QUESTION 1.

[2]

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]**

(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.

The interrupted program continues its execution.

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.

(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

QUESTION 3.

Question	Answer	
1(a)(i)	**3**	
1(a)(ii)	**1 mark** per bullet point • Number of pixels: 6 × 6 = 36 • Number of bits: Number of pixels (36) × 3 • 108 bits / 13.5 bytes	
1(b)(i)	**1 mark** per bullet point • Number of pixels: 50 000 × 50 000 = 2 500 000 000 • Number of bytes: Number of pixels (2 500 000 000) × 4 // 10 000 000 000 // Number of bits: Number of pixels (2 500 000 000) × 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.	**4**
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**

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	✓	

Question	Answer	Marks

QUESTION 4.

1(a)	**1 mark** for each correct indication and explanation **3A.21.2H.1** Invalid H is not a valid hexadecimal digit **299.53.2.2** Invalid 299 is not in the correct range **192.2.1.0** Valid Consists of four numbers in the range 0–255 separated by full stops	
1(b)	**1 mark** per bullet point to **max 3** • URL is parsed to obtain the Domain name • Domain name is sent to the nearest Domain Name Server (DNS) • DNS holds a list of Domain names and matching IP addresses • DNS name resolver searches its database for the Domain name • If DNS does not find the Domain name, the request is forwarded to a higher level DNS • If the Domain name is found, the IP address is returned • If the Domain name is not found, the request is passed to a higher level server • If the Domain name is finally not found, an error message is generated	**3**
1(c)	**1 mark** for each correct term Real-time On-demand	**2**
1(d)(i)	**1 mark** per bullet point to **max 1** • The data files are very large • It would take a long time to send the uncompressed file // Compressed files will download faster • A higher bandwidth would be needed to transmit the uncompressed file	**1**
1(d)(ii)	**1 mark** per bullet point to **max 1** • Data is lost • The decompressed file is not the same as the original	**1**
1(d)(iii)	**1 mark** per bullet point to **max 3** • Lossy creates a smaller file than lossless // lossy compresses further than lossless • The recording of the concert is a large file size and needs significant reduction in size • Lossy removes detail which can be lost without people noticing • By example e.g. reduction in sound quality will not be noticed	**3**