Chhetri Academy

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GCSE COMPUTER SCIENCE

3.1

Edexcel 1CP2 | Specification point 3.1.1

The von Neumann stored program concept and the role of main memory (RAM), CPU (control unit, arithmetic...

Untiered

Answers and examiner comments

6	2015-2023	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 2

The full source mark scheme begins on page 17. Use the original paper code, tier and question number shown above.

Original question 4

The full source mark scheme begins on page 51. Use the original paper code, tier and question number shown above.

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	A – Solid state (1)		**1**

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	• ROM stores BIOS / bootstrap / start-up (1) • RAM stores **currently executing** programs and data (1)		**2**

Question Number	Answer	Additional Guidance	Mark
4(a)(iii)	• Data (1) • Instructions (1)		**2**

Question Number	Answer	Additional Guidance	Mark
4(a)(iv)	B – Control unit (1)		**1**

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	Any two from: • All processes are held in a queue (1) • Processes are prioritised (1) • (and) Processes are switched (1) • On each clock cycle (1)	• Award explanations if attributable to a bullet point	**2**

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	C – Converting files (1)		**1**

5(a)	C - Processor		**1**

Question Number	Answer	Additional Guidance	Mark
5(b)	Any **two** from: • Registers • Clock • CU • ALU		**2**
Question Number	Answer	Additional Guidance	Mark
5(c)	Response identifies any **four** from: • data and instructions are stored in main memory (1) • data and instructions are fetched by the CPU (1) • on the pulse of a clock (1) (as 'required'/ notified / assigned by the program counter) • correctly identify role of address bus (1) • correctly identify role of data bus (1) • instructions decoded by the CU (1) • instructions executed (with data, as appropriate) by the ALU (1) Data and instructions are fetched from main memory (1), from addresses requested by the CPU (1) on the address bus (1). (Data and instructions are **sent**) using the data bus (1). (Data and instructions are then) decoded and executed in the CPU (1). Results of operations are **sent back** to the memory (1) on the data bus (1).	Response must cover both main memory and CPU Accept CPU for bullets 6 and 7	**4**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(d)</td><td>Indicative content:
Both translate source code written in high level programming languages into machine code.
<table>
<tr><th>Compiler</th><th>Interpreter</th></tr>
<tr><td>Produces a single executable file that is portable between machines</td><td>Source code needs special environment to run</td></tr>
<tr><td>Needs to be compiled for a particular architecture</td><td>Can run on any architecture that has the translator/interpreter</td></tr>
<tr><td>Entire source code file is translated at once</td><td>Code is translated line by line</td></tr>
<tr><td>Provides error report at the end of the compilation</td><td>Errors more obvious in sequence</td></tr>
<tr><td>The program source code is not available (so helps protect IP)</td><td>Source code is available</td></tr>
<tr><td>Only has to be translated once (affecting the speed of execution)</td><td>Has to be translated each time therefore (affecting the speed of execution)</td></tr>
<tr><td>Requires two files to be maintained (one for execution and for editing purposes)</td><td>Requires only one file to be maintained</td></tr>
</table></td><td></td><td>6</td></tr>
</table>

Level	Mark	Descriptor
	0	No rewardable content
Level 1	1-2	A comparison may be attempted but with limited application of knowledge and understanding of key concepts/principles of computer science to the theoretical context. The comparison will contain basic information with some attempt made to link knowledge and understanding to the given context.
Level 2	3-4	A comparison will be given with adequate application of knowledge and understanding of key concepts/principles of computer science to the theoretical context. Lines of reasoning are occasionally supported through a linkage. The comparison shows some linkages and lines of reasoning with some structure.
Level 3	5-6	A comparison will be given with comprehensive application of knowledge and understanding of key concepts/principles of computer science to the theoretical context. Line(s) of reasoning are supported throughout by sustained application of relevant evidence. The comparison shows well-developed and sustained lines of reasoning which are clear, coherent and logically structured.

Question Number	Answer	Additional Guidance	Mark

Original question 2

The full source mark scheme begins on page 81. Use the original paper code, tier and question number shown above.

