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EDEXCEL INTERNATIONAL GCSE COMPUTER SCIENCE: QUESTIONS BY TOPIC

Data (Topic 3)

International GCSE Computer Science Topic 3

10 questions · 112 marks · Mark schemes included

Pearson Edexcel International GCSE (9–1) Computer Science 4CP0, Papers 1 & 2, June 2019 - June 2022

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HOW TO USE THIS BOOKLET

Grouped by sub-topic, lowest mark tariff first. Paper 2 answers use the Python mark scheme (2A).

Click any heading or question row below to jump straight to it.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION	SOURCE	MARKS	PAGE
3(a) BINARY AND NUMBER REPRESENTATION		4 questions · 51 marks	3
1. Q2	Paper 1 November 2020	9	4
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3(b) DATA REPRESENTATION: SOUND AND IMAGES		2 questions · 25 marks	14
5. Q4	Paper 1 November 2020	12	15
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3(c) DATA STORAGE AND COMPRESSION		1 questions · 14 marks	20
7. Q4 <i>also Topic 4</i>	Paper 1 June 2019	14	21
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QUESTIONS

10 questions · 112 marks · grouped by sub-topic



SUB-TOPIC 3(a)

3(a) BINARY AND NUMBER REPRESENTATION

4 questions in this booklet



2 Computers use binary digits to represent data.

(a) Sign and magnitude and two's complement are two ways of representing signed integer numbers.

(i) Convert the denary number -94 to a binary pattern using sign and magnitude representation.

(2)

(ii) 1000 1001 is a signed integer that uses two's complement representation.

Convert this signed integer to denary.

(2)

(b) Denary numbers use base 10

Identify the base for hexadecimal numbers.

(1)

- ☐ A 32
- ☐ B 16
- ☐ C 8
- ☐ D 2

(c) Computers encode characters using ASCII and Unicode.

(i) State the number of characters that can be represented using standard ASCII.

(1)

(ii) The ASCII system uses 7 bits to represent a character. The ASCII code for the character 'A' using denary is 65; other alphabetical characters follow on from this in sequence.

Identify the ASCII code for 'H'.

(1)

- ☐ **A** 1000111
- ☐ **B** 1001010
- ☐ **C** 1001000
- ☐ **D** 1000101

(iii) Explain why Unicode was developed.

(2)

(Total for Question 2 = 9 marks)



1 Binary digits (bits) are grouped together to represent different types of data.

(a) Hexadecimal notation is sometimes used to represent patterns of binary digits.

Identify **one** reason why programmers use hexadecimal notation.

(1)

- ☐ A Easier for a computer to understand.
- ☐ B Easier for humans to read.
- ☐ C Takes up less computer memory.
- ☐ D Quicker than binary to execute.

(b) Convert the bit pattern 0101 1010 to hexadecimal.

(2)

(c) Identify the number of binary patterns that can be represented by 8 bits.

(1)

- ☐ A 128
- ☐ B 256
- ☐ C 512
- ☐ D 1024



(d) Complete the table by adding these two 8-bit binary integers.

(2)

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

(e) Give the result of performing a logical left shift of 1 place on the binary integer 0100.

(1)

(f) Give the number of bits per character used by standard ASCII.

(1)

(g) **Figure 1** shows a black and white bitmap image.

The pixels in row 5 are represented by the binary pattern 1001 1001

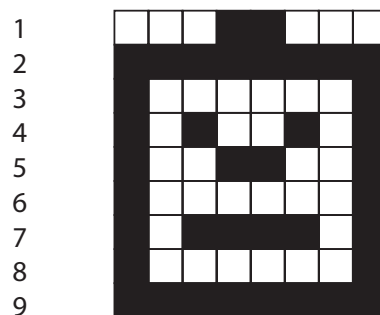


Figure 1

(i) State what is meant by the term **pixel**.

(1)

(ii) Construct an expression to show the number of pixels in the image.

(1)

(iii) The image is changed so that any pixel can be one of 16 different colours.

State the minimum number of bits that would be needed to represent **one** pixel.

(1)

(Total for Question 1 = 11 marks)



2 Computers use binary to represent and store data.

(a) The denary number 78 is the ASCII code for the character **N**.

(i) Convert the denary number 78 to 8-bit binary.

(2)

(ii) Identify the number of characters that can be represented using standard ASCII.

(1)

- ☐ **A** 64
- ☐ **B** 128
- ☐ **C** 256
- ☐ **D** 512

(iii) Explain **one** reason for using Unicode rather than ASCII to encode languages other than English.

(2)

(b) Convert the denary number –43 to 8-bit binary using sign and magnitude representation.

(2)

(c) Complete the table by adding these two 8-bit binary integers.

(2)

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

(d) A bitmap image is made up of pixels.

(i) An image has five colours.

Complete the table by adding a unique binary pattern for each colour.

Each pattern must use the **same minimum colour depth**.

(2)

Colour	Binary pattern
Green	
Black	
White	
Red	
Blue	

(ii) Another image is 3579 pixels high and 6128 pixels wide.

