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CAMBRIDGE
International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/33**

Paper 3 Advanced Theory **October/November 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 October/November 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 standard isation 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	Guidance
1(a)(i)	**One** mark per mark point (**Max 2**) MP1 `TYPE Spectrum =` MP2 `(Red, Orange, Yellow, Green, Blue, Indigo, Violet)` Example answer `TYPE Spectrum = (Red, Orange, Yellow, Green, Blue, Indigo, Violet)`	**2**	
1(a)(ii)	**One** mark per mark point (**Max 2**) MP1 the list is ordered/ordinal MP2 the list contains all possible values MP3 no duplicate values in list MP4 all values are the same data type	**2**	

1(b)	**One** mark for `TYPE ColourData` **and** `ENDTYPE` correct
	One mark for correct use of DECLARE in all declarations
	One mark for correct use of `Spectrum` in declaration
	One mark for remaining four declarations correct (STRING, INTEGER, REAL, BOOLEAN)
	
	Example answer
	`TYPE ColourData`
	`  DECLARE ColourCode : STRING`
	`  DECLARE Colour : Spectrum`
	`  DECLARE Wavelength : INTEGER`
	`  DECLARE Frequency : REAL`
	`  DECLARE PrimaryColour : BOOLEAN`
	`ENDTYPE`
		4	

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Question	Answer	Marks	Guidance
2(a)	**One** mark per mark point (**Max 3**) MP1 the precision of the number stored in the mantissa will be reduced MP2 the number of bits available for the exponent will **increase to 6** MP3 … this will increase the range of numbers that can be stored.	**3**	
2(b)	**One** mark per mark point (**Max 3**) MP1 a process involving a calculation / the multiplication of two large numbers could take place MP2 the result might be outside of the range of values possible to store in the given system MP3 … leading to the most significant bits of the mantissa/exponent being lost (which is an overflow).	**3**	

Question	Answer	Marks	Guidance
3	**One** mark per mark point (**Max 4**) MP1 the message is divided into small chunks called packets MP2 each **packet** is given a header with important data including source and destination IP addresses MP3 each **packet** is sent independently // **packets** can be sent through different routes MP4 **packets** are sent through the optimum route // **packets** can be re-routed if a route is unavailable MP5 **packets** are reassembled at the destination into the whole message	**4**	

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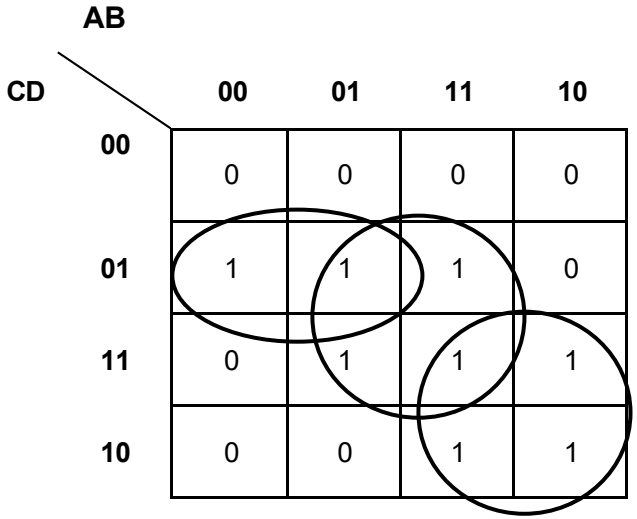
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Question	Answer	Marks	Guidance
4	**One** mark for a correct protocol and **one** mark for a correct corresponding description (**Max 6**) **Three** from: HTTP/S [1] a protocol/secure protocol used to transfer hypermedia documents / web pages / (data) files between networked devices [1] FTP [1] a protocol to download, upload and transfer files from one location to another **on a network** [1] POP3 [1] a protocol used to retrieve/receive emails **from a mail server to a computer** [1] IMAP [1] allows users to access/read their emails **from any device without removing** the message from the mail server // **synchronises** emails **on any device** [1] SMTP [1] a protocol used to send emails **between mail servers** // a protocol used to send emails **from a computer to a mail server** [1] BitTorrent [1] a communication protocol used for peer-to-peer file sharing [1]	**6**	

