

IGCSE Computer Science

0478/0984

Answer Key

Course	Cambridge IGCSE Computer Science
Topic	Chapter 1 : Data Representation
Paper Code	0478 (9 - 1) / 0984 (A* - G)

**To be used by students who are taking
0478 (9-1) IGCSE, the 0984 (A*-G) IGCSE
Computer Science, and the 2210 O Level
for examination in 2023 onwards.**

Students of other boards may also find this useful

Question	Answer	Marks
1(a)	97 1 0 0 1 0 1 1 1 1 mark1 mark 5C 0 1 0 1 1 1 0 0 1 mark1 mark E1 1 1 1 0 0 0 0 1 1 mark1 mark	6
1(b)	Four from: - Media Access Control (address) - Used to identify a device - It is a unique (address) - It is a static address // It does not change - It is set by the manufacturer - The first part is the manufacturer ID/number/identifies the manufacturer - The second part is the serial number/ID	4
1(c)	Two from e.g.: - Colour codes // Colour in HTML / CSS - Error messages - Locations in memory - Memory dump // debugging - IP address - ASCII // Unicode - Assembly language - URL	2

Question	Answer	Marks
5	Five from: - A (compression) algorithm is used - No data is removed in the process // original file can be restored Repeated words (are identified) // Patterns in the data (are identified) ... and are indexed/put into a table // by example ... and are replaced with their index // by example ... and their positions are stored (in the table) // by example ... and the number of times the word/pattern appears is stored (in the table) // by example NOTE: Other valid methods of lossless compression can be awarded marks	5

4(b)(i)	2 marks for any two correct stages of working, 1 mark for correct answer. – $500 * 300 * 10 // 150\,000 * 10$ – $* 8$ then $\div 8$ (anywhere in the process) – $1\,500\,000 \div 1024 \div 1024 // 1\,500\,000 \div 1\,048\,576$ – $= 1.43\text{ MB}$	3
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Question	Answer	Marks																																																
1(a)	<table><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td colspan="4">1 mark</td><td colspan="4">1 mark</td><td colspan="4">1 mark</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td colspan="4">1 mark</td><td colspan="4">1 mark</td><td colspan="4">1 mark</td></tr></table>	1	1	0	1	0	0	1	0	1	1	1	0	1 mark				1 mark				1 mark				0	0	1	1	1	1	1	1	0	1	0	1	1 mark				1 mark				1 mark				6
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1 mark				1 mark				1 mark																																										

Question	Answer	Marks								
2(a)	One mark for each correct denary value <table><tr><th>Binary</th><th>Denary</th></tr><tr><td>0001001110</td><td>78</td></tr><tr><td>0110110111</td><td>439</td></tr><tr><td>1000000001</td><td>513</td></tr></table>	Binary	Denary	0001001110	78	0110110111	439	1000000001	513	3
Binary	Denary									
0001001110	78									
0110110111	439									
1000000001	513									
2(b)	Two from: ∞ Uses fewer characters // shorter ∞ Easier to read / write / understand ∞ Less likely to make mistakes // less error prone ∞ Easier to debug	2								
2(c)	One mark for each correct hexadecimal value in correct order 2 B 5	3								

Question	Answer	Marks
6(d)(i)	Two from: ∞ File size is reduced ... ∞ ... so it uses less storage space ∞ ... so faster transmission ∞ ... so quicker to download	2
6(d)(ii)	α Lossless	1

Question	Answer	Marks															
1	One mark for each correct tick <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Statement</th><th>True (✓)</th><th>False (✓)</th></tr> </thead> <tbody> <tr> <td>25 kB is larger than 100 MB</td><td></td><td>✓</td></tr> <tr> <td>999 MB is larger than 50 GB</td><td></td><td>✓</td></tr> <tr> <td>3500 kB is smaller than 2 GB</td><td>✓</td><td></td></tr> <tr> <td>2350 bytes is smaller than 2 kB</td><td></td><td>✓</td></tr> </tbody> </table>	Statement	True (✓)	False (✓)	25 kB is larger than 100 MB		✓	999 MB is larger than 50 GB		✓	3500 kB is smaller than 2 GB	✓		2350 bytes is smaller than 2 kB		✓	4
Statement	True (✓)	False (✓)															
25 kB is larger than 100 MB		✓															
999 MB is larger than 50 GB		✓															
3500 kB is smaller than 2 GB	✓																
2350 bytes is smaller than 2 kB		✓															

Question	Answer	Marks								
4(a)	∞ 52	1								
4(b)	<table><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>	1	1	0	1	0	0	0	0	1
1	1	0	1	0	0	0	0			
4(c)	∞ It is multiplied by 4	1								