The image is stored with a 32-bit colour depth.

The metadata for the image is 732 bytes.

Construct an expression to show how the file size, in **megabytes**, is calculated.

You do **not** need to do the calculation.

(4)

1 Computers use binary to represent and store data.

(a) Binary and hexadecimal notation can be used to represent numbers.

(i) Convert the denary number 77 to 8-bit binary.

(2)

(ii) Convert the denary number -126 to 8-bit binary using two's complement.

(2)

(iii) Convert the binary pattern 11000110 to hexadecimal.

(2)

(b) Images are stored as binary data.

(i) A bitmap image is 400 pixels wide by 200 pixels high.

It has a colour depth of 12 bits.

Construct an expression to show how the image size, in bytes, is calculated.

Do **not** calculate the answer.

(2)

(ii) **Figure 1** is an image of an icon, set out in an 8×8 pixel grid.

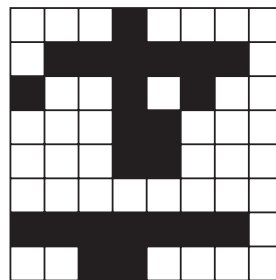


Figure 1

A run-length encoding compression algorithm uses:

- W for white pixels
- B for black pixels.

Give the result of compressing the first 4 lines of the icon using the algorithm.

(3)

Line 1

Line 2

Line 3

Line 4

(iii) Run-length encoding is a type of lossless compression.

State what is meant by the term **lossless** in this context.

(1)

(c) Raoul wants to record a song and store it as a digital sound file.

Figure 2 shows an overview of the process of recording a song and storing it as a digital sound file.

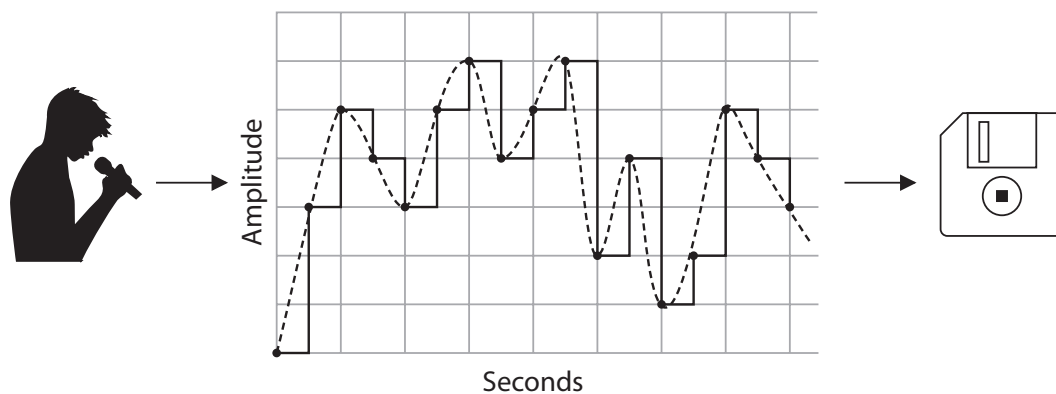


Figure 2

(i) Describe the steps taken to convert the analogue sound to a digital sound file.

(3)

(ii) Raoul uses a lossy algorithm to compress the file.

Give **one** reason why the sound quality of the compressed file may not be as good as the uncompressed version.

(1)

(Total for Question 1 = 16 marks)

SUB-TOPIC 3(b)

3(b) DATA REPRESENTATION: SOUND AND IMAGES

2 questions in this booklet



4 Ibrahim works in the music industry.

(a) He is learning how sound is represented in binary.

Figure 3 illustrates this process.

