

CH1 WORKSHEET 2 20191122

NAME:

SCORE:

1 A product designer is creating a poster.

(a) The designer creates a 6-colour bitmap image for the poster as shown.

Each colour is represented by a letter, for example, R = red, B = blue.

R	R	P	P	P	G
B	R	R	P	G	G
B	W	B	B	O	O
B	W	W	P	P	O
B	B	R	P	G	O
B	R	R	P	G	O

(i) State the minimum number of bits needed to represent each pixel in the image in **part (a)**.

.....[1]

(ii) Calculate the minimum file size of the image shown in **part (a)**. Show your working.

Working

.....

.....

File size

[3]

(b) (i) The designer takes a photograph to put on the poster. The photograph has a resolution of 50 000 pixels by 50 000 pixels. The colours are represented using 4 bytes per pixel.

Estimate the file size of the photograph in gigabytes. Show your working.

Working

.....

.....

.....

Estimated file size

[4]

- (ii) The photograph needs to be sent by email but the file size is too big. It needs to be compressed.

The table lists several methods of making an image file size smaller.

Tick (✓) **one** box on each row to indicate whether each method is lossy or lossless.

Compression method	Lossy	Lossless
Cropping the image		
Reducing the resolution of the image		
Using run-length encoding (RLE)		
Reducing the colour depth of the image		

[4]

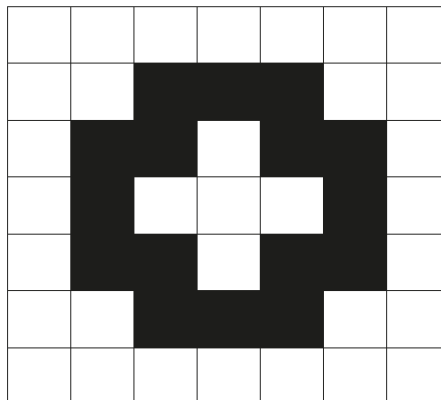
- (c) Explain how run-length encoding would compress the image in **part (a)**.

Question	Answer	Marks
1(a)(i)	3	1
1(a)(ii)	1 mark per bullet point <ul style="list-style-type: none"> • Number of pixels: $6 \times 6 = 36$ • Number of bits: Number of pixels $(36) \times 3$ • 108 bits / 13.5 bytes 	3
1(b)(i)	1 mark per bullet point <ul style="list-style-type: none"> • Number of pixels: $50\,000 \times 50\,000 = 2\,500\,000\,000$ • Number of bytes: Number of pixels $(2\,500\,000\,000) \times \underline{4} //$ 10 000 000 000 // • Number of bits: Number of pixels $(2\,500\,000\,000) \times \underline{32} //$ 80 000 000 000 • Conversion to gigabytes • 10 GB / 9.3 GB 	4

1(b)(ii)	1 mark for correct tick in each row. <table border="1"> <thead> <tr> <th>Compression method</th><th>Lossy</th><th>Lossless</th></tr> </thead> <tbody> <tr> <td>Cropping the image</td><td>✓</td><td></td></tr> <tr> <td>Reducing the resolution of the image</td><td>✓</td><td></td></tr> <tr> <td>Using run-length encoding (RLE)</td><td></td><td>✓</td></tr> <tr> <td>Reducing the colour depth of the image</td><td>✓</td><td></td></tr> </tbody> </table>	Compression method	Lossy	Lossless	Cropping the image	✓		Reducing the resolution of the image	✓		Using run-length encoding (RLE)		✓	Reducing the colour depth of the image	✓		4
Compression method	Lossy	Lossless															
Cropping the image	✓																
Reducing the resolution of the image	✓																
Using run-length encoding (RLE)		✓															
Reducing the colour depth of the image	✓																
1(c)	1 mark per bullet point to max 3 <ul style="list-style-type: none"> Looks for runs of consecutive pixel of the same colour Stores the colour value once and the number of times it occurs Lossless method of compression Reference to the given image in context 	3															

2.

A black and white bitmap image is shown.



(a) State the **minimum** number of bits needed to represent each pixel in this image.

.....[1]

(b) Run-length encoding (RLE) is used to store the image with the following colour codes.

Colour	Code
Black	1A
White	3B

Show how run-length encoding is used to store the image.

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

- (c) An image has 30 different colours.

State the **minimum** number of bits needed to represent each pixel in the 30-colour image.

..... [1]

- (d) When the image is saved, a header is added to the file.

