OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL GCSE

COMPUTER SCIENCE

Paper 2 Concepts and principles of computer science

Time allowed: 2 hours

Materials

You will need no other materials.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of the page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- 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 booklet. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
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8	
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10	
11	
12	
13	
14	
15	
TOTAL	

Answer **all** questions in the spaces provided.

Do not write outside the box

0 1 **Figure 1** shows the contents of a byte of memory in **binary**.

Figure 1

1	1	0	0	1	0	0	1

0 1 . 1 Convert the contents of the byte in **Figure 1** to **hexadecimal**.

[1 mark]

0 1 . 2 How many different hexadecimal numbers can be represented using one byte?

[1 mark]

0 1 . 3 How many different decimal numbers can be represented using one byte?

[1 mark]

0 1 . 4 Represent the decimal number 88 in **binary** using one byte.

[1 mark]

4

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 2 Bitmaps are one way of representing images in a computer's memory.
A bitmapped image consists of pixels.

0 2 . 1 Explain what a pixel is.

[1 mark]

0 2 . 2 Increasing the colour depth of a bitmapped image means that more colours can be represented.

State **one** disadvantage of increasing the colour depth.

[1 mark]

0 2 . 3 How many colours can be represented if a bitmapped image has a colour depth of three?

[1 mark]

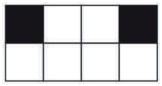
Do not write outside the box

0 2 . 4 **Table 1** shows five different bitmapped images.

Complete the second column of **Table 1** by writing yes or no to indicate if the bitmapped image in the first column could be represented by the bit pattern
01101111

[3 marks]

Table 1

Image	Represented using bit pattern? (Yes/No)
	
	
	
	
	

6

Turn over for the next question

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0 3 . 1 Tick (✓) **one** box to indicate which statement about translation software is true.

[1 mark]

A	An assembler can be used to convert a high-level language program into assembly language.	
B	An assembler can be used to convert an assembly language program into machine code.	
C	An interpreter produces object code as output which can be executed on a computer that does not have the interpreter installed.	
D	If a program contains an error such as an incorrectly spelt keyword then a compiler will still be able to execute some parts of it.	
E	When a company wants to distribute software to customers it will usually use an interpreter to translate it.	

0 3 . 2 Tick (✓) **one** box to indicate which number system is used to represent machine code instructions inside the computer so that they can be executed by a processor.

[1 mark]

A	Binary	
B	Decimal	
C	Hexadecimal	
D	Octal	

Do not write outside the box

0 3 . 3 Explain the differences between low-level and high-level languages.

[4 marks]

6

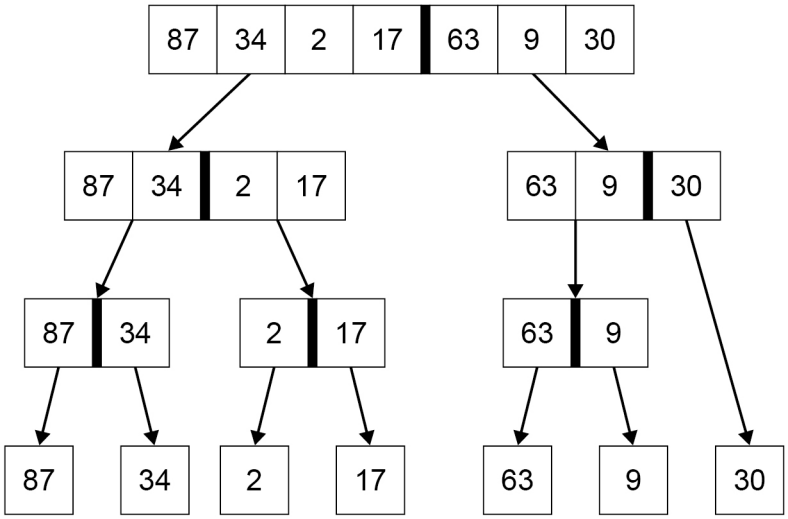
Turn over for the next question

0 4 **Figure 2** shows how the list 87, 34, 2, 17, 63, 9, 30 has been broken down into shorter lists as part of the merge sort process.

Complete **Figure 2** to show how the one-item lists would be merged to produce the sorted list.

[3 marks]

Figure 2



3

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0 5 . 1 Explain why sound must be sampled before it can be stored and played back by a computer.

[1 mark]

0 5 . 2 A recording has been made of a sound and stored in a file. The sample resolution used was 16 bits and the sample rate was 10 000Hz. The file, which contains only the samples of the sound, is 1 megabyte in size.

What is the length of the recording in seconds?

Show your working.

[3 marks]

Recording length (seconds) _____

4

Turn over for the next question

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0 6 . 1 Explain why computer systems need secondary storage.