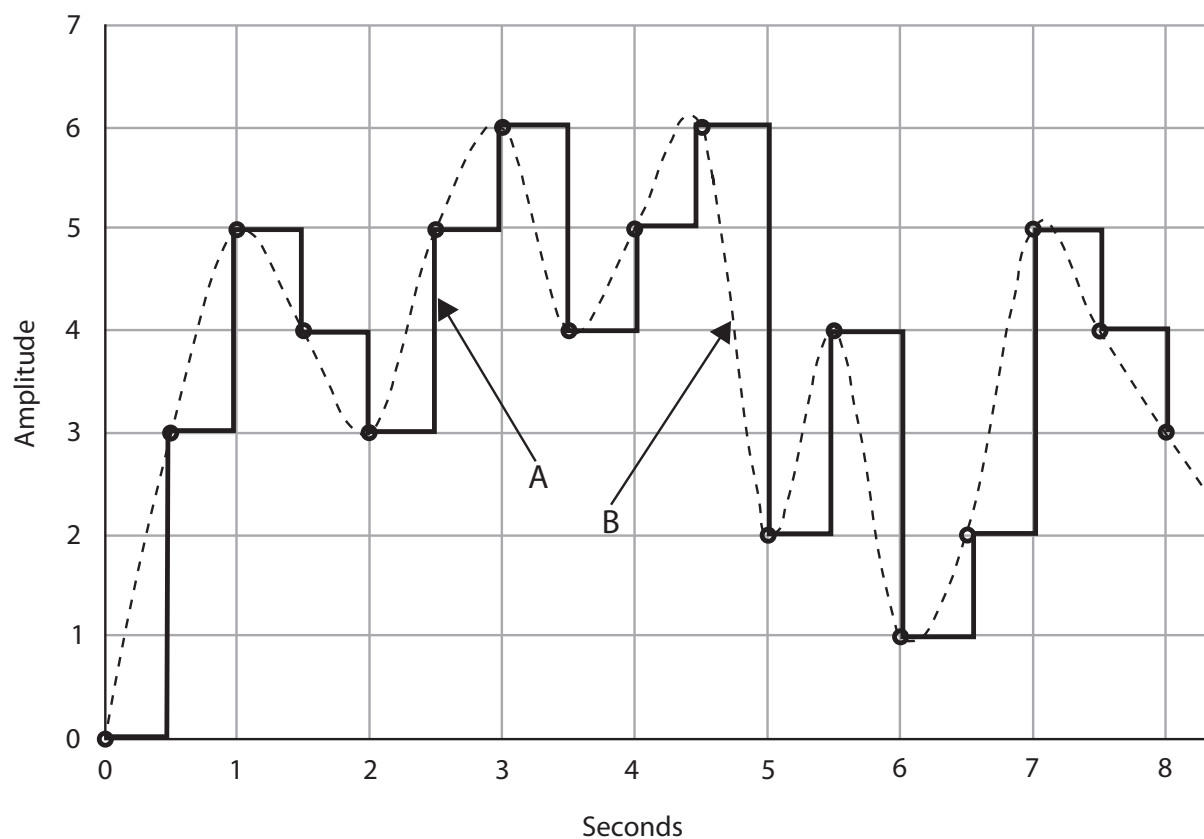


Figure 3

(i) State what the solid line labelled **A** represents.

(1)

(ii) State what the dashed line labelled **B** represents.

(1)

(iii) Give the sampling frequency, including the correct units.

(1)

(iv) Give **one** impact of increasing the sampling frequency.

(1)

(v) The bit-depth measures the resolution of the sound sample.

State the minimum bit-depth needed to store the sound sampled in **Figure 3**.

Justify your answer.

(2)

Bit-depth

Justification

(vi) Give the value in binary of the audio sample at the 4th second.

(1)



(b) Ibrahim wants to store a music file.

- The sampling frequency is 47 kHz.
- The bit-depth is 64
- The analogue signal lasts for 819 seconds.

Construct an expression to show how the file size, in bytes, is calculated.

You do **not** need to do the calculation.

(4)

(c) Ibrahim wants to upload a music file to his online storage. The file has been compressed using a lossy algorithm.

Give **one** drawback of using a lossy algorithm for this purpose.

(1)

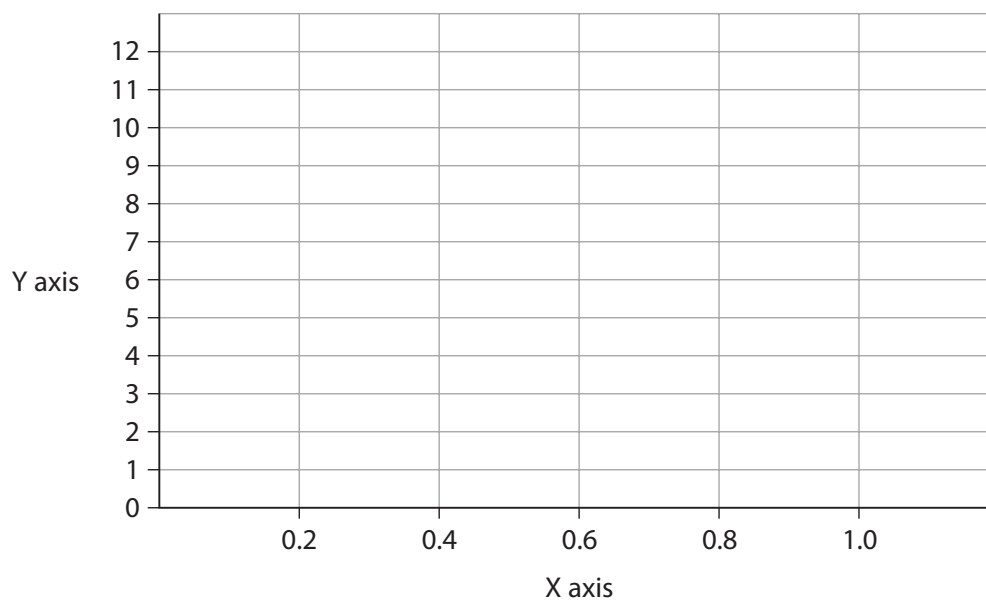
(Total for Question 4 = 12 marks)

3 Alyssa is a music producer.

- (a) **Figure 1** shows the denary values of five samples of an analogue sound using a sample interval of 0.2 seconds.

