

Cambridge O Level

COMPUTER SCIENCE**2210/11**

Paper 1 Theory

May/June 2026

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **18** printed pages.

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: - the specific content defined in the mark scheme - the specific skills defined in the mark scheme or in the level descriptions - the standard of response required as exemplified by the standardisation scripts.
2	Examiners must award whole marks (not half marks, or other fractions).
3	Examiners must award marks positively . This means that: - marks are not deducted for errors or omissions - marks are awarded for correct/valid answers as defined in the mark scheme and also for other valid answers which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate - the quality of spelling, punctuation and grammar are judged only when the mark scheme indicates that these features are specifically assessed in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must consistently apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the full range of marks defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and must not award marks with grade thresholds or grade descriptions in mind.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	Correct point
	Incorrect point
	Unclear response
	Follow through
	Repetition
	Ignore
	Benefit of doubt given
	Benefit of doubt not given
	Content of response too vague
	Not answered question

Annotation	Meaning
	Omission
	Section not relevant
	Section incorrect
Highlighter	Information copied from the text
	Page or response seen by examiner

Mark scheme abbreviations

/	separates alternative words / phrases within a marking point
//	separates alternative answers within a marking point
<u>underline</u>	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be awarded
()	the word / phrase in brackets is not required, but sets the context
MP	mark point

Note: No marks are awarded for using brand names of software packages or hardware.

Question	Answer	Marks	Guidance
1(a)	A	1	If more than one box is ticked, no mark can be given.
1(b)	3	1	Mark the first answer given. Ignore any reference to unit. If no answer is written in the answer space an obvious correct answer can be awarded in the working space.
1(c)	C	1	If more than one box is ticked, no mark can be given.

Question	Answer	Marks	Guidance
2(a)(i)	One from: - Program counter // PC - Memory Address register // MAR	1	Mark the first answer given.
2(a)(ii)	Three from: - The instruction is sent/copied to the current instruction register/CIR/control unit/CU // The CIR/CU receives the instruction // The CIR stores/holds the instruction from the memory data register/MDR - The control unit/CU decodes the instruction - An <u>instruction set</u> is used (to decode the instruction) - The instruction is decoded/converted into the <u>Opcode</u> and <u>Operand</u>	3	BOD data in place of instruction MP1 – BOD instruction register/IR in place of CIR MP1 – this is given for the instruction being sent to the CIR/control unit. Allow if it is coming from an incorrect or inaccurate place e.g. MAR/PC MP3 – It must clearly state the CU is decoding the instruction
2(a)(iii)	One from: - Arithmetic logic unit // ALU - Accumulator // ACC - Control unit // CU (Data/address/control) bus - Memory data register // MDR - Memory address register // MAR - Program counter // PC - Random access memory // RAM	1	Mark the first answer given. Register alone is NE Do not award CIR Award appropriate registers that are outside the specification e.g. Index register (IX) and status register (SR)

Question	Answer	Marks	Guidance
2(b)	Two from: - It can execute more instructions/FDE/FE/clock cycles simultaneously // four instructions/FDE/FE/clock cycles can be executed simultaneously rather than two - It can execute more instructions/FDE/FE/clock cycles per second ... as it has double the number of cores // It has twice as many cores // It has more cores // It has 4 cores instead of 2 cores	2	Tasks/processes/code/information/command s/actions/data is TV for instructions MP1 and 2 – BOD clock ticks/pulses in place of cycles
2(c)(i)	Two from: For example: - Touchscreen - Microphone - Keyboard/keypad - Button - Sensor (Digital) camera	2	Mark the first answer given. Award any appropriate example of a sensor. Sensor can only be awarded once. Do not allow onscreen keyboard as this is software. Do not allow touchpad as it is not relevant to context.
2(c)(ii)	Two from: For example: - Screen // touchscreen - Speaker - LED // light - Actuator	2	Mark the first answer given. Display alone is NE for screen.

