Chhetri Academy

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GCSE COMPUTER SCIENCE

2.3

Edexcel 1CP2 | Specification point 2.3.1

That data storage is measured in binary multiples (bit, nibble, byte, kibibyte, mebibyte, gibibyte,...

Untiered

Answers and examiner comments

5	2015-2025	Untiered
question groups	available papers	tier

Using this booklet

1. Answer numbers match the companion question booklet.
2. Follow the original question number on marking tables.
3. Examiner comments are included where available.

Name _____ **Date** _____

Some entries use full source marking material in an appendix. Any unavailable mark schemes are identified beside the relevant answer.

Original question 3

The full source mark scheme begins on page 16. Use the original paper code, tier and question number shown above.

Original question 2

The full source mark scheme begins on page 50. Use the original paper code, tier and question number shown above.

Question Number	Answer	Additional Guidance	Mark
1(a)	**C** Unsigned integers store more positive values **The only correct answer is C** **A** is not correct because unsigned integers are not more accurate **B** is not correct because overflow errors can still occur with unsigned integers **D** is not correct because the use of a parity bit is not relevant to the scenario.		**1**

Question Number	Answer	Additional Guidance	Mark
1(b)	Award **one** mark for sight of either 1024^4 **OR** x4 Award **both** marks for a correct expression including 1024^4 **AND** x4 (with nothing else) e.g. 1024^4 x 4 Accept for 1024^4 any equivalent showing understanding that 1 terabyte is 2^{40} bytes e.g. • 1024 x 1024 x 1024 x 1024 (bytes) • 2^{10} x 2^{10} x 2^{10} x 2^{10} (bytes) • 1,099,511,627,776 (bytes) Award **both** marks for 4,398,046,511,104 (bytes).	Equivalent expressions are awarded.	**2**

Question Number	Answer	Additional Guidance	Mark
1(c)	Award **both** marks for. • P AND (T OR S) • (P AND T) OR (P AND S) Award **one** mark for: • (P AND T) OR S • P AND T OR S	Award equivalent expressions Award equivalent symbols: NOT, ¬, ~, ! AND, Λ, •, & OR, V, +, || Do not award '+' as equivalent to 'AND'	**2**

Question Number	Answer	Additional Guidance	Mark
1(d)	One from : • 68 • 82 – 14 • R – D • 18 – 4 Plus • 0100 0100	Final conversion must be expressed in 8 bits.	**2**

Question Number	Answer data	Additional Guidance	Mark
1(e)	To prevent unauthorised reading/use/analysis/understanding (1) of sensitive/payment/personal/customer data (1)	Do not accept unauthorised **access** for first mark.	**2**

Question Number	Answer	Additional Guidance	Mark
5(a)	Award up to two marks for a linked description, such as: • (Removed) data (1) cannot be restored / means that the original file/information cannot be fully recreated/represented (1) • When data is removed (1) humans may perceive/interpret the image/sound/text/information differently (1)	For both marks, the expansion must associate with the statement. Award both marks for reference to loss of data and an example of the effect of that. Do not accept reference to 'quality' as an effect.	(2)

Question Number	Answer	Additional Guidance	Mark
5(b)	Award up to two marks for a linked explanation, such as: • One bit can only have two values (1), so can only represent black and white (1) • The three colours in this image cannot be represented (1) because one bit can only have two values (1) • It is not possible to represent each pixel with three colours / as greyscale / as anything other than black and white (1) because one bit can only represent two unique values (1)	For both marks, the expansion must associate with the statement.	(2)

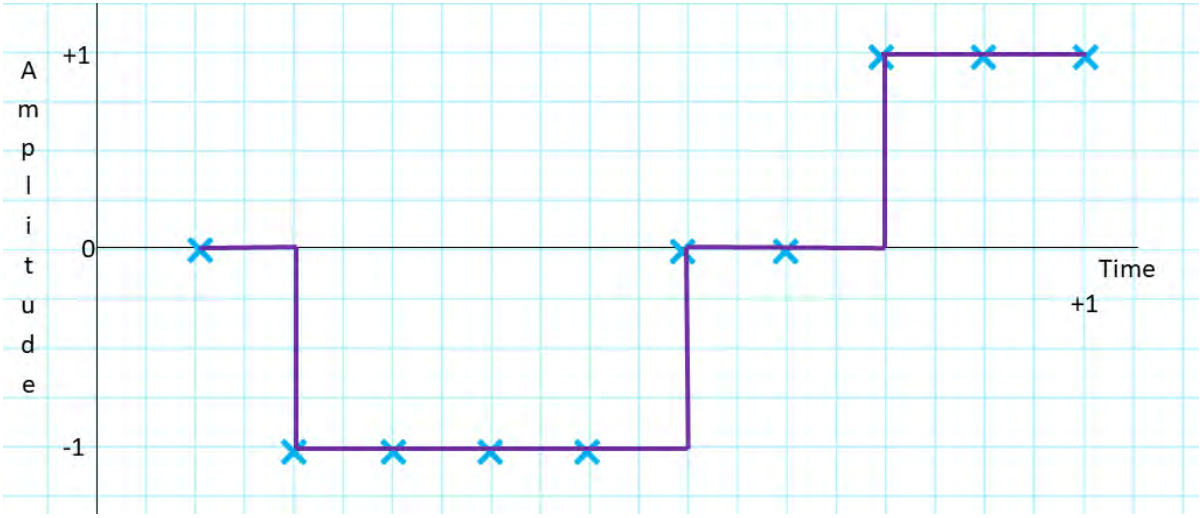
Question Number	Answer	Additional Guidance	Mark
5(c)	Award up to two marks for a linked description, such as: • An arithmetic shift fills from the left with a copy of the most-significant bit (MSB) (1), whereas a logical shift fills from the left with a 0 (1) • An arithmetic shift keeps the most-significant bit (MSB) the same (1) whereas a logical shift always fills the MSB bit with a 0 (1)	Both statements must be provided for two marks, as an arithmetic shift will fill with 0s, if the MSB is 0. Read carefully responses that indicate what the fill character is. Allow 'sign bit' for MSB	(2)

Question Number	Answer	Additional Guidance	Mark
5(d)(i)	Award one mark for: • 66 (1)		(1)

Question Number	Answer	Additional Guidance	Mark
5(d)(ii)	Award one mark for each correct digit in the correct order: • 5B		(2)

Question Number	Answer	Additional Guidance	Mark
5(e)(i)	Award one mark for any of the following: • 64 (1) • 2^6 (1) • 2^6 (1) • 2**6 (1) • 2 x 2 x 2 x 2 x 2 x 2 (1)	Allow any expression that evaluates to 64	(1)

Question Number	Answer	Additional Guidance	Mark
5(e)(ii)	Award one mark for any of the following up to a maximum of two marks: • Sight of 100 x 600 (1) • x 32 in numerator **and** 8 in the denominator (1) • + 1024 applied to whole expression (1) Award three marks for all three elements presented as a correct expression such as: • $\frac{100 \times 600 \times 32}{8} + 1024$ • ((100 x 600 x 32) / 8) + 1024	Consider order of operations (BIDMAS) Award mental reductions, such as (100 x 600 x 4) + 1024	(3)

Question Number	Answer	Additional Guidance	Mark
5(f)	Award one mark for any of the following up to a maximum of six marks: • x-axis labelled correctly as time/seconds (1) • y-axis labelled correctly as amplitude/value/sample (1) • value labels on x-axis as 0 and 1 (1) • value labels y-axis as -1 and 1 (1) • all 10 values plotted to correct points (1) • points joined to form a square wave, even if not all points are there or some are plotted inaccurately (1) 	Allow first sample at time 0 Award inverse (vertical flip) if y-axis labels also flipped, i.e. must recognise 11111 as -1. Ignore any other values on x and y axes Accept binary representation for value labels on y axis.	(6)

