CAMBRIDGE
International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/31**

Paper 3 Advanced Theory **May/June 2025**

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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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
	Incorrect
	To indicate where a key word/phrase/code is missing.
	Not relevant or used to separate parts of an answer.
	Indicates a part of the answer that is incorrect.
Highlighter	To draw attention to a particular aspect or to indicate where parts of an answer have been combined.
	Too vague.
	Repetition
	No examples or not enough.

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Annotation	Meaning
BOD	Benefit of Doubt.
NAQ	Not Answered Question.
SEEN	Indicates that work or a page has been seen including blank answer spaces and blank pages.
FT	Follow through.
I	Ignore

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Question	Answer	Marks
1(a)	**One** mark per mark point MP1 `TYPE Vehicle =` MP2 `(M100, M230, T101, T102, T120, T150)` Example answer: `TYPE Vehicle = (M100, M230, T101, T102, T120, T150)`	**2**

1(b)	**One** mark per mark point
	MP1 `TYPE Booking` and `ENDTYPE` correct
	MP2 Declare used correctly for every field in the response
	MP3 Any four fields correct
	MP4 Remaining fields correct
	
	Example answer:
	`TYPE Booking`
	`  DECLARE BookingNumber : STRING`
	`  DECLARE Destination : STRING`
	`  DECLARE ClientName : STRING`
	`  DECLARE ClientTelephone : STRING`
	`  DECLARE DateOfDeparture : DATE`
	`  DECLARE PickupAddress : STRING`
	`  DECLARE TaxiUsed : Vehicle`
	`ENDTYPE`
		4

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>One mark per mark point
MP1 Correct mantissa
MP2 Correct exponent

Mantissa
0 1 1 0 1 0 1 1 1 0

Exponent
1 1 1 0 1 0</td><td>2</td></tr>
<tr><td>2(b)</td><td>One mark per mark point for working (Max 2)
• number converted to binary e.g., positive binary version of 25.3125 = (0)11001.0101
• two’s complement version
bits flipped and 1 added = 100110.1011
• -32 + 4 + 2 + 0.5 + 0.125 + 0.0625 // -32 + 4 + 2 + 1/2 + 1/8 + 1/16
• movement of binary point seen (5 places)