Question	Answer	Marks	Guidance
5(a)	To enable multiple programs/processes to be executed at the same time	**1**	
5(b)	**One** mark per mark point (**Max 3**) MP1 the operating system monitors the state of each task/process MP2 using **scheduling** to ensure hardware resources are used efficiently MP3 … and making sure that tasks/processes do not clash.	**3**	

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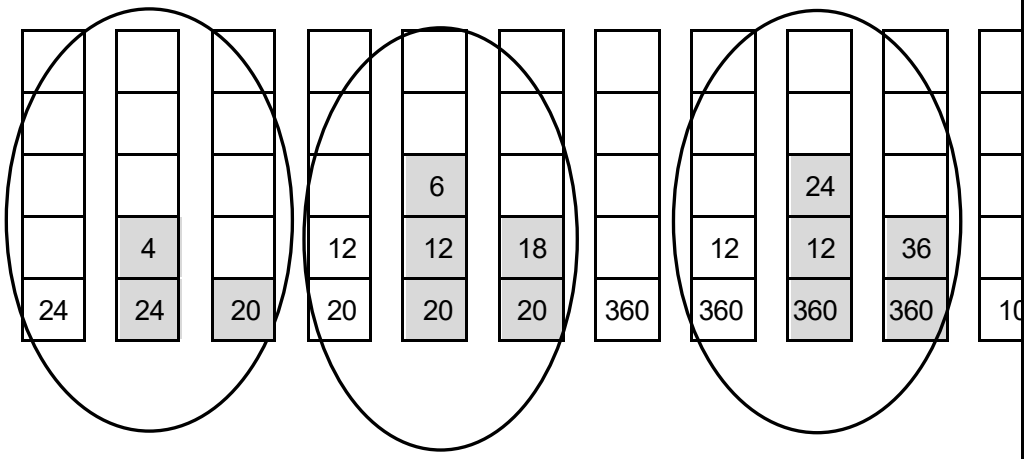
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Question	Answer	Marks	Guidance
6(a)(i)	**One** mark for each correct loop **(Max 3)**  	**3**	
6(a)(ii)	**One** mark per mark point (**Max 2**) MP1 One correct Boolean term with an OR sign MP2 All three correct Boolean terms connected by OR signs and no other terms present. $\bar{A}.\bar{C}.D + B.D + A.C$	**2**	

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Question	Answer	Marks	Guidance
6(b)	**One** mark for correct use of De Morgan's laws **One** mark for correct use of any other Boolean algebra law $X = \overline{\overline{A+B+C} + \overline{\overline{B}+C}}$ (X=) $\overline{A}.\overline{B}.\overline{C} + \overline{\overline{B}}.\overline{C}$ ……(De Morgan's) (X=) $\overline{A}.\overline{B}.\overline{C} + B.\overline{C}$ ……(Double negation) (X=) $\overline{C}.(\overline{A}.\overline{B} + B)$ ……..(Distributive) **One** mark for correct answer (X=) $\overline{C}.(\overline{A} + B)$ ……..(Redundancy)	**3**	

Question	Answer	Marks	Guidance
7(a)	**One** mark per mark point (**Max 2**) MP1 To identify and remove redundant code / To simplify expressions / To reorder the code MP2 … so that storage size/memory use/power consumption/program execution time/CPU time is minimized.	**2**	
7(b)	**One** mark per mark point (**Max 2**) MP1 6 12 + MP2 16 10 – / MP3 18 * Final correct expression 6 12 + 16 10 – / 18 *	**3**	

Question	Answer	Marks	Guidance
7(c)	**One** mark per ring (**Max 3**) **One** mark for the interim total (360) **and** the final total (10). 	**4**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>8</td><td>
One mark per mark point - working (Max 3)
May be seen on diagram or in working section

MP1 Initialisation – setting Start to 0
MP2 … and the rest of the towns to ∞
MP3 Evidence to show values at nodes being updated
MP4 Evidence to show ‘visited node(s)’
MP5 Evidence to show a correct calculation of at least one route
MP6 Evidence to show more than one route has been calculated for at least one town