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	**The only correct answer is A** *B is not correct because a kibibyte contains 8192 bits* *C is not correct because a mebibyte contains 8192 x 8192 bits* *D is not correct because a nibble contains 4 bits*	The correct answer is gibibyte	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	Award **one** mark for any of the following: • 2^7 (1) • 128 (1) • 2 × 2 × 2 × 2 × 2 × 2 × 2 (1)	Allow equivalent	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	Award **one** mark for: • 71 (1)		**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	Award **one** mark for any of the following up to a maximum of **two** marks: • Base 16 number (1) • Needs 16 different symbols to represent the range of values (1) • Hexadecimal uses the digits 0-9 (to represent values between denary 0 and 9) (1) • Hexadecimal uses the letters A-F (to represent values between denary 10 and 15) (1) • Each hexadecimal symbol requires 1 nibble/4 bits to represent it (1) • Because there are **more** (hexadecimal) **digits/symbols** than there are (denary) digits, it uses letters (1)	Do not award responses comparing hexadecimal to binary/denary Do not award responses indicating 'number' instead of 'digit', without clarification (0-9, A-F) Responses must be related to characteristics and not benefits or drawbacks of hexadecimal notation.	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	Award up to **two** marks for a linked explanation such as: • Hexadecimal numbers are easy to understand/remember (1) because they contain fewer digits (than binary) (1) • Hexadecimal numbers are easier to read/write (1) because they are not just 1s and 0s (1) • Hexadecimal numbers are shorter/easier for programmers to read/write (1) because memory addresses are binary patterns (1) • Hexadecimal numbers are less prone to error when entering values (1) because there are fewer symbols to type (1) • Memory addresses are long binary patterns (1) so hexadecimal numbers are shorter/easier to read/write (1)	For both marks, the expansion must follow/associate with the statement. Do not accept 'easier' on its own without expansion as to what is easier.	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	Award up to **two** marks for a linked explanation such as: • Some frequencies/data can be removed permanently (1) because they are out of human hearing range (1) • Because the sounds/data outside the range of human hearing (1) can be completely removed (1) • Improves streaming (1) because it decreases the download time (1) • To achieve a higher compression ratio than lossless (1) because the sound will be understandable with some content removed (1) • More files can be saved (on a finite resource) (1) because it reduces the amount of storage space each file uses (1)	For both marks, the expansion must follow/associate with the statement. Do not award responses indicating quality of playback	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	Award **one** mark for each of the following: • 315 and 923 in the numerator (1) • 7 in the numerator (1) • 8 in the denominator (1)	Award equivalent expressions	**(3)**

Question Number	Answer	Additional Guidance	Mark
1(d)(i)	**The only correct answer is C** *A is not correct because a shift has not been applied (0001 1100)* *B is not correct because 1101 1000 is the result of a left binary shift of 1* *D is not correct because 1011 0000 is the result of a left binary shift of 2*	The correct answer is: 0001 1011	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(d)(ii)	Award **one** mark for each nibble: 0001(1) 1001(1)	Nibbles must be in the right order Each nibble must be 4 bits	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(d)(iii)	Award **one** mark for each nibble: 1111(1) 0011(1)	Nibbles must be in the right order Each nibble must be 4 bits	**(2)**

edexcel

Mark Scheme (Results)

June 2015

Pearson Edexcel
GCSE Computer Science (1CP0/01)
Paper 1: Principles of Computer Science

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1(a)</td><td>1 or 2 correct = 1 mark
3 or 4 correct = 2 marks
5 or 6 correct = 3 marks

<table>
<tr><th></th><th>Input</th><th>Process</th><th>Output</th><th>Neither</th></tr>
<tr><td>Actuator</td><td></td><td></td><td>x</td><td></td></tr>
<tr><td>Infrared Sensor</td><td>x</td><td></td><td></td><td></td></tr>
<tr><td>Wheel</td><td></td><td></td><td></td><td>x</td></tr>
<tr><td>Calculate Distance</td><td></td><td>x</td><td></td><td></td></tr>
<tr><td>Programming Language</td><td></td><td></td><td></td><td>x</td></tr>
<tr><td>Movement Sensor</td><td>x</td><td></td><td></td><td></td></tr>
</table>
</td><td></td><td>3</td></tr>
</table>

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1(b)</td><td>• Data (1)
• Instructions (1)</td><td></td><td>2</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	• 121		**1**

Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	• 122		**1**

Question Number	Answer	Additional Guidance	Mark
1(c)(iii)	• Any one of: ○ IF (statement) ○ IF….THEN…..ELSE ○ Selection ○ Conditional **If unsure, please send it to review**		**1**

Question Number	Answer	Additional Guidance	Mark
1(d)	0 0 0 0 1 1 0 0		**1**

Question Number	Answer	Additional Guidance	Mark
1(e)	1 1 1 1 0 0 1 0		**1**

Question Number	Answer	Additional Guidance	Mark
1(f)(i)	1 0 0 0 0 0 0 1		**1**

Question Number	Answer	Additional Guidance	Mark
1(f)(ii)	• The result of the calculation cannot fit into the size of the location assigned to hold it • Two 8-bit numbers added together resulted in a number that could not be stored in 8 bits • The addition resulted in a number >= 1 0000 0000 binary (note the overflow out of the destination field) • The result is >255 • The result needs 9-bits to store it	Do not accept - the number is too big - without further explanation	**1**

Question Number	Answer	Additional Guidance	Mark
1(f)(iii)	• Introduces errors in subsequent calculations • Compounds errors in subsequent calculations; snowballs • Signed numbers may change sign • Any indication that arithmetic performed on inaccurate calculated numbers results in subsequent inaccurate results	• Ignore examples	**1**

Question Number	Answer	Additional Guidance	Mark
1(g)	• Table or any other suitable notation Input | Output 0 | 1 1 | 0 • NOT (0) == 1 • NOT (1) == 0		**1**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1(h)(i)</td><td>

NOT R column correct = 1 mark
First 2 rows correct of Q = 1 mark
Last 2 rows of Q = 1 mark

<table>
<tr><th>NOT R</th><th>Q</th></tr>
<tr><td>1</td><td>0</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td></tr>
</table>
</td><td></td><td>3</td></tr>
</table>

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1(h)(ii)</td><td>

Q=(R OR B) AND S
Alternative correct solutions should be awarded e.g.

(R AND S) OR (B AND S)
R AND S OR B AND S – works by order of precedence

</td><td>

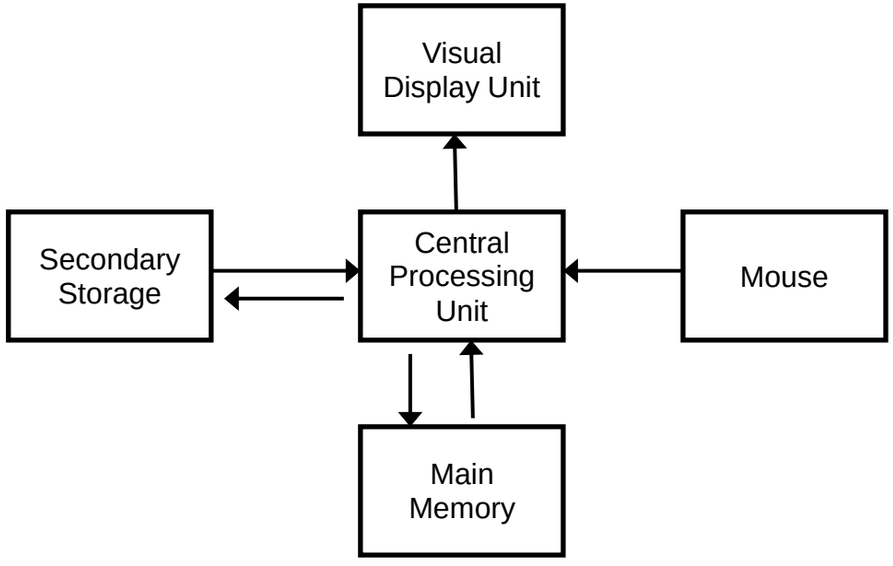
Q= not required
Accept correct transpositions
Order of precedence is (); NOT; AND; OR

</td><td>1</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
2(a)	Identifying any two (2) of the following (Maximum 2 marks): • Database • Bibliographic • Project Management • Presentation • Desktop Publishing • Word Processing • Web Browser • Image Editing • Video Editing • Email • Animation • CAD (not expected) • Programming Environment • Live Chat – Only if example confirms working context • Exclude software whose main purpose is entertainment • Any other appropriate software which could sensibly be used in a general working environment Any two (2) examples of software use (Maximum 2 marks): Answers may include • Image Editing – Cropping images for insertion into a presentation • Live Chat – For getting technical support help from a vendor support site • Web Browser – For looking up the address of a colleague at a	Do not accept spreadsheet and bee colonies Marks must be awarded 2 x 2 Identifying 4 applications cannot earn 4 marks Do not award brand names (Excel, Google, EndNote, PhotoShop, etc.) Use must follow example software given; if mismatch, then do not award example mark • Use must be appropriate for a "general" working environment • Do not award examples indicating entertainment • Use must be main purpose of application. Although word processors can crop	4

	different university • Presentation – Showing results of his research to colleagues at a conference. • Bibliographic – Keeping track of sources for his research. • Video Editing – Creating a video to put on YouTube of his lectures for his students. • CAD - molecular, synthetic, and genetic biology • Programming environment – Creating customised models	images, the more appropriate software choice would be an image/picture editor. • A programming language is not an application; an IDE, editor, or compiler is an application.	

