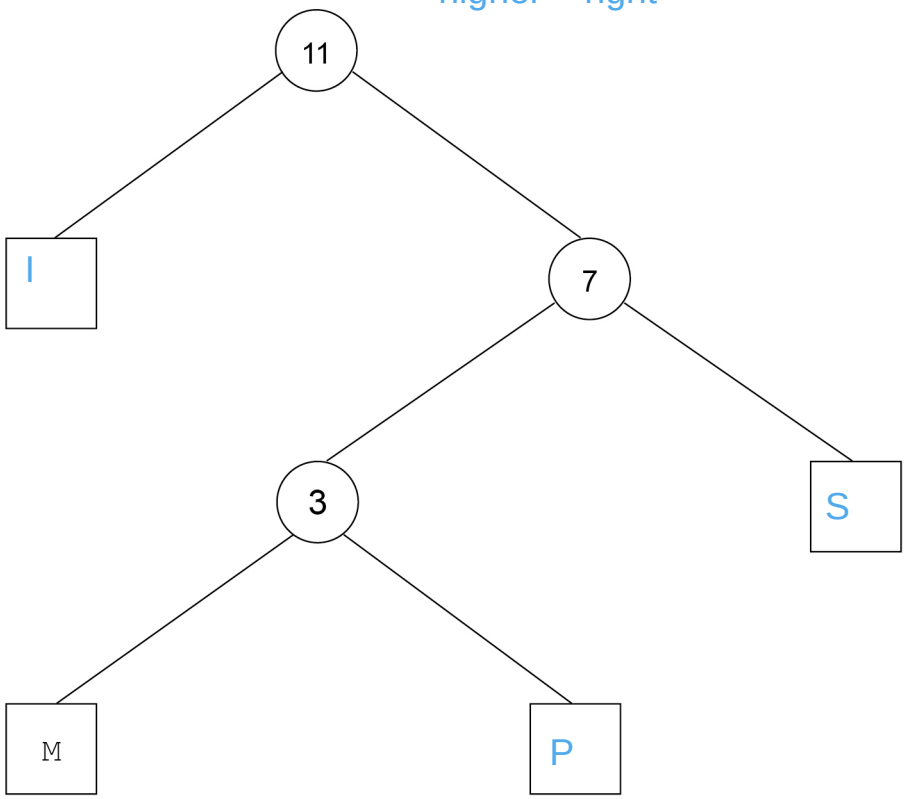
Figure 3

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]

lower = left
higher = right



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]

Database with multiple tables that reference each other

Do not write outside the box

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

[1 mark]

Reduces data redundancy

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]

MemberID (as it is unique identifier)

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

[1 mark]

MemberID (as it is a unique identifier from a related table), but not the primary key

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

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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]

```
SELECT FirstName,LastName,DatePresented
FROM Member,Award
WHERE Member.MemberID= Award.MemberID
 AND AwardName = 'Leader'
ORDER BY DatePresented ASC
```

(always SELECT,FROM,WHERE)

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 Member

B VALUES

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END OF QUESTIONS

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