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	Award one mark for each correct cell: Bus / Role Control (1) / Carries a read signal to main memory Address (1) / Carries the memory location of a piece of data Data (1) / Carries an instruction from main memory to the CPU		(3)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	The only correct answer is D *A is not correct because the ALU carries out operations, rather than stores data* *B is not correct because the clock is an electrical signal, it does not store data* *C is not correct because main memory is not a component within the CPU*		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	Award one mark for any of the following: • Machine code (1) • Binary (1) • Object code (1) • Executable code / an executable (1)		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	Award one mark for any of the following up to a maximum of two marks: • Compile/Compilation (1) • Interpret/Interpretation (1) • Assemble (1)	Allow compiler/compiling, interpreter/interpreting, assembler/assembling	(2)

Question Number	Answer	Additional Guidance	Mark
1(c)	The only correct answer is C *A is not correct because optical media does not use magnetic charges, unlike a hard disc* *B is not correct because the portability does not affect how data is read from it* *D is not correct because volatility is not what makes the media readable*		(1)

Question Number	Answer	Additional Guidance	Mark
1(d)	Award one mark for any of the following: • Forms part of another device / system (1) • Performs a single/dedicated/specific task (1)		(1)

Question Number	Answer	Additional Guidance	Mark
1(e)	Award one mark for each correct cell: **Code review carried out by** / **Disadvantage** By a programmer: • Adds additional/significant time (to the development cycle) (1) • Introduces human error (1) • Requires an extra person/resource/labour (1) • Requires more experienced programmer (1) By an automated system: • May not identify all issues (that it is not programmed to find) (1) • May only find well known problems (1)	Do not award cost of buying software or paying additional programmer, as given in the question. Do not accept: - 'algorithmic bias' - 'does not find logic errors'	(2)

Question Number	Answer	Additional Guidance	Mark
1(f)	The only correct answer is C *A is not correct because defragmentation software does not compress data* *B is not correct because defragmentation software does not encrypt data* *D is not correct because defragmentation software does not protect data*		(1)

Question Number	Answer	Additional Guidance	Mark
1(g)(i)	Award one mark for any of the following up to a maximum of two marks: • A scheduler/scheduling algorithm controls processes (1) • Each process gets a time slice/small amount of (CPU) time (1) • Processes are held in a data structure (1) • Each process may be held in order / priority (1) • Incomplete processes go to the back of the queue (1)	Allow use of 'program' instead of 'process' Award examples e.g. 'round-robin'. For MP3 – award any example of a data structure e.g. array, list, queue.	(2)

Question Number	Answer	Additional Guidance	Mark
1(g)(ii)	Award one mark for any of the following: • File management (1) • Peripheral management (1) • User management (1) • User interface (1)	Allow memory management Allow a specific example, only if it can clearly be attributed to one of the bullets	(1)

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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>

Question Number	Answer	Additional Guidance	Mark
1(b)	• Data (1) • Instructions (1)		**2**

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**

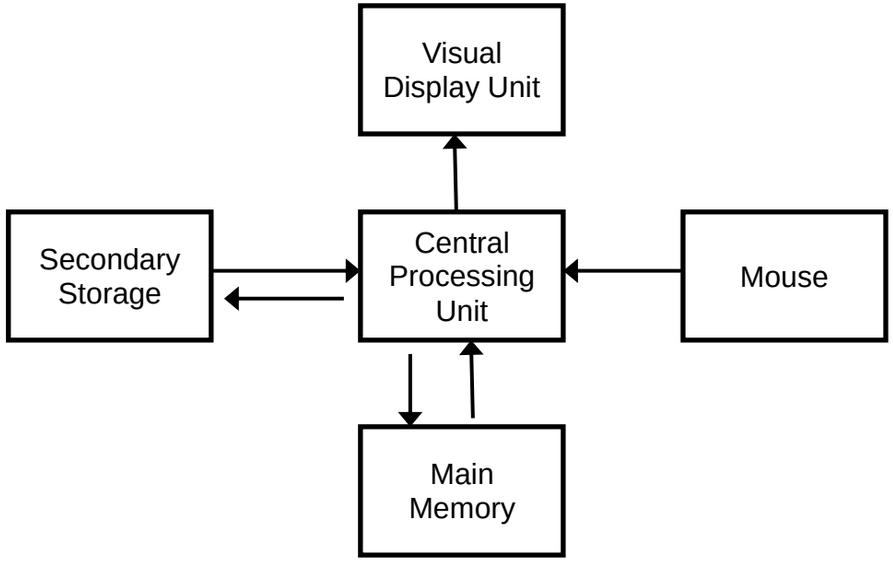
Question Number	Answer	Additional Guidance	Mark
1(h)(i)	• NOT R column correct = 1 mark • First 2 rows correct of Q = 1 mark • Last 2 rows of Q = 1 mark **NOT R** | **Q** 1 | 0 1 | 1 0 | 0 0 | 0		**3**

