



AS COMPUTER SCIENCE 7516/2

Paper 2

Mark scheme

June 2025

Version: 1.0 Final



Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

To Examiners:

- **When to award '0' (zero) or '-' (hyphen) when inputting marks on CMI+**

A mark of 0 should be awarded where a candidate has attempted a question but failed to write anything creditworthy.

Insert a hyphen when a candidate has not attempted a question, so that eventually the Principal Examiner will be able to distinguish between the two (not attempted/nothing creditworthy) in any statistics.

- This mark scheme contains the correct responses which we believe that candidates are most likely to give. Other valid responses are possible to some questions and should be credited. Examiners should refer responses that are not covered by the mark scheme, but which they deem creditworthy, to a **Team Leader**.

The following annotation is used in the mark scheme:

- ;
 - //
 - /
 - A.
 - R.
 - NE.
 - I.
 - DPT.
- means a single mark
 - means an alternative response
 - means an alternative word or sub-phrase
 - means acceptable creditworthy answer
 - means reject answer as not creditworthy
 - means not enough
 - means ignore
 - means "Don't penalise twice". In some questions a specific error made by a candidate, if repeated, could result in the loss of more than one mark. The **DPT** label indicates that this mistake should only result in a candidate losing one mark, on the first occasion that the error is made. Provided that the answer remains understandable, subsequent marks should be awarded as if the error was not being repeated.

Examiners are required to assign each of the candidate's responses to the most appropriate level according to **its overall quality**, and then allocate a single mark within the level. When deciding upon a mark in a level, examiners should bear in mind the relative weightings of the assessment objectives.

eg

In the following question the marks available are as follows:

Question 07.1 (max 2 marks)

AO1 (knowledge) – 1 mark

AO1 (understanding) – 1 mark

Where a candidate's answer only reflects one element of the AO, the maximum mark they can receive will be restricted accordingly.

Qu	Pt	Marking Guidance	Marks
01	1	Marks are for AO1 (understanding) A (0); E (998); R. more than two lozenges shaded	2

Qu	Pt	Marking Guidance	Marks
01	2	Mark is for AO1 (knowledge) Ordinal numbers are used to represent/describe the position/index of an object/entity placed in order/sequence; A. By example (1 st , 2 nd , 3 rd , etc) as long as at least three given.	1

Qu	Pt	Marking Guidance	Marks
01	3	Mark is for AO1 (understanding) Real world quantities are not necessarily whole/positive numbers // natural numbers do not have a fractional part to represent real world / continuous quantities // natural numbers cannot represent negative values;	1

Qu	Pt	Marking Guidance	Marks
02	1	Mark is for AO2 (application) 256 // 2^8 ;	1

Qu	Pt	Marking Guidance	Marks
02	2	Mark is for AO2 (application) 67;	1

Qu	Pt	Marking Guidance	Marks
02	3	Marks are for AO2 (application) Answer: 0101 1010; Carry row: 000 1111; The 1 carry bits (or some similar notation) must be shown in the correct sequence but 0 carry bits can be omitted and the columns may be shifted. Some working must be shown for any marks to be awarded.	2

Qu	Pt	Marking Guidance	Marks
02	4	Marks are for AO2 (application) –8 (lowest); 7 (highest);	2

Qu	Pt	Marking Guidance	Marks
02	5	Marks are for AO2 (application) 1 mark for correct conversion from 00110100 (52) to 11001100 (–52) 1 mark for binary addition of 01101101 (109) to 11001100 (–52) to give 100111001 1 mark for discounting the additional bit on the binary addition to give the final answer as 00111001 (57) A. If no other marks awarded, award 1 mark for correct conversion of 01101101 (109) to 10010011 (–109) A. Follow through using incorrect representation of –52 for second mark R. Reject all three marks if decimal subtraction has been used	3

Qu	Pt	Marking Guidance	Marks
02	6	Marks are for AO2 (application) 0101.1100 1 mark for correct integer part 1 mark for correct fractional part Max 1 if answer not in correct format	2

