# Past Papers May/June 2015 to 2018, Oct/Nov 2015 till 2017: Topic 1.1.1 Number representation

Q1/- (i) Convert the following binary number into hexadecimal.	
10111000	
	[1]
(ii) Convert the following denary number into BCD format.	
9 7	
	[1]
(iii) Using two's complement, show how the following denary numbers cou an 8-bit register:	ıld be stored in
114	
- 93	
	[2]
Q2 (a) Sound can be represented in a computer in a digital format.	
(i) Give the definition of the term sampling.	



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# (P1)Topical Past papers of (1.1.1- Number System 1.1.2 – Images, 1.1.3 Sound, 1.1.4 Video, 1.1.5 Compression) www.majidtahir.com

(ii) Give one reason why 16-bit sampling is used in an audio compact disc (CD).	
(iii) Explain what is meant by the term sampling resolution.	
(iv) Give one benefit and one drawback of using a higher sampling resolution.  Benefit	
Drawback	
(b) Describe two typical features found in software for editing sound files.  1	
2	
(c) Explain the difference between lossless and lossy data compression technique	



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3(a) (i) Using two's complement, show how the following denary numbers could be stored in an 8-bit register:

1	24											
-	-77											
i) Convert the two numbers in part (a) (i) into hexadecimal.												
-	-77 										[2]	
				SCD) is a SCD form	۱.	ay of rep		_			[1]	
ii) Desc	cribe a	use of	BCD nı	umber re							. נין	
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		•	wing d	enary int	eger into	8-bit bii	nary.					
					55							
b) Conv	vert the	e follow	ing Bin	ary Code	ed Decim	nal (BCD	) numbe	er into de	enary.	[1]		
,			Č		10000		,		,		F41	
											.[1]	



# (P1)Topical Past papers of (1.1.1- Number System 1.1.2 – Images, 1.1.3 Sound, 1.1.4 Video, 1.1.5 Compression) www.majidtahir.com

(c) Convert the following denary integer into 8-bit two's complement.
-102
[2] (d) Convert the following hexadecimal number into denary. 4E
[1]
5. 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.
[3]
<ul><li>(b) The students use software to compress the sound clips before emailing them.</li><li>(i) Circle your chosen method of compression and justify your choice.</li></ul>
Lossy / Lossless
Justification:
[3]
Students also email images to the radio station for use on its website.
These are compressed before sending using run-length encoding (RLE).



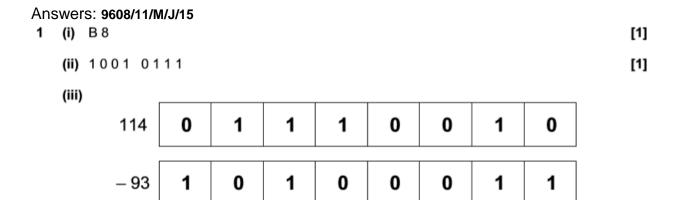
# (P1)Topical Past papers of (1.1.1- Number System 1.1.2 – Images, 1.1.3 Sound, 1.1.4 Video, 1.1.5 Compression) www.majidtahir.com

(ii) Expla	in wh	nat is	mea	nt b	y rur	n-len	gth e	nco	odir	ng.								
	[3]																	
(iii) The f	ollow	/ing (	diagra	ams	shov	w:												
			colou				enres	sen	ts e	eac	h col	our						
			ee rov											_				
				٩	Colou	ır syı	mbol				olour (den		е					
						В					15	3						
						w					25	5						
	0	1	2	3	4	5	6	7	7 8 9 10 11					12	13	14	15	
0	В	В	В	В	В	В	В	В	T	В	В	w	w	w	В	В	В	
1	В	В	В	В	В	В	В	В	T	В	w	w	w	w	w	w	В	
2	В	В	В	В	В	В	В	w	,	w	w	w	w	w	w	w	w	
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95									Ť									
Show ho	w RL	 .E wi	ll con	npre	ess th	ne fir:	st thi	ree	rov	ws o	of thi	s ima	age.					Į
Row 1: .				-								- ····	<u></u> .					
Row 2: .																		
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[2]

[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

#### (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
- gusually 8 bit, 16 bit, 24 bit or 32 bit

# (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.

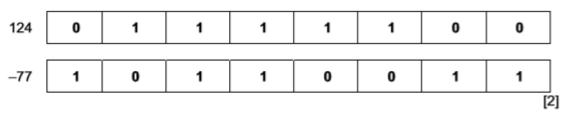
- lossless designed to lose none of the original detail/lossless allows original file to be recreated exactly
- lossless technique based on some form of replacement
- mention of type of replacement, for example RLE, FLAC etc.
- by example: e.g. 000–1111–222222–333 = 3–0, 4–1, 6–2, 3–3 etc.
- maximum 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]

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3.

(a) (i)



(ii) 124: 7 C

–77: B 3 [2]

(b) (i) 0 0 1 1 0 1 0 1 1 0 0 1 [1]

(ii)

when denary numbers need to be electronically coded

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- e.g. to operate displays on a calculator where each digit is represented
- decimal fractions can be accurately represented
  [2]



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4. (a)	00110111	[1]
(b)	83	[1]
(c)	10011010	[2]
	allocated as follows: c for the most significant bit 1 mark for the remaining 7 bits	
(d)	78	[1]
5 (a) T	hree 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) l	No mark awarded for identifying method. Three marks for justification.	[3]
logifia -	<ul> <li>Three points from:</li> <li>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.</li> <li>Email has limits on file sizes (on attachments) / a smaller file will take less time to transmit.</li> <li>The file may not need to be of high precision / accuracy.</li> <li>The producer has requested an mp3 file.</li> </ul>	

# **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



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