One mark per mark point
• correct mantissa
• correct exponent

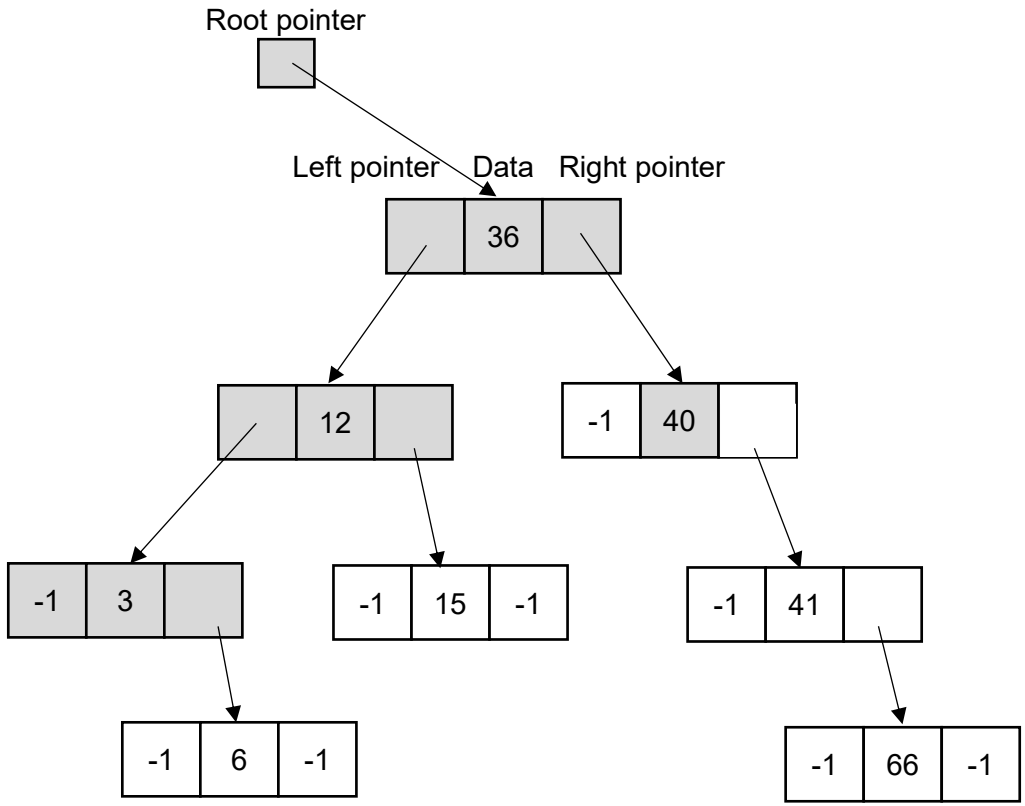
Mantissa
1 0 0 1 1 0 1 0 1 1

Exponent
0 0 0 1 0 1</td><td>4</td></tr>
</table>

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Question	Answer	Marks
3(a)	**One** mark per mark point (**Max 5**) **One** mark per mark point for **purpose** of Application Layer (**Max 3**) MP1 To provide services / interface with the user // access to applications, for example login, file transfer, network file access, email, etc MP2 To provide mechanisms for securing communication e.g. encryption/authentication MP3 To define/provide protocols used to allow the exchange of data/communication // to contain programs that exchange data MP4 Error detection and recovery mechanisms to handle application specific errors **One** mark per mark point for **purpose** of Transport Layer (**Max 3**) MP5 To provide logical communication between applications running on different hosts // To ensure that data is delivered to the correct application process on the destination machine MP6 To ensure error-free, end-to-end delivery of data between a source and a destination, in sequence // to provide error recovery techniques such as error detection codes and automatic repeat request MP7 To break data into segments when sent and to reconstruct when received // To reassemble segments at destination MP8 To regulate network connections // to provide flow control mechanisms to prevent data loss.	**5**
3(b)	**One** mark per mark point (**Max 4**) MP1 Data are broken into equal sized packets MP2 Data packets have headers containing information such as the IP addresses of the sender and receiver MP3 Each packet of data is sent independently to the destination // Packets don't necessarily follow the same route MP4 Each packet is sent via the most optimum path available MP5 Packets don't necessarily arrive in the order they were sent // Packets are reconstructed at the destination in the correct order MP6 Missing / damaged packets are re-sent	**4**

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Question	Answer	Marks
4(a)	**One** mark per mark point MP1 Any two nodes added correctly with correct data (6, 15, 41, 66) and arrows MP2 Remaining two nodes added with correct data (6, 15, 41, 66) and all nodes with connecting arrows starting from pointer boxes MP3 Correct null pointers (-1) added throughout MP4 … with no entries in other pointer boxes and all nodes correctly positioned and connected 	**4**

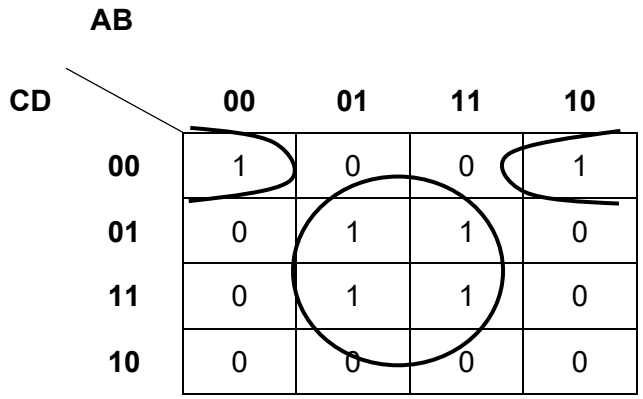
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Question	Answer	Marks
4(b)	**One** mark per mark point MP1 A technique used to solve problems using a function/procedure/subroutine that calls itself (general case) MP2 … until the terminating condition / base case is achieved, when no further recursive calls are made	**2**
4(c)	**One** mark • Stack	**1**

Question	Answer	Marks
5(a)	**Two** marks for all **six** correct terms **One** mark for any **three** correct terms **Z =** $\bar{A}.\bar{B}.\bar{C}.\bar{D} + \bar{A}.B.\bar{C}.D + \bar{A}.B.C.D + A.\bar{B}.\bar{C}.\bar{D} + A.B.\bar{C}.D + A.B.C.D$	**2**
5(b)(i)	**Two** marks if no errors present **One** mark if one error present	**2**

CD \ AB	00	01	11	10
00	1	0	0	1
01	0	1	1	0
11	0	1	1	0
10	0	0	0	0

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Question	Answer	Marks
5(b)(ii)	**One** mark for each correct loop  	**2**
5(b)(iii)	**One** mark for each mark point • One correct Boolean term • Boolean terms and operator correct and no other terms present **Z =** B.D + $\overline{B}.\overline{C}.\overline{D}$ // $\overline{B}.\overline{C}.\overline{D}$ + B.D	**2**

Question	Answer	Marks
6	**One** mark for each mark point (**Max 4**) MP1 The interpreter translates the source code one line at a time MP2 If the line is syntax error free it is executed MP3 It is not stored in executable format MP4 If an error is found, the program halts with an error message MP5 Each line must be translated every time it is run, including lines running multiple times for example in loops	**4**

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Question	Answer	Marks
7(a)	**One** mark for each correct answer **#Jd7** – must begin with a member of the group uppercase // cannot begin with a symbol **C%6A** – the fourth character cannot be a member of the group uppercase // the fourth character must be either a symbol, digit or lowercase	**2**