Question	Answer	Marks
5(a)	Four from: ∞ A compression algorithm is used ∞ Discards any unnecessary sounds ... ∞ ... using perceptual musical shaping ∞ ... such as removing background noise / sounds humans can't hear // or other suitable example ∞ Reduces sample size / resolution // by example ∞ Reduces sample rate // by example ∞ Sound is clipped ∞ The data is permanently removed	4
5(b)(i)	One from: ∞ The file size will be smaller than lossless ∞ Requires less storage space ∞ Requires less time to transmit	1
5(b)(ii)	One from: ∞ The quality of the sound will be reduced ∞ The original file cannot be restored	1

1(c)(i)	<table><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td colspan="4">1 mark</td><td colspan="4">1 mark</td><td colspan="4">1 mark</td></tr></table> <table><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td colspan="4">1 mark</td><td colspan="4">1 mark</td><td colspan="4">1 mark</td></tr></table>	1	1	1	1	1	0	0	1	0	0	1	0	1 mark				1 mark				1 mark				1	0	1	0	0	0	0	1	0	0	0	0	1 mark				1 mark				1 mark				6
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1 mark				1 mark				1 mark																																										

Question	Answer	Marks
1(c)(ii)	One mark for identification: ∞ Compression Three from e.g.: ∞ Best compression would be lossy ∞ Use compression algorithm ∞ This would remove all the unnecessary data from the file // removes detail/sound that the human eye/ear may not see/hear ∞ Reduce colour palette ... ∞ ... so each pixel requires fewer bits ∞ Reduce resolution ∞ Only store what changes between frames // temporal redundancy	4

Question	Answer	Mark
3(d)	Any two from: • Uses a compression algorithm • Does not permanently remove any data • Repeated patterns of notes are identified ... • ... and are grouped, with an index NOTE: Other possible methods of lossless compression of sound can be credited	2

Question	Answer	Mark						
5(a)	Any two from: • Computer consist of transistors / logic circuits • ... that can only store/process data in two states / as high-low / on-off / 1 and 0	2						
5(b)	1 mark per each correct 8-bit binary value: <table><tr><th>Denary Value</th><th>8-bit binary register</th></tr><tr><td>129</td><td>10000001</td></tr><tr><td>56</td><td>00111000</td></tr></table>	Denary Value	8-bit binary register	129	10000001	56	00111000	2
Denary Value	8-bit binary register							
129	10000001							
56	00111000							

Question	Answer	Mark												
5(c)	1 mark per each correct conversion: <table><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr></table> 1 mark 1 mark 1 mark	0	0	1	1	1	0	1	0	1	0	0	1	3
0	0	1	1	1	0	1	0	1	0	0	1			
5(d)	Any two from: • Represent colours in HTML // HTML colour codes • MAC address • Assembly Language • Error messages • IP address • ASCII values • URL • Memory dump • Memory locations	2												

Question	Answer	Marks
7(a)(i)	– 12 (ignore leading zeros)	1
7(a)(ii)	– 198 (ignore leading zeros)	1
7(a)(iii)	– 1217	1
7(b)	One mark per each correct hex value in correct order – 0E9	3

Question	Answer	Marks
1(a)	– 21 – 258 – 169	3
1(b)	1 mark for each correct hex value – 50 – 3D	4

Question	Answer	Marks												
2(a)	One mark for each correct binary conversion One mark for each correct denary conversion <table border="1" style="margin-top: 10px; width: 100%;"> <thead> <tr> <th>Hexadecimal ticket number</th><th>12-bit binary value</th><th>Denary value</th></tr> </thead> <tbody> <tr> <td>028</td><td>0000 0010 1000</td><td>40</td></tr> <tr> <td>1A9</td><td>0001 1010 1001</td><td>425</td></tr> <tr> <td>20C</td><td>0010 0000 1100</td><td>524</td></tr> </tbody> </table>	Hexadecimal ticket number	12-bit binary value	Denary value	028	0000 0010 1000	40	1A9	0001 1010 1001	425	20C	0010 0000 1100	524	6
Hexadecimal ticket number	12-bit binary value	Denary value												
028	0000 0010 1000	40												
1A9	0001 1010 1001	425												
20C	0010 0000 1100	524												

