

Please write clearly in block capitals

Centre number

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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.

Advice

For Examiner's Use

Question	Mark
1–6	
7	
8	
9–10	
11	
12	
13	
14	
15	
16	
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 in the spaces provided.

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 ~~X~~ Hexadecimal can represent a greater range of numbers than binary. ☐

B ☒ Hexadecimal is easier for people to read than binary. ☒

C ~~X~~ Hexadecimal is faster for a computer to process than binary. ☐

D ~~X~~ Hexadecimal is more accurate than binary. ☐

E ~~X~~ 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]

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

$$171 - 128 = 43$$

$$11 \cdot 8 = 3$$

$$43 - 32 = 11$$



0 2 . 2

Convert the hexadecimal number $2D$ into binary.

You should show your working.

$$D = 13$$

0010

1101

[2 marks]

 $= 00101101$ Answer 00101101

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
<hr/>								
	1	0	1	1	1	0	0	
<hr/>								

If two 1's, put 0 and
carry the digit.If three 1's, put 1 and
carry the digit

0 4

Convert 16 000 000 bits to megabytes (MB).

You should show your working.

[2 marks]

$$16,000,000 \div 8 = 2,000,000 \text{ bytes}$$

$$2,000,000 / 1000 = 2,000 \text{ kilobytes}$$

$$2000 / 1000 = 2 \text{ megabytes}$$

Answer 2 MB

Turn over ►



0 5

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

[1 mark]

RIGHT shift 2 places

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]

A sound sample per second

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]

$$20000 \times 4 = 80,000$$

$$80000 \times 50 = 4,000,000 \text{ bits}$$

$$4,000,000 / 8 = 500,000 \text{ bytes}$$

$$500,000 / 1,000,000 = 0.5 \text{ megabytes}$$

Answer

0.5

MB

15



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ►



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

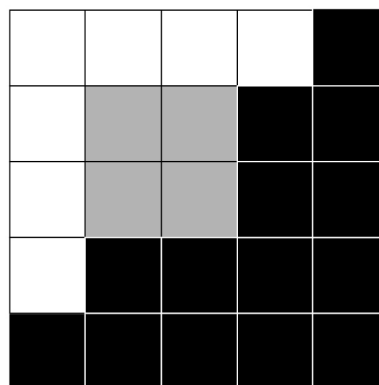
Define the term pixel.

[1 mark]

A pixel is the smallest part / point in an image

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]

In Bitmaps, the pixels are stored in consecutive memory locations

We can represent black pixels as 00

White pixels as 01

Grey pixels as 10

Metadata is needed to be stored about the image, like width + height, colour depth



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

[1 mark]

Physical components of a computer

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

[3 marks]

Clock Sends a regular electronic pulse to regulate speed of computing operations

Control unit Controls the flow of data through the CPU

Register Acts as temporary memory - holds data when an instruction is executing

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]

Two cores, the computer may be able to process two instructions simultaneously

One core, the computer can only process one instruction at once



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

[1 mark]

Memory that keeps its data when power is lost

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

[1 mark]

RAM

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

[2 marks]

Secondary storage is needed to store data when the computer is turned off, using non-volatile memory

To store data in virtual memory

9

Turn over for the next question

Turn over ►



0 9 . 1

Define the term **software**.

[1 mark]

Non physical component of computer,
instructions that are executed

0 9 . 2

Define the term **system software**.

[1 mark]

Manages the computers hardware, provides a platform
for application software

0 9 . 3

Define the term **application software**.

[1 mark]

Enables users to perform specific tasks such as sending
emails

1 0 . 1

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

[2 marks]

Data is fetched from main memory to be executed

The result of an executed instruction is
stored in main memory

1 0 . 2

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

[2 marks]

Fetch stage The next instruction to be executed is
fetched from memory

Decode stage The instruction to be
executed is decoded



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

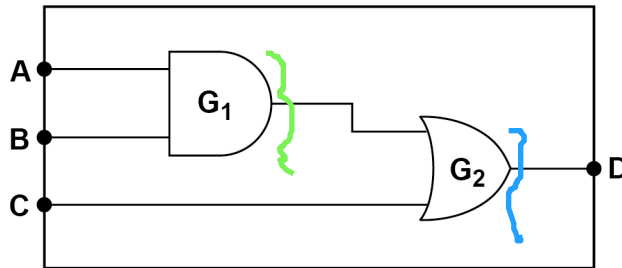
[1 mark]

XOR is one
or the other,
not both

	A	B	A XOR B
X	0	0	0
✓	0	1	1
✓	1	0	1
X	1	1	0

Figure 3 shows a logic circuit.