Question Number	Answer	Additional Guidance	Mark
2(b)	Any 4 from: • Software can be redistributed • Source code is available • Source code can be modified • Modified code can be redistributed • A fee can be charged for the software • A fee is not usually charged for the software • Modified code must be made available under the same licence as original code. • Licence may require an acknowledgement of the original author to be included in the code. • Source code can be freely used, changed and shared by anyone subject to conditions specified in the license.	• Accept any other correct feature • Do not award "free" or "no cost" by itself	**4**

Question Number	Answer	Additional Guidance	Mark
2(c)	1 or 2 correct = 1 mark 3 or 4 correct = 2 marks 5 or 6 correct = 3 marks **If there are more than 6 arrows, 2 marks Max.**  **If unsure, please send it to review**	• Lines without direction cannot be awarded.	**3**

Question Number	Answer	Additional Guidance	Mark
2(d)	One mark for name and one mark for use (must match) • Control Unit (CU) ○ Sends signals to other components to coordinate the cycle • Arithmetic / Logic Unit (ALU) ○ Performs arithmetic (+,-,/,*, etc.) and logic (AND,NOT, OR, etc.) • Registers ○ Very fast storage locations which hold instructions, data, or memory addresses. • Cache (Not expected) ○ Sits between components in the microprocessor to make up for the difference in physical speed of the components • Address Bus ○ Holds the address of physical memory or the address of an input/output device that is to be read from/written to • Data Bus ○ If an instruction needs data, the data is loaded onto the data bus before being read by the CPU ○ All data/instructions moved here to go to or from Memory • Clock ○ Provides the timing for the cycle Other correct uses should be awarded.	• "Bus" or "Buses" alone is not awarded; must include qualifier. • Allow "arithmetic" or "logic" unit	**2**

Question Number	Answer	Additional Guidance	Mark
2(e)	Accept any **three** from the following. 1 mark each to a max of 3 marks: • The computer ***appears to be running*** more than one program/process at a time. • **More than one process can be loaded** into memory at one time. • Each process has its **own memory space**/partition. • Each process is given ***a small amount of time*** (time slice) to execute in the central processing unit. • Processes are held in a **queue/FIFO list**. • O/S **switches between processes** • Some processes may have **higher priority** than others may. • Higher priority processes may be **given more time** slices/processing time. • Processes can communicate by using shared memory	• Thread is accepted as equivalent to process • Program is accepted as equivalent to process There is a distinction between the assertion that "two programs ***are running*** at the same time" and that "two programs ***appear to be running*** at the same time". The first instance is an incorrect statement in the context of this question about a single microprocessor. As such, it cannot be awarded any marks. Ignore reference to multi-core processors.	**3**

Question Number	Answer	Additional Guidance	Mark
2(f)	Any two of: • Implement formulas which represent the relationships between the given data variables, such as hours of sun and quantity of honey. • Use a programming language to write a customised application to model the colony • Allow user to input initial values for data variables (food, sun) • Use graphical user interface components (boxes, sliders) to adjust input variables will show effects on outputs • Present outputs using graphs showing relationships between food and sun, etc. • Present outputs showing real number of bees and resources (yellow dots are bees; red dots are pollen) • Variables could be changed in real-time with immediate update to the screen (e.g. move a slider, the amount of pollen decreases) Any other appropriate and correct response incorporating modelling, simulation, or visualisation should be awarded.	The idea here is modelling, simulation, or visualisation of the real world context. Award positively any appropriate responses indicating that software can be used in this manner. Explicit connection to the context is required.	**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	• Pixel(s) • Pel(s) • Not "picture element" as it is given in the following question	• Do not penalise spelling	**1**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	• Resolution or Pixel Density • Dots per inch, dpi • Pixels per inch, ppi • Dots per centimetre, dpcm • Pixels per centimetre, ppcm	• Do not penalise spelling	**1**

Question Number	Answer	Additional Guidance	Mark
3(a)(iii)	• Colour depth • Bit depth is awardable	• Do not penalise spelling	**1**

Question Number	Answer	Additional Guidance	Mark
3(b)	One mark for each row **Category of secondary storage** magnetic optical solid state	Do not penalise spelling Do not award examples	**3**

Question Number	Answer	Additional Guidance	Mark
3(c)	Award 1 mark for each correct answer to a max of 2 marks • Any two of the following: ○ Timestamp ○ Sequence number ○ Version ○ Protocol type ○ Data ○ Flags ○ Size ○ Routing information ○ Any other appropriate answer	Do not accept source, destination, and check sum, which are provided in the question	**2**

Question Number	Answer	Additional Guidance	Mark
3(d)	• Identifying errors (introduced during transmission)		**1**

Question Number	Answer	Additional Guidance	Mark
3(e)	Divide 4096 by 1024 4096÷1024 4096MB / (1024 MB/GB) = 4 GB	• Ignore attempts to calculate an answer	**1**

Question Number	Answer	Additional Guidance	Mark
3(f)	• Internet (Any 1 of the following): ○ Interconnected networks of networks/machines**/hardware** ○ Geographically distributed networks/machines/hardware ○ Uses protocols for communication • World Wide Web (Any 1 of the following) ○ The **information** stored on the hardware ○ Pages of information stored on servers (pages written in HTML) ○ Uses HTTP / HTTPS to send/receive pages between servers and clients Accept any other correct comparison	• Only one topic addressed earns 1 mark max	**2**

Question Number	Answer	Additional Guidance	Mark
3(g)(i)	• Line numbers 5 – 10	Accept lines 4 - 11	**1**

Question Number	Answer	Additional Guidance	Mark
3(g)(ii)	• Any one of the following: ○ The tags refer back to line number 10/the "li" style ○ The <a> tags refer back to line number 6/the "a" style ○ The tags and <a> refer back to the information in the CSS	Allow: <a:hover> equivalent to <a> Allow: Missing </> tag in any description	**1**

Question Number	Answer	Additional Guidance	Mark
3(h)(i)	Amplitude		**1**

Question Number	Answer	Additional Guidance	Mark
3(h)(ii)	Any one of the following – 1 mark • (The more samples,) the smoother the digital representation of the original audio. • (Higher sampling rates) result in less distortion of the original audio • This makes the resulting digital representation more accurately match the original audio.	• Do not award "better", "better quality", or similar	**1**

Question Number	Answer	Additional Guidance	Mark
3(i)	Must have idea of ***runs*** (1) being compressed to ***a single item + a count*** of that item (1) Example: Simple mono-chrome icon will have long sequences of bits of same colour (1) Sequences/runs of identical data are translated/stored as a single data value and a count (1)		**2**

Question Number	Answer	Additional Guidance	Mark
4(a)	Any three of the following impacts: • Pollution (water, air, noise) resulting from the manufacturing process • High energy and water volumes needed for the manufacturing process • Mineral mining contaminates ground water • Mineral (copper, gold, silver, lithium) resource depletion • High energy use to keep machines cool with air conditioning or fans • Contain toxic components which means computing devices are hazardous waste • Batteries (laptop, lithium cells) disposal is hazardous and needs specialised disposal facilities • Computing devices sent to landfills contaminate ground and water resources • Any other appropriate responses as long as they're distinct from each other Any one of the following actions: • Check national and local legislation • Some countries/states/regions require sellers to recycle own waste • Research recycling facilities to see if e-waste is acceptable • Find if local/national/regional government agencies charge for collection and disposal of e-waste • Find sellers offering exchange old for new + cost purchase options • Find charities (local, regional) which take donations of old devices • Turn off machines when not in use to save energy. • Any other appropriate response as long as it is interpretable to match an impact.	• 3 marks maximum for environmental impacts • 1 mark maximum for suggestion to reduce environmental impact • Suggestion does not have to follow impact. • Example: Mining of minerals pollutes the water and depletes valuable mineral stocks. Ground water is contaminated by sending batteries to landfill sites. Energy can be saved by turning the machines off at night. (4 marks)	4

Question Number	Answer	Additional Guidance	Mark
4(b)	Any two of the following Easier / faster to: ○ Sort ○ Search (by using queries) ○ Produce reports ○ Analyse data ○ Keep organised	Do not accept: • Primary or foreign keys • Relationships • Tables • Relational Database	**2**

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	• Primary Key **Ignore additional information in the answer**	Do not accept 'Key' by itself	**1**

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	• Foreign Key **Ignore additional information in the answer**	Do not accept 'Key' by itself	**1**

Question Number	Answer	Additional Guidance	Mark
4(c)(iii)	• Any one of the following: ○ To form a relationship between the tables ○ To make connections between the tables ○ To facilitate the use of queries across tables ○ To relate the records in one table to records in another		**1**

Question Number	Answer	Additional Guidance	Mark
4(d)	One mark for **UPDATE** with correct table name One mark for **SET** with correct field name and new value One mark for **WHERE** with primary key and value Example: • UPDATE tblOutlet SET (Outlet_Address = "360 Pinnacle Place") WHERE Outlet_ID=2;	Do not penalise spelling of field names or table prefixes Do not penalise capitalisation of key words Do not penalise minutiae of syntax such as brackets, semi-colons, quotes	**3**

