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GCSE COMPUTER SCIENCE

5.2

Edexcel 1CP2 | Specification point 5.2.2

Ethical and legal issues associated with the use of artificial intelligence, machine learning and...

Untiered

Answers and examiner comments

3	2016-2023	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 5

The full source mark scheme begins on page 7. Use the original paper code, tier and question number shown above.

Original question 4

The full source mark scheme begins on page 37. Use the original paper code, tier and question number shown above.

Question Number	Answer	Additional Guidance	Mark
3(a)	Award up to two marks for a linked explanation, such as: • Worms make copies of themselves (1) and send them to everyone in the computer's email contacts list / send them via previous connections used by the computer (1) • Worms can spread (themselves) through emails (1) and do not need a user to unknowingly distribute/execute them (1) • Worms self-replicate (1) and spread without the need for a host file (1)	For both marks, the expansion must associate with the statement. Do not accept: Worms spread through links in emails.	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)	Award one mark for: • Licensing (1)		(1)

Question Number	Answer	Additional Guidance	Mark
3(c)	Award up to two marks for a linked explanation, such as: • The landing program may crash / display incorrect data / not deal with extreme scenarios (weather / wind / animal / visual / emergency) (1) because: • the system could be out of date / have errors / bugs / not been tested enough • the scenario is beyond the range of what it has been programmed to respond to (1) • A computer's input may be wrong/compromised (1) because of a sensor/hardware/mechanical error (1) • A computer cannot make moral/ethical judgements (1) because it is only capable of following instructions (1)	For both marks, the expansion must associate with the statement.	(2)

Question Number	Answer	Additional Guidance	Mark
3(d)	Award up to two marks for a linked description, such as: • The land/rivers/seas will be polluted (1) if contaminated/uncleaned waste water is released (1) • Homes/businesses/agriculture/wildlife/people may not have enough water (1) if too much is taken from the rivers/reservoirs (1) • Water is polluted/contaminated (during the manufacturing process) (1) and could pose a health risk (1) • Large amounts of energy is required (to extract/clean water) (1) resulting in more use of CO2 / CO2 contributes to global warming (1)	For both marks, the expansion must associate with the statement. Do not accept responses that refer to global warming due to the use of water without implying associated energy use.	(2)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>3(e)</td><td>Award one mark for each correct cell:
<table>
<tr><th>Situation</th><th>Ethical or legal concern</th></tr>
<tr><td>A teacher uses another teacher's login to change student grades</td><td>Misuse (1)
Hacking (1)
Unauthorised access/changing/ editing/modification (1)</td></tr>
<tr><td>A school displays closed-circuit television (CCTV) screens in a public area</td><td>Privacy (1)
Consent/Permission (1)
Data Protection / GDPR / General Data Protection Regulations (1)</td></tr>
</table></td><td></td><td>(2)</td></tr>
</table>

edexcel

Mark Scheme (Results)

Summer 2016

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

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Summer 2016
Publications Code 1CP0_01_1606_MS
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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.
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- 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)	<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

PMT



Mark Scheme (Results)

June 2022

Pearson Edexcel GCSE In Computer Science (1CP2/01) Paper 1: Principles of Computer Science

PMT

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June 2022
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PMT

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- 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**

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**

PMT

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**

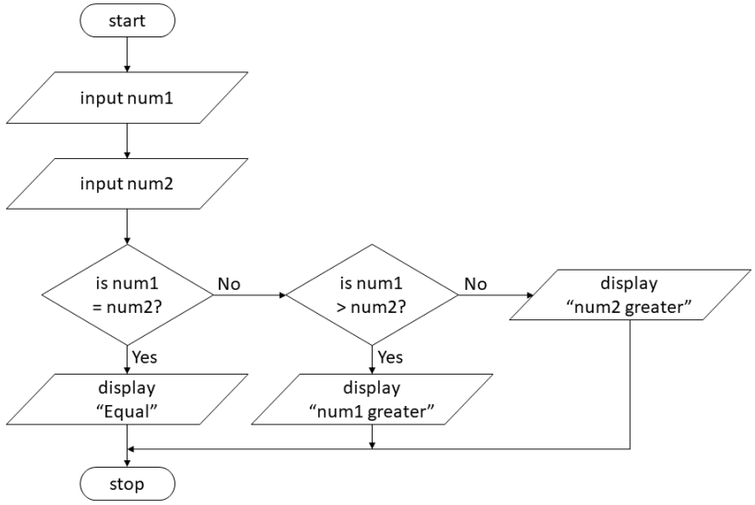
<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(c)</td><td>One mark for each correct row showing relationship of variable changes.
<table>
<tr><th>count</th><th>accept</th><th>reject</th><th>weight</th><th>Display</th></tr>
<tr><td>0</td><td>0</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.