1(b)(ii)	One mark per each nibble:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			</
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Question	Answer	Marks
1(c)(ii)	One from: – Lossy (compression) Any three from: – A (compression) algorithm is used – Removes redundant/unnecessary data from the file – Removes sounds that cannot be heard by the human ear/background noise – Reduces sample rate – Reduces sample resolution – Data is permanently removed // original file cannot be re-instated – Perceptual music shaping is used NOTE: If lossless given, marks can be awarded for a correct description of lossless as follow through. Any three from (lossless): – A (compression) algorithm is used – Repeating patterns are identified – ... are replaced with a value – ... and indexed – No data is permanently removed // original file can be re-instated – Suitable example of a lossless algorithm	4
1(c)(iii)	Any two from: – Quicker for her to upload – Quicker for users to download – Won't slow website down as much when loading – Takes up less storage space	2

Question	Answer	Marks																				
3(a)	One mark per each correct row: <table><tr><th>Denary</th><th>Binary Conversion</th><th>Correct (✓)</th><th>Incorrect (✓)</th></tr><tr><td>145</td><td>10010001</td><td>✓</td><td></td></tr><tr><td>179</td><td>10110101</td><td></td><td>✓</td></tr><tr><td>11</td><td>00010011</td><td></td><td>✓</td></tr><tr><td>100</td><td>01100010</td><td></td><td>✓</td></tr></table>	Denary	Binary Conversion	Correct (✓)	Incorrect (✓)	145	10010001	✓		179	10110101		✓	11	00010011		✓	100	01100010		✓	4
Denary	Binary Conversion	Correct (✓)	Incorrect (✓)																			
145	10010001	✓																				
179	10110101		✓																			
11	00010011		✓																			
100	01100010		✓																			
3(b)	One mark for each correct conversion in the correct order: – C – 4 – 0	3																				

Question	Answer	Marks																											
1(a)	1 mark each <table><tr><th>Denary Value</th><th colspan="8">8-bit binary</th></tr><tr><td>46</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>171</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td></tr></table>	Denary Value	8-bit binary								46	0	0	1	0	1	1	1	0	171	1	0	1	0	1	0	1	1	2
Denary Value	8-bit binary																												
46	0	0	1	0	1	1	1	0																					
171	1	0	1	0	1	0	1	1																					
1(b)	– 255	1																											
1(c)	– 11	1																											

Question	Answer	Marks								
2(a)	Any three from: – A compression algorithm is used – Data will be lost/deleted permanently // original file cannot be recreated – Reduce the range of colours used / colour depth / bits per pixel – Reduce the number of pixels / image resolution removes data that will not be noticed by the user // removes unnecessary data	3								
2(b)	1 mark for 1 line, 2 marks for 3 lines <table><thead><tr><th>Term</th><th>Details</th></tr></thead><tbody><tr><td>IP address</td><td>192.168.0.255</td></tr><tr><td>MAC address</td><td>https://www.cambridgeinternational.org</td></tr><tr><td>URL</td><td>00:15:E9:2B:99:3C</td></tr></tbody></table>	Term	Details	IP address	192.168.0.255	MAC address	https://www.cambridgeinternational.org	URL	00:15:E9:2B:99:3C	2
Term	Details									
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Question	Answer	Marks																
1(a)	One mark per each correct register. <table><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr></table> <table><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td></tr></table>	1	0	1	0	0	1	1	1	1	1	0	1	0	1	1	0	2
1	0	1	0	0	1	1	1											
1	1	0	1	0	1	1	0											

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
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												
1(a)	One mark per each correct binary value. One mark per each correct hex value. <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Denary</th><th>Hexadecimal</th><th>8-bit binary</th></tr> </thead> <tbody> <tr> <td>49</td><td>31</td><td>00110001</td></tr> <tr> <td>123</td><td>7B</td><td>01111011</td></tr> <tr> <td>200</td><td>C8</td><td>11001000</td></tr> </tbody> </table>	Denary	Hexadecimal	8-bit binary	49	31	00110001	123	7B	01111011	200	C8	11001000	6
Denary	Hexadecimal	8-bit binary												
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123	7B	01111011												
200	C8	11001000												
1(b)	Any two from: – Easier/quicker to read/write/understand – Easier/quicker to identify errors/debug – Takes up less screen/display space – Less chance of making an error	2												
1(c)	Any three from: – MAC address – URL – Assembly language – Error codes // error messages – IP addresses – Locations in memory – Memory dumps	3												

Question	Answer	Marks
1(a)(i)	– manufacturer	1
1(a)(ii)	One mark per each correct binary value. – 00010100 – 10100000 – 11001001	3
1a(iii)	One mark per each correct denary value. – 41 – 200	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