Figure 3



1 1 . 2 State the type of logic gate labelled **G₁** in **Figure 3**.

[1 mark]

AND Gate

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 = $AB + C$

Turn over ►



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
<pre>x = 14 y = 3 z = x + y OUTPUT (z)</pre>	<pre>LDR R0, #14 LDR R1, #3 ADD R2, R0, R1 STR R2, 63 OUT R2</pre>	<pre>0000 00001110 0001 00000011 0110 00010000 1010 10111111 1110 00000000</pre>

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	B
High-level language	A
Machine code	C

1 2 . 2

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

Assembly language runs faster -
requires less translation

[1 mark]

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

Turn over ►



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






[2 marks]

Difference 1 Pan is very short distance (personal), where as WAN is spread across large area

Difference 2 PAN is owned by one person, WAN is managed by multiple organisations

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

[2 marks]

- | | | | |
|--|----------|--|-------------------------------------|
|  | A | LANs <u>always</u> use the Ethernet protocol. | <input type="checkbox"/> |
|  | B | LANs <u>always</u> use wireless technology. | <input type="checkbox"/> |
|  | C | LANs are usually controlled or owned by a single organisation. | <input checked="" type="checkbox"/> |
|  | D | LANs connect a <u>maximum of 150</u> devices. | <input type="checkbox"/> |
|  | E | LANs cover one room, building or site. | <input checked="" type="checkbox"/> |

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

[2 marks]

Difference 1 Bus network has all computers connected to one cable, star has all devices connected to a central hub

Difference 2 _____

If main cable fails on bus , whole network fails. On star topology, this is not likely to happen



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

Define the term **network protocol**.

[2 marks]

Network protocol is a SET OF RULES that allows devices within a network to communicate

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 Internet

2 Network / Link

10

Turn over for the next question

Turn over ►



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	<u>StudentID</u>	<u>CopyID</u>	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



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]

CopyID or StudentID

1 4 . 3

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

[1 mark]

FLOAT / REAL

Question 14 continues on the next page

Turn over ►



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



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]

```
SELECT FirstName, LastName, CopyID, DepositPaid
FROM Student, Loan
WHERE Student.StudentID = Loan.StudentID
AND YearGroup = 11
ORDER BY LastName ASC
```

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 Loan

WHERE CopyID = "PB002" AND StudentID = "TUC004"

12

Turn over ►



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]

Need a developed answer weighing up benefits and issues

Need to logically structure our answer

PROS:

Keeping of data allows for tracking of health goals

Can be motivational for maintaining peoples fitness

Shared data can increase social engagement, promotes others to be healthy

Can identify health issues before they progress to being worse

Data may be important in legal investigation

CONS:

Lots of personal data being collected, that can be used or sold to companies

Could affect the price of user life insurance

Users often unaware who is being shared their personal data

Personal data can be used for blackmail

Personal data can be compromised during cyber attacks

Collection of data may not comply with data protection regulations

9



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

[2 marks]

Protecting computer networks + data from attack or unauthorised access

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

[1 mark]

Ransomware

Question 16 continues on the next page

Turn over ►



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]

How threats could be exploited:

Weak admin passwords may allow hackers to gain administrative access

Default passwords allow effortless access for hackers

Stolen passwords may be published online, anyone can access it

Misconfig. access rights may allow lower level staff in areas they are not supposed to access

Staff may be able to create new user accounts to give themselves administrative powers

Outdated software may have known weaknesses that can be exploited

How we may be able to protect ourselves

Enforce strong password policy, including admin accounts

Use of biometric features such as fingerprint, facial recognition

Make sure users only have access to the data they need

Give read-only access instead of full access where possible

Software patches may be able to keep the system up to date, ensuring discovered bugs or issues are patches

END OF QUESTIONS**12**

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