Question	Answer	Marks	Guidance
3(a)	One from: - Denary // decimal - Two's complement	1	Mark the first answer given. Accept other system outside syllabus e.g. octal, BCD BOD Base-10
3(b)	0010 1010	1	Mark the first answer given. Correct number of leading zeros must be present If no answer is written in the answer space an obvious correct answer can be awarded in the working space.
3(c)	0001 0000 0001	1	Mark the first answer given. Correct number of leading zeros must be present If no answer is written in the answer space an obvious correct answer can be awarded in the working space.
3(d)	71	1	Mark the first answer given. If no answer is written in the answer space an obvious correct answer can be awarded in the working space.
3(e)	2D8	1	Mark the first answer given. If no answer is written in the answer space an obvious correct answer can be awarded in the working space.

Question	Answer	Marks	Guidance
3(f)	One mark for each correct nibble (MAX 2) One mark for the three correct carries as working One mark for one overflow bit For example: <pre> 1 1 1 1 0 0 1 1 1 0 1 + 1 1 1 1 0 0 0 0 ----- 1 1 0 0 0 1 1 0 1 </pre>	4	Carries can be shown above/below. Award where seen as long as for the correct columns. BOD 4 carries shown if the overflow is shown as a carry first, then as overflow. Ignore the crossing out of carries. Award the number of carries seen.

Question	Answer	Marks	Guidance
4(a)	One from: - To input data // interact with/navigate the computer/interface - To control/move the cursor on the screen - To act as a pointing device/pointer - To allow the user to click/select/choose/drag (items on the screen) // by example - To scroll through different pages/a page	1	MP1 – ‘it is an input device’ is NAQ MP4 – BOD ‘open’ in place of click etc
4(b)	Four from: (Serial) transmits the data one bit at a time ... down a single wire/channel/line (Half-duplex) transmits the data (between the computer and the mouse) in both directions/ways but only one direction/way at a time	4	MP1 – BOD bit by bit MP2 – cable/path is TV
4(c)	Two from: - Cannot plug the cable in the wrong way round Different data transmission speeds are supported - High/adequate speed of data transmission - Universal connection/standard - Connection is backwards compatible - It will power the mouse // It will charge the mouse (if it has wireless capabilities) - The mouse will be automatically detected // Mouse drivers will be automatically downloaded // plug and play - Unlikely to have interference/crosstalk	2	Mark whole answer. Do not accept ‘can be used over long distance’; this is not relevant to the context. Do not accept reference to skewing/errors as this is given in the question. MP3 – BOD fast/faster transmission. Fast/faster alone is NE. MP8 – Mouse is automatically connected is TV

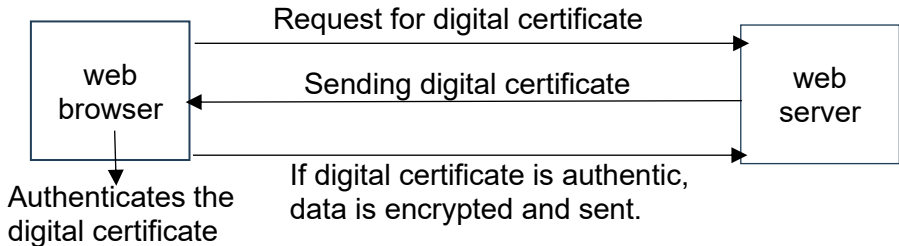
Question	Answer	Marks	Guidance										
4(d)	One mark for each correct function name or role <table><tr><th>function</th><th>role</th></tr><tr><td>providing an interface</td><td> - To allow a user to communicate/interact with the computer/device/system </td></tr><tr><td>managing memory</td><td>It makes sure that two processes do not access the same memory location at the same time.</td></tr><tr><td>managing interrupts</td><td> - Checks the source of the interrupt - Assigns/checks interrupt priority // Finds highest priority interrupt // Decides which interrupts to action - Controls/checks the interrupt queue - Calls/uses the interrupt service routine/ISR </td></tr><tr><td>managing (user) accounts // providing/managing (system) security</td><td>It allows the user to set a username and password.</td></tr></table>	function	role	providing an interface	To allow a user to communicate/interact with the computer/device/system	managing memory	It makes sure that two processes do not access the same memory location at the same time.	managing interrupts	- Checks the source of the interrupt - Assigns/checks interrupt priority // Finds highest priority interrupt // Decides which interrupts to action - Controls/checks the interrupt queue - Calls/uses the interrupt service routine/ISR	managing (user) accounts // providing/managing (system) security	It allows the user to set a username and password.	4	Providing an interface – BOD hardware/software in place of computer Providing an interface – if an example alone is given e.g. ‘It allows the use of buttons’, this is NE. Managing interrupts – BOD reference to handling the queue in any correct way Managing interrupts – allow any correct reference to dealing with the priority of an interrupt Managing interrupts – allow reference to moving current CPU task to stack. The OS does not strictly do this, but it is a fundamental part of the managing interrupts process Managing accounts – ‘manages users’ is TV
function	role												
providing an interface	To allow a user to communicate/interact with the computer/device/system												
managing memory	It makes sure that two processes do not access the same memory location at the same time.												
managing interrupts	- Checks the source of the interrupt - Assigns/checks interrupt priority // Finds highest priority interrupt // Decides which interrupts to action - Controls/checks the interrupt queue - Calls/uses the interrupt service routine/ISR												
managing (user) accounts // providing/managing (system) security	It allows the user to set a username and password.												