Sample number	Denary value
1	1
2	10
3	12
4	5
5	3

Figure 1



- (i) Complete this graph using the sample information from **Figure 1** to show the digital sound wave.

(3)

- (ii) Give a suitable label for the X axis.

(1)

- (iii) Give a suitable label for the Y axis.

(1)



(b) Alyssa uploads music files to her cloud storage.

(i) She compresses the files before she uploads them using a lossless algorithm.

Give **one** disadvantage of using a lossless rather than a lossy algorithm for this purpose.

(1)

(ii) Explain **one** benefit to Alyssa of storing her music files in the cloud.

(2)

(iii) Give **one** possible security issue associated with storing music files in the cloud.

(1)

(iv) One of Alyssa's music files is stored at <https://www.cloudisfab.com/re12/ru2.mp3>

Complete the table by adding a description of each URL component.

(4)

URL component	Description
https	
www.cloudisfab.com	
re12	
ru2.mp3	

(Total for Question 3 = 13 marks)



SUB-TOPIC 3(c)

3(c) DATA STORAGE AND COMPRESSION

1 question in this booklet



4 One function of an operating system is file management.

(a) Both kibibyte and kilobyte can be used as measures of file size.

Compare kibibyte and kilobyte.

(2)

(b) An image is 2322 pixels high and 4128 pixels wide.

The image is stored with a 16-bit colour depth.

The metadata for the image is 975 bytes.

Construct an expression to show how the file size, in megabytes, is calculated.

You do **not** need to do the calculation.

(4)

(c) Operating systems often include compression software for reducing file sizes.

(i) Give **two** reasons for reducing file sizes.

(2)

1

2

(ii) Give **two** drawbacks of using compression software.

(2)

1

2

(d) A text file is stored on a hard disc.

The file holds information from one side of a sheet of paper.

The sheet of paper is represented as a grid, 80 columns wide and 66 rows long.

Each cell in the grid contains a single 2-byte Unicode character.

The file also contains 40 characters of metadata.

The hard disc allocates space in blocks of 1024 bytes.

Construct an expression to show the number of blocks required to store the file.

You do **not** need to do the calculation.

(4)

SUB-TOPIC 3(d)

3(d) ENCRYPTION

3 questions in this booklet



4 Encryption is used to encode data.

(a) Identify the word that describes a Pigpen cipher.

(1)

- ☐ A Plaintext
- ☐ B Random
- ☐ C Shift
- ☐ D Substitution

(b) **Figure 1** shows a Pigpen cipher grid.

(3)

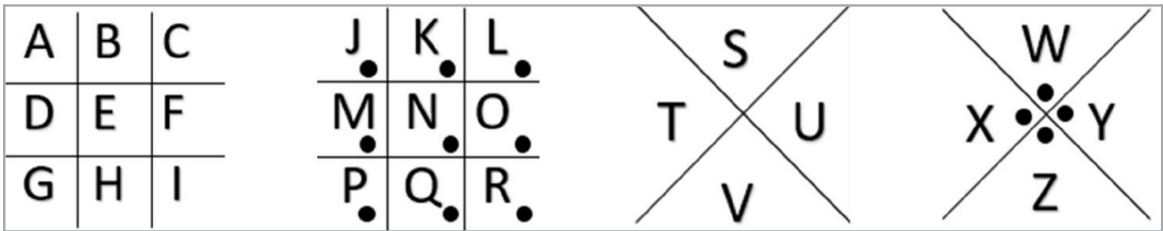


Figure 1

Complete the table to decode the symbols using the grid in **Figure 1**.

Symbol	Letter

(c) **Figure 2** shows another grid.

C	O	M	A.	B.	D.	L	N	Q
P	U	T	F.	G.	H.	V	W	X
E	R	S	I.	J.	K.	Y	Z	.

Figure 2

State whether this set of symbols meets the requirements of a Pigpen cipher.

Justify your answer.

(3)

State

Justification

(Total for Question 4 = 7 marks)

4 Several encryption algorithms have been developed.

(a) Identify what is meant by **encryption**. (1)

- ☐ A Conversion of ciphertext into plaintext
- ☐ B Conversion of plaintext into ciphertext
- ☐ C Conversion of code into data
- ☐ D Conversion of data into information

(b) **Figure 1** shows a Pigpen cipher grid.

