Chhetri Academy

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GCSE COMPUTER SCIENCE

1.2

OCR J277 | Specification point 1.2.4

Data storage

Untiered

Past paper question booklet

13	2014-2025	Untiered
question groups	available papers	tier

Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

3 **(a)** Add the following two 8-bit binary numbers.

1	0	0	1	1	0	1	1
0	1	0	1	0	1	0	0

[2]

(b) An overflow error can occur when adding two 8-bit binary numbers.

Describe what is meant by an overflow error.

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..... **[2]**

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9 **(a)** The number 62 could be a denary number or a hex number.

(i) If 62 is a hex number, calculate its value as a denary number.

You **must** show your working.

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..... **[2]**

(ii) If 62 is a denary number, calculate its value as a hex number.

You **must** show your working.

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..... **[2]**

(b) Explain why people sometimes use hex numbers to represent numbers stored in computers, even though computers do not use hex numbers.

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..... **[3]**

8 **(a)** Convert the decimal number 191 into 8-bit binary.

..... **[1]**

(b) Perform the following binary addition

$$\begin{array}{r} 01101011 \\ +\ 01011011 \\ \hline \end{array}$$

[2]

2 Shannon is creating a website using HTML.

(a) An HTML file will contain the text to be displayed on the webpage.

(i) Identify **one** further item that will be included in the HTML file.

..... **[1]**

(ii) Explain **one** benefit of HTML being a standard.

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..... **[2]**

(b) In HTML, colours are represented by a series of 6 hexadecimal digits.

- The first 2 digits represent the amount of red in the colour
- The middle 2 digits represent the amount of green in the colour
- The last 2 digits represent the amount of blue in the colour

For example, FF0000 is red, 00FF00 is green, 0000FF is blue.

(i) The quantity of red, green and blue in a shade of purple are given in the table below. Convert each of the decimal numbers into its hexadecimal equivalent.

	Red	**Green**	**Blue**
Decimal	111	58	156
Hexadecimal	6F	.....	.....

[2]

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(ii) State **one** reason why hexadecimal is used to represent the numbers instead of binary.

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..... **[1]**

(c) Shannon is uploading a large number of images and videos to her website. She compresses the files before uploading them.

Explain why Shannon compresses the files before uploading them.

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..... **[2]**

(d) Shannon has a URL (uniform resource locator) for her website.

Explain how a domain name server is used to connect a user to the URL they have entered into a web browser.

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..... **[3]**

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Turn over

5 **(a)** **(i)** Convert the denary number **132** into an 8 bit binary number.

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..... **[2]**

(ii) Convert the binary number **10110101** to its hexadecimal equivalent.

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..... **[2]**

(iii) Show the effect of a binary shift right of two places on the binary number **00110100**.

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..... **[1]**

(iv) Describe a shift that can be used to double the value of the binary number **00100100**.

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..... **[2]**

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Turn over

(b) The table below (Fig. 3) shows the ASCII codes for a number of characters.

The lower case ASCII code for a character can be found by adding **0100000** to the upper case version.

Character	ASCII code
R	1 0 1 0 0 1 0
r	1 1 1 0 0 1 0
A	1 0 0 0 0 0 1
a	
E	1 0 0 0 1 0 1
e	

Fig. 3

(i) Complete the table above by filling in the missing ASCII codes. **[2]**

(ii) Compare the use of ASCII and Extended ASCII to represent characters.

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..... **[2]**

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5 **(a)** Convert the hexadecimal number **A3** to denary. Show your working.

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..... **[2]**

(b) Convert the binary number **1011011** to denary. Show your working.

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..... **[2]**

(c) The symbol **^** is used for exponentiation.

Give the result of a^b when a = 3 and b = 2.

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..... **[1]**

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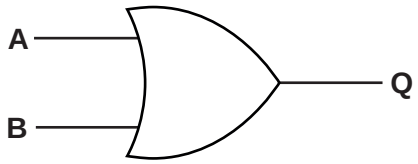
(d) Add the following binary numbers.

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

[2]

(e) Complete the truth table for the following logic gate.



A	B	Q
0	0	0
0	1	1
	0	
1		

[4]

4 **(a)** Convert the binary value **1110 0011** into hexadecimal.

.....

.....

.....

..... **[2]**

(b) Convert the denary value **105** into an 8 bit binary number.

.....

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.....

..... **[2]**

(c) Give **two** reasons why computer scientists use hexadecimal to represent numbers instead of binary.

1 .....

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2 .....

.....
[2]

(d) `DIV` and `MOD` are both operators used in computing-related mathematics.

(i) State the value of `13 DIV 4`

.....

..... **[1]**

(ii) State the value of `13 MOD 4`

.....