[1 mark]

0 6 . 2 Explain how an optical disc, such as a DVD-ROM, represents data and how this can be read from the disc.

[4 marks]

5

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0 7 **Figure 3** shows an algorithm expressed using pseudocode.

The algorithm operates on an array called `List`. The current contents of the array `List` are shown in **Figure 4**.

Figure 3

```
Result ← 0
Num ← USERINPUT
FOR Count ← 0 TO LEN(List) - 1
  IF Num > List[Count] THEN
    Temp ← Num - List[Count]
  ELSE
    Temp ← List[Count] - Num
  ENDIF
  IF Temp > Result THEN
    Result ← Temp
  ENDIF
ENDFOR
```

Figure 4

Index	[0]	[1]	[2]
Contents	4	9	6

0 7 . 1 Complete the trace table below to show the execution of the algorithm in **Figure 3** on the array contents in **Figure 4**. Assume that the user enters the number 5

You may not need to write in all of the rows of the table.

[5 marks]

Result	**Count**	**Temp**

0 7 . 2 What is the purpose of the algorithm shown in **Figure 3**?

[1 mark]

6

Turn over ►

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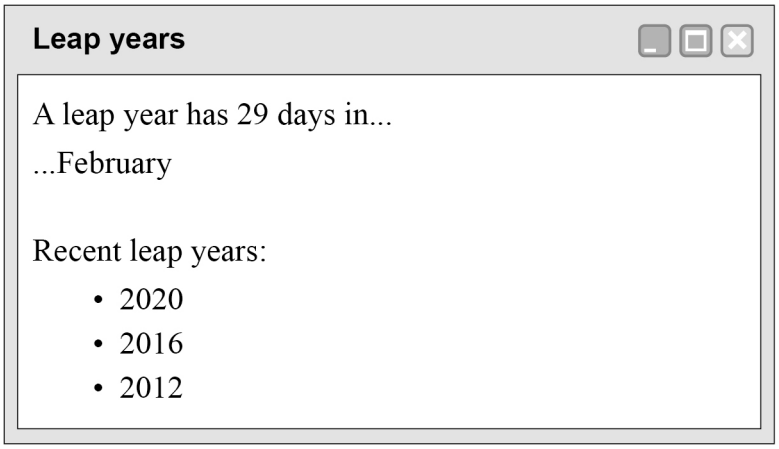
0 8 **Figure 5** shows a web page displayed in a web browser window.

The web page has been written in HTML only. No CSS has been used.

Figure 5



0 8 . 1 The HTML code used to produce the web page is shown below. Some code has been missed out.

Fill in the gaps to complete the HTML code.

[3 marks]

```
<html>
  <head>
     <title>Leap years<_____>
  </head>
  <body>
    <p>A leap year has 29 days in...<_____>
...February</p>
    <p>Recent leap years:</p>
    <_____>
      <li>2020</li>
      <li>2016</li>
      <li>2012</li>
    <_____>
  </body>
</html>
```

Do not write outside the box

0 8 . 2 The web page is to be changed so that `29` appears in bold blue text on a yellow background. This will be achieved by using a CSS style rule.

The HTML code for the line in the web page that includes `29` has been changed but some code has been missed out.

Fill in the gaps to complete the CSS code.

[2 marks]

```
<p>A leap year has <span style = "background-color:

yellow; _____: blue; _____: bold

">29</span> days in...
```

0 8 . 3 Tick (✓) **one** box to indicate which of the tags below are available in both HTML5 and earlier versions of HTML.

[1 mark]

A	`<canvas>`	
B	`<img />`	
C	`<video>`	

6

Turn over for the next question

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0 9 The control unit, Arithmetic Logic Unit (ALU) and buses are components of a computer.

0 9 . 1 Explain the role of the control unit.

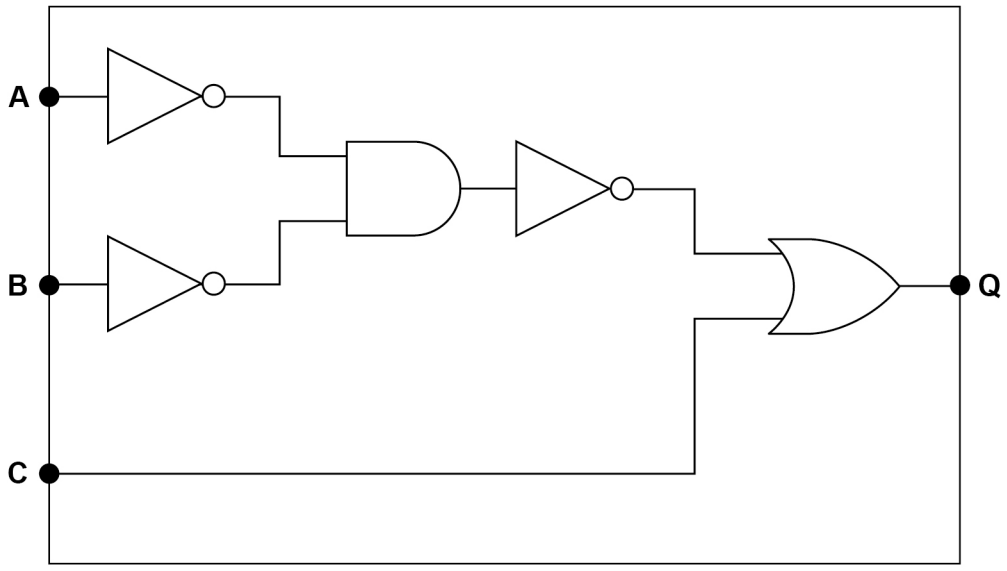
[1 mark]