Question Number	Answer	Additional Guidance	Mark
1(h)(ii)	• 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	• **Q=** not required • Accept correct transpositions • Order of precedence is (); NOT; AND; OR	**1**

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>
<tr><td></td><td></td><td></td><td>72</td><td></td></tr>
<tr><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>80</td><td></td></tr>
<tr><td></td><td></td><td>4</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>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>

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

Plain Text	Shift	Cipher Text
d i g i t	+3	g l j l w
b i n a r y	-2	z g l y p w

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)			**3**

EU Cookie Law (e-Privacy Directive)	Computer Misuse Act	Copyright, Designs, and Patents Act
		X
	X	
X		

Question Number	Answer	Additional Guidance	Mark
2(b)(i)			**4**

High-Level Programming Language	Low-Level Programming Language
X	
	X
X	
	X

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: $\frac{\left(\frac{10 Kilobytes}{1}\right)\left(\frac{1024 bytes}{Kilobytes}\right)\left(\frac{8\ bits}{byte}\right)}{\left(\frac{10 Megabits}{Seconds}\right)\left(\frac{1000 Kilobits}{Megabits}\right)\left(\frac{1000\ bits}{Kilobits}\right)}$ $\frac{10\ \times 1024\ \times 8}{10\ \times 1000\ \times 1000}$ $\frac{81920}{10000000}$ $\frac{8192}{1000000}$ 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

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Mark Scheme (Results)

June 2022

Pearson Edexcel GCSE In Computer Science (1CP2/01) 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.

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	Any **two** from: • Can share files/data • Can share applications/software • Can collaborate • Can share peripherals (printers, speakers) • Can share connectivity (Internet connection, hotspot) • Can access files **from any computer / hot desk** • Central control/management (security, software updates, backup, remote support, users, remote monitoring) • Allows communication (email, social media, video conferencing, online meeting, collaborative games)		**2**

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	A description such as: • A LAN covers a small (geographic) area / a WAN covers a large (geographic) area (2) • A LAN uses infrastructure owned by one company / a WAN uses third-party infrastructure (2) • A LAN connects individual devices / uses switches (1), whereas a WAN connects LANs / uses gateways (1)	Do not accept 'smaller/larger' in reference to the physical size of the network.	**2**

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	B 17 080 000 *A 17 080 is not correct because it is 17.08 multiplied by 1000* *C 17 080 000 000 is not correct because it is 17.08 multiplied by 1000^3* *D 17 080 000 000 000 is not correct because it is 17.08 multiplied by 1000^4*	17 080 000 is 17.08 multiplied by 1000^2	**1**

Question Number	Answer	Additional Guidance	Mark
1(a)(iv)	The delay/amount of time between data/signal being sent and it being received	Do not accept reference to delay/lag on its own.	**1**

Question Number	Answer	Additional Guidance	Mark
1(b)i **Clerical**	Any **one** from: • IP (address) • MAC (address)		**1**

Question Number	Answer	Additional Guidance	Mark
1(b)ii	A Data being sent *B is not correct because it is located in the header* *C is not correct because it is located in the header* *D is not correct because it is not located in a packet*		**1**

Question Number	Answer	Additional Guidance	Mark
1(c)	A description to include two from: • Monitors/checks traffic (1) using a set of rules / list of authorised/unauthorised computers/addresses/protocols (1) to decide if data is allowed into or out of the network (1)		**2**

Question Number	Answer	Additional Guidance	Mark
1(d) **Clerical**	Any **one** from: • POP3 • IMAP • SMTP	Accept POP	**1**

Question Number	Answer	Additional Guidance	Mark
1(e)	A linked explanation such as: • All communication could fail (1) because/if the central device fails (1) • It can be difficult/expensive to set up (1) because each device needs a cable to connect to the central device (1) • The number of devices that can be connected is limited (1) because the central device supports a fixed number of connections (1)	For 'central device': • Accept 'router' or 'hub' (as a term to refer to a device that contains a switch). • Accept 'switch' (as this is the correct term to refer to the central device) • Do not accept 'server'	**2**

Question Number	Answer	Additional Guidance	Mark
2(a)i	Any **one** from: • To represent an instruction/command • To make an instruction/command easy to read/write/learn/remember/understand • An instruction in a set of instructions	Accept generic definitions of mnemonic such as: 'To shorten a piece of information so it is easy to remember.'	**1**

Question Number	Answer	Additional Guidance	Mark
2(a)ii **Clerical**	Assembly language		**1**

