1.2 & 1.3 Data Representation - Text, Sound & Images Compression
ANSWERS

Question	Answer	Marks
5(a)	Any **five** from: – (The analogue sound is) recorded using a microphone – The sound wave is sampled – … measuring the height/amplitude – Each amplitude has a unique binary value – The sample rate is set – … that is the number of samples taken per second – The sample resolution is set – … that is the number of bits used for each sample – Each sample taken is converted to binary	**5**
5(b)	**Two** from: – Increase the sample rate – Increase the sample resolution	**2**
5(c)	Any **three** from: – They want to be able to edit the original sound file – They want the highest sound quality for the file // They want the sound to be closest to the original recording – … using lossy would reduce the sound quality – … using lossy will permanently remove some of the data // no data will be permanently removed with lossless	**3**
5(d)	Any **four** from (**MAX 3** for ASCII/Unicode alone): – ASCII has limited/fewer characters // Unicode has a more characters – ASCII covers a limited set of languages/fewer languages – Unicode includes many/more languages/emojis – ASCII requires 7/8 bits per character – Unicode requires up to 16/32 bits per character – ASCII has 128/256 characters – Unicode has 65 536/4 294 967 296 characters // approx. 60/70 thousand/4 billion characters	**4**

Question	Answer	Marks
5(a)	Any **one** from: – The recording of the song is more accurate/closer to original	**1**
5(b)	Any **one** from: – The file size will be increased – The file will require more **storage** space	**1**
5(c)	Any **two** from: – The number of bits that are used **per sample** – … that provides the variation in amplitude that can be stored for each sample // defines the number of different amplitudes that can be recorded – … that determines how quiet/loud the sounds are that can be recorded – Example e.g. 16-bit	**2**
5(d)	– Lossless	**1**

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Question	Answer	Marks
7(a)	– The dimensions of an image // Number of pixels wide by number of pixels high	1
7(b)	– The number of bits used to represent each/a colour	1
7(c)	Any **one** from: – A greater range of colours can be seen/used – Image will be closer to the actual content of the image/real life – The image will have more detail	1
7(d)	– Lossy	1
7(e)	Any **two** from: – Quicker to transmit/upload/download – Not as much bandwidth needed to transmit file – To fit in limitation of file size on e.g. email	2

Question	Answer	Marks
2(a)	**One** mark for each correct definition: • The sample rate is the number of samples taken in a second/per time unit • The sample resolution is the number of bits per sample	2
2(b)	• Lossy compression	1

Question	Answer	Marks
3(a)	Any **three** from: • A character set is used • … such as Unicode/ASCII • Each character has a **unique binary** value	3
3(b)(i)	• It reduces the **file** size	1
3(b)(ii)	Any **four** from: • A compression algorithm is used • … such as RLE/run length encoding • **Repeating** words/characters/phrases are identified // Patterns are identified • … and indexed • … with number of occurrences • … with their position	4
3(b)(iii)	Any **two** from: e.g. • To save **storage** space • To make it quicker to transmit • To make it small enough to attach to an email • To reduce the bandwidth needed to transmit	2

1.2 & 1.3 Data Representation - Text, Sound & Images Compression
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Question	Answer	Marks
4(a)	**One** mark each: Pixel: • **One** square/circle of **one** colour // the **smallest component** of the image Resolution: • The number of pixels per set area/cm/inch // the number of pixels wide by the number of pixels high // number of pixels in an image	**2**
4(b)	**One** mark for answer: • 2 000 000 bytes **One** mark for working from: • 1000 × 1000 (= 1 000 000) • 1 000 000 * 2 (= 2 000 000)	**2**
4(c)	**One** mark for each term: Solid-state storage is **non-volatile**. This means that the data is **not** lost when the power is turned off. Solid-state storage is made of **transistors** that are laid out in a **grid**. Gates are used to control the flow of the **electrons** through the transistors. This changes the data in the transistors from 1 to 0, or from 0 to 1.	**4**
4(d)	Any **one** from: • Reduce the file size • Increase transmission speed // Reduce transmission time • Reduce **storage** space required • Less bandwidth required for transmission	**1**

Question	Answer	Marks
3	**One** mark for the correct answer • 262 // 250 **Three** marks for three stages of working • 100 × 100 • 10 000 * 16 then / 8 // 10 000 *2 • 20 000 / 1024 or 1000 = 19.5 kB // 20 kB • 5 × 1024 = 5120 // 5 × 1000 = 5000 • 5120 / 19.5 // 5000 / 20	**4**

