Please write clearly in block capitals

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

Surname _____

Forename(s) _____

Candidate signature _____

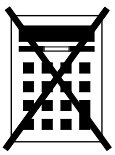
I declare this is my own work.

# GCSE
# COMPUTER SCIENCE

## Paper 2 Computing concepts

Thursday 25 May 2023 Afternoon 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.

| For Examiner's Use | |
|---|---|
| Question | Mark |
| 1–6 | |
| 7 | |
| 8 | |
| 9–10 | |
| 11 | |
| 12 | |
| 13 | |
| 14 | |
| 15 | |
| 16 | |
| **TOTAL** | |

### Advice

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 in the spaces provided.

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**0 1 . 1** The number base 2 is called **binary**.

Shade **one** lozenge to show which number base is called **hexadecimal**.

**[1 mark]**

**A** 6 ⬭

**B** 8 ⬭

**C** 10 ⬭

**D** 16 ⬭

**0 1 . 2** Shade **two** lozenges to show the statements that are true about hexadecimal.

**[2 marks]**

**A** Hexadecimal can represent a greater range of numbers than binary. ⬭

**B** Hexadecimal is easier for people to read than binary. ⬭

**C** Hexadecimal is faster for a computer to process than binary. ⬭

**D** Hexadecimal is more accurate than binary. ⬭

**E** Hexadecimal takes less space in RAM than binary. ⬭

**F** Hexadecimal takes less time to type than binary. ⬭

**0 2 . 1** Convert the decimal number 171 into binary.

**[1 mark]**

Do not write outside the box

**0 2 . 2** Convert the hexadecimal number 2D into binary.

You should show your working.

**[2 marks]**

Answer _____

**0 3** Add together the following three binary numbers and give your answer in binary.

**[2 marks]**

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

**0 4** Convert 16 000 000 bits to megabytes (MB).

You should show your working.

**[2 marks]**

Answer _____ MB

Do not write outside the box

**0 5** Describe the binary shift that would be used to divide a binary number by four.

**[1 mark]**

**0 6 . 1** When a sound wave is converted to a digital form it is sampled. The sampling rate is measured in hertz (Hz).

Define the term **hertz**.

**[1 mark]**

**0 6 . 2** A sampling rate of 20 000 Hz and a sample resolution of four bits is used to make a digital recording of a sound that lasts 50 seconds.

What is the minimum file size of the recording in megabytes (MB)?

You should show your working.

**[3 marks]**

Answer _____ MB

**15**

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**Turn over for the next question**

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**ANSWER IN THE SPACES PROVIDED**

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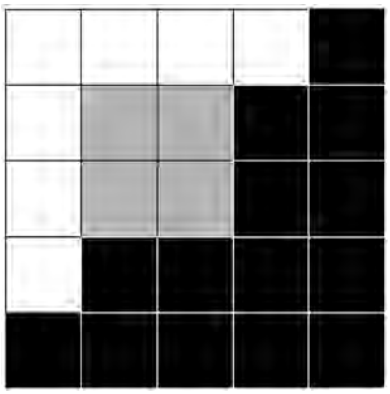
**0 7 . 1** The term pixel is short for Picture Element.

Define the term **pixel**.

**[1 mark]**

**0 7 . 2** **Figure 1** shows a 5 pixel x 5 pixel image. A minimum colour depth of two bits is needed to store the image.

**Figure 1**



Explain how the image in **Figure 1** can be represented as a bitmap.

**[3 marks]**

Do not write outside the box

**0 7 . 3** A 10 pixel x 10 pixel image contains five different colours.

Calculate the minimum file size, in bits, of this image when represented as a bitmap.

You should show your working.

**[2 marks]**

Answer _____ bits

**0 7 . 4** A black and white image has been compressed using run length encoding (RLE).

The first bit in each byte of the bit pattern represents the colour and the remaining seven bits of the byte represent the number of pixels in the run.

The image has a run of 60 black pixels followed by a run of 30 white pixels and is represented by the bit pattern shown in **Figure 2**.

**Figure 2**

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |

Using the same RLE method, give the bit pattern for a black and white image that has a run of 64 white pixels followed by a run of 15 black pixels.

Write your answer in **Table 1**.

**[2 marks]**

**Table 1**

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |

8

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**0 8 . 1** Define the term **hardware**.

**[1 mark]**

**0 8 . 2** Describe the role of each of the following components of a CPU:

**[3 marks]**

Clock

Control unit

Register

**0 8 . 3** Give **one** reason why a CPU with **two** cores might perform faster than an equivalent CPU with only one core.