Question Number	Answer	Additional Guidance	Mark
2(a)iii	A linked description such as: • They are microprocessor/CPU/machine specific (1) so they can manipulate the hardware directly (1) • They can be highly optimised (1) to make efficient use of the hardware/execute more quickly/use minimal memory (1) • Each line of code (1) is one instruction only (1) Award responses that refer to machine code as a low level language, such as: • **Machine code** is written in binary (1) so instructions can be processed **directly** by the CPU / do not need to be translated (1) Award **one** mark for: • Machine code does not need to be translated (1)	Accept: (Assembly language) instructions are assembled (1) to machine code (1)	**2**

Question Number	Answer	Additional Guidance	Mark
2(a)iv **Clerical**	Interpreter		**1**

Question Number	Answer	Additional Guidance	Mark
2(b)	• Data • Instructions		**2**

Question Number	Answer	Additional Guidance	Mark
2(c)i	A description to include **two** from: A laser heats/burns (areas of a disk) (1), which creates lands/pits (1) representing binary / 1s and 0s (1)		**2**

Question Number	Answer	Additional Guidance	Mark
2(c)ii **Clerical**	Solid state / flash *Accept 'SSD' for solid state*		**1**

Question Number	Answer	Additional Guidance	Mark
2(d)	Any **two** from: • Limited processing resources • Low power consumption • Simple/robust operating system • Low cost per unit • Smaller in size • Less storage • Limited user interface	Do not accept: 'Carries out a specific task': This is the opposite of 'general purpose', which is given in the question.	**2**

Question Number	Answer	Additional Guidance	Mark
2(e) **Clerical**	A Reduces data transfer times C Reduces required storage space *B is not correct because parts of a compressed file can still be written to several different places on a disk* *D is not correct as compression does not make data more secure like encryption does* *E is not correct because error detection/correction mechanism are still needed in network packets*		**2**

Question Number	Answer	Additional Guidance	Mark
2(f)	Any **two** from: • Programming language specific vulnerabilities (directly manipulating memory) • Security (vulnerability) • Weak design • Insufficient testing • Bad programming practices (not following standards, using unvalidated 3rd party libraries) • Inadequate validation (that fails to prevent incorrect/inappropriate data input) • Inadequate authentication (that enables hackers to gain unauthorised access) • Sensitive data not encrypted		**2**

Question Number	Answer	Additional Guidance	Mark
2(g)	A linked explanation such as: • Users can be added/deleted (1) so multiple people can use the same computer (1) • Edit user permissions (1) so only specific users can securely access their storage space (1) • Control the amount of resources/storage each user can access (1) so the limited storage on the machine can be shared (1) • Enforce user permissions (1) so only certain users are allowed to install programs / access certain files (1)		**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(i) **Clerical**	1 mark for each nibble: 0011(1) 1001(1)		**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii) **Clerical**	1 mark for each digit in the correct location: 2D		**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(iii)	A linked description such as: • Flip all the bits (1) and add one (1) • Copy/keep all the 0s from the right/LSB, up to and including the first 1 (1), then flip the remaining bits (1) • Flip all the bits from the left/MSB (1) up to, but not including, the 1 nearest the right/LSB (1)		**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(iv)	A linked explanation such as: • There are not enough bits (1) to store the result (1) • An overflow occurs (1) because 1 + 1 = 0 with a 1 carry / because the result is more than 255 (1)		**2**

Question Number	Answer	Additional Guidance	Mark
3(b) **Clerical**	Lossy		**1**

Question Number	Answer	Additional Guidance	Mark
3(c)	A description to include **two** from: • A standard • For representing text/characters • Allows data to be interchangeable between computers (from different manufacturers) • Each character is mapped to a unique number/binary equivalent • ASCII (encoding) uses 7/8 bits • There are 128 unique characters (allow 256 for 128)	Award a mark for an example of an ASCII character equivalence e.g. A = 65 as this can be awarded from mark point 4. (A = 01000001 could similarly be awarded.)	**2**

Question Number	Answer	Additional Guidance	Mark
3(d)(i)	Any **one** from: • The number of pixels **per** (square) **inch** is higher • The density of pixels is higher		**1**

Question Number	Answer	Additional Guidance	Mark
3(d)(ii)	Award **one** mark for each number in the correct location for a maximum of 4: • 15 in numerator (1) • 1028 x 640 in numerator (1) • 1024×1024 in denominator (1) • 8 in denominator (1) Example of expression that gains full marks: $\frac{1028 \times 640 \times 15}{1024 \times 1024 \times 8}$	Award equivalent representations of 1024 (2^{10})	**4**