Question	Answer	Marks	Guidance
5(a)	To translate/convert high-level language into low-level language/machine code/binary	1	Just translates code/program to low-level/machine code is NE
5(b)	Assembler	1	Mark the first answer given. Do not accept 'assembly'.
5(c)	One mark for each correct letter One mark for each corrected statement • A • An interpreter translates and executes the code one line/statement at a time • E • A compiler produces an executable file	4	If an incorrect letter is given, do not read on to statement correction. Accept minor variations for correct statements that have the same meaning. For letter A we are looking for a correction on the use of variable. For letter E we are looking for a correction on the use of non-executable file. If no answer is given in answer space, look to see if indication is given in the table.

Question	Answer	Marks	Guidance
5(d)	One mark for each correct function One mark for a matching purpose - Code editor - Allows the user/programmer to write/change the program - Run-time environment - Allows the user to run/execute the code and see the output/result // Allows the user to input data to run/execute the code // To allow the user to <u>test</u> the code - Error diagnostics // debugging tools // by example e.g. break points, stepping, variable watch window - Finds/identifies/detects errors in the code // by example - Auto-completion - Gives options to complete the remainder of a command word/key term/identifier/syntax (to limit errors/speed up development) // It predicts the rest of a command word/key term/identifier (to limit errors/speed up development) // It predicts the required syntax e.g. when a bracket is needed (to limit errors/speed up development) - Auto-correction - Corrects spelling errors in command words/key terms/identifiers/syntax (to limit errors in the code) - Prettyprint // syntax highlighting // colour coding - Changes the colour of text in the code to highlight command words/key terms/identifiers (to make them easier to identify) - Line numbers - To give (incremented) numbers to each line in the code (to allow a line in the code to be easily/quickly found)	4	Do not accept translator/interpreter/compiler, this is given in the question. Mark first function given. If the function name is TV/blank, read on to the purpose to see if a correct function name is included. Award both correct name and purpose if seen. Award the purpose if the function name is still TV but it is obvious what is meant. Code editor – BOD just editor alone Code editor purpose – BOD edit in place of write/change Error diagnostics – just ‘debugging’ alone is TV Just ‘words’ alone is TV for command word/key term/identifier/syntax Allow minor spelling variations on function names. If you see something that you think is a viable alternate to the function name, please refer to your TL. Other viable functions outside the syllabus may be seen, such as: - artificial intelligence - auto-documentation - expand/collapse code blocks - built-in libraries/functions In this case, accept the function and a correct description of the purpose. The description must be specific and not generic. Refer to TL if in doubt.

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Question	Answer	Marks	Guidance
6(a)	One mark for each correct term in the correct place. • domain name server (DNS) • IP address • web browser • request • hypertext markup language(HTML) The user types the URL into the address bar. The web browser sends the domain name from the URL to the domain name server (DNS). This searches for the matching IP address and sends this back to the web browser. The web browser sends a request to the web server for the web page. The web server then sends the data for web page back to the web browser. The web browser renders the hypertext markup language (HTML) to display the web page.	5	