..... **[1]**

(e) Show the outcome of a right shift of three places on the binary value 0111 1000

.....

..... **[1]**

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(f) **(i)** Draw the logic diagram for the logic system **P = A OR (B AND C)**

[3]

(ii) Complete the truth table for the logic system **P = NOT (A OR B)**

A	B	P
0	0	1
0	1	
1	0	

[4]

5 **(a)** Convert the denary value **178** into an 8-bit binary number.

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..... **[2]**

(b) Computers make use of electronic switches called transistors.

Describe how transistors can be used to store a value in binary.

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..... **[2]**

(c) Convert the binary value **1100 0111** into hexadecimal.

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..... **[2]**

(d) Azmi says, "hexadecimal is used because it takes up less storage space in the computer's memory than binary."

Tick **one** box to identify whether Azmi is correct. Justify your answer.

	Tick (✓)
Correct	
Incorrect	

Justification .....

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.....

[2]

(e) Binary shifts can be used for multiplication and division.

Draw **one** line from each shift on the left to its correct outcome on the right.

Binary shift	Outcome
Right shift of 2 places on 1010 1000	0011 1010, divides by 4 with a loss of precision
Left shift of 1 place on 0010 1101	0010 1010, divides by 4
Right shift of 2 places on 1110 1001	0101 1010, multiplies by 2
Left shift of 3 places on 0001 1111	1111 1000, multiplies by 8

[3]

(f) Add the following 8 bit binary integers, giving your answer in binary.

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

[2]

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1 Computers represent data in binary form.

(a) Tick (✓) **one** box in each row to identify the binary unit equivalent of each of the given file sizes.

File size	2 megabytes	2 petabytes	2 kilobytes	2 bytes	2 gigabytes
2000 bytes					
2000 terabytes					
16 bits					
4 nibbles					

[4]

(b) Convert the denary number 221 into 8 bit binary. Show your working.

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..... **[2]**

(c) Convert the hexadecimal number 2F into denary. Show your working.

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..... **[2]**

(d) Convert the binary number 10110000 into hexadecimal.

.....

..... **[1]**

(e) Identify how many unique values can be represented by 4 bits.

..... **[1]**

(f) Perform a binary shift of 3 places right on the binary number 10001110.

..... **[1]**

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1 Computers represent data in binary form.

(a) Tick (✓) **one** box to identify the statement about binary that is true.

- ☐ Binary digits can only be the values 0, 1 and 2
- ☐ The left-most bit of a binary integer has the smallest value
- ☐ Binary is used because computers are made of switches that can only be on or off
- ☐ The smallest whole number that can be stored in 8 bits is the number 1

[1]

(b) Complete the table by writing the missing denary, 8-bit binary or hexadecimal values.

Denary	8-bit binary	Hexadecimal
	00000111	7
49		31
	01100110	66
244	11110100	

[4]

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(c) Tick (✓) **one** box to identify the largest file size.

- ☐ 2 000 000 bytes
- ☐ 2300 KB
- ☐ 200 MB
- ☐ 0.1 GB

[1]

(d) Tick (✓) **two** boxes to identify the two file sizes that are equal to each other.

- ☐ 4 500 000 bytes
- ☐ 450 KB
- ☐ 4.5 MB
- ☐ 0.45 GB

[1]

(e) Complete the binary addition by adding these two 8-bit binary numbers.

Show all your working.

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

[2]

(f) Identify the binary shift that has been applied to the 8-bit binary number 10110000 to get the result 10000000.

.....

..... **[2]**

3 Binary numbers can represent different forms of data.

(a) One form of data is characters.

Complete the description of how computers represent characters in binary using the given list of terms. Not all terms will be used.

2	4	8	9	16	32	256	
71	72	74	76	78	80	81	
all	different	identical	one	repeated	similar	some	unique

A character set stores ..... of the characters that the computer can represent. Each character is given a ..... binary code. Lower-case and upper-case letters in a character set are given ..... binary codes.

One example of a character set is ASCII. This character set uses ..... bits for each character. If the code value for the character 'F' is 70 then the code value for the character 'L' is ..... .

[5]

(b) Binary numbers can also represent images.

The table shows the colours that are used in an image and the binary value for each colour.

Colour	Binary value
Red	0000
Green	0010
Blue	1000
Purple	0110

The metadata states that the image is 3 pixels wide by 4 pixels high.

The data in the file starts in the top left of the image and goes from left-to-right, top-to-bottom.

(i) State what is meant by **metadata** in an image file.

.....