Question Number	Answer	Additional Guidance	Mark
4(a)	A linked explanation such as: • It helps prevent loss of data (1) because malware could deliberately delete data / because data can be deleted/corrupted accidentally (1) • It helps minimise disruption following a system failure (1) because data can be restored (1) • Data can be restored (1) because physical hazards (fire/flood) (can damage storage devices) (1)		**2**

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Question Number	Answer	Additional Guidance	Mark
4(b)	Any **two** from: • That they are giving consent • That they can say no / refuse • That they are not denied service, if they say no • What the data is being collected for • What processing will be done on their data/purpose of the processing/how data will be processed • That they can withdraw consent at any time • That the data will be shared (with third parties) • How long it will be stored • That the data will be stored securely		**2**

Question Number	Indicative content	Additional Guidance	Mark
4(c)	Discuss how algorithmic bias can affect the decisions police forces make. **Causes of algorithmic bias** • Machine learning having been trained using insufficient/inappropriate data • Human bias leading to discrimination and a lack of fairness • Poor design of the algorithm **Impacts on individuals and communities of algorithmic bias** • Deploying officers to the wrong areas • Individuals may feel as though they are being monitored/targeted/subjected to unfair treatment as a result of the output of a biased algorithm deploying too many officers / too few officers • Discrimination/equality (e.g. resourcing police more heavily in particular communities) • Feedback loops (if a model predicting crime rates based on historical arrest data is used to prioritise police resources, then arrests in high risk areas could increase further, reinforcing the imbalance) source **Methods available to reduce the risk of algorithmic bias** • Human oversight and 'sense checking' and confidence/error ratings of predictions • Governance (anticipating and managing risks and make sure legal requirements are adhered to) • Auditing to enable identification and mitigation of systematic bias • Open to scrutiny / transparent • Involvement of communities during development • Improve the training data		**6**

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–2	Basic, independent points are made, showing elements of understanding of key concepts/principles of computer science. (AO1) The discussion will contain basic information with little linkage between points made or application to the context. (AO2)
Level 2	3–4	Demonstrates adequate understanding of key concepts/principles of computer science. (AO1) The discussion shows some linkages and lines of reasoning with some structure and application to the context. (AO2)
Level 3	5–6	Demonstrates comprehensive understanding of key concepts/principles of computer science to support the discussion being presented. (AO1) The discussion is well developed, with sustained lines of reasoning that are coherent and logically structured, and which clearly apply to the context. (AO2)

Question Number	Answer	Additional Guidance	Mark
5(a)(i) **Clerical**	Any **one** from: • Array • List		**1**

Question Number	Answer	Additional Guidance	Mark
5(a)(ii) **Clerical**	Yellow		**1**

Question Number	Answer	Additional Guidance	Mark
5(a)(iii) **Clerical**	Abstraction		**1**

Question Number	Answer	Additional Guidance	Mark
5(a)(iv) **Clerical**	Decomposition		**1**

Question Number	Answer	Additional Guidance	Mark
5(b)	A linked description such as: • If the value of the item at the current index position in the array is more than the value of the target (1), no more passes of the loop are required / the loop will exit (1) • If the pass through the loop goes past the expected location of the target value (1), the third condition for the loop to execute will not be met (1) • If the value (of 'theTarget') is exceeded without reaching the end of the array (1) the algorithm will end (1)	Do not accept 'index' in place of 'the value at the index'.	**2**

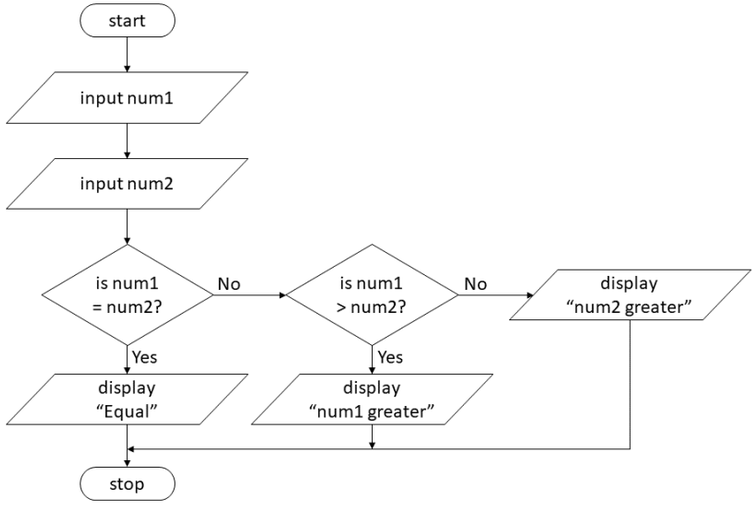
<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(c)</td><td>One mark for each correct row showing relationship of variable changes.
<table>
<tr><th>count</th><th>accept</th><th>reject</th><th>weight</th><th>Display</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>1</td><td>1</td><td></td><td>404</td><td></td></tr>
<tr><td>2</td><td></td><td>1</td><td>393</td><td></td></tr>
<tr><td>3</td><td>2</td><td></td><td>395</td><td></td></tr>
<tr><td>4</td><td>3</td><td></td><td>405</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>3 1</td></tr>
</table></td><td>Different versions of trace tables are acceptable.