Qu	Pt	Marking Guidance	Marks
03	1	Mark is for AO2 (application) 1010100;	1

Qu	Pt	Marking Guidance	Marks
03	2	Mark is for AO1 (understanding) Assumes English as the default/standardised language; Number of different characters is limited to 128 (2^7); Does not include a wide variety of international character sets (eg Chinese) / popular characters (eg emojis) // must be extended to represent foreign languages / languages other than English; Max 1	1

Qu	Pt	Marking Guidance	Marks
04	1	Mark is for AO1 (understanding) A measurement of the amplitude of the (analogue) sound wave (at a point in time); A. Height for amplitude. NE. Each pattern is a measurement of the sound wave.	1

Qu	Pt	Marking Guidance	Marks
04	2	Marks are for AO1 (understanding) Role of DAC: DAC transforms digital data/information into analogue (audio) <u>signal/</u> <u>/wave/voltage</u>; DAC converts PCM pulses back to PAM (and smooths the output); Max 1 Why necessary: The laptop speakers/headphones can only play back an analogue signal;	2

Qu	Pt	Marking Guidance	Marks
04	3	Mark is for AO2 (application) 1100 (Hz) // 1.1 kHz;	1

Qu	Pt	Marking Guidance	Marks
05	1	Mark is for AO1 (understanding) To reduce storage requirements // so the files take up less storage space // to store more files per amount of storage space; To allow faster transmission of the files (across a network); Max 1	1

Qu	Pt	Marking Guidance	Marks
05	2	Mark is for AO2 (application) (B, 2) (G, 3) (R, 4) (W, 1); A. Frequency and value either way around if consistent I. Brackets, spaces and commas, eg B2 G3 R4 W1 is correct.	1

Qu	Pt	Marking Guidance	Marks
06	1	Marks are for AO1 (knowledge) Hardware is the <u>physical/electronic</u> components (of the system); Software is the programs/applications/code/instructions (that are run on the hardware);	2

Qu	Pt	Marking Guidance	Marks
06	2	Marks are for AO1 (knowledge) System software controls/manages the system // system software helps a computer run // system software performs tasks that are machine-oriented; A. Computer/hardware for system Layer(s) of software that abstract the user from how the computer works; A. software that hides complexity of hardware from user A. software that provides a virtual machine Application software performs (specific) tasks for the user/user-oriented tasks;	2

Qu	Pt	Marking Guidance	Marks
06	3	Marks are for AO1 (understanding) Programs written in a low-level language (usually) run/execute faster / take less time to run/execute; R. references to increased speed relating to faster/no translation Programs written in <u>machine code</u> require no translation/can be directly executed; Programs written in a low-level language allow more direct/precise control of underlying hardware resources A. by example such as can specify which registers/memory locations to use; Programs written in a low-level language use less memory // are more memory efficient; Max 2	2

Qu	Pt	Marking Guidance	Marks
06	4	Mark is for AO1 (knowledge) Machine code; A. Object code/Intermediate code/byte code	1

Qu	Pt	Marking Guidance	Marks
06	5	Marks are for AO1 (understanding) Translates assembly code/language into machine/executable code; Computers cannot execute assembly code/language directly // computers can only execute machine/object code; Max 2	2