0 9 . 2 Explain the role of a bus.

[1 mark]

The ALU contains logic circuits that are used to complete logical and arithmetic operations. A logic circuit is shown in **Figure 6**.

Figure 6



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0 9 . 3 Complete the Boolean expression below so that it is equivalent to the logic circuit in **Figure 6**:

[3 marks]

$$Q = \overline{A}.B$$

0 9 . 4 Complete the **Output** column of the truth table below for the logic circuit shown in **Figure 6**. Four rows have been completed for you.

[2 marks]

Inputs			Output
A	**B**	**C**	**Q**
0	0	0	
0	0	1	
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	
1	1	1	

Question 9 continues on the next page

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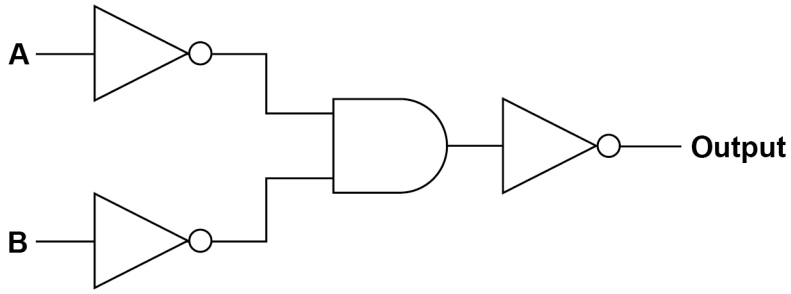
Part of the logic circuit from **Figure 6**, and the equivalent truth table, are shown again in **Figure 7**.

Figure 7



Inputs		Output
A	B	
0	0	0
0	1	1
1	0	1
1	1	1

0 9 . 5 Which **one** logic gate could have been used instead of the entire logic circuit shown in **Figure 7**?

[1 mark]

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A logic circuit in the ALU may be replaced with another circuit that produces exactly the same outputs but uses fewer logic gates. Doing this will improve the performance of the CPU as any instructions that use that circuit will execute faster.

Two other ways of improving CPU performance are to increase the number of cores and to increase the size of the cache memory.

0 9 . 6 Explain why increasing the number of cores can improve the performance of the CPU.

[2 marks]

0 9 . 7 Explain why increasing the size of the cache memory can improve the performance of the CPU.

[2 marks]

12

Turn over for the next question

Do not write outside the box

1 0 . 1 Explain what a computer network is.

[1 mark]

1 0 . 2 Describe the benefits and risks of computer networks.

[4 marks]

5

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1 1 . 1 Explain what a protocol is.

[1 mark]

1 1 . 2 State what each of these protocols would be used for.

[2 marks]

SMTP

HTTPS

3

Turn over for the next question

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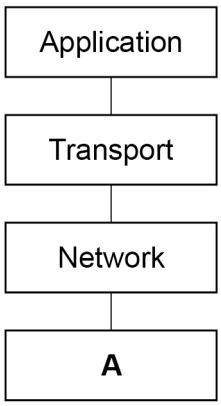
1 2 **Figure 8** is an incomplete diagram of the TCP/IP model. The name of one of the layers has been replaced by the letter **A**.

Figure 8



1 2 . 1 State the name of the TCP/IP layer that is labelled **A** in **Figure 8**.

[1 mark]

1 2 . 2 Describe the main function of the network layer.

[1 mark]

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1 2 . 3 The TCP and UDP protocols both operate at the transport layer.

Explain **one** difference between these two protocols **and** give an example of an application for which UDP might be chosen instead of TCP.

[2 marks]

4

Turn over for the next question

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1 3 . 1 David is an administrator at a bank.

One social engineering method that a criminal might use to obtain David's login details is shouldering.

Name and describe **one other** social engineering method that a criminal could use to obtain David's login, so that they can access the bank's computer systems.

[3 marks]

1 3 . 2 The bank uses penetration testing to help ensure that their systems are secure.

Explain what penetration testing is.

[2 marks]

5

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1 4 . 1 What is the purpose of data compression?