Blanks can be replaced with contents of previous row.

Final ‘3 1’ can be included on row above.

Ignore formatting of 3 1 in Display column (e.g. accept ‘3,1’)

Allow ‘Enter weight of box:’ in Display column until 3 1 should be displayed.</td><td>6</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(d)	• Both start and stop terminators present **and** algorithm terminates correctly at the stop terminator (1) • Two separate inputs for two integers (1) [can be in the same input symbol] • Test for equivalence, greater than or less than in one decision box (1) • Different test (for equivalence, greater than, or less than) in separate decision box (1) • Two outputs, labelled Yes and No, for each decision box (1) • Logic of flowchart links to **three** logically valid outputs (1) 	• Award 'End', 'Stop', 'Start' and 'Begin' as text for terminator symbols. • Award '==' and '=' used for equivalence inside decision symbol. • Accept 'Print' or 'Output' as an alternative to 'Display' in the output symbols. No quotes required around output string. • Accept True/False for Yes/No labels	**6**

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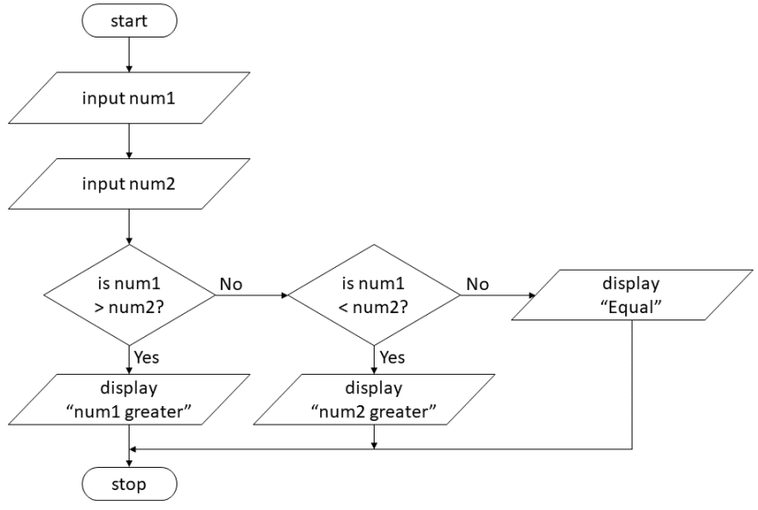

