

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

Computer Science Worked

Candidate signature

Solutions

I declare this is my own work.

GCSE COMPUTER SCIENCE

Paper 2 Computing concepts

Tuesday 21 May 2024

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
1–4	
5–6	
7–8	
9	
10–12	
13	
14–17	
18	
19	
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.



J U N 2 4 8 5 2 5 2 0 1

IB/G/Jun24/G4004/E8

8525/2

Answer **all** questions.**0 1**Which statement best describes what computers represent using binary?Shade **one** lozenge.**[1 mark]**

- ✓ **A** All data are represented using binary. ☒
- ✗ **B** All data and instructions are represented using binary. ☐
- ✗ **C** Some data and instructions are represented using binary. ☐
- ✗ **D** Some instructions are represented using binary. ☐

0 2 . 1Convert the binary number 10110111 into decimal.**[1 mark]**

128 64 32 16 8 4 2 1

1 0 1 1 0 1 1 1

 $128 + 32 + 16 + 4 + 2 + 1 = 183$ **0 2 . 2**Convert the decimal number 112 into hexadecimal.

You should show your working.

[2 marks] $112 \text{ DIV } 16 \text{ (how many 16s go into 112)} = 7$ $112 \text{ MOD } 16 \text{ (remainder after } 112/16) = 0$

so hex number is 70

Answer 70

0 3

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

[2 marks]

$$\begin{array}{r}
 \begin{array}{cccccccc}
 & | & | & | & & | & & \\
 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\
 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
 + & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\
 \hline
 \end{array} \\
 \begin{array}{cccccccc}
 | & | & 0 & | & 0 & | & 0 & | \\
 \hline
 \end{array}
 \end{array}$$

If two 1's then put 0 and carry

If three 1's then put 1 and carry

0 4 . 1

Figure 1 shows a bit pattern.

Figure 1

00110011

If LEFT SHIFT: delete bits from left hand side, and add 0's to the right

If RIGHT SHIFT: delete bits from right and add 0's to the left

State the result of applying a left binary shift of two to the bit pattern shown in **Figure 1**.

[1 mark]

1	1	0	0	1	1	0	0
---	---	---	---	---	---	---	---

0 4 . 2

The decimal equivalent of the bit pattern shown in **Figure 1** is 51State the result of applying a left binary shift of one to the bit pattern shown in **Figure 1**.Give your answer in **decimal**.

left shift by 1 = x2

[1 mark]

$$51 \times 2 = 102$$

Question 4 continues on the next page





Turn over ►




0 4 . 3 Which statement best describes where a single binary shift can be used?

Shade **one** lozenge.

[1 mark]

-  **A** Multiply or divide numbers by any even number. ☐
-  **B** Multiply or divide numbers by any number. ☐
-  **C** Multiply or divide numbers by any odd number. ☐
-  **D** Multiply or divide numbers by powers of two. ☒

 eg left shift by 1 bit = $\times 2$ left
shift by 2 bits = $\times 2^2 = \times 4$