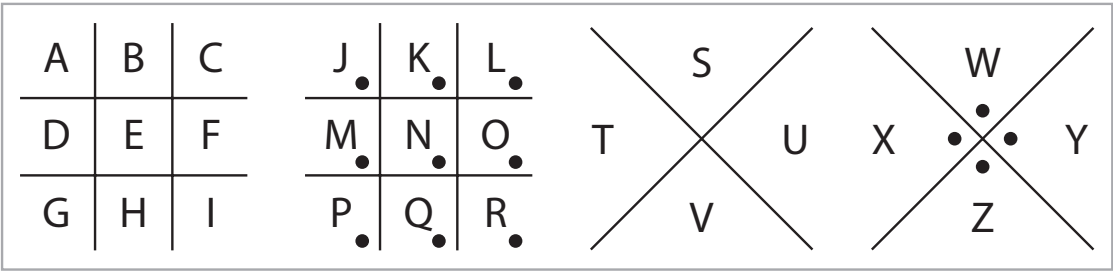


Figure 1

Complete the table by adding the symbol for each letter in the word **MAY**. (3)

Letter	M	A	Y
Symbol			

(c) The message THE ENEMY IS NEAR is encoded using a different encryption algorithm.

Figure 2 shows the first stage of the encryption process.

T								I					
	H						Y		S				
		E				M				N			
			E		E						E		R
				N								A	

Figure 2

(i) Give the key used in the first stage of the encryption process.

(1)

(ii) Give the ciphertext that is produced by the encryption algorithm.

(1)

(iii) Give the name of the encryption algorithm that has been used to produce the ciphertext.

(1)

(Total for Question 4 = 7 marks)



3 Several encryption algorithms have been developed.

(a) State what is meant by the term 'encryption'.

(1)

(b) Give **one** reason why data may need to be encrypted.

(1)

(c) (i) Perform a Rail Fence cipher encryption of the text **COMPUTATIONAL** using a key of 4.

Show your working.

(4)

Encrypted text:

(ii) Explain **one** reason why the Rail Fence cipher is a weak encryption algorithm.

(2)

(Total for Question 3 = 8 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question Number	Answer	Additional Guidance	Mark
2(a)(i)	1101 1110 Award one mark for: • MSB = 1 (1) • Rest of pattern correct (1)		2

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	- (1) 119 (1)		2

Question Number	Answer	Additional Guidance	Mark
2(b)	B 16		1

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	128	Allow the range 0-127	1

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	C		1

Question Number	Answer	Additional Guidance	Mark

2(c)(iii)	Award two marks for a linked explanation such as: (Before Unicode existed) there are hundreds of different encoding systems (1) and no single encoding system could contain enough characters to represent all major languages (1) Standard ASCII only provides 128 different patterns (1) can't represent all major languages/symbols/characters (1) Unicode uses a minimum of 16 bits (1) so can represent at least 2^{16} characters (1) Unicode has very large number of characters (1) can represent all languages/ASCII was developed (just) for English (1)		2
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Question Number	Answer	Additional Guidance	Mark
1(a)	The only correct answer is B A is not correct because computers only understand binary C is not correct because Hex values will be held as binary so take up the same space D is not correct because Hex values are held as binary and so take the same time to execute		1

Question Number	Answer	Additional Guidance	Mark
1(b)	Award one mark for each of: • 5 • A	Must be in the correct order	2

Question Number	Answer	Additional Guidance	Mark
1(c)	The only correct answer is B A is not correct because this is the number of binary patterns that can be represented by 7 bits C is not correct because this is the number of binary patterns that can be represented by 9 bits D is not correct because this is the number of binary patterns that can be represented by 10 bits		1

Question Number	Answer	Additional Guidance	Mark
1(d)	Award one mark for each nibble 0110 0101		2

Question Number	Answer	Additional Guidance	Mark
1(e)	Award one mark from: • 01000 (1) • 1000 (1)		1



Question Number	Answer	Additional Guidance	Mark
1(f)	7		1

Question Number	Answer	Additional Guidance	Mark
1(g)(i)	Award one mark from: • The smallest block (of colour) in an image (1) • A single dot in a picture (1) • A picture element (1) • A single element of a digital screen (1)		1
1(g)(ii)	Award one mark from: • 8 x 9 (1) • 9 x 8 (1)	Accept 72	1
1(g)(iii)	4		1

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	Award up to two marks for: 0100 (1) 1110 (1)	Accept any number of leading zeros.	2
2(a)(ii)	The only correct answer is B <i>A is not correct because standard ASCII uses 7 bits, 64 characters would need only 6 bits</i> <i>C is not correct because standard ASCII uses 7 bits, 256 characters would need 8 bits</i> <i>D is not correct because standard ASCII uses 7 bits, 512 characters would need 9 bits</i>		1
2(a)(iii)	Award up to two marks for a linked explanation such as: All of the major languages/symbols/characters can be represented by Unicode (1) because it uses a minimum of 16 bits/more bits/32 bits/65536 characters (1) Unicode can represent all/more characters/any language (1) whereas ASCII can only represent English/Latin/128 characters/doesn't have enough characters (1) Unicode can represent all characters (1) because it uses 16 bits/2 bytes /more bits instead of 8 bits/1 byte (1)	Accept the reverse argument Allow examples of non-latin characters	2

Question Number	Answer	Additional Guidance	Mark
2(b)	1010 1011 Award up to two marks for: - MSB = 1 (1) - Rest of pattern correct 010 1011 (1)		2