Question Number	Answer	Additional Guidance	Mark
4(e)	Justification expected in context of the question: ○ Can represent a larger number of characters ○ 16-bit representation is larger than 8-bit representation Example (in context of question) ○ Foreign language characters (ö, ú, ê, ç) ○ Foreign language characters used as alphabet	Not applicable to context of question (do not award) Smiley (WingDings, DingBats…) Mathematical symbols Copyright and trademark Foreign currency symbols Any other symbols supported by Unicode	**1**

Question Number	Answer	Additional Guidance	Mark
4(f)	Any one of: • 0 – 255 • 255 - 0	Do not award 256. Do not award 255.	**1**

Question Number	Answer	Additional Guidance	Mark
4(g)	Any three of the following: ○ Server can embed scripts into HTML page ○ Script is executed on the server ○ Result of execution is sent back to the client as an HTML page ○ All processing takes place on the server, not on the client ○ No software plugins to install on client machines ○ Software updates and patches only performed on server ○ Faster than client-side scripting ○ More secure than client-side scripting	○ Do not credit 'Script may interact with a database'	**3**

Question Number	Answer	Additional Guidance	Mark
5(a)	Compiler – Any of the following: • Translates all the source code as a single block • Object code is produced which can be linked to other modules • Compilers can perform optimisation on object code • Generated executable does not need compiler to execute • Executable can be moved between machines independent of compiler • Executable file runs more quickly than an interpreter with source code • Needs to be recompiled with each code change therefore development is slower. Interpreter – Any of the following: • Code is translated one line at a time and immediately executed • Code needs the interpreter to be run • Code cannot be moved between machines, unless the interpreter is moved as well • Debugging could be easier as interpreter **immediately** identifies line with error • Readable source code may need to be given to people who use the program • Runs less quickly than an executable file • Very good for creating prototypes due to quick development environments Quality of Written Communication	• A bulleted list of advantages or disadvantages is only worth 2 marks max.	**6**

	• 1-2: Some basic points from **at least one** of the categories; No recommendation or recommendation is not justified; Spelling, grammar, and punctuation **errors hinder meaning**. • 3-4: At least one relevant point **from each category**; Includes recommendation with minimal justification. Spelling, grammar, and punctuation **errors occur**, but do not hinder meaning. • 5-6: Relevant points from **both categories**; Includes well-justified recommendation. Spelling, grammar, and punctuation are **used accurately** and meaning is clear. **Example:** A compiler translates all the code at one time. The program can be run on any machine. (One category only; no recommendation; QWC ok; 2 marks max) **Example:** A compiler can perform optimisation on the code to make it more efficient. An interpreter can't because it executes one line at a time. A compiler makes a program that can be run on any machine. A compiler would be better for the pupil. (Two categories; unjustified recommendation; QWC ok; 4 marks max) **Example:** A compiler translates source code in a whole block to make an executable file. The executable file can run on any machines with the target operating system. It does not need the compiler to run. An interpreter translates each line of source code one at a time and executes it. To run the program on another machine, you need the interpreter and the source code. I recommend a compiler for the pupil because it makes		

	giving the program to another person easier, as they don't need the interpreter. (Two categories; justified recommendation; QWC ok; 6 marks max) **Example**: I recommend an interpreter because: • Translates one line at a time • Easier to see errors • Good for quick development I don't recommend a compiler because: • It's slow • Have to give away interpreter as well as code (Two categories; justified recommendation; QWC unmarkable; 2 marks max)		

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	• (Line number) 3		**1**

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	9-16, both must be provided		**1**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(c)</td><td>

1 mark = 0-5 sequence under column i
1 mark = 78, 83, 72, 80, 83 sequence under column anArray[i]

<table>
<tr><th>b</th><th>f</th><th>i</th><th>anArray[i]</th><th>c</th></tr>
<tr><td>75</td><td>FALSE</td><td>0</td><td></td><td>-1</td></tr>
<tr><td></td><td></td><td></td><td>78</td><td></td></tr>
<tr><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>83</td><td></td></tr>
<tr><td></td><td></td><td>2</td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td><td>83</td><td></td></tr>
<tr><td></td><td></td><td>5</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td></td><td>2</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(d)	• Examples: ○ WHILE ((NOT f) AND (i < LENGTH (anArray)) DO ○ WHILE (NOT f) AND (i < 5) DO ○ WHILE (f = FALSE) AND (i < 5) DO ○ WHILE (NOT f) AND i < 5 DO ○ WHILE NOT f AND i < 5 DO ○ WHILE (i < LENGTH (anArray) DO	• Any sensible pseudocode is awardable • Brackets not required • Accept <= in place of <	1

Question Number	Answer	Additional Guidance	Mark
5(e)	Any one of: • Finding the ***location*** of a target number in an array • Finding the **position** of a number in an array	• "Finding a number in an array" is not awardable. • The idea of location is important because of the ***return*** statement value	1

Question Number	Answer	Mark

5(f)	• Flowcharts are not awarded, stated in question
	• Do not penalise pseudocode or programming language syntax errors, as long as logic is discernible
	• Many alternative solutions are possible and should be awarded
	  ○ Reading all measurements into an array and then processing, if correct, should be awarded
	  ○ STEP on FOR loop not required for mark
	  ○ Comments not required
	• For full marks, solution must be correct and work
		7

```
// Initialisation of variables
SET totalWeight TO 0

// Print prompt and get count of weights
SEND "How many weights do you want to enter?" TO DISPLAY
RECEIVE numWeights FROM (INTEGER) KEYBOARD

// Loop for count as entered
FOR i FROM 1 TO numWeights STEP 1 DO
    SEND "Enter a weight:" TO DISPLAY
    RECEIVE aFruit FROM (INTEGER) KEYBOARD

    // Add up as each weight is entered
    SET totalWeight TO totalWeight + aFruit
END FOR

// Find average and print out
SET averageWeight = (REAL) totalWeight / numWeights
SEND "Average weight is: %2d" + averageWeight TO DISPLAY
```

Initialise variables sensibly = 1 mark (**1.1.2**)
totalWeight must be set before first use, if used in calculation.

Retrieving count from keyboard = 1 mark (**2.4.1**)

Any loop control for multiple weights with correct bounds = 1 mark (**2.2.2**)

Adding up total inside loop = 1 mark (**1.1.2**)

Calculating average = 1 mark (**1.1.8**)
Output average = 1 mark (**1.1.2**)

Attempt to deal with INTEGER/REAL/STRING conversion = 1 mark, even if not correct (**1.1.2**)

Content Mapping Grid

Question	Specification	Marks
1a	4.1.3, 4.2.5	3
1b	3.1.1	2
1c(i)	4.2.3	1
1c(ii)	4.2.3	1
1c(iii)	2.2.2	1
1d	3.1.2	1
1e	3.1.2	1
1f(i)	3.1.4	1
1f(ii)	3.1.4	1
1f(iii)	3.1.4	1
1g	4.3.1	1
1h(i)	4.3.1	3
1h(ii)	4.3.2	1
2a	4.4.2	4
2b	6.1.4	4
2c	4.2.1	3
2d	4.2.2	2
2e	4.4.1	3
2f	4.4.3	2

Question	Specification	Marks
3a(i)	3.2.2	1
3a(ii)	3.2.2	1
3a(iii)	3.2.2	1
3b	4.2.4	3
3c	5.1.6	2
3d	5.1.7	1
3e	3.3.1	1
3f	5.2.1, 5.2.2	2
3g(i)	5.2.3	1
3g(ii)	5.2.3	1
3h(i)	3.2.3	1
3h(ii)	3.2.3	1
3j	3.3.3	2

Question	Specification	Marks
4a	6.1.2	4
4b	3.5.1	2
4c(i)	3.5.2	1
4c(ii)	3.5.2	1
4c(iii)	3.5.2	1
4d	3.5.3	3
4e	3.2.1	1
4f	3.2.4	1
4g	5.2.4	3
5a	4.5.2	6
5b(i)	2.2.1	1
5b(ii)	2.2.1	1
5c	2.1.6	2
5d	1.1.5	1
5e	1.1.3	1
5f	1.1.2, 2.4.1, 2.2.2, 1.1.8	7

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edexcel

Mark Scheme (Results)

Summer 2016

GCSE Computer Science (1CP0/01)
Paper 1: Principles of Computer Science

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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Question Number	Answer	Additional Guidance	Mark
1(a)(i)	Any one of: • To allow connected machines to communicate • To provide the rules of communication between two networked devices	Any other response indicating communication	**1**

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	Any one of: • Backbone • Connecting backbone • Internet backbone • Fibre backbone • Network backbone		**1**

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	Ring		**1**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1(a)(iv)</td><td>One mark for each correct cell.