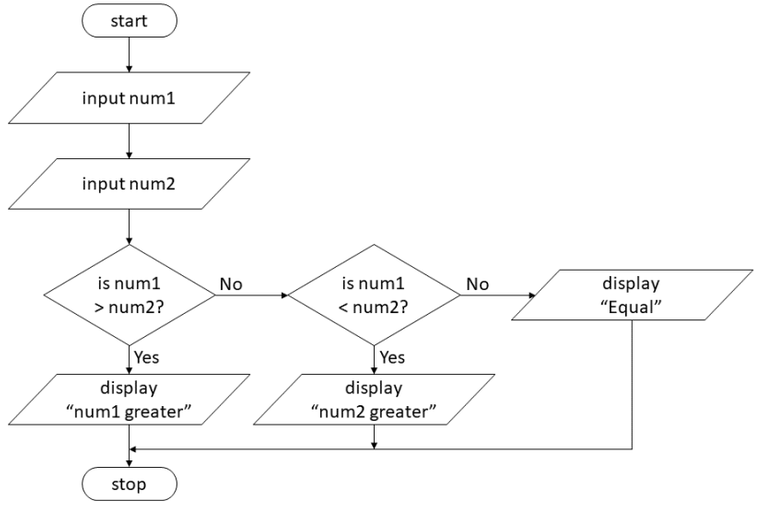
Final ‘3 1’ can be included on row above.

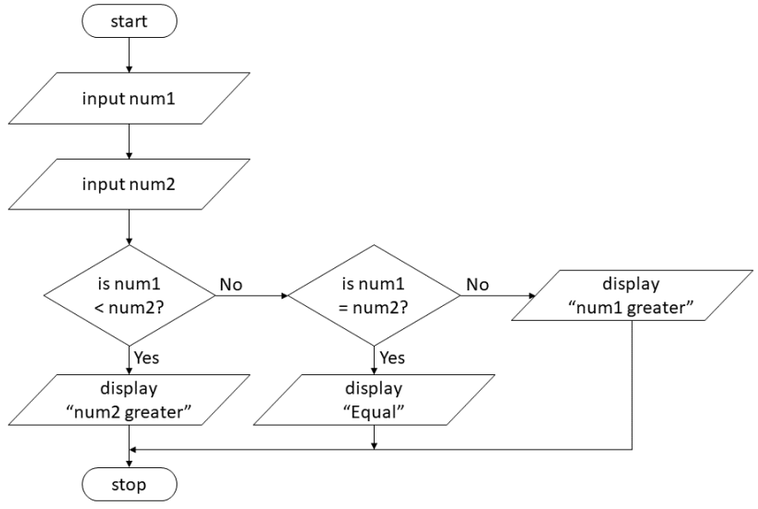
Ignore formatting of 3 1 in Display column (e.g. accept ‘3,1’)

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**

PMT





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1CP2-01

PMT

Question 4 (a)

The majority of candidates were able to explain why files should be backed up relating to:

- the risk of losing files
- preventing loss of data
- damaged or corrupted files

Many candidates explained the impact of restoring data.

Some candidates mentioned examples such as physical hazards and disruption to system failure.

4 Issues and impact

(a) Explain **one** reason why files should be backed up regularly.