Correct Answers (Max 2)
Two marks for all six correct values
One mark for four or five correct values.
<table>
<tr><th>T</th><th>V</th><th>W</th><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>6</td><td>10</td><td>13</td><td>18</td><td>21</td><td>28</td></tr>
</table>
</td><td>5</td><td></td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>9</td><td>
One mark per mark point (Max 4)
MP1 the company generates a public and private key pair locally using a web browser and an RSA key generator tool, which may be part of the CA’s web page
MP2 the company requests a digital certificate from a Certificate Authority (CA)
MP3 the CA responds with its public key and digital certificate,
MP4 … signed with its private key
MP5 the company gathers authentication information e.g. its public key
MP6 … and sends it to the CA signed with the company’s private key and encrypted with the CA’s public key
MP7 the CA verifies the received information and generates/issues the digital certificate.
</td><td>4</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance

10(a)	**One** mark per mark point (**Max 3**)
	MP1 Correct declaration of constant `Maximum`
	MP2 Both correctly declared integers
	MP3 Correct array declaration
	
	Example answer
	`CONSTANT Maximum = 100`
	`DECLARE Base : INTEGER`
	`DECLARE Top : INTEGER`
	`DECLARE StackArray : ARRAY[1:100] OF STRING`
		3	

10(b)	**One** mark per mark point (**Max 3**)
	MP1 Correct procedure definition structure
	MP2 Base pointer with appropriate value (0 or 1)
	MP3 Top pointer with appropriate value (–1, 0, 1)
	
	Example answer
	`PROCEDURE InitialiseStack()`
	`  Base ← 0`
	`  Top ← 0`
	`ENDPROCEDURE`
		3	

Question	Answer	Marks	Guidance
11	**One** mark per mark point (**Max 3**) MP1 Recursion is beneficial for problems that can be broken down into smaller, repetitive problems MP2 … especially for problems that have many possible branches / are too complex for an iterative approach MP3 An example e.g. solving mathematical series, sorting a pile of documents, etc.	**3**	

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Question	Answer	Marks	Guidance
12(a)	**One** mark per mark point (**Max 3**) MP1 An exception is an **unplanned / unexpected** event that occurs when a **program is running** MP2 … due to an error in programming/logic that wasn't detected during program construction/compilation MP3 The effect of an exception can be that the program halts unexpectedly.	**3**	
12(b)	**One** mark per mark point (**Max 2**) MP1 **One** mark for an example of an exception (see list in guidance) MP2 **One** mark for the reason for the **given exception** Example answer Division by zero The processor will not be able to evaluate this answer because a number divided by zero is infinity, so the program will crash.	**2**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>13</td><td>
One mark per mark point (Max 7)
MP1 <code>LDM #250</code> seen
MP2 Correct use of <code>LDD 563</code>
MP3 Correct use of <code>ADD</code> with labelled address <code>X</code>
MP4 Correct use of <code>SUB</code> with address <code>899</code>
MP5 At least one correct use of <code>STO</code>

<table>
<tr><th>Opcode</th><th>Operand</th></tr>
<tr><td>LDM</td><td>#250</td></tr>
<tr><td>STO</td><td>X</td></tr>
<tr><td>LDD</td><td>563</td></tr>
<tr><td>STO</td><td>Y</td></tr>
<tr><td>ADD</td><td>X</td></tr>
<tr><td>SUB</td><td>899</td></tr>
<tr><td>STO</td><td>Total</td></tr>
</table>
</td><td>7</td><td></td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>13</td><td>MP6 Correct setting up of at least one labelled address and its value
MP7 Correct setting up of remaining two labelled addresses and their values

<table><tr><th>Label</th><th>Contents</th></tr><tr><td>X:</td><td>250</td></tr><tr><td>Y:</td><td>125</td></tr><tr><td>Total:</td><td>312</td></tr><tr><td></td><td></td></tr></table></td><td></td><td></td></tr>
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