State the purpose of the **file header**. Give **two** examples of the file header contents.

Purpose

.....

Example 1

.....

Example 2

.....

[3]

-
- (e) Graphics software is used to edit a digital photograph.

Give **three** features of graphics software that can be used to edit the photograph.

Describe the effect each has on the photograph.

Feature 1

Effect

.....

.....

Feature 2

Effect

.....

.....

Feature 3

Effect

.....

.....

[6]

Question	Answer	Marks
6(a)	1	1
6(b)	1 mark for correct method (colour code and number of pixels) 1 mark for first 7 groups correct 1 mark for remainder correct <input type="checkbox"/> 3B9 1A3 3B3 1A2 3B1 1A2 3B2 <input type="checkbox"/> 1A1 3B3 1A1 3B2 1A2 3B1 1A2 3B3 1A3 3B9	3
6(c)	5	1

6(d)	1 mark for purpose <input type="checkbox"/> Stores data about the file contents/image/metadata Max 2 marks for examples of contents <input type="checkbox"/> <u>Confirmation</u> that the file is a BMP // confirmation of file type <input type="checkbox"/> File size <input type="checkbox"/> Location / offset of image data within the file <input type="checkbox"/> Dimensions of the image (in pixels) // <u>image</u> resolution <input type="checkbox"/> Colour depth (bits per pixel, 1, 4, 8, 16, 24 or 32) <input type="checkbox"/> Type of compression used (if any)	3
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6(e)	1 mark for naming tool, 1 mark for describing effect on the photograph e.g. <input type="checkbox"/> Resize <input type="checkbox"/> Increase / decrease the size of the image <input type="checkbox"/> Crop <input type="checkbox"/> Remove part of the image <input type="checkbox"/> Blur <input type="checkbox"/> Reduce the focus <input type="checkbox"/> Red eye reduction <input type="checkbox"/> Reduces red (light reflected from human eyes)	6
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3.

A group of students broadcast a school radio station on a website. They record their sound clips (programmes) in advance and email them to the producer.

(a) Describe how sampling is used to record the sound clips.

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.....

.....

.....[3]

- (i)** Circle your chosen method of compression and justify your choice.

Justification:

.....

.....

.....

.....

[3]

These are compressed before sending using run-length encoding (RLE).

- [3]

- the denary colour code that represents each colour
- the first three rows of a bitmap image

Colour symbol	Colour code (denary)
B	153
W	255

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	B	B	B	B	B	B	B	B	B	B	W	W	W	B	B	B
1	B	B	B	B	B	B	B	B	B	W	W	W	W	W	W	B
2	B	B	B	B	B	B	B	W	W	W	W	W	W	W	W	W
...																
95																

Show how RLE will compress the first three rows of this image.

Row 1:

Row 2:

Row 3:[2]

(a) **Three** from: [3]

- The height/amplitude of the (sound) wave is determined.
- At set (time) intervals // by example of sensible time period.
- To get an approximation of the sound wave
- And encoded as a sequence of binary numbers // and converted to a digital signal.
- Increasing the sampling rate will improve the accuracy of the recording.

(b) (i) **No mark** awarded for identifying method. **Three marks** for justification. [3]

Lossy – Three points from:

- The human ear will not notice that the decompressed stream will not be identical to the original (file) / that parts of the original data have been discarded / removed / deleted.
- File size reduction is greater than using lossless.
- Email has limits on file sizes (on attachments) / a smaller file will take less time to transmit.
- The file may not need to be of high precision / accuracy.
- The producer has requested an mp3 file.

Lossless – Three points from:

- The file needs to be high precision / accuracy.
- None of the original data is lost / the decompressed file will be identical to the original.
- The producer has requested a flac file.

(ii) **Three** points from: [3]

- Lossless method of compression.
- Reduces (the physical size of) a string of adjacent, identical characters/pixels / bytes etc..
- The repeating string (a run) is encoded into two values.
- One value represents the number of (identical) characters in the run (the run count).
- The other value is the code of the character / colour code of pixel etc. in the run (the run value).
- The run value and run count combination may be preceded by a control character.
- Any valid example given.

(iii) **Two marks** for **three** correct rows, **one mark** for **two** correct rows. [2]

Row 1: 153 10 255 3 153 3

Row 2: 153 9 255 6 153 1

Row 3: 153 7 255 9

Alternative correct answer:

Row 1: 153 9 255 2 153 2

Row 2: 153 8 255 5 153 0

Row 3: 153 6 255 8