(2)

Because in the event of a fire, flood or other emergency that causes you to lose your files it will be much easier to recover any data

ResultsPlus Examiner Comments

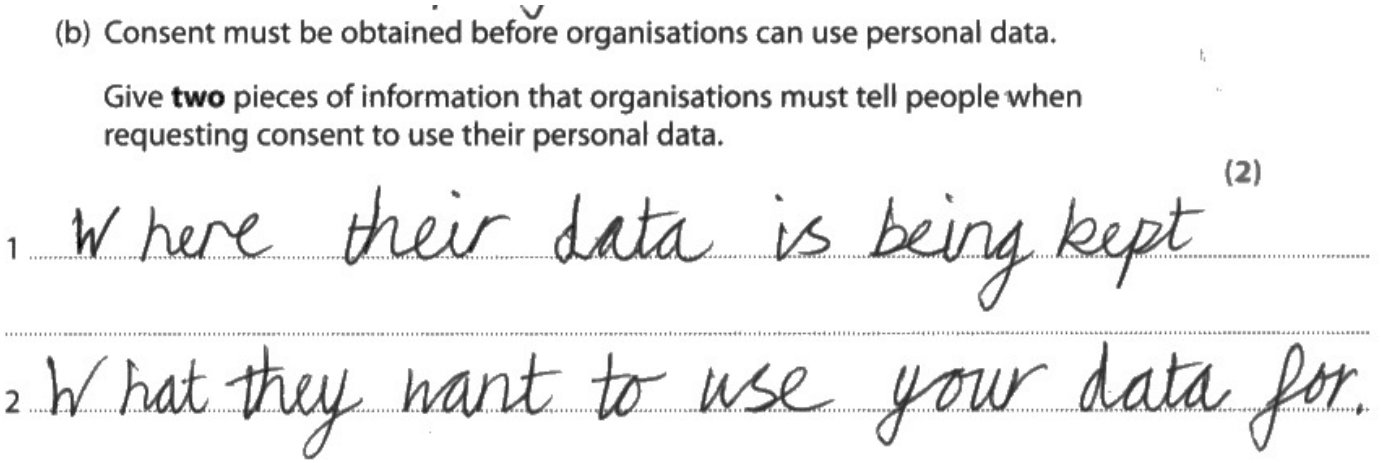
This is a typical example of a response that gained both marks.

Total: 2 Marks

Question 4 (b)

The most frequent response related to what the purpose of using the data will be.

Some responses mentioned that information should be provided if data could be shared with third parties.


(b) Consent must be obtained before organisations can use personal data.

Give **two** pieces of information that organisations must tell people when requesting consent to use their personal data.

(2)

1 Where their data is being kept

2 What they want to use your data for.

ResultsPlus
Examiner Comments

A frequent, incorrect, response was that people must be told where their data is being kept.

Total: 1 Mark

Question 4 (c)

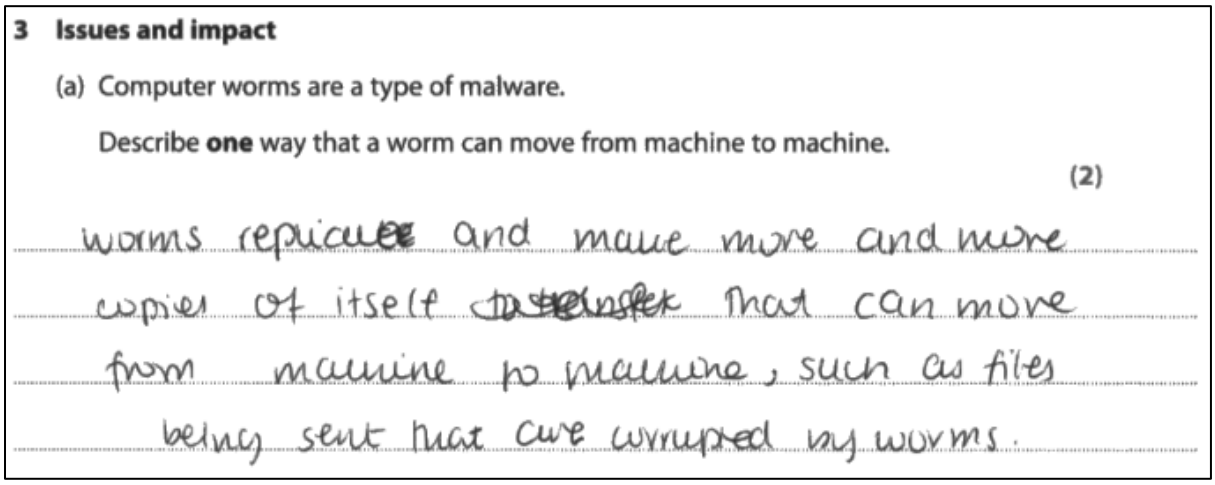
The candidates were clearly aware of the topic.