9



Turn over for the next question

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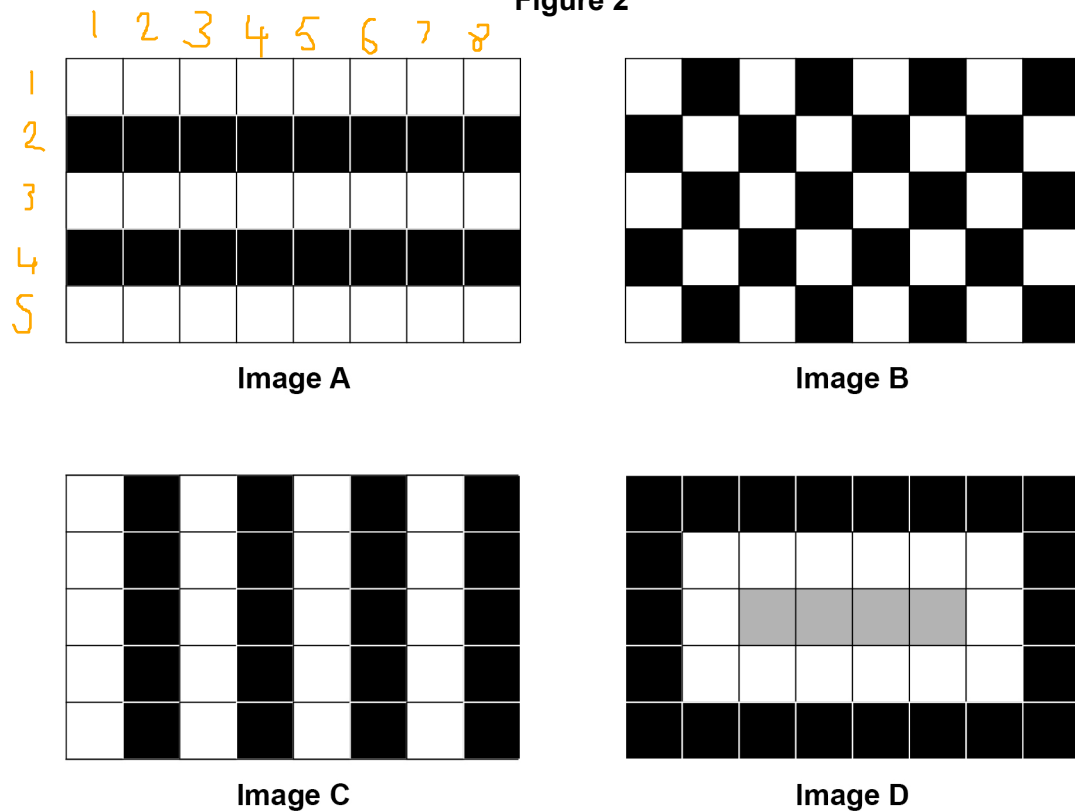
Turn over ►



0 5

Figure 2 shows four bitmap images.

Figure 2



0 5 . 1

State the number of pixels in Image A in Figure 2.

[1 mark]

8 wide x 5 tall = 40 pixels

0 5 . 2

State the minimum colour depth required to represent Image B in Figure 2.

[1 mark]

There are two colours (black and white)

We can represent this as black = 0 , white = 1

Therefore each is represented by 1 bit ,
so minimum colour depth is 1 BIT

0 5 . 3

Calculate the minimum amount of storage required to store Image D from **Figure 2**.

Give your answer in **bytes**.

Show your working.

[2 marks]

8 wide x 5 tall = 40 bits

3 colours can't be represented with 1 bit, so min
colour depth is 2

40 bits x 2 colour depth = 80 bits

80 bits / 8 = 10 bytes

Answer 10 bytes

Question 5 continues on the next page

Turn over ►



Figure 2 has been included again below.