<table>
<tr><th>LAN</th><th>WAN</th><th>PAN</th><th>VPN</th></tr>
<tr><td></td><td></td><td>X</td><td></td></tr>
<tr><td>X</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>X</td></tr>
<tr><td></td><td>X</td><td></td><td></td></tr>
</table></td><td></td><td>4</td></tr>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1(b)(i)</td><td>Any one of:

• To keep information private/secure/secret as it is being transmitted across networks
• So that unauthorised persons will not be able to translate/understand the transmitted data</td><td>Do not accept:
• to keep secure when stored on devices, which is not the context of the question</td><td>1</td></tr>
</table>

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1(b)(ii)</td><td>
<table>
<tr><th>Plain Text</th><th>Shift</th><th>Cipher Text</th></tr>
<tr><td>d i g i t</td><td>+3</td><td>g l j l w</td></tr>
<tr><td>b i n a r y</td><td>-2</td><td>z g l y p w</td></tr>
</table>
</td><td></td><td>2</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	1 0 0 1 0 1 0 1		**1**

Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	6 E	Ignore case	**1**

Question Number	Answer	Additional Guidance	Mark
1(c)(iii)	1 1 0 0 0 1 0 0	Ignore spacing Must be 8-bits	**1**

Question Number	Answer	Additional Guidance	Mark
1(c)(iv)	Any one of: • 2^n and n=8 • 2^8 • 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 • 2^4 x 2^4 • 2^2 x 2^2 x 2^2 x 2^2 • Any other appropriate formula giving a result of 256		**1**

Question Number	Answer	Additional Guidance	Mark
1(d)(i)	Any one of the following: • Data is permanently lost (during the compression process) • Resolution is lost in images, (usually where it will not be noticed by the human eye) • Signal is degraded in audio files, (usually not noticeable to the human ear)	Accept answers that indicate a loss of quality	**1**

Question Number	Answer	Additional Guidance	Mark
1(d)(ii)	Any one of: B = JPEG		**1**

Question Number	Answer	Additional Guidance	Mark
1(e)	One mark for each of: • X-Dimension = 2 • Y-Dimension = 3 Examples: • (2,3) • X=2, Y=3	Values of 2 and 3 alone, with no indication of ordering, cannot be awarded. Accept any other notation clearly indicating (x,y) ordering and values	**2**

(Total for Question 1 = 18 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)	<table><tr><th>EU Cookie Law (e-Privacy Directive)</th><th>Computer Misuse Act</th><th>Copyright, Designs, and Patents Act</th></tr><tr><td></td><td></td><td>X</td></tr><tr><td></td><td>X</td><td></td></tr><tr><td>X</td><td></td><td></td></tr></table>		**3**

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	<table><tr><th>High-Level Programming Language</th><th>Low-Level Programming Language</th></tr><tr><td>X</td><td></td></tr><tr><td></td><td>X</td></tr><tr><td>X</td><td></td></tr><tr><td></td><td>X</td></tr></table>		**4**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	Comment(s) / Annotation(s)	Do not penalise spelling	**1**

Question Number	Answer	Additional Guidance	Mark
2(b)(iii)	cubeNum	Do not penalise spelling Do not award if other information from function header is provided because the question asks for name only.	**1**

Question Number	Answer	Additional Guidance	Mark
2(b)(iv)	Any one of: • 18 to 22 • 18 - 22 • 18, 19, 20, 21, 22 • 18, 20, 22	Entire range must be provided Award any discernible notation	**1**

Question Number	Answer	Additional Guidance	Mark
2(b)(v)	Any one of: • 25 • 27		**1**

Question Number	Answer	Additional Guidance	Mark
2(b)(vi)	Any one of: • 10 • 19 • 21 • 23		**1**

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	First box = $\frac{1}{2}$ or equivalent expression for 1 mark / 0.5 Second box = $\frac{1}{4}$ or equivalent expression for 1 mark / 0.25 Conversion = $2\frac{3}{4}$ or equivalent expression for 1 mark / 2.75		**3**

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	4		**1**

Question Number	Answer	Additional Guidance	Mark
2(c)(iii)	One mark for: • Numerator (top) calculation • Denominator (bottom) calculation Any of the following: $\frac{\left(\frac{10Kilobytes}{1}\right)\left(\frac{1024bytes}{Kilobytes}\right)\left(\frac{8\ bits}{byte}\right)}{\left(\frac{10Megabits}{Seconds}\right)\left(\frac{1000Kilobits}{Megabits}\right)\left(\frac{1000\ bits}{Kilobits}\right)}$ $\frac{10\ \times 1024\ \times 8}{10\ \times 1000\ \times 1000}$ $\frac{81920}{10000000}$ $\frac{8192}{1000000}$ Any other correct calculation where the unit conversions are discernible.		**2**

(Total for Question 2 = 18 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)	One mark for each concept: Organisation of files is in a **hierarchy/tree** structure A **node** is either a folder/directory/sub-folder/sub-directory or the file itself The top node/folder/directory/drive is the **root**		**3**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	One mark for each concept: The client makes a connection / shares its IP with the server The client machine (web browser) **sends a request to the server** for a web page The server machine **sends the (requested) page back** to the client machine		**2**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	One mark for One mark for both items in One mark for inside Example (3 marks) - Socket - Open Ended Example (2 marks) - Socket Example (1 mark) - Socket - Open Ended	Ignore formatting as long as enclosure <> and </> are correct	**3**

Question Number	Answer	Additional Guidance	Mark
3 (c)(i)	Any two of: • Library code has already been debugged, so it should not have a bug • Library code has already been tested, so it should produce the correct results • Using libraries can reduce the time needed to develop a solution • Library code is usually optimised/faster than own code • Library code can be reused many times without having to rewrite the code	Do not accept just 'saves time'	**2**

Question Number	Answer	Additional Guidance	Mark

3(c)(ii)	One mark for each of (**in this order only**):
	
	1. AND
	2. OR
	3. NOT
	4. AND
	
	==========
	1 Mon, 2 Tues, 3 Wed, 4 Thur, 5 Fri, 6 Sat, 7 Sun
	
	IF day >= 1 AND day <= 5 THEN
	SEND "weekday" TO DISPLAY
	ENDIF
	IF day = 6 OR day = 7 THEN
	SEND "weekend" TO DISPLAY
	ENDIF
	IF NOT (day >= 1 AND day <= 7) THEN
	SEND "error" TO DISPLAY
	ENDIF
			4

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>3(d)</td><td>One mark for each row (maximum 4 marks):

<table>
<tr><td>(1)</td><td>SELECT (id, description)</td><td></td></tr>
<tr><td>(1)</td><td>FROM tblProduct</td><td></td></tr>
<tr><td rowspan="2">(1)</td><td>WHERE id LIKE 'G%'</td><td>Pattern must be discernible as a string (“”), the letter G (g), and a wild card character (*,#,?)</td></tr>
<tr><td>WHERE id>=”G000” AND id <=”G999”</td><td>Pattern must be discernible as a string (“”), the letter G (g), and the operator “AND”</td></tr>
<tr><td>(1)</td><td>ORDER BY id ASC</td><td>Award ASCEND(ING)</td></tr>
</table></td><td>Do not penalise spelling</td><td>4</td></tr>
</table>

(Total for Question 3 = 18 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)	Any two of: • Both the instructions and data for a program are stored in main memory • Instructions and data are stored in binary code • Instructions and data are fetched, decoded, and executed in a sequence by the CPU		**2**

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	One mark for: • Software (layer) One mark for any of: • Allows the operating system on one physical computer **to simulate another computer**, usually of a different operating system. • Allows a **guest operating system** to reside on a machine • Allows **a program written for one machine to run on another** wit**hout changes (Java Virtual Machine).** • Any other appropriate and correct response.	An example (JVM or Linux on Windows) is not enough for marks	**2**

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	At least one from both sections for full marks Any four of: Sequential: • Individual instructions are executed one after another • Flow control is accomplished by jump/branch/goto instructions • Results are usually achieved less quickly than parallel processing (do not award twice) Parallel: • Individual instructions can be routed to different processors for simultaneous execution • Results are usually achieved quicker than sequential instruction (do not award twice) • Requires multi-core processors or multiple microprocessors • Tasks may be split into different parts with each part executed on a different processor • Results need to be merged back together after completion Any other appropriate and correct response.		**4**

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	Coding solution **(one mark for each item):** • **Calli**ng code must provide an input parameter • `calcCircleArea` signature must take an input parameter • Input parameter must be used in calculation 47 48 calcCircleArea (radiusOfCircle) 49 50 PROCEDURE calcCircleArea (radiusOfCircle) 51 BEGIN PROCEDURE 52 SET area TO Pi * radiusOfCircle * radiusOfCircle 53 SEND area TO DISPLAY 54 END PROCEDURE 55	Ignore any reference to data types	**3**