A minority of candidates demonstrated depth of understanding. In particular, they showed a clear understanding of the role of biased data and subconscious bias of programmers. They understood that this could feed into the algorithms with the result in ethical bias and potential injustice that could manifest in the real world. Some responses focussed more on the obvious social impacts of biased policing with some good understanding that bias can cause an effect on deploying officers and discrimination.

Some candidates, who did not gain as many marks, referred to the system being related to hiring/choosing which police officers to employ for a job instead – missing how it could impact communities. There were a few candidates that made the assumption that 'algorithmic bias' was a kind of software.

Question 3a

The idea of worms self-replicating was the main correct response provided by students. Lots of incorrect responses were mostly confusing worms with a virus.



3 **Issues and impact**

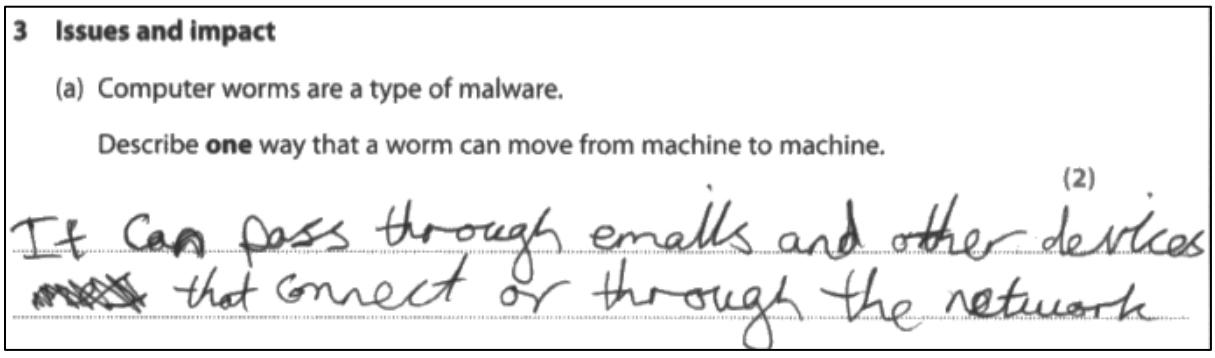
(a) Computer worms are a type of malware.

Describe **one** way that a worm can move from machine to machine.

(2)

worms replicate and make more and more copies of itself ~~to transfer~~ that can move from machine to machine, such as files being sent that are corrupted by worms.

'Worms replicate and make more and more copies of itself', scored 1 mark. A second mark was not awarded as there is no correct reference to how worms move (worms do not require a host file in the same way a 'trojan' virus does).



3 **Issues and impact**

(a) Computer worms are a type of malware.

Describe **one** way that a worm can move from machine to machine.