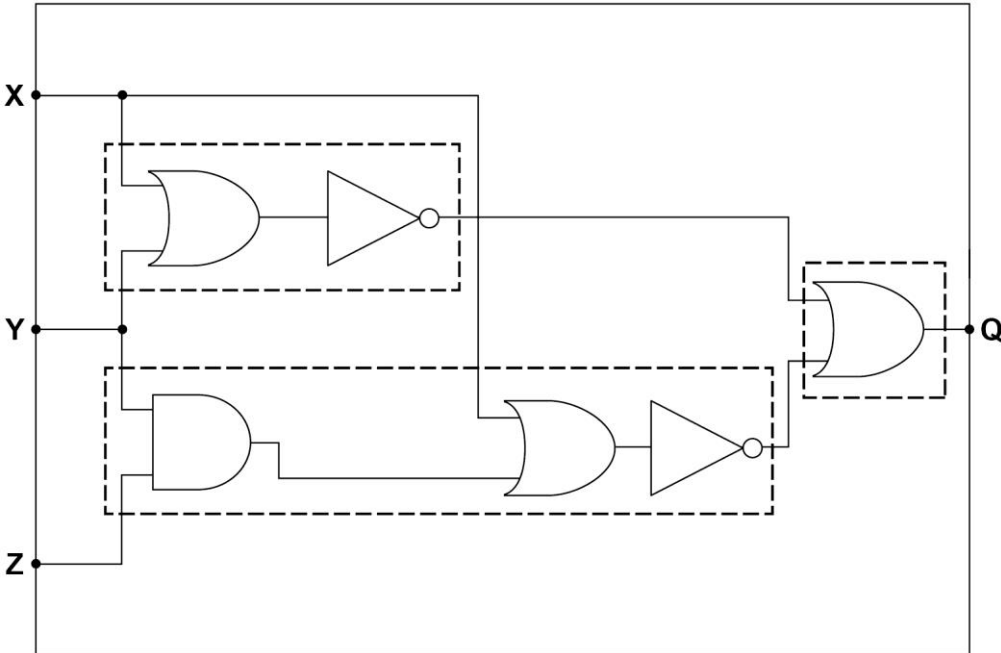
Qu	Pt	Marking Guidance	Marks
07	1	1 mark is for AO1 (knowledge) and 1 mark is for AO1 (understanding) 1 mark for AO1 (knowledge): XOR // X-OR // EXOR // EX-OR // Exclusive OR; 1 mark for AO1 (understanding): XOR gate produces a 1 on its output when its inputs are different // XOR gate produces a 1 on its output when there is a 1 on one input and a 0 on the other input;	2

Qu	Pt	Marking Guidance	Marks
07	2	Marks are for AO2 (application) Even (parity); The circuit outputs a 0 in cases where the number of 1s in the input is even (and outputs a 1 in cases where the number of 1s in the input is odd);	2

Qu	Pt	Marking Guidance	Marks
07	3	Marks are for AO1 (understanding) Alice uses her (copy of the) logic circuit with the 4-bit message as input to produce the parity bit; The parity bit is appended/prepended to the 4-bit message for transmission (of a 5-bit message) across a communication channel; Bob can detect (single bit) errors by separating out the message received and comparing the parity bit received against the result of feeding the 4-bit message into his (copy of the) logic circuit;	3

Qu	Pt	Marking Guidance	Marks
07	4	Mark is for AO1 (understanding) Parity bits can miss errors when an even number of bits are changed; Parity bits cannot determine the position of errors (so an entire message must be resent when an error is detected); A. Parity bits cannot correct errors Max 1	1

Qu	Pt	Marking Guidance	Marks
08	1	Mark is for AO2 (application) $\overline{A} + \overline{B}$;	1

Qu	Pt	Marking Guidance	Marks
08	2	Marks are for AO2 (application)  1 mark for implementation of subexpression $\overline{X + Y}$ 1 mark for implementation of subexpression $\overline{(Z \cdot Y) + X}$ 1 mark for combining subexpressions to form $\overline{X + Y} + \overline{(Z \cdot Y) + X}$ A. Combining any two subexpressions using + to produce the final output Max 2 for a circuit that does not correctly implement $\overline{X + Y} + \overline{(Z \cdot Y) + X}$ DPT. for a circuit that uses logic gates other than AND, OR and NOT	3

Qu	Pt	Marking Guidance	Marks
09	1	Marks are for AO1 (understanding) Memory address register (MAR): (MAR) contains address of the (memory location containing the) instruction to be fetched; Memory buffer register (MBR): The fetched instruction is stored in the MBR // The value stored at the memory address (indicated by the MAR) is stored in the MBR; TO. References to storing into RAM/main memory	2

Qu	Pt	Marking Guidance	Marks
09	2	Marks are for AO1 (understanding) Current instruction register (CIR) stores the instruction currently being decoded/executed // decode instruction held by CIR; Instruction is split into opcode and operand; Control unit decodes the instruction // control unit determines the type of instruction to carry out;	3