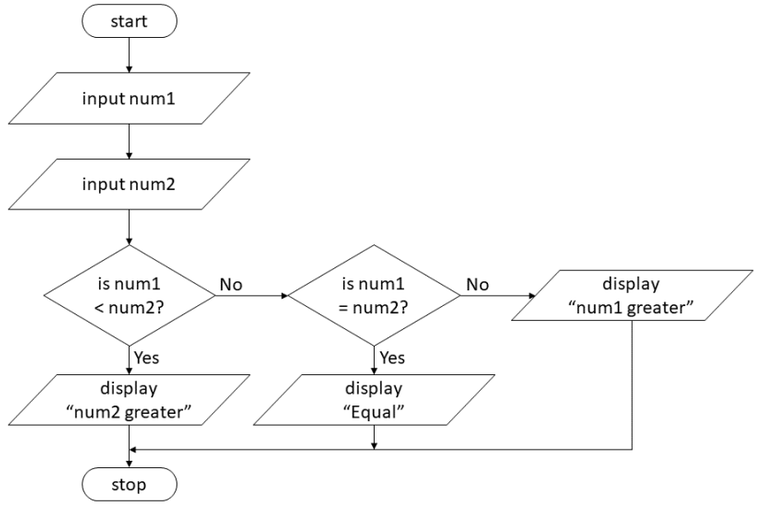

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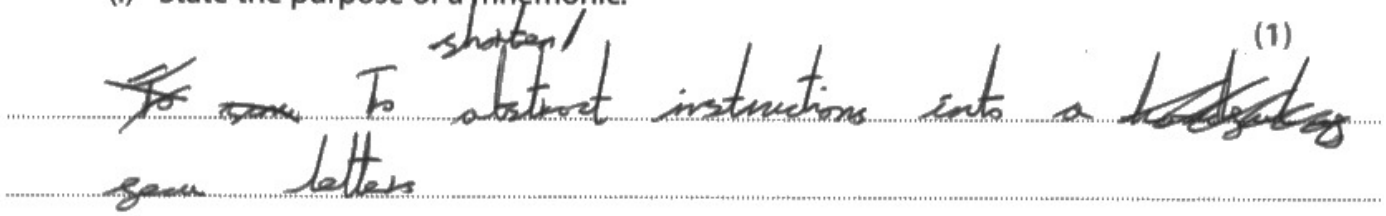
Question 2 (a)(i)

One common misconception was that low-level programming languages allow a computer to understand the code.

2 Computers

(a) Some low-level programming languages use mnemonics.

(i) State the purpose of a mnemonic.



ResultsPlus
Examiner Comments

This is an example of a response that gains the mark.

Total: 1 Mark

Question 2 (a)(ii)

Fewer than a quarter of candidates gained the mark for this question.

Question 2 (a)(iii)

Many responses to this question repeated the answer that was given to Q2(a)(i) and either did not appear to understand that this question was looking for different characteristics, or had not answered Q2(a)(i) correctly but put a correct description of a mnemonic here.

(iii) Mnemonics are one characteristic of some low-level languages.
Describe **one other** characteristic of a low-level language.

(2)

Binary

ResultsPlus Examiner Comments

Machine code is written in binary. Binary is not a low-level language.

Total: 0 Marks

(iii) Mnemonics are one characteristic of some low-level languages.
Describe **one other** characteristic of a low-level language.

(2)

A low level language is able to directly control hardware processes as it is CPU specific code.

ResultsPlus Examiner Comments

This response gains both marks from mark point 1.

Total: 2 Marks

Question 2 (a)(iv)

Almost half of the candidates gained the mark for this question.

Question 2 (b)

Almost half of the candidates did not gain a mark on this question, which is concerning, considering it is one of the fundamental definitions.

Question 2 (c)(i)

Again: almost half of the candidates did not gain a mark, with many referring to reading of the data rather than writing it.

Question 2 (c)(ii)

Rather more than half of the candidates gained the mark.

Question 2 (d)

Over three-quarters of the candidates did not gain the mark for this question.

Many candidates restated the question, by saying an embedded system has one specific purpose.

Question 2 (e)

The majority of candidates gained both marks.

Question 2 (f)

There were a few responses on types of errors: syntax and logic were mentioned quite frequently.

Over half of the candidates did not gain a mark, but there were some good responses related to security vulnerability and unvalidated 3rd party libraries.

Question 2 (g)

A number of candidates were of the opinion that the operating system granted permissions directly to the users.

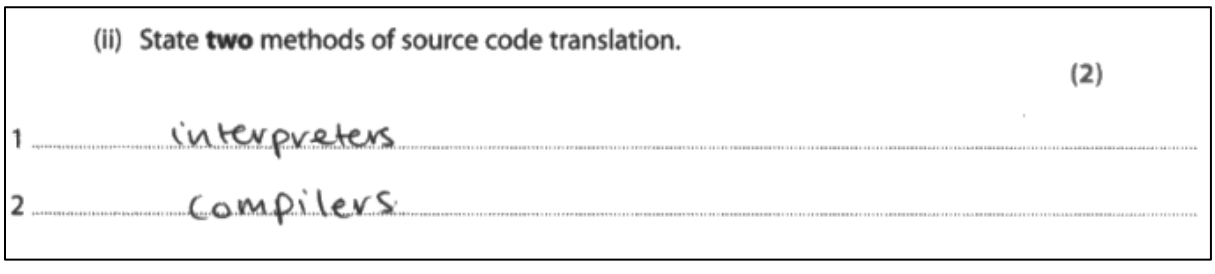
Many candidates identified correctly that administrators can add and delete users, but then did not achieve the linked mark for 'so multiple people can use the same computer'.