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	One mark for each correct cell **Pupil Number Visited** / **Sub-list** 2245 / 837, 1529, 1683 1529 / 1683 1683 /		**5**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>4 (c)(iii)</td><td>One mark for each correct column

<table>
<tr><th>A</th><th>B</th><th>R = A OR B</th><th>S=NOT(A AND B)</th><th>Q=R AND S</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
</table></td><td></td><td>3</td></tr>
</table>

(Total for Question 4 = 19 marks)

Question Number	Answer	Additional Guidance	Mark
5(a)	Characteristics – Any of the following: • Branch of computer science based on enabling computers to behave like humans/mimic aspects of human intelligence • AI is implemented in software. • Combines psychology, biology, linguistics, mathematics, neuroscience, and philosophy (ethics) • AI is not the same as the general intelligence of human beings Uses – Any of the following: • Game playing (chess, quiz, video games) • Analytics (analyse buying patterns, predicting behaviours, predictive text, financial markets) • Image processing (recognising objects/patterns) • Logistics (scheduling, order fulfilment) • Control systems (cars, manufacturing, weapons, navigation) • Expert systems (medical, mechanical, electrical diagnosis) • Neural networks (simulating neuron behaviours as in brains) • Natural languages processing (chatterbots, chatbots, speech recognition) • Robotics (dangerous situations, help aged or disabled) Ethical issues – Any of the following: • Take the work of humans, thereby affecting employment rates • Is a computer to be trusted to make decisions (life-death)?	A bulleted list of facts is only worth 2 marks max.	**6**

	• If a computer discovers something that humans can't prove, should it be accepted as truth? • Do AI machines have rights? • Will people be comfortable interacting with machines that are considered intelligent? Quality of Written Communication: • 1-2: Some basic points from **at least one** of the categories; little clarification or expansion of points; spelling, grammar, and punctuation **errors hinder meaning**. • 3-4: At least one relevant point **from two categories**; some clarification or expansion of points; spelling, grammar, and punctuation **errors occur**, but do not hinder meaning. • 5-6: Relevant points from **three categories**; comprehensive clarification or expansion of points; spelling, grammar, and punctuation are **used accurately** and meaning is clear. **Example:** Robots are machines that use artificial intelligence to do jobs that people tell them to. They are not as smart as real humans. One category only; no expansion; QWC ok; 2 marks max) **Example:** Artificial intelligence is based on getting machines to behave like humans. The cleverness of AI is really in the software. AI is used in game playing. Recently the AI software has beat humans at some games. (Two categories; Some expansion; QWC ok; 4 marks max)		

	Example: AI is a branch of computer science that tries to make software imitate human intelligence. However, we're not there yet. It is used in expert systems to diagnose problems with car engines. It can also be used to predict which products people might buy in a grocery store based on their loyalty card purchases. There are problems with AI. One is the issue of ethics. Courts may decide that AI robots have the same rights as humans. People may not like the idea of computers making life and death decisions, such as when to turn off life support systems. This may make people very uncomfortable. (Three categories; Comprehensive expansion; QWC ok; 6 marks max) **Example**: AI: • Making robots behave like humans Uses: • Used to help people with disabilities live in normal homes Ethical Issues: • They will be taking over human jobs and putting people out of work (Three categories; QWC unmarkable; 2 marks max)		

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(b)(i)</td><td>One mark for initialisation of variables (max 1 mark)
One mark for each complete pass of loop (max 4 marks)

<table>
<tr><th>R3</th><th>R4</th><th>R5</th><th></th></tr>
<tr><td>1</td><td>2</td><td>4</td><td>1 mark</td></tr>
<tr><td>2</td><td></td><td></td><td rowspan="2">1 mark</td></tr>
<tr><td></td><td></td><td>3</td></tr>
<tr><td>4</td><td></td><td></td><td rowspan="2">1 mark</td></tr>
<tr><td></td><td></td><td>2</td></tr>
<tr><td>8</td><td></td><td></td><td rowspan="2">1 mark</td></tr>
<tr><td></td><td></td><td>1</td></tr>
<tr><td>16</td><td></td><td></td><td rowspan="2">1 mark</td></tr>
<tr><td></td><td></td><td>0</td></tr>
</table>

Other formats for this table are acceptable. For example, each combination of 2 values may be on a single line (indicated in grey).</td><td></td><td>5</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	Calculates the number defined as one of (or equivalent statement) • $R4^{R5}$ • 16 • 2^4 • 2 x 2 x 2 x 2		**1**

Question Number	Answer	Additional Guidance	Mark
5(b)(iii)	<table><tr><th>Part</th><th>Name</th></tr><tr><td>MOV</td><td>Opcode / operation code field / operation</td></tr><tr><td>R4,#2</td><td>Operand / operand code field / operand field</td></tr></table>	• Do not penalise spelling	**2**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(b)(iv)</td><td>One mark for each of:
• Initialisation (R3, R4, R5)
• Correct loop construction showing blocking
• Correct two lines inside of loop blocking

<table>
<tr><td><pre>SET R3 TO 1
SET R4 TO 2
SET R5 TO 4
WHILE R5 <> 0
    SET R3 TO R3 * R4
    SET R5 TO R5 - 1
END WHILE</pre></td><td><pre>SET R3 TO 1
SET R4 TO 2
SET R5 TO 4
FOR X FROM 1 TO R5 DO
    SET R3 TO R3 * R4
    SET R5 TO R5 - 1
END FOR</pre></td></tr>
<tr><td><pre>SET R3 TO 1
SET R4 TO 2
SET R5 TO 4
REPEAT
    SET R3 TO R3 * R4
    SET R5 TO R5 - 1
UNTIL R5 = 0</pre></td><td><pre>SET R3 TO 1
SET R4 TO 2
SET R5 TO 4
FOR EACH X FROM R5 DO
    SET R3 TO R3 * R4
    SET R5 TO R5 - 1
END FOR</pre></td></tr>
</table>
</td><td>• Accept alternate solution of DO/WHILE as long as test is “R5 <> 0”
• Do not penalise pseudocode usage as long as response is blocked and discernible
• A specific language construct of a while, repeat, or for loop should be awarded if blocked and discernible</td><td>3</td></tr>
</table>

```
SET R3 TO 1
SET R4 TO 2
SET R5 TO 4
REPEAT R5 TIMES
    SET R3 TO R3 * R4
    SET R5 TO R5 - 1
END REPEAT
```

```
SET R3 TO 1
SET R4 TO 2
SET R5 TO 4
FOR X FROM 1 TO R5 STEP 1 DO
    SET R3 TO R3 * R4
    SET R5 TO R5 - 1
END FOR
```

Other solutions may be correct, as long as it includes a sensible loop with the correct test for terminating condition.

(Total for Question 5 = 17 marks)

Total for paper = 90 marks

Content Mapping Grid

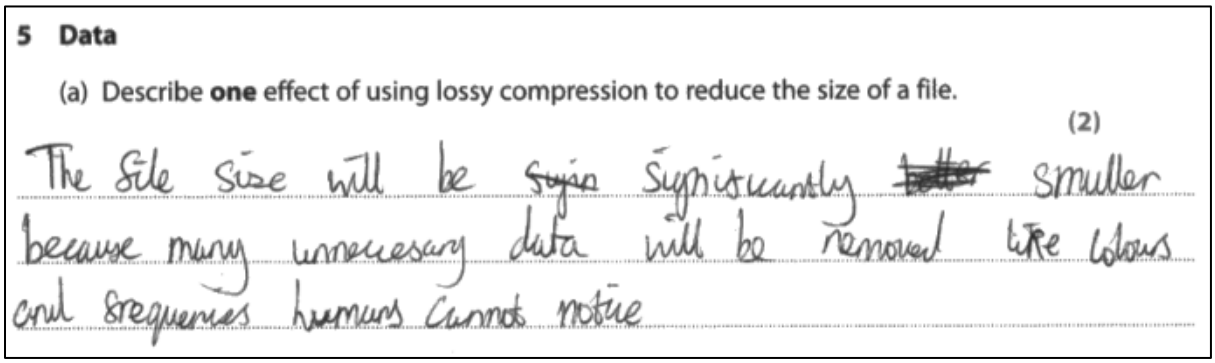
Question	Specification	Marks
1a(i)	5.1.5	1
1a(ii)	5.2.1	1
1a(iii)	5.2.9	1
1a(iv)	5.1.2	4
1b(i)	3.4.1	1
1b(ii)	3.4.2	2
1c(i)	3.1.4	1
1c(ii)	3.1.5	1
1c(iii)	3.1.5	1
1c(iv)	3.2.4	1
1d(i)	3.3.2	1
1d(ii)	3.3.2	1
1e	2.4.3 1.1.1	2
2a	6.1.3	3
2b(i)	4.5.1	4
2b(ii)	2.1.2	1
2b(iii)	2.2.1	1
2b(iv)	2.2.2	1

Question	Specification	Marks
2b(v)	2.3.5	1
2b(vi)	2.3.5	1
2c(i)	3.1.2	3
2c(ii)	3.3.1	1
2c(iii)	3.3.4	2
3a	4.4.1	3
3b(i)	5.2.4	2
3b(ii)	5.2.3	3
3c(i)	2.6.1	2
3c(ii)	4.3.2	4
3d	3.5.3	4
4a	4.2.2	2
4b(i)	4.1.1	2
4b(ii)	4.1.2	4
4c(i)	2.6.3	3
4c(ii)	1.1.8	5
4c(iii)	4.3.1	3
5a	6.1.1	6

Question	Specification	Marks
5b(i)	2.1.6	5
5b(ii)	1.1.1	1
5b(iii)	4.2.3	2
5b(iv)	2.2.2	3

Question 5a

Many students showed a good understanding of lossy compression, particularly with regards to permanent data loss. Some went as far as comparing with lossless. The use of examples that could describe how data loss affects file quality was not always well explained.