Question Number	Answer	Additional Guidance	Mark
2(c)	Award up to two marks for: 0100 (1) 1010 (1)		2



Question Number	Answer	Additional Guidance	Mark												
2(d)(i)	Award up to two marks for: • 3 bits used for all patterns (1)/ • No pattern repeated (1) Example: <table><tr><th>Colour</th><th>Binary pattern</th></tr><tr><td>Green</td><td>000</td></tr><tr><td>Black</td><td>001</td></tr><tr><td>White</td><td>010</td></tr><tr><td>Red</td><td>011</td></tr><tr><td>Blue</td><td>100</td></tr></table>	Colour	Binary pattern	Green	000	Black	001	White	010	Red	011	Blue	100		2
Colour	Binary pattern														
Green	000														
Black	001														
White	010														
Red	011														
Blue	100														
2(d)(ii)	Award one mark for each of: • 3579 x 6128 x 32 (1) • ÷ 8 (1) • + 732 (1) • ÷ (1000 x 1000) (1) Examples 3579 x 6128 x 32 8 732 1000 x 1000 ((3579 x 6128 x 32) ÷ 8) + 732 1000 x 1000 (3579 x 6128 x 4) + 732 1000 x 1000	• Units are not required • Equivalent expressions are accepted • Calculations not explicit but expressed gain the mark • Award 1 mark for correct calculated answer of 87.73 if no other marks awarded	4												
Total for question 2			15												

Question Number	Answer	Additional Guidance	Mark
1(ai)	0100 1101 100 1101 Award one mark for each correct nibble	Must be in the correct order	2
1(a)(ii)	1000 0010 Award one mark for each correct nibble	Must be in the correct order	2
1(a)(iii)	Award one mark for each of: • C (1) • 6 (1)	Must be in the correct order	2

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	400 pixels x 200 pixels x 12 bits / 8 bits per byte Allow expression in word form $\frac{400 \times 200 \times 12}{8}$ 400 x 200 OR 80000(1) 12/8 OR 1.5 (1)	Accept any other use of 400, 200, 12, 8 that gives the correct answer Allow one mark for 120,000 with no expression	2
1(b)(ii)	Spaces are to help legibility. Award three marks for: Line 1 3W 1B 4W Line 2 1W 6B 1W Line 3 1B 2W 1B 1W 1B 2W Line 4 3W 2B 3W Award two marks for any three lines correctly encoded Award one mark for any two lines correctly encoded	Allow one error in the sequence Accept letter before number but must be consistently used	3
1(b)(iii)	Award one mark from: • None of the original (image) detail/quality is lost (when the image is stored) (1) • None of the data/information is (permanently) removed (1) • It can be decompressed without losing detail (1)		1

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	Award up to three marks for a linked description: • set the sample rate/parameters/bit-depth (1) • sample (the analogue sound) (1) • measure the sound amplitude/volume/frequency (1) • give a (binary) value/number for each measurement (1) • store data as sample rate and values / digital signals (1)		3
1(c)(ii)	Award one mark from: • sound may be missing some frequencies (1) • some audio information/data is lost/deleted during the (compression) process (1)		1
Total			16



4(a)(i)	Digital (signal) / converted analogue (signal) (1)		1
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Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	Analogue (signal) / analogue (sound wave) (1)		1

Question Number	Answer	Additional Guidance	Mark
4(a)(iii)	2 Hertz / hertz / Hz (1)	- Do not penalise spelling - Accept 2 samples/cycles per second	1

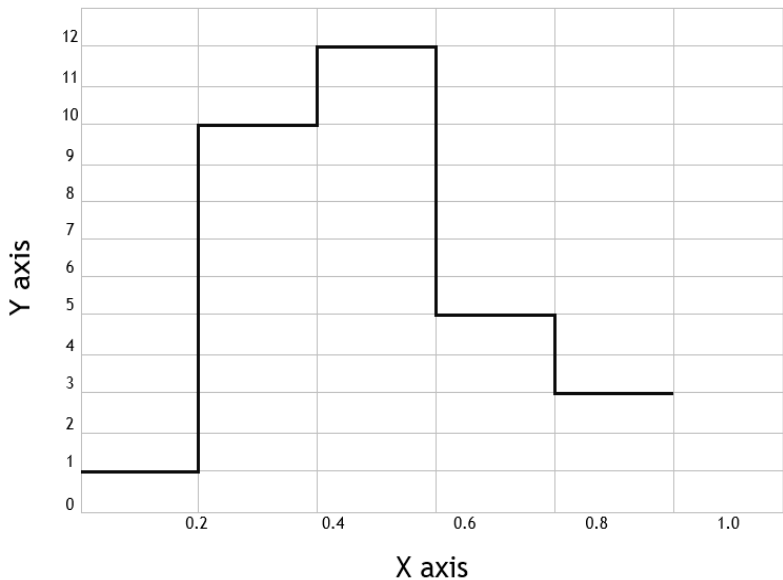
Question Number	Answer	Additional Guidance	Mark
4(a)(iv)	Any one mark for: - The (analogue sound) wave will be represented more accurately / the fidelity/quality of the recording is improved (1) - The file size will increase / more data stored (as each sample takes up disk space) (1)		1