Figure 2

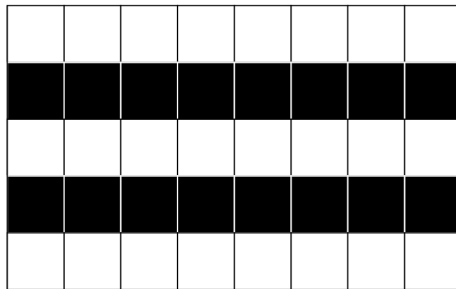


Image A

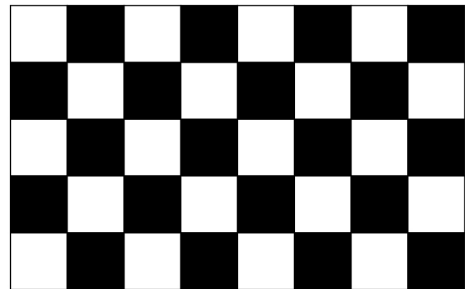


Image B

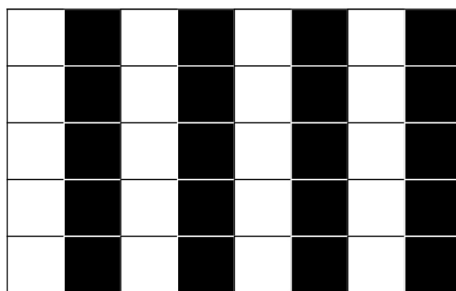


Image C

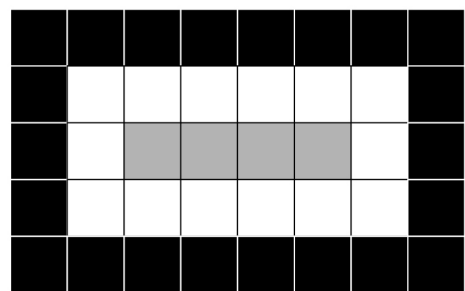


Image D



0 5 . 4 Figure 3 shows how Image D can be represented as binary data.

Figure 3

01	01	01	01	01	01	01	01
01	00	00	00	00	00	00	01
01	00	10	10	10	10	00	01
01	00	00	00	00	00	00	01
01	01	01	01	01	01	01	01

Complete the table to show the binary representation of each colour in **Image D**.

[1 mark]

Colour	Binary representation
White	00
Black	01
Grey	10

0 5 . 5 The number of colours used in **Image C** and **Image D** in **Figure 2** are both increased by one.

State the impact of this increase on the minimum file sizes of both **Image C** and **Image D**.

[2 marks]

Image C We can't represent 3 colours with 1 bit, so min colour depth increases from 1 to 2, so min file sizes DOUBLES

Image D 4 colours can still be represented with 2 bits (2^2), so min colour depth stays the same, so min file size remains the same

Turn over ►



0	6
---	---

Calculate the number of bits in 7 MB.

Show your working.

[2 marks]

$$7 \text{ MB} = 7000 \text{ KB} = 7,000,000 \text{ Bytes}$$

$$7,000,000 \text{ Bytes} \times 8 = 56,000,000 \text{ bits}$$

Answer 56,000,000 bits

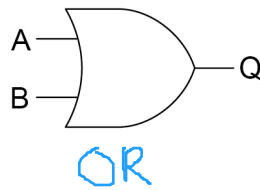
9



0 7

Figure 4 shows a logic gate.

Figure 4



0 7 . 1

Which truth table matches the logic gate in Figure 4?

Shade **one** lozenge.

[1 mark]

A

A	B
0	1
1	0

~~X~~
☐

B

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

✓

~~X~~~~X~~

✓

☐

C

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1

✓

✓

✓

✓

☒

D

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

✓

✓

✓

~~X~~
☐

Question 7 continues on the next page

Turn over ►



0 7 . 2 Figure 5 shows a truth table.

Figure 5

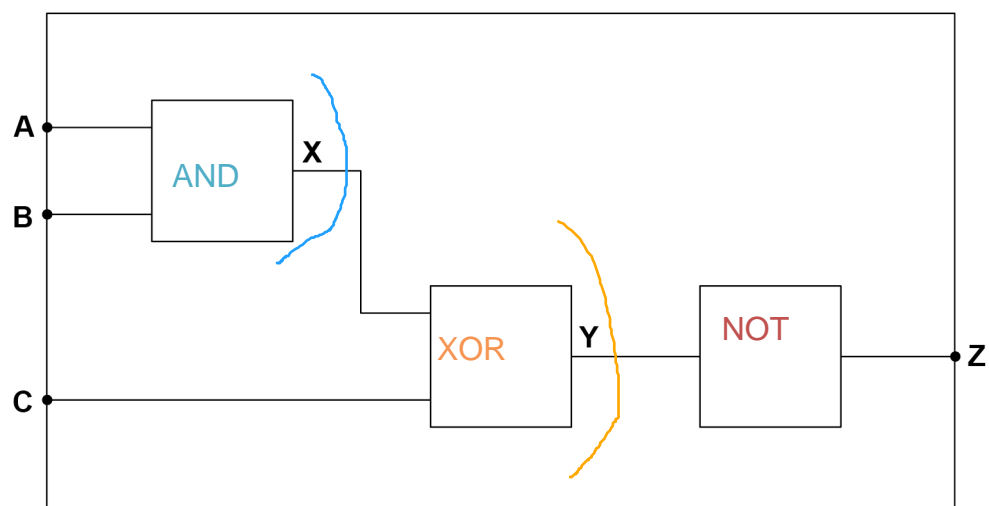
A	B	C	X	Y	Z
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	0	1
0	1	1	0	1	0
1	0	0	0	0	1
1	0	1	0	1	0
1	1	0	1	1	0
1	1	1	1	0	1

Complete the logic circuit by writing the **name** of a logic gate in each empty box.