5 Data

(a) Describe **one** effect of using lossy compression to reduce the size of a file.

(2)

The file size will be ~~sign~~ significantly ~~better~~ smaller because many unnecesary data will be removed like colours and frequencies humans cannot notice

This response scored 2 marks.

(a) Describe **one** effect of using lossy compression to reduce the size of a file.

(2)

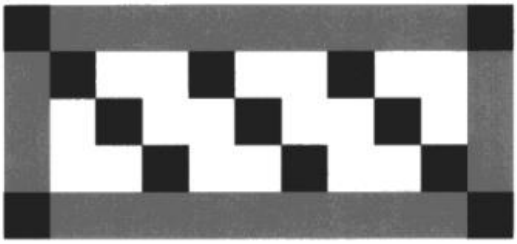
An effect of using lossy compression is that it will make file transmission faster leading to being able to send more files faster and efficiently.

This response scored 0 marks.

Question 5b

Some responses showed good understanding of how an image is constructed and how the number of colours impacted the number of bits required for the colour depth of the image, while a lot of responses thought the question was about resolution and thought that the image was not clear because 1-bit resolution was too low.

(b) Here is an original image.



There is one bit available to represent each pixel.

Explain **one** reason why the image cannot be accurately represented using one bit for each pixel.

(2)

only 2^1 (2) colours can be represented with a color depth of 1 so it will be in black and white, whereas this original image portrays black, grey and white (3 colors) which would need at least 2 bits to represent as 1 only shows black and white

This response scored 2 marks. 1 mark for 'colours can be represented' and 1 mark for 'so it will be in black and white'.

Question 5c

Lots of confusion around this question with some students knowing what a logical shift was, but many struggled with arithmetic shifts. Many students did not reference the most significant bit in their responses.

A **logical** shift right is performed on a pattern.

An **arithmetic** shift right is performed on the same original pattern.

Describe the reason the results will be different.

(2)

Logic shifts right replace blank spaces the MSB with a 0, whereas Arithmetic shifts copy the MSB to use for the ne MSB

(c) Shifts are performed on binary patterns.

A **logical** shift right is performed on a pattern.

An **arithmetic** shift right is performed on the same original pattern.

Describe the reason the results will be different.

(2)

because logical shift will replace the value on the farmost left with 0 and arithmetic will replace it with the value it lost.

These responses scored 2 marks.

Question Q5eii

A number of responses did not set out the expression accurately, or show understanding the arithmetic process required. Generally, at least one mark was awarded for 100 X 600. There were still some misconceptions around converting into bytes. In many instances the +1024 was included in the numerator, rather than being applied to the whole expression.

(ii) A file format uses a 100 × 600 table of 32-bit integers.

The file uses 1 kibibyte of additional data.

Construct an expression to show the number of **bytes** of storage needed to store the file.

(3)

100 x 600 x 32 + 1024

This response scored 2 marks.

Question 5f

Students did not always label the axes correctly, especially the y axis. It was often the case that not all points were accurately plotted. Very few students produced a square wave and some students stopped plotting at point 9 rather than point 10. Some students mistakenly flipped the two's complement values, leading to incorrect amplitudes in their representation, others gave amplitude values from 0 to 1 to 15, instead of -1 to 0 to 1.

The sound is one second long and is sampled at 10 Hz.

The digital representation has a bit depth of 5 and is stored in two's complement.

Sound data:

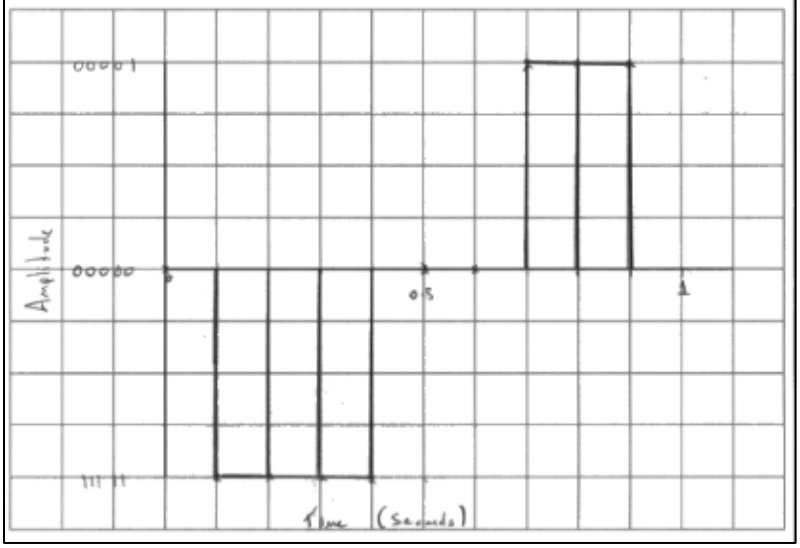
00000 11111 11111 11111 11111
00000 00000 00001 00001 00001

Draw a graph to represent the data sampled.

You must include:

- labels for the x and y axes
- values for the x and y axes
- each sample plotted as an X
- samples joined up to show the digital form.

(6)



This response scored 6 marks. X-axis labelled correctly, 1 mark. Y-axis labelled correctly, 1 mark. Value of X-axis as 0 and 1, 1 mark. Binary values on y axis, 1 mark. All 10 values plotted to correct points (starting from 0), 1 mark. Points join to form a square wave, 1 mark.

Paper Summary

Based on their performance on this paper, students are offered the following advice:

- Expand and explain answers using examples and reasons, especially where more than a simple statement or list is requested.
- Where a context or scenario is provided, respond with the context of the question in mind.
- Read and interpret the question prompt to focus on the specific requirements and provide more relevant responses that address the critical aspects of the question.
- Develop a clear understanding of data representation, e.g. the number of states that can be represented with 1 bit and focus on understanding the key elements of representing analogue and digital signals.
- Familiarise yourself with the appropriate symbols and conditions to ensure clarity and accuracy in diagrammatic representations of algorithms.

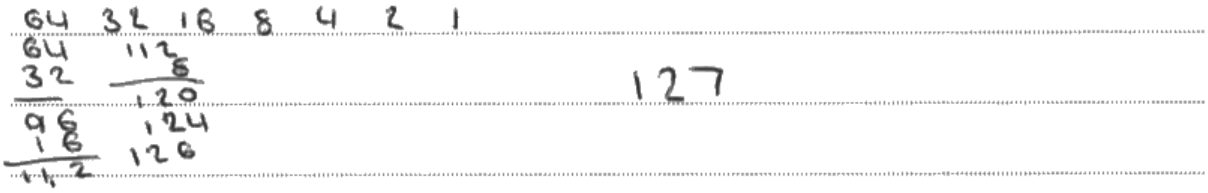
Question 1(a)ii

Most candidates responded correctly giving either 128 or 2^7.

Some candidates gave 127 which is the largest number that can be represented with 7 bits, but is not the total number of unique representations.

(ii) State the number of unique values that can be represented with 7 bits.

(1)



ResultsPlus
Examiner Comments

This response scored 0 marks for an incorrect value. It was off-by-one exemplifying a typical candidate misconception giving the largest number that can be represented rather than the number of unique values.