Qu	Pt	Marking Guidance	Marks
10	1	Mark is for AO1 (understanding) #13; R. 13	1

Qu	Pt	Marking Guidance	Marks
10	2	Marks are for AO3 (programming) 1 mark: Changing the values of two registers 1 mark: Use of ADD/SUB to increment/decrement register used as a loop counter 1 mark: Correct logic for a loop that iterates n or $n + 1$ times 1 mark: Correct calculation of nth triangular number and storing in register R1. Max 3 if any errors Example solution 1 <pre> MOV R1, #0 MOV R2, #0 loopstart: ADD R1, R1, #1 ADD R2, R2, R1 CMP R1, R0 BLT loopstart MOV R1, R2 HALT </pre> Example solution 2 <pre> MOV R1, #0 loop: ADD R1, R1, R0 SUB R0, R0, #1 CMP R0, #0 BNE loop HALT </pre> Example solution 3: formula $\frac{n \times (n + 1)}{2}$ <pre> MOV R2, #0 ADD R1, R0, #1 loopstart: ADD R2, R2, R1 SUB R0, R0, #1 CMP R0, #0 BNE loopstart LSR R2, R2, #1 MOV R1, R2 HALT </pre>	4

Qu	Pt	Marking Guidance	Marks
11	1	Marks are for AO1 (understanding) Each cell / photosensor outputs an analogue voltage / outputs a voltage determined by the amount of light falling on it / proportional to brightness // sensor converts photons into electrons / accumulated electrical charge; Analogue-to-digital converter / ADC converts voltages to digital format / binary; Use of CCD (charge-coupled device) or CMOS (complementary metal-oxide semiconductor) for sensor array electronics; Red, green and blue filters used to measure colour components of light for colour images; Max 3	3

Qu	Pt	Marking Guidance	Marks
11	2	Marks are for AO1 (understanding) Data is stored in floating gate transistors // data is stored in transistors that do not lose their charge/state <u>when power is no longer applied</u> // electrons are trapped between oxide layers; Presence of trapped electrons / charge or absence indicates 0 / 1; A. 0 or 1 either way around A. state represents 0 or 1 A. off = 0, on = 1 (or other way around) A. “bit” for 0 or 1, but not “binary” R. positive and negative charges NAND memory // flash memory // EEPROM memory is used; Data is organised into pages / blocks; A whole block (A. page) of data must be written // it is not possible to write individual values; A block (A. page) must be erased before it can be overwritten; Controller manages the organisation of the data // controller manages the reading and writing of data; Max 3	3