Question	Answer	Marks
1(a)	– Base-2	1
1(b)	– 9 – 16 – 40 – 161	4

Question	Answer	Marks
4(a)	Two marks for any two correct workings and one mark for the correct answer. Working: – $100 \times 50 = 5000$ bits – $5000 \times 8 = 40,000$ bits – $40,000 / 8 = 5,000$ bytes – $5,000 \times 10 = 50,000$ bytes – $50,000 / 1024$ Answer: 48.83 kB // 49 kB NOTE: Alternative correct methods of working can be credited. Answer can be given to any number of dp.	3
4(b)	One mark per correct method, two marks per justification. – Lossless – Lossy would remove data permanently // lossless would not remove any data permanently // File could be restored to original ... – ... that could affect the quality (lossy) // ... to maintain the quality (lossless)	3

Question	Answer	Marks
1(a)	– Base-10	1
1(b)	– 5 – 32 – 26 – 171	4
1(c)(i)	– 00100101	1
1(c)(ii)	– 00011011	1
1(d)(i)	Any one from: – To represent HTML colour codes – In error messages	1
1(d)(ii)	Any one from: – Assembly code/language – Memory address locations – In error messages – Memory dump	1

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

Question	Answer	Marks								
1(a)	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>	File Size	Tick (✓)	999 kB		1 MB	✓	850 000 bytes		1
File Size	Tick (✓)									
999 kB										
1 MB	✓									
850 000 bytes										
1(b)	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>	File Size	Tick (✓)	4000 MB		2 GB	✓	2 500 000 kB		1
File Size	Tick (✓)									
4000 MB										
2 GB	✓									
2 500 000 kB										

Question	Answer	Marks
2(a)	One mark for correct binary value, one mark for leading zeros 00000000 01000111	2
2(b)	One mark for leading zeros, one mark for correct binary value 00000001 00000001	2
2(c)	– 0516	1

7(b)(i)	Any three from: – Compression algorithm used – ..., e.g. RLE – Repeating frames/pixels are identified – ... and are collated/indexed – No data is permanently removed – It just records the changes between frames/pixels	3
7(b)(ii)	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
1(a)	85	1
1(b)	C0	1
1(c)	26	1
1(d)	16	1

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
1(a)(i)	• Sound	1
1(a)(ii)	• Lossy compressed file	1

Question	Answer	Marks
4(a)	• Computer consist of transistors / logic circuits/gates ... • ... that can only store/process data in two states / high-low / on-off / 1 and 0	2
4(b)	• 01000000 • 01100101 • 11110010	3
4(c)	• 0100 (1 mark) 0010 (1 mark) • 1100 (1 mark) 1110 (1 mark)	4

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

Question	Answer	Marks														
1(a)	One mark for each correct line <table><thead><tr><th>Denary</th><th>8-bit binary</th></tr></thead><tbody><tr><td></td><td>00100001</td></tr><tr><td>41</td><td>10100110</td></tr><tr><td></td><td>00101001</td></tr><tr><td>174</td><td>10000110</td></tr><tr><td></td><td>10101110</td></tr><tr><td>86</td><td>01010110</td></tr></tbody></table>	Denary	8-bit binary		00100001	41	10100110		00101001	174	10000110		10101110	86	01010110	3
Denary	8-bit binary															
	00100001															
41	10100110															
	00101001															
174	10000110															
	10101110															
86	01010110															
1(b)	One mark for correct working, one mark for correct answer Working e.g. 256 + 64 + 16 + 4 + 2 + 1 Answer: 343	2														

Question	Answer	Marks																														
2(a)	Two marks each correct conversion (one mark for the first four bits, one mark for the second four bits) <table><tbody><tr><td>2F</td><td><table><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table></td></tr><tr><td>15</td><td><table><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr></table></td></tr><tr><td>D6</td><td><table><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td></tr></table></td></tr></tbody></table>	2F	<table><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>	0	0	1	0	1	1	1	1	15	<table><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr></table>	0	0	0	1	0	1	0	1	D6	<table><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td></tr></table>	1	1	0	1	0	1	1	0	6
2F	<table><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>	0	0	1	0	1	1	1	1																							
0	0	1	0	1	1	1	1																									
15	<table><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr></table>	0	0	0	1	0	1	0	1																							
0	0	0	1	0	1	0	1																									
D6	<table><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td></tr></table>	1	1	0	1	0	1	1	0																							
1	1	0	1	0	1	1	0																									
2(b)	Any two from: - IP address - Error messages/codes - Assembly language // low-level language - URL // web address - Memory dumps - Locations in memory	2																														

Question	Answer	Marks
2(a)	Per each binary conversion, one mark for 2 correct character conversions, two marks for three correct character conversions • 0000 0101 1010 • 0001 1000 1100 • 0010 1001 1111	6

