

QUESTION 1.



2 (a) (i) Any **one** from:

- amplitude of sound wave taken at different points in time
- measurement of value of analogue signal at regular time intervals/a point in time [1]

(ii) Any **one** from:

- bit depth/sampling resolution sufficient for good quality sound
- higher bit depth/sampling resolution would mean bigger files
- ...hence less (music) content on each CD
- can represent dynamic range of about 90 dB
- 90 dB is basically the maximum dynamic range of human hearing
- compromise between quality and reasonable file size

[1]

(iii) Any **two** from:

- resolution is the number of distinct values available to encode/represent each sample
- specified by the number of bits used to store/record each sample
- sometimes referred to as bit depth
- the higher the sampling resolution, the smaller the quantization error
- a higher sampling resolution results in less distortion of the sound
- usually 8 bit, 16 bit, 24 bit or 32 bit

[2]

(iv) **1 mark** for benefit and **1 mark** for drawback.

benefit

- allows for larger dynamic ranges
- ...as dynamic range is approximately six times the bit depth
- more accurate representation/crisper sound quality

drawback

- bigger files/occupies more memory/storage
- longer to transmit data/download music
- greater processing power needed

[2]

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(b) Any **two** from:

- edit start time, stop time and duration of any sound/timeline
- extract/delete/save part of a clip
- frequency, amplitude, pitch alteration
- fade in/out of a clip
- mix/merge multiple sound sources/tracks
- combine different sources at various volume levels
- pan between tracks/channels
- use of filters
- playback to speakers, processors or recording medium
- conversion between different audio file formats
- etc...

[2]

(c) Any **three** from:

For full marks both techniques must be mentioned.

- lossless designed to lose none of the original detail/lossless allows original file to be recreated exactly
- lossless technique based on some form of replacement
- mention of type of replacement, for example RLE, FLAC etc.
- by example: e.g. 000–1111–222222–333 = 3–0, 4–1, 6–2, 3–3 etc.
- maximum compression about 50%
- lossy may result in loss of detail compared to original file/lossy does not allow original file to be re-created exactly
- lossy techniques make decision about what parts of sound/sound file are important and discards other information
- only keeps sounds human ear can process/discards sounds most people cannot hear
- ... then applies lossless technique, for further reduction
- lossy compression can reduce to about 10%
- an example of jpeg, mp3 or other correct examples of compressed formats.

No double credit to opposite answers, e.g. lossless maintains detail, but lossy loses detail just one mark.

[3]

QUESTION 2.



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.

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(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 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)	1 mark per bullet point to max 3 - The microphone has a diaphragm - The incoming sound waves cause vibrations ... causing a coil to move past a magnet (dynamic microphone) // changing the capacitance (condenser microphone) - An electric current is generated / changed	
1(b)	1 mark per bullet point - The sampling resolution number of bits used to store each <u>sample</u> - Increasing the (sampling) resolution means a larger file size // Decreasing the (sampling) resolution means a smaller file size - Increasing the (sampling) resolution gives a more accurate representation of the analogue sound // Decreasing the (sampling) resolution gives a less accurate representation of the analogue sound - Increasing the (sampling) resolution means a greater range of values can be stored // Decreasing the (sampling) resolution gives a smaller range of values that can be stored - Increasing the (sampling) resolution reduces the quantization errors // Decreasing the (sampling) resolution causes greater quantization errors	3
1(c)	For 2 features 1 mark for identifying feature, 1 mark for describing what it does. For example: - Cut/delete ... Remove part of the sound file - Copy and paste ... Replicate part of the sound - Amplify ... Increase the volume of a section of sound	4
1(d)(i)	60 images are recorded per second	1
1(d)(ii)	1 mark per bullet point to max 2 - Each frame contains (all the lines for) the <u>complete image</u> - All the frame data is recorded at the same time - Each frame contains all the scan lines - The number of images stored is the same as the frame rate	2
1(e)	1 mark per bullet point to max 1 - A meta file / wrapper - Contains various different types of data	1

QUESTION 6.



Question	Answer	
6(a)	1 mark per bullet point to max 3 - The data from a single frame is split into two separate fields - One field has data for the odd numbered <u>rows/lines</u> and the other field has data for the even numbered <u>rows/lines</u> - Odd numbered line fields alternate with even numbered line fields - The viewer sees data from two frames simultaneously	
6(b)	1 mark per bullet point to max 1 - Produces what appears to be a higher refresh rate - Lower bandwidth needed // Halves the bandwidth requirements	1
6(c)	1 mark per bullet point to max 2 - Identifies pixels that do not change between frames - Records only the differences between the frames	2
6(d)(i)	1 mark per bullet point to max 3 - The amplitude of the wave is measured /sound wave is sampled - At <u>set/regular</u> time intervals - Each sample is stored as a binary number - Samples are stored in order in a file	3
6(d)(ii)	1 mark per bullet point to max 1 for each Sample rate: - Increasing the sample rate means more samples per second hence more bits per second <u>and</u> larger file size - Decreasing the sample rate means fewer samples per second hence fewer bits per second <u>and</u> smaller file size Sample resolution: - A higher sampling resolution means more bits per sample <u>and</u> a larger file size - A lower sampling resolution means fewer bits per sample. a smaller file size	2

QUESTION 7.



Question	Answer	Marks
2(a)	1 mark per bullet point to max 4 for each management task, max 6 in total Process Management • Manages the scheduling of processes • ... allows multi-tasking / multi-processing • ... ensures fair access • ... handles priorities • Manages which resources the processes require • Enables processes to share information • Prevents interference between processes // resolution of conflicts Memory Management • Allocates memory to processes • Ensures fair usage of memory • Organises memory / by example • Makes use of virtual memory • Keep processes separate • To release memory when a process stops	6



Question	Answer	
2(b)(i)	1 mark per bullet point to max 2 - The amplitude of the wave is measured ... at set, regular time intervals - The value is stored as a binary number	
2(b)(ii)	1 mark per bullet point - Sampling resolution of 44100 Hz takes more samples per second, so the file size will be larger // Sampling resolution of 21000 Hz takes fewer samples per second, so the file size will be smaller - At a resolution of 44100 Hz, the sound recording is a closer / more accurate representation of Leonardo's voice // At a resolution of 21000 Hz, the sound recording is a less accurate representation of Leonardo's voice	2
2(b)(iii)	1 mark for naming a feature, 1 mark for description, max 2 marks for each feature e.g. - Amplify ... Increase the volume of a section of sound - Change pitch ... Increase/decrease frequency of section(s) - Change sampling resolution ... to change the accuracy of the sound / file size	4