

QUESTION 1.



4 (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.

Page 4	Mark Scheme	
	Cambridge International AS/A Level – May/June 2016	



(ii) **Three** points from:

- Lossless method of compression.
- Reduces (the physical size of) a string of adjacent, identical characters/pixels / 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

QUESTION 2.



7 (a) **One mark** for the name and **one mark** for the explanation for **three** utility programs

- Disk formatter
- Prepares a hard disk to allow data to be stored on it
- Virus checker
- Checks for viruses and then quarantines removes any virus found
- File compression
- Reduces file size by removing redundant details (lossy / lossless)
- Backup software
- Makes copy of files on another medium in case of corruption / loss of data
- Firewall
- Prevents unauthorised access to computer system from external sources

[6]

(b) **Four** from:

- Bitmap is made up of pixels
// Vector graphic store a set of instructions about how to draw the shape
- Bitmap files are usually bigger than vector graphics files // Take up more memory space
- Enlarging a bitmap can mean the image is pixelated
// vector graphic can be enlarged without the image becoming pixelated
- Bitmap images can be compressed (with significant reduction in file size)
// Vector graphic images do not compress well
- Bitmaps are suitable for photographs / scanned images
// Vector graphics are suitable for more geometric shapes
- Bitmap graphics use less processing power than vector graphics
- Individual elements of a bitmap cannot be grouped
// Individual elements of a vector graphic can be grouped
- Vector graphics need to be 'rasterised' in order to display or print

[4]

Page 9	Mark Scheme	
	Cambridge International AS/A Level – October/November 2016	



- (c) (i) • Hackers can still access the data (and corrupt it, change it or delete it)
- Encryption simply makes data incomprehensible (without decryption key)

(ii) Any **two** from:

- This is an explanation of data verification (not validation)
- Data validation ensures that data is reasonable / sensible / within a given criteria
- Original data may have been entered correctly but is not reasonable (e.g. age of 210)

[2]

- (iii) • A password does not prevent unauthorised access, it makes it more difficult

QUESTION 3.



Question	Answer	
3(a)	Sampling rate The <u>number of samples</u> taken <u>per unit time</u> // the number of times the amplitude is measured <u>per unit time</u> Increasing the sampling rate will increase the accuracy / precision of the digitised sound // Increasing the sampling rate will result in smaller quantisation errors.	1 1
3(b)(i)	Pixel Smallest picture element which can be drawn Screen resolution The number of pixels which can be viewed horizontally and vertically on the screen // or by example - A typical screen resolution is 1680 pixels × 1080 pixels.	1 2
3(b)(ii)	8	1
3(b)(iii)	Working: Max <u>two</u> from: - Number of pixels is 2048×512 - One pixel will be stored as one byte - Number of kilobytes = $(2048 \times 512) / 1024$ Answer: <u>One</u> mark: Number of kilobytes = 1024 KB	1 1 1 1
3(b)(iv)	<u>One</u> from: - Confirmation that the file is a BMP - File size - Location/offset of image data within the file - Dimensions of the image in pixels // image resolution - Colour depth (bits per pixel) - Type of compression used, if any	1 1 1 1 1 1



Question	Answer
4(a)(i)	500
4(a)(ii)	496

QUESTION 4.



Question	Answer	Marks
3(a)	Definition: Max two from: - The number of distinct values available to encode/represent each sample 1 - Specified by the number of bits used to encode the data for one sample 1 - Sometimes referred to as bit depth 1 Explanation: Max two from: - A larger sampling resolution will mean there are more values available to store each sample 1 - A larger sampling resolution will improve the accuracy of the digitised sound // A larger sampling resolution will decrease the distortion of the sound 1 - Increased sampling resolution means a smaller quantization error 1	Max 3
3(b)(i)	One from: - The <u>number of pixels</u> per <u>unit measurement</u> 1 - The number of pixels in an image 1 - The number of pixels wide by the number of pixels high 1 - Number of pixels per row by the number of rows 1	1
3(b)(ii)	4	1
3(b)(iii)	Working: Max two from: - Number of pixels is 8192×256 1 - One pixel will be stored as one byte 1 - Number of kilobytes = $(8192 \times 256) / 1024$ 1 Answer: One mark: Number of kilobytes = 2048 KB 1	3
3(b)(iv)	Two from: - Confirmation that the file is a BMP 1 - File size 1 - Location/offset of image data within the file 1 - Dimensions of the image (in pixels) // image resolution 1 - Colour depth (bits per pixel, 1, 4, 8, 16, 24 or 32) 1 - Type of compression used, if any 1	Max 2

QUESTION 5.