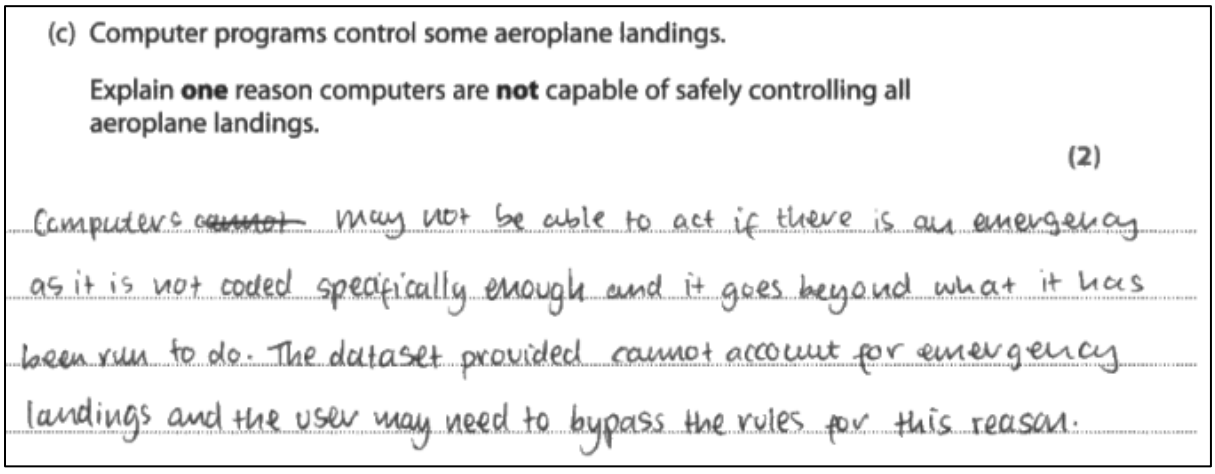
(2)

It can pass through emails and other devices ~~which~~ that connect or through the network

This response also scored 1 mark.

Question 3c

Many responses were related to weather, but only few made references to extreme weather events. This meant that marks could not be awarded for this alone.



(c) Computer programs control some aeroplane landings.

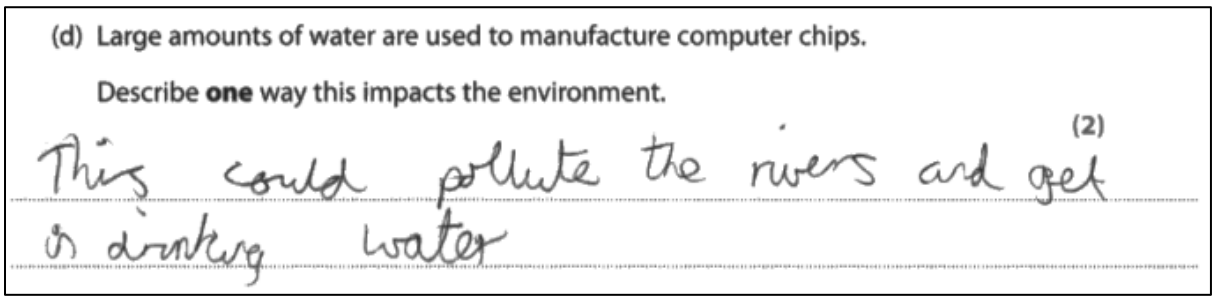
Explain **one** reason computers are **not** capable of safely controlling all aeroplane landings.

(2)

Computers ~~cannot~~ may not be able to act if there is an emergency as it is not coded specifically enough and it goes beyond what it has been run to do. The dataset provided cannot account for emergency landings and the user may need to bypass the rules for this reason.

This response score 2 marks; 1 mark for 'may not be able to act if there is an

Many responses correctly identified that the rivers would be polluted or showed understanding that the scarcity of water due to use in chip manufacturing would impact the environment. However, responses on how this would affect the environment was rather mixed. For example, there were lots of responses mentioning drought as a major impact of using large amounts of water to manufacture chips.


(d) Large amounts of water are used to manufacture computer chips.

Describe **one** way this impacts the environment.

(2)

This could pollute the rivers and get in drinking water

This response scored 2 marks. 1 mark for 'this could pollute the rivers' and 1 mark for 'get in drinking water', as this implies posing a risk to people.

Question 3e

The most common response from box 1 was misuse / unauthorised access. Many responses mentioned consent and privacy for box 2.