Qu	Pt	Marking Guidance	Marks												
12		9 marks are for AO2 (analyse) Level of response question: <table><tr><th>Level</th><th>Description</th><th>Mark Range</th></tr><tr><td>3</td><td>A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. Answers in this level demonstrate balance and reason in the points addressed. The response covers a wide and nuanced range of issues and is likely to cover the moral/ethical, legal and cultural aspects of the question. A range of the points made will have been expanded upon using clear examples and references to real-world implications.</td><td>7–9</td></tr><tr><td>2</td><td>A line of reasoning has been followed to produce a mostly coherent, relevant, substantiated and logically structured response. Answers in this level demonstrate a degree of balance and reason in the points addressed, though not so consistently. The response is likely to cover at least two of the aspects of the question. Some of the points made will have been expanded on and some of these may use examples but these might not always exemplify the points made or be lacking in references to real-world implications.</td><td>4–6</td></tr><tr><td>1</td><td>There is little evidence that a line of reasoning has been followed. Answers in this level may lack balance and reason in the points addressed. The response will attempt to identify some issues raised by the question; points are not likely to be expanded upon but where they are, the examples may not be relevant or not relate to the points being made.</td><td>1–3</td></tr></table> Indicative content Moral, ethical, legal and cultural issues Moral/Ethical (individual beliefs/society) • Individuals might not wish for images of them to be uploaded to the platform but are unlikely to have much (if any) say when someone else uploads an image. • Individuals could have their privacy infringed by having images featuring them (accidentally or deliberately) uploaded to the platform. • The company could have access to a lot of personal information based on the content of images and the associated metadata. • The company intends to sell the images it owns to third-parties potentially without credit to the creators, which is arguably unethical, even before the nature of the third-parties or the true ownership of images are considered. • The images uploaded could be illegal or provide evidence relating to criminal activity, hence it could be argued the company has an ethical duty to report all such images to the authorities.	Level	Description	Mark Range	3	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. Answers in this level demonstrate balance and reason in the points addressed. The response covers a wide and nuanced range of issues and is likely to cover the moral/ethical, legal and cultural aspects of the question. A range of the points made will have been expanded upon using clear examples and references to real-world implications.	7–9	2	A line of reasoning has been followed to produce a mostly coherent, relevant, substantiated and logically structured response. Answers in this level demonstrate a degree of balance and reason in the points addressed, though not so consistently. The response is likely to cover at least two of the aspects of the question. Some of the points made will have been expanded on and some of these may use examples but these might not always exemplify the points made or be lacking in references to real-world implications.	4–6	1	There is little evidence that a line of reasoning has been followed. Answers in this level may lack balance and reason in the points addressed. The response will attempt to identify some issues raised by the question; points are not likely to be expanded upon but where they are, the examples may not be relevant or not relate to the points being made.	1–3	9
Level	Description	Mark Range													
3	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. Answers in this level demonstrate balance and reason in the points addressed. The response covers a wide and nuanced range of issues and is likely to cover the moral/ethical, legal and cultural aspects of the question. A range of the points made will have been expanded upon using clear examples and references to real-world implications.	7–9													
2	A line of reasoning has been followed to produce a mostly coherent, relevant, substantiated and logically structured response. Answers in this level demonstrate a degree of balance and reason in the points addressed, though not so consistently. The response is likely to cover at least two of the aspects of the question. Some of the points made will have been expanded on and some of these may use examples but these might not always exemplify the points made or be lacking in references to real-world implications.	4–6													
1	There is little evidence that a line of reasoning has been followed. Answers in this level may lack balance and reason in the points addressed. The response will attempt to identify some issues raised by the question; points are not likely to be expanded upon but where they are, the examples may not be relevant or not relate to the points being made.	1–3													

	• It might be possible to apply facial recognition to identify individuals or establish relationships with individuals. • It might be possible to identify locations or track the movement of people across time. Legal • Images are likely to be transmitted internationally, passing through countries with different laws regarding data collection and privacy. • Computer Misuse Act would be applied in the UK to prevent unauthorised access to subscriber data, the images collected and any other personal information residing on company servers. • The provenance/ownership to the images would need to be confirmed before the company could sell them or claim them as company property, lest the company be in breach of the Copyright Designs and Patents Act. • General Data Protection Regulation (GDPR) affords protections to data subjects and provides rights relating to access, accuracy, deletion, etc. • A non-subscriber uploading an image might not actually own the image, hence they are unable to transfer ownership to the company. Cultural (subgroups) • Photographs can have different significance across different cultures, with the photographs of some subject matters being considered offensive or inappropriate. • Images taken inside religious buildings for some purposes may be considered inappropriate. • Some cultural beliefs may not allow photography of people. • Need for balance between cultural sensitivities and freedom of expression.	
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Qu	Pt	Marking Guidance	Marks
13	1	Mark is for AO1 (knowledge) Data is sent along a single wire/cable/path // bits are sent one after another;	1

Qu	Pt	Marking Guidance	Marks
13	2	Mark is for AO1 (understanding) By sending more than one bit per signal change;	1

Qu	Pt	Marking Guidance	Marks
13	3	Marks are for AO1 (understanding) The network uses a bus transmission protocol (eg CSMA/CD); A. examples of bus protocols eg CSMA/CD. The network uses appropriate (physical) switching // (switch) creates temporary buses between two nodes; A. hub transmits data to all devices	2

Qu	Pt	Marking Guidance	Marks
13	4	Marks are for AO1 (understanding) (Wireless) access point stops sending out network SSID/name // network SSID/name will not appear in list of available networks // the SSID/name of the network will not be visible when trying to connect to a network; Users must know the network name to connect // users won't accidentally try to connect to the network; Attackers won't know the network name unless they packet sniff; Max 2	2