Question	Answer	Marks	Guidance
6(b)	Five from, one mark for each correct section of the diagram. - Web browser sending a request to the web server for its (digital) certificate/to identify itself - Web server sending (digital) certificate to the web browser Web browser authenticating/validating the (digital) certificate showing the data sent if it is valid // showing data not sent if it isn't valid - The data is encrypted // Encryption is used using public and private keys // using asymmetric encryption ... to make any data sent meaningless - The web browser uses the public key to encrypt the data - The web server uses the private key to decrypt the data For example:  <pre> sequenceDiagram participant WB as web browser participant WS as web server WB->>WS: Request for digital certificate WS-->>WB: Sending digital certificate WB->>WB: Authenticates the digital certificate WB->>WS: If digital certificate is authentic, data is encrypted and sent. </pre>	5	MP3 - Checking the certificate/web server is safe is TV. MP3, MP4 and MP5 can be awarded in one annotation e.g. If the web browser thinks the certificate is authentic the encrypted data is sent. MP4 – BOD ‘communication begins if certificate is authentic’ in place of the data being sent. MP4 – Data could be sent either way, so from browser to server or server to browser MP6 – BOD two different keys are used, just 2 keys is TV

Question	Answer	Marks	Guidance
7(a)	Acoustic sensor	1	Mark the first answer given. Sound/noise sensor is TV. Microphone is NE.
7(b)	Any two from: - Proximity sensor - Infrared sensor - Light sensor - Magnetic field sensor	2	Mark the first answer given.
7(c)(i)	Any one from: - It has a mechanical structure/framework - It is programmable - It has the ability to move	1	Mark whole answer. MP1 – It is mechanical is TV MP2 – It can follow instructions is TV
7(c)(ii)	Any three from: - The microprocessor/it compares the received data/data sent to the stored value/preset value (of 10) - If the data/value received is less than 10, (the microprocessor) sends a signal to stop the robot (The signal is sent) to an actuator that is used to stop the robot	3	MP2 – ‘when an object/distance/robot is less than 10cm’ is TV. MP3 – just reference to an actuator is NE here. Must be saying the actuator is what is used to trigger the action to stop the robot in some way.

Question	Answer	Marks	Guidance
7(d)	Any four from: For example: • It can use machine learning • ... by adapting its own data/rules/processes • It can create/makes a (digital) map (of the room) // Records/collects data about the shape/dimensions of the room • ... and record/store the location of objects • GPS may be used to record the location of objects • It can update its (digital) map • ... to record/store when objects are moved/removed/added • It can store successful/unsuccessful routes/actions (that avoid objects)	4	Do not accept 'it can learn where objects are placed in the room'. This is given in the question.

Question	Answer	Marks	Guidance												
8(a)	Any three from: - A character set is used that contains all the characters (that can be represented) - It can use ASCII/Unicode Each/a character is given/has a (binary) value	3	MP4 – BOD if code used in place of value												
8(b)(i)	One mark for each correct term or definition. <table><tr><th>term</th><th>description</th></tr><tr><td>pixel</td><td>the smallest unit of an image that is made up of one colour</td></tr><tr><td>sound sample</td><td>a (single) measure/representation of the amplitude/height of a sound wave</td></tr><tr><td>(image) resolution</td><td>the dimensions of an image</td></tr><tr><td>colour depth</td><td>the number of bits that are used for each/a colour/pixel (in an image) // the (maximum) number of colours that can be represented (in an image)</td></tr><tr><td>Sample/sampling rate/frequency</td><td>the number of samples that are recorded each second</td></tr></table>	term	description	pixel	the smallest unit of an image that is made up of one colour	sound sample	a (single) measure/representation of the amplitude/height of a sound wave	(image) resolution	the dimensions of an image	colour depth	the number of bits that are used for each/a colour/pixel (in an image) // the (maximum) number of colours that can be represented (in an image)	Sample/sampling rate/frequency	the number of samples that are recorded each second	5	Colour depth – ‘the number of colours in the image’ is not accurate
term	description														
pixel	the smallest unit of an image that is made up of one colour														
sound sample	a (single) measure/representation of the amplitude/height of a sound wave														
(image) resolution	the dimensions of an image														
colour depth	the number of bits that are used for each/a colour/pixel (in an image) // the (maximum) number of colours that can be represented (in an image)														
Sample/sampling rate/frequency	the number of samples that are recorded each second														
8(b)(ii)	Lossy // by example e.g. motion estimation Lossless // by example e.g. RLE	2	Mark the first answer given. Do not accept file formats e.g. MP4, ZIP BOD lossyless for lossless												