Question Number	Answer	Additional Guidance	Mark
4(a)(v)	3 (1) - The range of sampled sound is from 0-6. To store 7 distinct values, you need 3 bits (111 binary = 7 denary) (1) OR graph shows 8 possible values, 3 bits can store 0 - 7 / 8 values (1)		2

Question Number	Answer	Additional Guidance	Mark
4(a)(vi)	Correct binary value 101 (1)	Ignore leading zeros	1

4(b)	819 seconds * 8 bytes * 47,000 hertz $819 \times 8 \times 47000$ 819 seconds * $64 \div 8$ bytes * 47,000 hertz $\frac{819 \times 64 \times 47000}{8}$ 819 (1) 8 or $64 \div 8$ (1) 47,000 (1) Fully correct expression (1)	Award equivalent expressions	4
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Question Number	Answer	Additional Guidance	Mark
4(c)	Any one from: - The sound quality may be poorer/lower (for some people) (1) - Cannot get the original back after compression (1)		1

Question Number	Answer	Additional Guidance	Mark												
3(a)(i)	Award one mark for each of: - At least four conversions plotted at the correct amplitude (1) - Correct start point (1) 0 – 1 digital. 0 – 0 analogue - Digital sound wave drawn (1) using candidate's plots <table border="1"><thead><tr><th>Sample number</th><th>Denary value</th></tr></thead><tbody><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>10</td></tr><tr><td>3</td><td>12</td></tr><tr><td>4</td><td>5</td></tr><tr><td>5</td><td>3</td></tr></tbody></table> 	Sample number	Denary value	1	1	2	10	3	12	4	5	5	3	MP1 does not have to start at 0.2 - 1	3
Sample number	Denary value														
1	1														
2	10														
3	12														
4	5														
5	3														
3(a)(ii)	Award one mark for: - Time (1) - Sample interval/period (1) - Seconds (1)		1												
3(a)(iii)	Award one mark for: - Amplitude / sound level / volume (1) - Metres/centimetres/nanometres (1) - m/cm/nm (1)		1												

Question Number	Answer	Additional Guidance	Mark								
3(b)(i)	Award one mark from: • Transfer time would be longer (1) • Larger file size / less compression (1) • Takes up more storage space (1) • Uses more of her data allocation (1)		1								
3(b)(ii)	Award up to two marks for a linked explanation such as: • Storage capacity can be scaled up and down (1) so no need to buy more secondary storage / only pay for what is used/needed (1) • Will have the files all in one place (1) rather than scattered across many secondary storage devices (1) • Files can be uploaded/downloaded anytime/anywhere/on any device (1) so long as there is an internet connection (1) • Can be set up to automatically backup / synchronise with mobile devices (1) therefore if any files/devices are lost/stolen her files will be available on the server (1)	Do not award a mark for cheaper without expansion.	2								
3(b)(iii)	Award one mark from: • Storage host could be targeted by hackers (1) • Alyssa has less control over her files (1) • An untrustworthy employee (of the cloud storage provider) could steal her files (1) • Reliant on the storage provider for security / safekeeping (1) • Files could be intercepted/corrupted during upload/download (1)		1								
3(b)(iv)	Award one mark for each of: <table><tr><th>URL component</th><th>Description</th></tr><tr><td>https</td><td>Protocol / scheme (1)</td></tr><tr><td>www.cloudisfab.com</td><td>Domain (name) / host / name of website (1)</td></tr><tr><td>re12</td><td>Folder/directory (on the website) / path / part of path(1)</td></tr></table>	URL component	Description	https	Protocol / scheme (1)	www.cloudisfab.com	Domain (name) / host / name of website (1)	re12	Folder/directory (on the website) / path / part of path(1)		4
URL component	Description										
https	Protocol / scheme (1)										
www.cloudisfab.com	Domain (name) / host / name of website (1)										
re12	Folder/directory (on the website) / path / part of path(1)										

	ru2.mp3	File/media/resource wanted (on the website)/ path / part of path (1)		
Total for question 3				13



Question Number	Answer	Additional Guidance	Mark
4(a)	Any two from: Kilobyte is a SI (physics/science) / International System of Units measurement, whereas Kibibyte is an IEC (computing) / International Electrotechnical Commission / International System of Quantities / ISO measurement (1) Kilobyte is equivalent to 1000 bytes, whereas a kibibyte is equivalent to 1024 bytes (1) Kilobyte is equivalent to 10^3 bytes, whereas a kibibyte is equivalent to 2^{10} bytes (1) Kilobyte is a base 10 measurement, whereas a kibibyte is a base 2 measurement (1)	Ignore units	2