The completed logic circuit should have the same functionality as the circuit represented by the truth table in **Figure 5**.

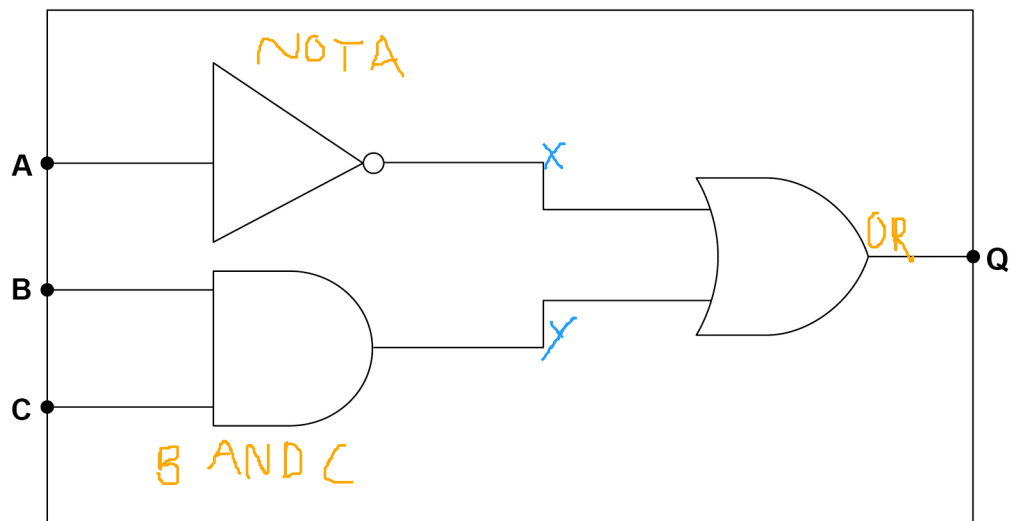
You should write the **name** of **one** logic gate only in each box.

[3 marks]



0 7 . 3 Figure 6 shows a different logic circuit.

Figure 6



Write a Boolean expression that represents the logic circuit shown in **Figure 6**.

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

[3 marks]

$$Q = \overline{A} + BC$$

(NOT A) OR (B AND C)

Turn over for the next question

Turn over ►



08.1

Three major components of a Central Processing Unit (CPU) are:

- control unit
- clock
- cache.

Describe the function of **each** of the three components.

[6 marks]

Control unit _____

Controls signals to other components in the CPU

Coordinates execution of instructions

Clock _____

Outputs a regular electrical pulse

Which synchronises components

Cache _____

Stores frequently used instruction/data for very
fast access

Makes data retrieval more efficient



08.2

Explain **three** ways to improve the performance of a CPU.**[3 marks]**

- 1 Increase number of processor cores for more multitasking
- 2 Increase cache size to store more frequently used data/instructions
- 3 Increase clock speed