2(c)	Per each hex conversion, one mark for 2 correct character conversions, two marks for three correct character conversions • 40D • 07E	4
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Question	Answer	Marks
6(a)	• Image	1
6(b)	• Lossy compressed file	1
6(d)	• Lossless compression	1

Question	Answer	Marks
3(a)	One mark each: 8 bytes = 16 nibbles 512 KiB = 0.5 MiB 4 GiB = 4096 MiB 1 EiB = 1024 PiB	4

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: $1000 \times 1000 (= 1\,000\,000)$ $1\,000\,000 \times 2 (= 2\,000\,000)$	2
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
6(a)	One mark each	4

Question	Answer	Marks
1(a)	B	1
1(b)	One mark per each correct conversion 00110010 01100110 11011101	3
1(c)	One mark for full method of working e.g. conversion to binary then flipping and adding 1 One mark for correct answer 10110010	2
1(d)	One marks per each correct nibble One mark for correct working in binary (showing 4 correct carries) <pre> 1 1 1 1 0 0 1 1 0 0 1 1 0 1 1 0 0 0 0 1 ----- 1 0 0 1 0 1 0 0 </pre>	3
1(e)	Two from: - The result of the calculation is greater than 255 // The value generated is larger than can be stored in the register - The result of the calculation would require more than 8 bits to be represented // A register has a predetermined number of bits and there are too many bits for it	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
2(a)	One mark per each correct character in the correct order: • 9 • 3 • 0 • D	4
2(b)(i)	• 00001111	1
2(b)(ii)	Any one from: • The value becomes incorrect/inaccurate as the right most bits are lost • It is divided by 8	1
2(c)	Any two from: • Easier/quicker to understand/read/write • Easier/quicker to debug • Less likely to make a mistake • Shorter representation // Takes up less screen space	2
2(d)	One mark for two correct characters, two marks for three correct characters in the correct order: • 1 • 2 • D	2

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 // <u>Patterns</u> 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

Question	Answer	Marks
1(a)	174	1
1(b)	- A - E	2
1(c)(i)	01110000	1
1(c)(ii)	B	1
1(d)	One mark for each correct nibble One mark for correct carries (or other correct working method) One mark for identification of overflow error 1 1 1 0001 1111	4
1(e)	9	1
1(f)	12	1

Question	Answer	Marks
2(a)	One mark for each correct part of the fee, in the correct order: – 17 – 70 (Correct fee \$17.70)	2
2(b)	One mark for each correct binary value: Register 1 – 00001110 Register 2 – 01100010	2

Question	Answer	Marks
2(c)	One mark for each correct hexadecimal value, in the correct order. – A – 0 – 3 – D (Ticket number A03D)	4
2(d)	Two from: – It contains logic gates/switches ... – ... that process the values 1 and 0 // have two states	2
2(e)	Any four from: – Compares the ticket number received to stored data – ... that is a database/file of ticket numbers – ... checks the ticket number is listed as paid – If the data matches/cost is paid it sends a signal to raise the barrier – If the data does not match/cost is not paid, the barrier remains down	4

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																																																		
2(a)	– 227	1																																																		
2(b)	One mark for each correct character in the correct order: – E3	2																																																		
2(c)	<table border="1"><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr></table>	1	0	0	0	1	1	0	0	1																																										
1	0	0	0	1	1	0	0																																													
2(d)	One mark for suitable working method e.g. flip and add 1 One mark for correct answer – 10011101	2																																																		
2(e)	One mark for each correct nibble (max 2) One mark for correct working e.g. correct carry One mark for showing overflow bit <table><tr><td></td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td></td></tr><tr><td>+</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td></td></tr><tr><td colspan="10"> </td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td></td></tr></table>		1										1	1	1	0	0	0	1	1		+	0	1	0	0	1	1	0	0												1	0	0	1	0	1	1	1	1		4
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1	0	0	1	0	1	1	1	1																																												

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 <u>bits</u> 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

1(c)(i)	– 8	1
1(c)(ii)	– 1024	1

Question	Answer	Marks
2(a)	Any two from: – It has a base of 2 – It only uses two values – ... that are 1 and 0	2
2(b)	– (0000)1110 – (00)111011 – 11101010	3
2(c)	– 9 – 1A – 41	3
2(d)	One mark for suitable working method e.g. conversion to binary One mark for correct answer – 01111011	2

Question	Answer	Marks
2(e)	One mark for each correct nibble (max 2) One mark for correct working e.g. correct carries <pre> 1 1 1 0 0 1 1 0 0 1 1 + 0 1 1 1 1 0 0 0 ----- 1 0 1 0 1 0 1 1 </pre>	3

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