Many candidates stated correctly that administrators can enforce permissions; quite often this came with stating that levels of read/write access for file resources could be enforced.

Quite a large number of candidates discussed enforcing user permissions, such as the type of access they would have to a file or installing programs.

Question 1bii

Some students understood methods of source code translation, referring to it in different ways, e.g. interpreter/compiler. A common mistake was referring to 'translation', which was in the question. Some students incorrectly used terms such as code, hex, binary, ascii.


(ii) State **two** methods of source code translation. (2)

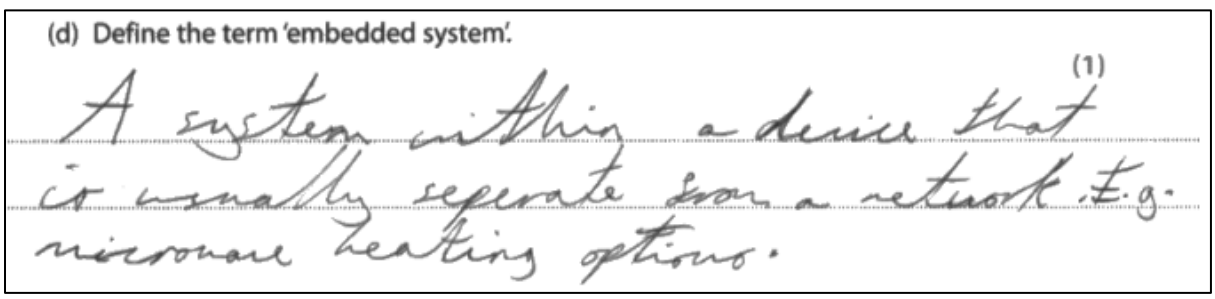
1 interpreters

2 compilers

This response scored 2 marks.

Question 1d

Many students showed an understanding of the idea that an embedded system is a (small) system contained within another system or one that performs a specific or dedicated task.


(d) Define the term 'embedded system'. (1)

A system within a device that is usually seperate from a network. E.g. microwave heating options.

This response scored 1 mark for 'system within a device'.

Question 1e

Adds time and human error were the most common answers for the first part and many got the second part incorrect by stating something to do with algorithmic bias, or mentioned logic errors.

(e) A code review is carried out by a programmer or an automated system.

Both methods cost money.

Complete the table with **one other disadvantage** for each method.

(2)

Method of code review	Disadvantage
By a programmer	Takes longer to complete
By an automated system	May not spot all errors ~~made~~ made.

This response scored 2 marks; 1 mark for 'takes longer' and another mark for 'may not spot all errors'.

(e) A code review is carried out by a programmer or an automated system.

Both methods cost money.

Complete the table with **one other disadvantage** for each method.

(2)

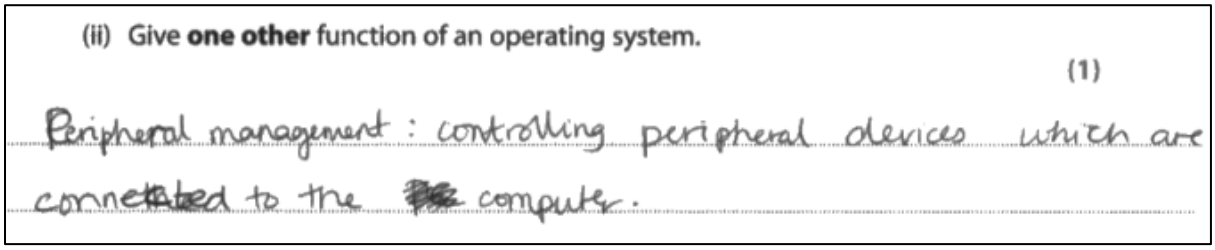
Method of code review	Disadvantage
By a programmer	could missread code
By an automated system	~~doesn't help to fix it in fut~~ unethical

The first response is an example of human error, so mark point is implied, 1 mark.

Many students gained the mark for referring to scheduling or priority order, but few responses linked these together for two marks. Many mentioned multitasking or the fetch decode and execute cycle, and buses, rather than answering the question. Students sometimes effectively talked about the management of tasks and allocating system resources.

Question 1gii

There was a good spread in terms of the options chosen for students' responses out of the possible functions of the operating system. However, the use of the terms 'control' and 'organise' were used for files, but without expanding on them to provide context.


(ii) Give **one other** function of an operating system.

(1)

Peripheral management : controlling peripheral devices which are connected to the [redacted] computer.

This response scored 1 mark for 'peripheral management'.