Question	Answer	
1(a)(i)	2	
1(a)(ii)	1 mark per bullet point - Number of pixels: $6 \times 6 // 36$ - Number of bits: Number of pixels (36) $\times 2 \dots$ $\dots = 72$ <u>bits</u> // 9 <u>bytes</u>	
1(b)(i)	1 mark per bullet point - Number of pixels: $1000 \times 1000 // 1\,000\,000$ - Number of bytes: Number of pixels (1 000 000) $\times 2 // 2\,000\,000 //$ - Number of bits: Number of pixels (1 000 000) $\times 16 // 16\,000\,000$ - Conversion to <u>megabytes</u> 2 (MB) // 1.91 (MB)	4
1(b)(ii)	1 mark per method correctly linked to its description max 3 1 mark for each compression type correctly linked to its method(s). max 2 Description Removes pixels Reduces number of pixels per inch Uses fewer bits per pixel Stores colour code and count of repetitions Method Crop the photograph Use run-length encoding Use fewer colours Compression type Lossy Lossless	5
1(c)	1 mark per bullet point. Max 2 marks for each reason. - Smaller file size - Can be transferred quicker/downloaded quicker - Enlarges without pixilation - Needs to be used on different screens / devices / resolutions	4

Question	Answer	Marks

QUESTION 6.



Question	Answer																
1(a)(i)	3																
1(a)(ii)	1 mark per bullet point - Number of pixels: $6 \times 6 = 36$ - Number of bits: Number of pixels (36) $\times 3$ 108 bits / 13.5 bytes																
1(b)(i)	1 mark per bullet point - Number of pixels: $50\,000 \times 50\,000 = 2\,500\,000\,000$ - Number of bytes: Number of pixels (2 500 000 000) $\times 4 //$ 10 000 000 000 // - Number of bits: Number of pixels (2 500 000 000) $\times 32 //$ 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" data-bbox="387 929 1244 1256"> <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															
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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 - 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															

Question	Answer	Marks

QUESTION 7.



Question	Answer															
5(a)	1 mark for each correctly linked box on the right <table><thead><tr><th>Maximum number of colours</th><th>Minimum number of bits</th></tr></thead><tbody><tr><td>68</td><td>1</td></tr><tr><td>256</td><td>2</td></tr><tr><td>127</td><td>3</td></tr><tr><td>2</td><td>7</td></tr><tr><td>249</td><td>8</td></tr><tr><td></td><td>9</td></tr></tbody></table>	Maximum number of colours	Minimum number of bits	68	1	256	2	127	3	2	7	249	8		9	
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68	1															
256	2															
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5(b)(i)	1 mark for correct answer 40 images or frames are <u>displayed/recorded</u> each second	1														
5(b)(ii)	1 mark per bullet to max 4 • Progressive – each frame contains (all the lines for) the complete image • Interlaced – each frame contains half the (number of lines) of the complete image • Progressive – frames are not divided into fields • Interlaced – each frame divided into two fields // One field contains the data for the even numbered rows / lines and the other has the data for the odd numbered rows / lines. • Progressive – complete frames are displayed in sequence • Interlaced – data from two frames is displayed simultaneously • Progressive – the number of images stored is the same as the frame rate // the rate of picture display is the same as the frame rate. • Interlaced – the rate of picture display (the field rate) is twice the rate of image frame display (the frame rate). • Progressive means the entire frame is refreshed each time • Interlaced means only half the frame is refreshed • Progressive has high bandwidth requirements • Interlaced halves the transmission bandwidth requirements.	4														



Question	Answer
5(c)	1 mark per bullet 88.2 kHz • The sound wave is sampled <u>88200</u> times per second 32 bits • Each sample is stored as a 32-bit binary number