**[1 mark]**

Do not write outside the box

**0 8 . 4** Define the term **non-volatile memory**.

**[1 mark]**

**0 8 . 5** Give **one** example of a type of **volatile** memory in a computer system.

**[1 mark]**

**0 8 . 6** Explain why secondary storage is required in a computer system.

**[2 marks]**

9

**Turn over for the next question**

Do not write outside the box

**0 9 . 1** Define the term **software**.

**[1 mark]**

**0 9 . 2** Define the term **system software**.

**[1 mark]**

**0 9 . 3** Define the term **application software**.

**[1 mark]**

**1 0 . 1** Explain the role of main memory in the **execute** stage of the Fetch-Execute cycle.

**[2 marks]**

**1 0 . 2** Describe the other **two** stages of the Fetch-Execute cycle.

**[2 marks]**

Fetch stage

Decode stage

7

Do not write outside the box

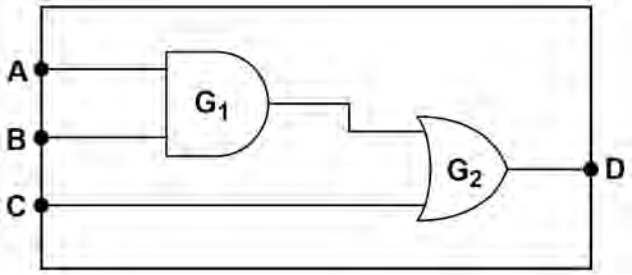
**1 1 . 1** Complete the truth table for the **XOR** logic gate.

**[1 mark]**

| A | B | A XOR B |
|---|---|---|
| 0 | 0 | |
| 0 | 1 | |
| 1 | 0 | |
| 1 | 1 | |

**Figure 3** shows a logic circuit.

**Figure 3**




**1 1 . 2** State the type of logic gate labelled $G_1$ in **Figure 3**.

**[1 mark]**

**1 1 . 3** Write a Boolean expression to show how the output **D** is calculated from the inputs **A**, **B** and **C** in **Figure 3**.

You **must** use the correct symbols for the Boolean operators in your expression.

**[2 marks]**

**D** = _____

4

Do not write outside the box

**1 2 . 1** **Figure 4** shows three programs (**A**, **B**, **C**) that add two numbers and output the result. The programs are written in different programming languages.

**Figure 4**

| A | B | C |
|---|---|---|
| `x = 14`<br>`y = 3`<br>`z = x + y`<br>`OUTPUT(z)` | `LDR R0, #14`<br>`LDR R1, #3`<br>`ADD R2, R0, R1`<br>`STR R2, 63`<br>`OUT R2` | `0000 00001110`<br>`0001 00000011`<br>`0110 00010000`<br>`1010 10111111`<br>`1110 00000000` |

Identify the type of programming language used for each program shown in **Figure 4** by writing **A**, **B** or **C** in the correct row of **Table 2**.

You **must** only use each letter once.

**[2 marks]**

**Table 2**

| | A, B or C |
|---|---|
| Assembly language | |
| High-level language | |
| Machine code | |

**1 2 . 2** State **one** advantage of writing programs in assembly language instead of a high-level language.

**[1 mark]**

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**1 2 . 3** Shade **one** lozenge to show which statement is true about program translators.

**[1 mark]**

**A** A compiler translates all the original program code before execution. ⬭

**B** Compiled code still needs the original program code to execute. ⬭

**C** Compiled code executes more slowly than code that is being interpreted. ⬭

**D** Interpreters generate machine code directly. ⬭

4

**Turn over for the next question**

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**1 3 . 1** Describe **two** differences between a PAN and a WAN.

**[2 marks]**

Difference 1 _____

_____

Difference 2 _____

_____

**1 3 . 2** Shade **two** lozenges to show which statements are true about LANs.

**[2 marks]**

**A** LANs always use the Ethernet protocol. ⬭

**B** LANs always use wireless technology. ⬭

**C** LANs are usually controlled or owned by a single organisation. ⬭

**D** LANs connect a maximum of 150 devices. ⬭

**E** LANs cover one room, building or site. ⬭

**1 3 . 3** State **two** differences between a bus topology and a star topology.

**[2 marks]**

Difference 1 _____

_____

Difference 2 _____

_____

Do not write outside the box

**1 3 . 4** HTTP is an example of a network protocol.

Define the term **network protocol**.

**[2 marks]**

**1 3 . 5** The application layer and the transport layer are two of the layers within the TCP/IP model.

What are the names of the other **two** layers of the TCP/IP model?

**[2 marks]**

1

2

**10**

**Turn over for the next question**

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**1 4** A teacher keeps a record of books loaned to students.

The teacher uses a relational database containing three tables, **BookCopy**, **Student** and **Loan**. **Figure 5** shows some data from the tables.