7(b)	**One** mark **per** mark point
	`<uppercase> ::= A | C | E | G | J`
	`<passcode> ::= <uppercase><code>`
	`<code> ::= <lowercase>|<symbol>|<digit>`
	`|<lowercase><code>|<symbol><code>|<digit><code>`
		4

Question	Answer	Marks
8(a)	**One** mark for each mark point MP1 Running multiple processes concurrently MP2 … which benefits process management by allowing more tasks to complete than would be the case if they had to run one task after another.	**2**
8(b)	**One** mark for each mark point (**Max 3**) MP1 The processes are queued as they arrive MP2 Processes with the shortest burst time are executed first MP3 It is a pre-emptive scheduling function // When a process with a shorter burst time arrives the existing process is replaced by the shorter process. MP4 The scheduler will continue to choose shorter processes over longer processes if they continue to be added to the queue can cause starvation for longer jobs **One** mark for benefit (**Max 1**) e.g. MP5 Processes with a short burst time are processed very quickly MP6 Waiting time is minimised	**4**

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Question	Answer	Marks
9(a)	**One** mark for each mark point (**Max 2**) MP1 Ensure security/privacy when using the internet MP2 Data encryption MP3 Identification / authentication of client and server	**2**
9(b)	**One** mark for each mark point (**Max 2**) MP1 When transmitting authentication data e.g. passwords, session cookies MP2 When transmitting data that must be protected from modification on its way to or from a server e.g. user input, or results from the server MP3 When transmitting data classified as non-public.	**2**

Question	Answer	Marks
10(a)	**One** mark for each mark point (**Max 2**) MP1 A graph is used in AI to record relationships between entities MP2 … using vertices / nodes and edges MP3 for example, to represent places on a map and the distances between them, in order to find the shortest route.	**2**
10(b)	**One** mark for each mark point (**Max 4**) MP1 Artificial neural networks are designed to work in the same way as the human brain MP2 ANNs provide the architecture and algorithms for learning from the data MP3 They have a large number of connected processing units / nodes MP4 … that are arranged in layers / interconnected and work together to process data MP5 Deep learning models learn from data by adjusting the weights/biases of the connections between neurons MP6 They use multiple hidden layers to extract complex features and to make predictions	**4**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>11(a)</td><td>One mark per mark point
MP1 Two correct attributes (<code>PatientID : INTEGER</code> and <code>Doctor : STRING</code>)
MP2 <code>SetTreatments(…)</code> and <code>SetMedications(…)</code> seen
MP3 … and appropriate parameters, with string data types
MP4 <code>GetPatientID()</code> and <code>GetDoctor()</code> seen
MP5 <code>SetDateSeen(…)</code> and <code>GetDateSeen</code> fully correct with appropriate parameter and correct data type in setter.

Appointment
DateSeen : DATE
PatientID : INTEGER
Doctor : STRING
Treatments : STRING
Medications : STRING

SetDateSeen(NewDate : DATE)
SetPatientID(PatientNumber : INTEGER)
SetDoctor(DoctorID : STRING)
SetTreatments(NewTreatments : STRING)
SetMedications(NewMedications : STRING)
GetDateSeen()
GetPatientID()
GetDoctor()
GetTreatments()
GetMedications()</td><td>5</td></tr>
<tr><td>11(b)(i)</td><td>Encapsulation</td><td>1</td></tr>
<tr><td>11(b)(ii)</td><td>One mark for each mark point (Max 2)
MP1 Inheritance is where a derived class takes properties / behaviours attributes / methods
MP2 … of a parent / super class / base class
MP3 The attributes / methods / properties taken from the parent / super class / base class can also be extended / copied / used / changed / overwritten / overridden in the subclass.</td><td>2</td></tr>
</table>

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Question	Answer	Marks

12	**One** mark for each correctly completed line (**Max 5**)
	`DECLARE Location : INTEGER`
	`DECLARE Item : STRING`
	`DECLARE Continue : BOOLEAN`
	`DECLARE Answer : CHAR`
	`Continue ← TRUE`
	`OPENFILE "StockList.dat" FOR RANDOM`
	`WHILE Continue`
	`  OUTPUT "Enter a location between 1 and 500: "`
	`  INPUT Location`
	`  SEEK "StockList.dat", Location`
	`  GETRECORD "StockList.dat", Item`
	`  IF Item = "" THEN`
	`  OUTPUT "This record is missing"`
	`  ELSE`
	`  OUTPUT "The item in stock is ", Item`
	`  ENDIF`
	`  OUTPUT "Another location (Y or N)?"`
	`  INPUT Answer`
	`  IF Answer <> 'Y' THEN`
	`  Continue ← FALSE`
	`  ENDIF`
	`ENDWHILE`
	`CLOSEFILE "StockList.dat"`
	`OUTPUT "End of program"`
		5

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