16

Turn over for the next question

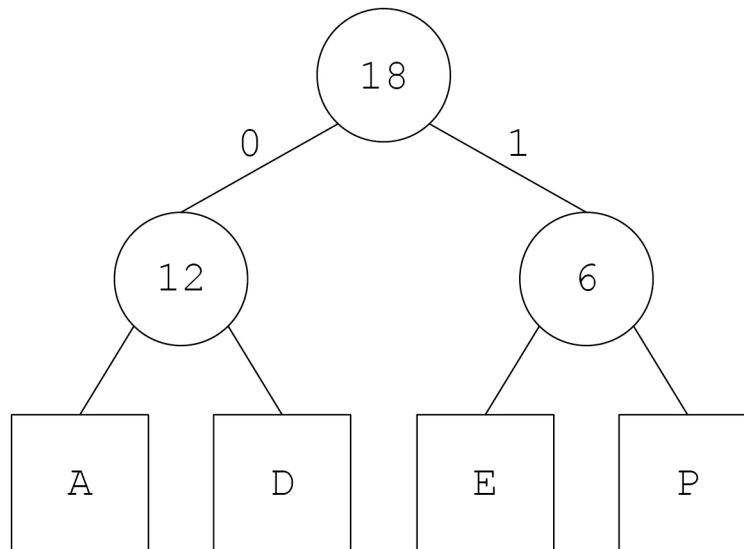
Turn over ►



0 9 . 1 Figure 7 contains a Huffman tree.

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Figure 7



The Huffman tree in **Figure 7** was used to encode a string, which resulted in the following bit pattern:

0001011001

 A D D E D

State the string that this bit pattern represents.

[2 marks]

ADDED



0 9 . 2 Table 1 shows the Huffman codes for the characters used in the string
HESELLSSEASHELLASHES

Table 1

Character	Character frequency	Huffman code
S	6	11
E	5	10
L	4	00
H	3	011
A	2	010
	20	

Calculate how many bits would be saved if the string HESELLSSEASHELLASHES was encoded using the Huffman codes shown in **Table 1**, rather than using ASCII.

You should show your working.

frequency x colour depth

[3 marks]

HUFFMAN S: $6 \times 2 = 12$

ASCII

E: $5 \times 2 = 10$

20 char x 7

L: $4 \times 2 = 8$

bits = 140

H: $3 \times 3 = 9$

bits

A: $2 \times 3 = 6$

= 45 bits

140 - 45 =

95 bits

Number of bits saved 95 bits

5

Turn over ►



1 0Which **two** statements are true about machine code?Shade **two** lozenges.**[2 marks]**

- | | | |
|---|--|-------------------------------------|
| ✓ | A Machine code is directly executed by the processor. | <input checked="" type="checkbox"/> |
| ✗ | B Machine code is easily understood by humans. | <input type="checkbox"/> |
| ✗ | C Machine code is shorter than high-level code. | <input type="checkbox"/> |
| ✗ | D Machine code is similar to English. | <input type="checkbox"/> |
| ✓ | E Machine code is specific to a family of processors. | <input checked="" type="checkbox"/> |
| ✗ | F Machine code is translated using a compiler. | <input type="checkbox"/> |

1 1Describe **three** differences between high-level programming languages and low-level programming languages.**[3 marks]**

1 Low level is usually more efficient

2 High level may require an interpreter and/or compiler to create an executable program

3 High level language is easier to learn, understand, read



1 2

Describe how compilers and interpreters operate.

[6 marks]**COMPILER:**

Translates entire program in one go

Creates an executable file at the end which
can be re-run

Produces list of errors following translation

INTERPRETER:Translates program one line at a time, stops execution once an
error is encountered

Executes programming code as it is being translated

Requires source code to be translated each time program runs (as doesn't
produce executable file)**Turn over ►**

1 3 . 1

Define the term **computer network**.

[2 marks]

Group of computers that are linked together

1 3 . 2

A school has purchased new computers for students and staff to use.

The school is considering installing the computers in a **network**.

Discuss the **advantages and disadvantages** to the school, staff and students of having the computers installed in a network.

[6 marks]

PROS:

We can store files centrally , so they can be accessed by any person who is authorised

Allows better monitoring of computers of students

Central backup of files

New devices i.e. students devices from home can be connected to the network

Cheaper to license resources when centrally stored rather than individually license for every student

CONS:

Expensive / difficult to maintain a large network

If malware (virus) infiltrates the server, it can spread easily

Speed of access of files deteriorates as size of network is large

Breakdown of network restricts access to all resources



[illegible]

8

1 4

SMTP and IMAP are email protocols.

Describe how SMTP and IMAP are used.