**Figure 5**

**BookCopy**

| CopyID | BookTitle |
|---|---|
| HT001 | HTML 4 Fun |
| PB002 | Python Basics |
| GC001 | GCSE Computing |
| GC002 | GCSE Computing |
| GC003 | GCSE Computing |
| GC004 | GCSE Computing |
| RG001 | GCSE Revision Guide |

**Student**

| StudentID | FirstName | LastName | YearGroup |
|---|---|---|---|
| TUC004 | Barry | Tucker | 8 |
| WAY002 | Shania | Wayneton | 10 |
| KOW001 | Bartek | Kowalski | 11 |
| AZE001 | Faisal | Azeez | 9 |
| BAK007 | Jolene | Baker | 11 |
| ANA002 | Aisha | Anand | 11 |
| OKA003 | Sani | Okafor | 10 |

**Loan**

| LoanID | StudentID | CopyID | DepositPaid |
|---|---|---|---|
| L0001 | TUC004 | HT001 | 0.50 |
| L0002 | WAY002 | GC004 | 2.00 |
| L0003 | KOW001 | GC001 | 2.00 |
| L0004 | TUC004 | PB002 | 0.75 |
| L0005 | BAK007 | RG001 | 2.50 |
| L0006 | BAK007 | GC002 | 2.00 |
| L0007 | OKA003 | GC003 | 2.00 |

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**1 4 . 1** Shade **two** lozenges to show which of the following statements are benefits of relational databases.

**[2 marks]**

**A** All the information can be stored in one table. ⬭

**B** Redundant data is less likely to be stored. ⬭

**C** Tables don't need primary keys. ⬭

**D** There are less likely to be data inconsistencies. ⬭

**1 4 . 2** State **one** field in the **Loan** table that is a foreign key.

**[1 mark]**

**1 4 . 3** State the most suitable data type for the **DepositPaid** field in the **Loan** table.

**[1 mark]**

**Question 14 continues on the next page**

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**Figure 5** has been included again below.

**Figure 5**

**BookCopy**

| CopyID | BookTitle |
|---|---|
| HT001 | HTML 4 Fun |
| PB002 | Python Basics |
| GC001 | GCSE Computing |
| GC002 | GCSE Computing |
| GC003 | GCSE Computing |
| GC004 | GCSE Computing |
| RG001 | GCSE Revision Guide |

**Student**

| StudentID | FirstName | LastName | YearGroup |
|---|---|---|---|
| TUC004 | Barry | Tucker | 8 |
| WAY002 | Shania | Wayneton | 10 |
| KOW001 | Bartek | Kowalski | 11 |
| AZE001 | Faisal | Azeez | 9 |
| BAK007 | Jolene | Baker | 11 |
| ANA002 | Aisha | Anand | 11 |
| OKA003 | Sani | Okafor | 10 |

**Loan**

| LoanID | StudentID | CopyID | DepositPaid |
|---|---|---|---|
| L0001 | TUC004 | HT001 | 0.50 |
| L0002 | WAY002 | GC004 | 2.00 |
| L0003 | KOW001 | GC001 | 2.00 |
| L0004 | TUC004 | PB002 | 0.75 |
| L0005 | BAK007 | RG001 | 2.50 |
| L0006 | BAK007 | GC002 | 2.00 |
| L0007 | OKA003 | GC003 | 2.00 |

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**1 4 . 4** Year 11 students must return their books after they have finished their GCSE exams.

Using the database shown in **Figure 5**, write an SQL query that lists all the loans for students who are in Year 11.

The query must **only** return:
- both names of the student
- the ID of the book borrowed
- the deposit paid.

The results must be in ascending order of the students' last names.

**[6 marks]**

**1 4 . 5** Barry Tucker has returned their copy of the book Python Basics.

Complete the SQL to delete the loan record for the book PB002.

**[2 marks]**

```
DELETE FROM _____

WHERE _____
```

12

**Turn over ►**

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**1 5** Wearable devices, such as smartwatches and fitness trackers, have become more popular in recent years. This has led to an increase in the amount of personal, health-related data being collected by technology companies.

Discuss the:

- benefits of collecting personal, health-related data using wearable devices
- data privacy issues related to the collection of personal, health-related data
- legal issues related to the collection of personal, health-related data.

**[9 marks]**

9

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**1 6 . 1** Define the term **cyber security**.

**[2 marks]**

**1 6 . 2** State **one** type of malware.

**[1 mark]**

**Question 16 continues on the next page**

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**1 6 . 3** The network manager of a new computer games company, AQAware, is configuring the network. They are concerned about potential cyber security threats that could affect the company's systems.

Discuss the potential impact of the following threats on AQAware:

- weak and default passwords
- misconfigured access rights
- unpatched and/or outdated software.

In your response you should include:

- how these threats could be exploited by an attacker
- how AQAware could protect themselves against these threats.

**[9 marks]**

**12**

**END OF QUESTIONS**

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| Question number | **Additional page, if required.**<br>**Write the question numbers in the left-hand margin.** |
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