Question	Answer	Marks
5	**Two** marks for two correct stages of working, **one** mark for correct final answer • 100 × 150 • 15 000 × 16 // 15 000 × 2 • 240 000 / 8 • 30 000 bytes	**3**

1.2 & 1.3 Data Representation - Text, Sound & Images Compression
ANSWERS

Question	Answer	Marks
2(a)	e.g. JPEG	1
2(b)	Any three from: • Image is made of pixels • Each pixel stores **one** colour • Image has a set number of pixels wide by pixels high • Each **colour** has a **unique** binary value // Each **colour** has a **unique** colour code • The colour/binary value of each pixel is stored in **sequence** • File contains metadata to identify how the file should be displayed • … metadata can be the colour depth / resolution	3
2(c)(i)	Reducing the **file size**	1
2(c)(ii)	Any two from: • reduces the **storage/memory** space taken on email server // reduces the storage space taken on her friend's computer when downloaded • sending/receiving email accounts may have restricted file size for attachments • reduces the time taken to transmit/upload/download to destination • reduces amount of bandwidth needed to transmit/download • file will mean less data usage is taken (for mobile clients)	2

Question	Answer	Marks
5(a)	Any **three** from: – Password – Add a biometric device to the laptop // set biometric password – Use two-step verification // Use two factor authentication – Physically lock the laptop away in a secure cupboard // Taking laptop with him at all times	3
5(b)(i)	Any **three** from: – A compression algorithm is used – The resolution could be reduced – **Colour** depth could be reduced // bits per pixel reduced – **Sounds** not heard by human ear could be removed // Perceptual music shaping can be used – Repeating frames could be removed	3
5(b)(ii)	Any **one** from: – Quality may be reduced – Data is lost // **original** file cannot be reconstructed	1
5(c)(i)	Any **one** from: – Maintains quality // quality better than lossy – Original file is retained // Data is not **permanently** lost – A significant reduction in file size is not required	1

Question	Answer	Marks
5(c)(ii)	Any **two** from: – Takes more time to transmit file // Takes more time to upload **to web server** // Takes more time to download **to customer** // Web page will load slower – Takes up more **storage** space – Data usage would be increased – Uses more bandwidth	2

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>One mark for the correct tick

<table><tr><th>File Size</th><th>Tick (✓)</th></tr><tr><td>999 kB</td><td></td></tr><tr><td>1 MB</td><td>✓</td></tr><tr><td>850 000 bytes</td><td></td></tr></table></td><td>1</td></tr>
<tr><td>1(b)</td><td>One mark for the correct tick

<table><tr><th>File Size</th><th>Tick (✓)</th></tr><tr><td>4000 MB</td><td></td></tr><tr><td>2 GB</td><td>✓</td></tr><tr><td>2 500 000 kB</td><td></td></tr></table></td><td>1</td></tr>
</table>

Question	Answer	Marks
7(a)(i)	**Four** from: – (Compression) **algorithm** is used – No data will be removed // original file can be restored – Example of type of algorithm that would be used e.g. RLE – Repeated patterns in the music are identified – … and indexed NOTE: If another lossless method is described, marks can be awarded.	**4**
7(a)(ii)	Any **one** from: – To provide the highest quality of music file (that compression will allow) – The user is able to listen to the original sound file – No loss of quality for the sound file provided	**1**
7(a)(iii)	Any **one** from: – Allow for quicker streaming speed – Would not require as much bandwidth (to stream) – Does not need as much RAM – Smoother listening experience // less lag – Will not use as much of data allowance	**1**

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Question	Answer	Marks
7(a)(iv)	**Two** from: – Streaming speed may be slower – … and may affect listening experience // buffering may occur – User may need more bandwidth to stream – … that could be more expensive – It would be a larger file size – … so may take longer to upload – … so will take up more storage space … – … on webserver	**2**

Question	Answer	Marks
2(a)	Any **three** from: – A compression algorithm is used – Redundant data is removed – Reduce colour depth – Reduce image resolution – Reduce sample rate – Reduce sample resolution – Reduce frame rate – Use perceptual music shaping – Data is **permanently** removed	3
2(b)	Any **two** from: – Lossy decreases the **file size** more – Take up less storage space on webserver/users' computer – Quicker to upload/download – May not need to be high quality – Website will load faster for users – Less lag/buffering when watching – Takes up less bandwidth to download/upload – Uses less data allowance	**2**