[1 mark]

One method for compressing data is to use Huffman coding.

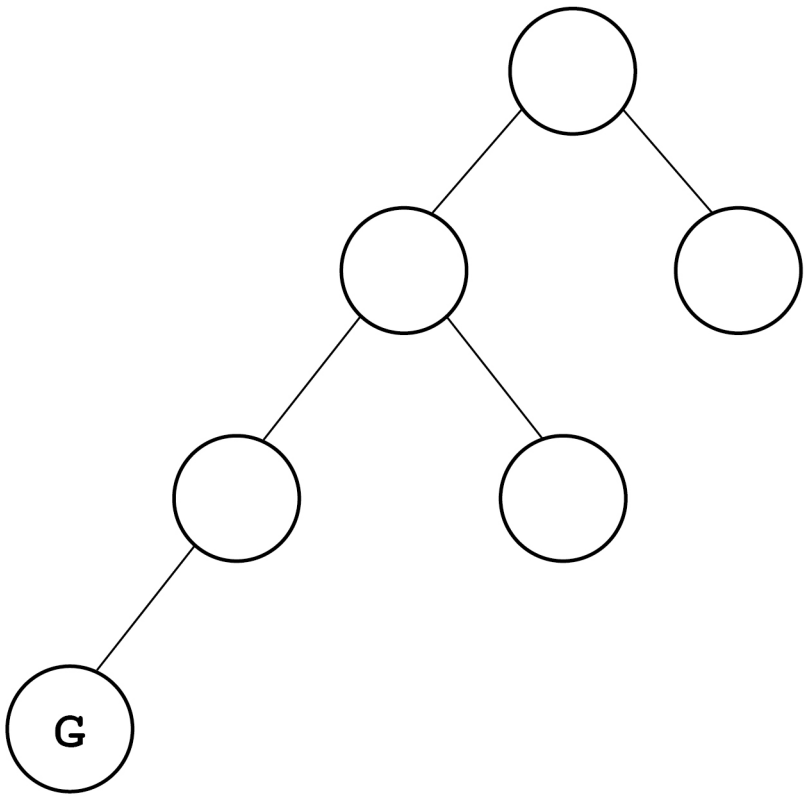
1 4 . 2 To create a Huffman coding a Huffman tree is often used.

Complete the Huffman tree in **Figure 9** assuming that it was created using the string AGATTACA

You will need to add a seventh node to the diagram and put the characters A, T and C in the correct places.

[3 marks]

Figure 9



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1 4 . 3 How many bits will be used to represent the character G with this Huffman coding?

[1 mark]

5

Turn over for the next question

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1 5 A relational database is being developed to store information about the books that are available to borrow in a school library and the students who can borrow the books.

The database contains two tables: **Student** and **Book**.

The database is currently being tested by the person who has developed it, so the tables only contain a small amount of data.

The contents of the tables are shown in **Figure 10**.

When a book is loaned out to a student, the `StudentID` of the person who has borrowed the book is recorded in the **Book** table. If a book is not on loan then it is in the library and a `StudentID` of –1 is recorded in the **Book** table to indicate this.

Figure 10

Student

StudentID	Forename	Surname	YearGroup
12	Bethany	Lerman	4
93	Mahat	Jalal	5
104	Henry	McCay	5
27	Harpreet	Singh	4
201	Maria	Sklair	5

Book

BookID	Title	Category	StudentID	DateDueBack	Cost
1	Mr Fish	Fiction	93	01/08/2020	4.49
2	Space Explorer	Fiction	–1		11.99
3	Solar System	Science	201	08/07/2020	8.99
4	Big Cats	Nature	27	05/06/2020	10.00
5	A Lovely Life	Biography	–1		12.00

1 5 . 1 State the name of a suitable data type that could be used for the `Cost` field in the **Book** table.

[1 mark]

Do not write outside the box

1 5 . 2 State the name of the field that has been used as the primary key in the **Student** table.

[1 mark]

1 5 . 3 The developer has written this SQL query:

```
SELECT Surname, BookID, Cost
FROM   Student, Book
WHERE  YearGroup = 5
       AND Student.StudentID = Book.StudentID
```

List the records that would be displayed when this query is carried out on the data shown in the tables in **Figure 10**.

[3 marks]

1 5 . 4 The student Harpreet Singh, who has a `StudentID` of 27, has left the school. Their record must be removed from the **Student** table.

Tick (✓) **one** box to show which SQL query is the correct one to remove the student from the table.

[1 mark]

SQL Query	Tick one
`DELETE StudentID 27` `FROM Student`	
`DELETE "Harpreet Singh"` `FROM Student`	

`DELETE`
`FROM Student`
`WHERE StudentID = 27`	

`DELETE 27`
`FROM StudentID`
`IN Student`	

6

END OF QUESTIONS

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