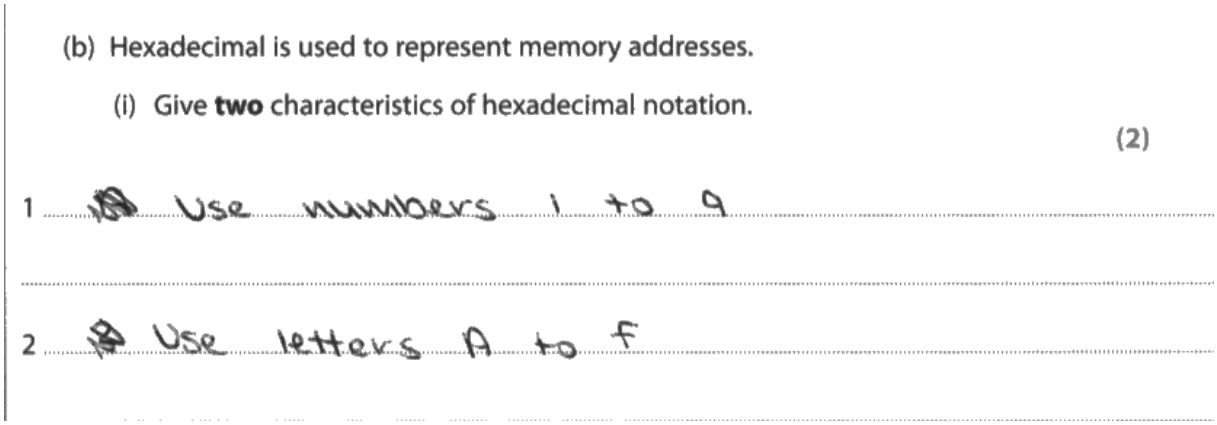
Question 1(a)iii

Most candidates gave the correct ASCII code for G which was 71.

Question 1(b)i

Candidates sometimes confused the benefits of using hexadecimal with its characteristics, giving the benefits of using hexadecimal rather than focusing on its intrinsic characteristics. The characteristics are the features of the notation. Where candidates gave characteristics, they were sometimes too vague. For example, specifying 'letters' rather than 'letters A to F are used'.

Some candidates also stated that hexadecimal digits went from 1 to 9 instead of specifying from 0 to 9.


(b) Hexadecimal is used to represent memory addresses.

(i) Give **two** characteristics of hexadecimal notation.

(2)

1 Use numbers 1 to 9

2 Use letters A to F

ResultsPlus
Examiner Comments

This response scored 1 mark for stating that hexadecimal uses letters A to F. To gain the second mark the candidate would have needed to state that numbers/digits 0 to 9 are used as well, and not just 1 to 9.

Question 1(b)ii

Many candidates were able to identify a reason why programmers use hexadecimal notation such as that it is easier to read or write, but fewer were able to give the required linked explanation to give the reason for their assertion. A number of candidates wrote that hexadecimal took less storage space than binary which is incorrect - the amount of bits required to store the value is identical.

(ii) Explain **one** reason why programmers use hexadecimal to specify memory addresses.

(2)

one reason why programmers use Hexadecimal is because it is easier for ~~other~~ other programmers to understand.

ResultsPlus Examiner Comments

This response scored 1 mark for identifying that hexadecimal is easier to understand/use, but there was no expansion to give a reason to explain why this was the case for the second mark.

Question 1(c)i

Some candidates confused lossless compression with lossy compression. Many candidates were able to state that lossy compression would give higher compression ratios by removing data that would be outside the range of human hearing. Other popular reasons related to decreased file sizes for improved streaming by reducing download times.

(c) Audio and image files store data in binary.

(i) Explain **one** reason why lossy compression is used to reduce the size of an audio file.

(2)

it can be reduced more than if you used lossless ~~as~~ as some parts of the file are discarded

ResultsPlus
Examiner Comments

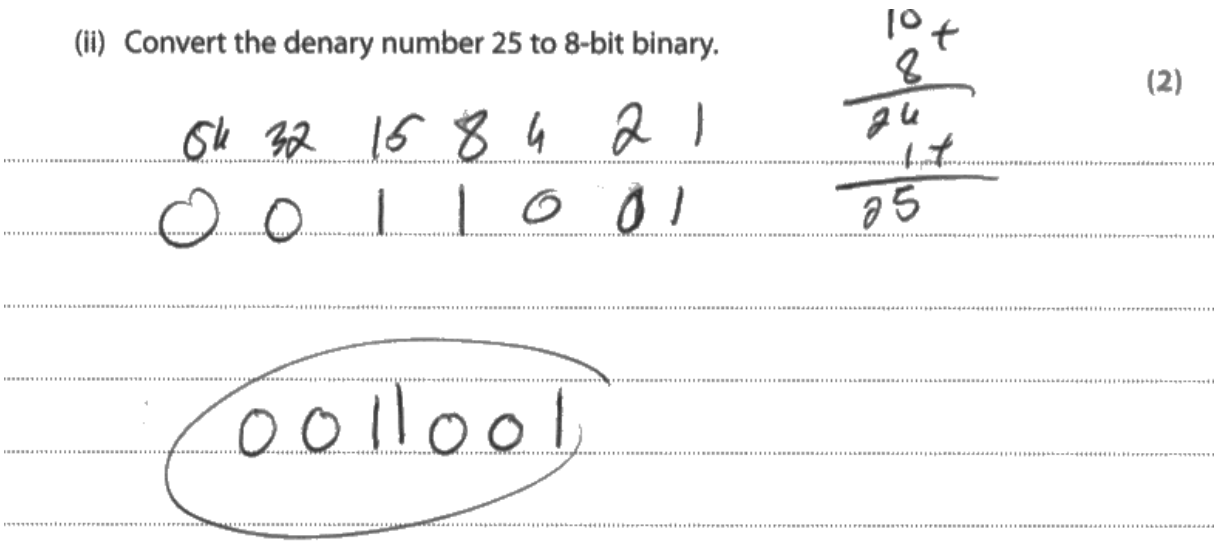
This response scored 2 marks without specifically relating to the context of lossy compression for audio. It did identify that lossy compression would achieve a higher compression ratio because some of the original data was discarded.

Question 1(c)ii

Most candidates scored at least one mark for multiplying the width (315) by the height (923) and many went on to give fully correct responses. Common errors included confusing the colour depth of 7 with 2^7 for the number of colours available and dividing by 1000 in an attempt to convert to KB rather than dividing by 8 to convert the total number of bits into bytes. A number of candidates also left one or more of the boxes empty rather than attempting to create a solution.

Question 1(d)ii

Candidates showed improved mathematical skills with the majority of candidates being able to convert an unsigned denary integer into binary. Some candidates converted the denary number 25 to the binary pattern 11001 rather than the 8-bit binary pattern 0001 1001, so scored one mark because they gave one correct nibble rather than two correct nibbles.



ResultsPlus Examiner Comments

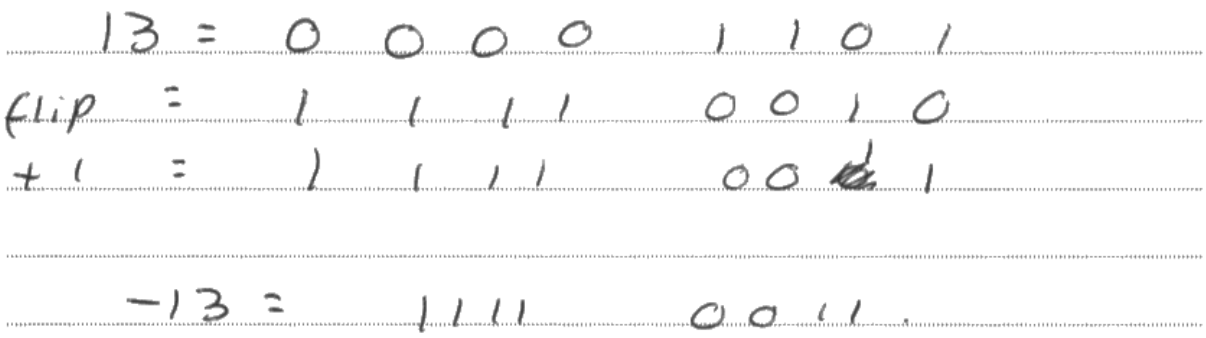
This response scored 1 mark. The response was not a full 8-bit binary number, but the right hand nibble could be identified to score a mark.

Question 1(d)iii

Fewer candidates were able to convert a negative denary integer into an 8-bit binary number using two's complement compared to a positive number conversion in d(ii). Where candidates attempted the conversion and produced incorrect responses, it was often because they tried to do the conversion by writing the positive value for -13 which was 0000 1101 and then flipping the bits to give 1111 0010, but then forgetting to add one. Many candidates also wrote out a number line starting with -128 for the most significant bit and then successfully completed the conversion using that technique.

(iii) Convert the denary number –13 to 8-bit binary using two's complement.

(2)



ResultsPlus Examiner Comments

This response scored 2 marks for a correct answer. It exemplified the method of flipping the bits and adding one to convert between positive and negative representations of numbers using two's complement.