[2 marks]

SMTP Simple Mail Transfer Protocol

Sends
emails

IMAP Internet Message Access Protocol

Retrieves
emails

1 5

Describe how encryption can make the transmission of data more secure.

[2 marks]

Encryption changes plaintext into ciphertext, so the text
can not be read by anyone unauthorised

1 6

Blagging and phishing are social engineering techniques.

Describe blagging and phishing.

[4 marks]

Blagging and phishing both try to get sensitive
information from a person by impersonating
someone or an organisation

Phishing is commonly done through email to text,
targeting a large group of people

Blagging is similar but usually targets on e individual person



1 7

Viruses, trojans and spyware are forms of malware.

Describe how two of these forms of malware work.

[4 marks]

Name of malware 1 Virus

Description _____

An executable which attaches onto another piece of software, spreading to the computer when executed

Name of malware 2 Trojan

Description _____

Software that pretends to be legitimate

Tricks user to execute the file

12

Turn over for the next question

Turn over ►



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1 8 . 1 Define the term database.

[1 mark]

A structured collection of data

1 8 . 2 Explain what is meant by data inconsistency within a database.

[2 marks]

Where two instances of the same data exists within a database, but they contradict themselves (they are not the same)

1 8 . 3 Define the term foreign key.

[2 marks]

A field in a table which is also a primary key in another table

Question 18 continues on the next page

Turn over ►



A relational database is being developed to store information about actors and the films they have performed in.

The database contains three tables: **Film**, **Performance** and **Actor**.

Some of the contents of the tables are shown in **Figure 8**.

Figure 8

Film

FilmID	Title	Year
100	Forrest Gump	1994
101	Toy Story 3	2019
102	Back to the Future	1985

Performance

PerformanceID	FilmID	ActorID
52	100	8
53	101	8
54	102	9

Actor

ActorID	Firstname	Lastname
8	Tom	Hanks
9	Lea	Thompson



1 8 . 4 State the identifier of a field from the Actor table in **Figure 8**.

[1 mark]

ActorID

1 8 . 5 A list of all the films from the year 2019 in the database is needed.

The following SQL is run to produce the list:

A FilmID, Title, Year
FROM Film
WHERE **B**

always in
form
SELECT
FROM
WHERE

Some parts of the SQL have been replaced by labels.

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

[2 marks]

A SELECT

B Year = 2019

1 8 . 6 The film with the title **Toy Story 3** has been entered incorrectly into the database and should have the title **Toy Story 4**.

Write the SQL to make this change!

always in form
UPDATE
SET
WHERE

[3 marks]

UPDATE Film

SET Title = "Toy Story 4"

WHERE Title = "Toy Story 3"

Question 18 continues on the next page

Turn over ►



Figure 8 has been included again below.

Figure 8

Film

FilmID	Title	Year
100	Forrest Gump	1994
101	Toy Story 3	2019
102	Back to the Future	1985

Performance

PerformanceID	FilmID	ActorID
52	100	8
53	101	8
54	102	9

Actor

ActorID	Firstname	Lastname
8	Tom	Hanks
9	Lea	Thompson



1 8 . 7

A film called **Gladiator** from the year 2000 is to be added to the database with a FilmID of 103

The following SQL is run:

```
INSERT INTO (A)
(B) (C)
```

Some parts of the SQL have been replaced by labels.

State the SQL that should have been written in place of
the labels (A), (B) and (C).

[3 marks]

(A) FILM

(B) VALUES

(C) 103,'Gladiator',2000

14

Turn over for the next question

Turn over ►



1 9 . 1

Define the term cyber security.

[2 marks]

The process of protecting networks/computers from
unauthorised access and attack

1 9 . 2

A website wants to improve its cyber security procedures.

Explain how CAPTCHA and email confirmations could improve the security of
the website.

[4 marks]

CAPTCHA CAPTCHA prevents bots from accessing a website by
running a Turing test to ensure user is human

Email confirmations

Prevents unauthorised users as they need to prove
who they are via confirmation of email

Prevents a high volume of accounts to be created
- protects database from bloating

END OF QUESTIONS



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