Question Number	Answer	Additional Guidance	Mark
4(b)	Award 4 marks for 19.17 or One mark for each of: • Calculates correct bits/bytes(1) • Adds metadata (1) • Calculates correct megabytes (1) • Completely correct response (1) Examples: $\frac{2322 \times 4128 \times 16}{8} + 975$ $\frac{1000 \times 1000}{1000 \times 1000}$ $\frac{(2322 \times 4128 \times 2) + 975}{1000 \times 1000}$ ((2322 x 4128 x 16 bits per colour) ÷ 8 bits per byte) + 975 bytes ----- 1000 bytes per KB x 1000 kilobytes per MB ((2322 x 4128 x 2 bytes per colour) + 975 bytes ----- 1000 bytes per KB x 1000 kilobytes per MB	• Arithmetic precedence rules must be clearly followed • Units are not required • Equivalent expressions are accepted • Calculations not explicit (8x1000x1000) but expressed (8000000) gain the mark	4

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	Any two from: - To save disc/storage space (1) - Reduce transmission time (1) - Meet email attachment size restrictions (1)		2

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	Any two from: - Compressing / decompressing the file takes execution time (1) - Both compressing and decompressing have to be done with compatible software / both ends of transmission have to use compatible software (1) (If the compression utility uses a lossy algorithm then) some of the data will be permanently removed / it won't be possible to reconstruct the original file. (1) - Can affect the quality of the file (1) - File size can increase (1)		2

Question Number	Answer	Additional Guidance	Mark
4(d)	Award 4 marks for 11 Award 3 marks for a value between 10 and 11 One mark for each: $80 \times 66 \times 2$ or $80 \times 66 \times 16 \div 8$ (1) $+ 40$ or $+ 80$ (1) $\div 1024$ (1) - Ceiling or RoundUp (1)	- Arithmetic precedence rules must be clearly followed - Units are not required - Alternative notations for ceiling are accepted - If 16 bits per Unicode character is not awarded, then allow follow through error - Allow follow through error, if interim calculations attempted - Equivalent expressions are accepted	4

Question	Answer	Additional Guidance	Mark						
4(a)	The only correct answer is D A is not correct because Plaintext is the original unencrypted text B is not correct because there is a consistency in the coding of the text C is not correct because a shift encryption replaces letters with other letters a given distance from the original letter (as in a Caesar cipher)		1						
4(b)	Award 3 marks for all rows correct Award 2 marks for 4 rows correct Award 1 mark for 2 rows correct <table><tr><td>G</td></tr><tr><td>Q</td></tr><tr><td>I</td></tr><tr><td>X</td></tr><tr><td>N</td></tr><tr><td>U</td></tr></table>	G	Q	I	X	N	U		(3)
G									
Q									
I									
X									
N									
U									
Q4(c)	One mark for correct decision: Yes (1) Up to two marks for the correct justifications: Each/every letter has a symbol / is represented (1) The symbol is a single/unique representation (1)	Award marks independently	(3)						

Question	mp	Answer	Additional Guidance	Mark
4 (a)	A1	The only correct answer is B A is not correct because this is decryption C is not correct because this is not an encryption D is not correct because this is not an encryption		(1)

Question	mp	Answer	Additional Guidance	Mark								
4 (b)	B1 B2 B3	Award 1 mark for each correct symbol <table><tr><th>Word</th><td>M</td><td>A</td><td>Y</td></tr><tr><th>Symbol</th><td></td><td></td><td></td></tr></table>	Word	M	A	Y	Symbol					(3)
Word	M	A	Y									
Symbol												

Question	mp	Answer	Additional Guidance	Mark
4 (c)(i)	C1	5		(1)
4 (c)(ii)	C2	TIHYSEMNEEERNA		(1)
4 (c)(iii)	C3	Rail (Fence cipher)		(1)

Question	mp	Answer	Additional Guidance	Mark
3 (a)	A1	Award one mark for any of: • Conversion of plain text into cipher (1) • Converting information/data into a code (1) • Converting information/data into an unreadable format (1)	Accept alternative wording	(1)

Question	mp	Answer	Additional Guidance	Mark
3 (b)	B1	Award one mark for any of: • To ensure that the data can only be read by an authorised person / can't be read by an unauthorised person. (1)	Accept alternative similar wording. Do not accept hacking.	(1)

Question	mp	Answer	Additional Guidance	Mark
3 (c) (i)	C1 C2 C3 C4	Award 4 marks for a correct response: • CAL OTTA MUIIN PO • PO MUIIN OTTA CAL Award 1 mark each up to a maximum of 3 for: • 4 lines of text (1) • Zigzag arrangement of letters (1) • Letters from each line reproduced / consistent use of the key 4: GSQTYEXMSREP/YKILQPWPEKJWH (1)		(4)

Question	mp	Answer	Additional Guidance	Mark
3 (c) (ii)	C5 C6	Award 2 marks for a linked explanation such as: • Limited number of usable keys (1) to allow for sufficient movement of characters / so can easily be decoded by trial		(2)



		and error / easy to use brute force to crack (1)		
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