..... **[1]**

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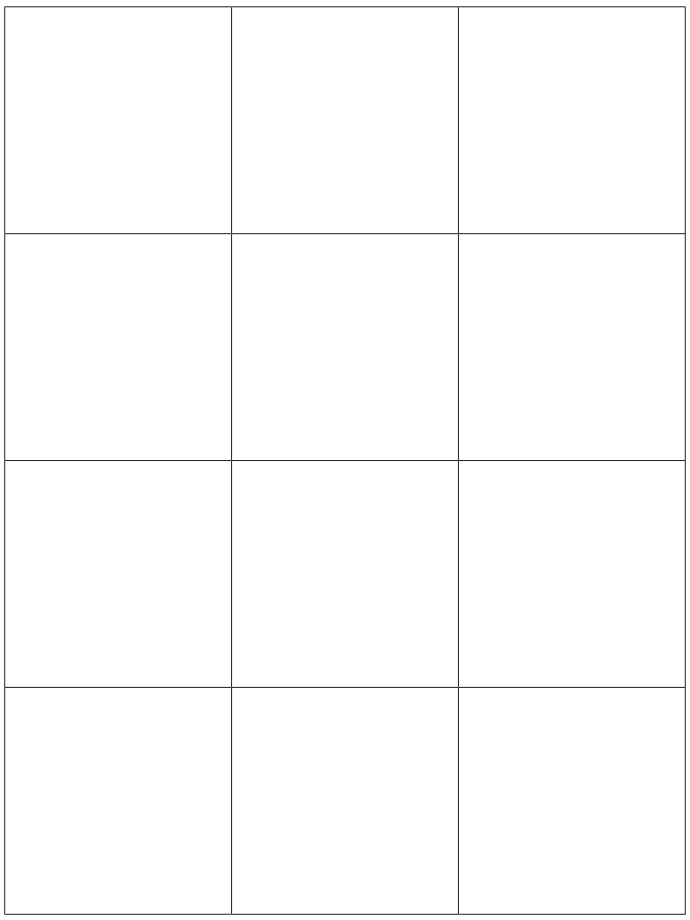
(ii) The binary data stored for the image is given:

00000000011010000010100001100110011000000010100 0

A grid is given for the image. Each square is one pixel.

Write the name of the colour in each square that the pixel will show for this image.



[2]

(iii) A colour depth of 4 is used. This means 4 bits are used to store the colour for each pixel.

State the maximum number of different colours that can be represented in 4-bits.

..... **[1]**

(iv) The colour depth is increased to 2 bytes.

State **two** effects that this change can have on the image.

1 .....

.....

2 .....

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[2]

(c) A student has a text document and an image file that need to be compressed separately.

The student needs to reduce the file size of both of these files as much as possible.

(i) Identify the most suitable type of compression for the **text** document. Justify your choice.

Type of compression .....

Justification .....

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.....

.....

[3]

(ii) Identify the most suitable type of compression for the **image** file. Justify your choice.

Type of compression .....

Justification .....

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.....

[3]

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1

(a) The following table has either the binary or denary value of 3 numbers.

Complete the table by converting the 8-bit binary number into denary and the denary number into 8-bit binary.

8-bit Binary	Denary
11110000	
	105
00011110	

[3]

(b) Complete the table by writing the answer to each statement.

Statement	Answer
The smallest denary number that can be represented by a 4-bit binary number	
The largest denary number that can be represented by a 6-bit binary number	
The maximum number of different colours that can be represented with a colour depth of 7-bits	
The minimum number of bits needed to represent 150 different characters in a character set	

[4]

(c) Show the result of a left binary shift of 4 places on the binary number 00001111.

..... **[1]**

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(d) Describe how to convert a 2-digit hexadecimal number into denary.

Use an example in your answer.

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..... **[3]**

(e) Add these two 8-bit binary numbers using binary addition.

Show your working out.

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

[2]

5

(a) Tick (✓) **one** box to identify the quantity of megabytes that is the same as 2 terabytes.

- ☐ 2000 MB
- ☐ 20 000 MB
- ☐ 200 000 MB
- ☐ 2 000 000 MB

[1]

(b) Each row in the table contains a number that is written as a denary value, 8-bit binary value and a 2-digit hexadecimal value. Some values are missing.

Complete the table by writing in the missing value for each number.

Denary	8-bit binary	2-digit hexadecimal
38		26
	01001110	4E
156	10011100	
215		D7

[4]

(c) Complete the binary addition of these two 8-bit binary numbers.

Show your working out.

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

[2]

(d) Tick (✓) **one** box to identify the result of a 2-place right binary shift on the binary number 01110111.

- ☐ 00011101
- ☐ 11101110
- ☐ 00111011
- ☐ 11011100

[1]

(e) Describe the binary shift that can be used to multiply any number by 8.

.....

..... **[2]**

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