CAMBRIDGE
International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/32**

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.

[Turn over

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.

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.

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

Symbol	Use / 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.
TV	Too vague.
REP	Repetition
NE	No examples or not enough.
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

Question	Answer	Marks

1(a)	**One** mark for each mark point
	MP1 Use of correct `Flight1` variable with given field names
	MP2 Correct assignments of four string data values
	MP3 Correct assignment of date data value
	
	Example answer
	`Flight1.FlightNumber ← "SB2789"`
	`Flight1.Destination ← "Dublin"`
	`Flight1.FlightDate ← 30/07/2025`
	`Flight1.Gate ← "N03"`
	`Flight1.Airline ← "Cambridge Airways"`
		3

1(b)(i)	**One** mark per mark point MP1 `TYPE GateID =` MP2 `(N01, N02, N03, W01, W02, W03, W04)` Example answer `TYPE GateID = (N01, N02, N03, W01, W02, W03, W04)`	**2**
1(b)(ii)	`DECLARE Gate : GateID`	**1**

Question	Answer	Marks
2(a)	**Two** marks for working • number converted to binary (0)1111100.0111 • use of exponent = 7 // Moving binary point the correct number (7) of places **One** mark for correct answer **Mantissa** 0 1 1 1 1 1 0 0 0 1 1 1 **Exponent** 0 1 1 1	**3**

Question	Answer	Marks
2(b)	**Two** marks for working • correct use of exponent seen • correct conversion method from binary to denary **One** mark for correct answer Working: 1010001.01011 // moving bp 6 places to right Evaluation of two's complement −64 +16 + 1 + 0.25 + 0.0625 + 0.03125 // −64 + 16 + 1 + 1/4 + 1/16 + 1/32 // Converting two's complement back and evaluating positive binary number 32 + 8 + 4 + 2 + 0.5 + 0.125 + 0.03125 // 32 + 8 + 4 + 2 + 1/2 + 1/8 + 1/32 Fractions methods - award both working marks for either (– 2048 + 512 + 32 + 8 + 2 + 1) / 2048 x 2^6 = -1493 / 32 **OR** – 1 + 1/4 + 1/64 + 1/ 256 + 1/1024 + 1/2048 x 2^6 = -1493 / 32 Answer: −46.65625 // $-46^{21}/_{32}$	**3**

Question	Answer	Marks
3(a)	**Two** from • Application Layer • Transport Layer • Internet Layer • Link Layer	**1**
3(b)	**One** mark per mark point (**Max 4**) MP1 The TCP/IP suite can be viewed as layers within a stack MP2 Each layer can only accept input from the next higher or the next lower layer/adjacent layer MP3 The user/sender/computer interfaces with the top layer/application layer to send/receive a message MP4 The message when sent passes from the top layer/application layer to the bottom layer/link layer MP5 The message when received passes from bottom layer/link layer to the top layer/application layer MP6 The link layer interfaces directly with the network and sends/receives the message.	**4**

Question	Answer	Marks
4	**One** mark for each benefit (**Max 2**) MP1 Suitable for long continuous transmission once the connection is made, it is available until the end of the transmission MP2 No time lost in resending/rearranging packets as no loss of packets or out of order packets MP3 Steady/high rate of transmission because the whole of the bandwidth is available MP4 Data loss unlikely as all data follows the same path **One** mark for each drawback (**Max 2**) MP5 Delays due to dedicated connection required to be set up/established before transmission can begin MP6 The dedicated connection cannot be used to transmit any other data MP7 System resources may be underutilised/inefficient/not very flexible because the bandwidth can't be shared/high bandwidth is required // Bandwidth may be wasted // May send empty frames // the circuit is always there whether or not used MP8 There are no alternative routes if there is a failure or fault on the line MP9 Reduced security due to use of single path MP10 Scalability is difficult	**4**

Question	Answer	Marks
5(a)	**One** mark per point • Running state • Ready state • Blocked state	**3**
5(b)	**One** mark per mark point (**Max 3**) MP1 The processes are queued as they arrive MP2 The process with the shortest time to complete/burst time is selected first and executed MP3 The process will continue until complete or put in a waiting state once execution has begun // it is non-pre-emptive 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 a benefit (**Max 1**) MP5 Shorter jobs don't have to wait for longer jobs to complete before processing // Significantly reduces the average overall waiting time for processes // Ensures starvation doesn't occur for process with shorter burst times MP6 Higher throughput of processes	**4**

Question	Answer	Marks
6(a)	**One** mark per point (**Max 2**) MP1 A graph uses vertices/nodes to identify/represent entities such as destinations, people, etc MP2 Edges are used to connect nodes and can represent possible paths between them // a path is the list of nodes connected by edges between two given nodes MP3 Nodes/edges can be labelled/weighted, and this is a weighting that can be applied and used in the context of the application MP4 A cycle is a list of nodes that return to the same node.	**2**
6(b)	**One** mark per mark point (**Max 4**) MP1 Supervised learning uses labelled data // Unsupervised learning makes use of unlabelled data. MP2 Labelled data means that known outcomes are applied to specific inputs to help the AI predict outcomes. MP3 Supervised learning requires initial human input/training // Unsupervised learning does not require human input/training. MP4 With unlabelled data in unsupervised learning, outcomes are not known MP5 … the AI has to search for hidden patterns/structures/clusters MP6 … within the data in order to predict outcomes.	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>One mark for working, (all four columns P, Q, R and S)
One mark for first eight rows of column Z (Shaded)
One mark for second eight rows of column Z (Unshaded)

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<tr><th colspan="4"></th><th colspan="4">Working space</th><th></th></tr>
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<tr><td>7(b)</td><td>One mark for correct answer (terms may be in any order)

Z = $\bar{A}.B.C.\bar{D} + A.\bar{B}.C.\bar{D} + A.\bar{B}.C.D + A.B.C.\bar{D}$</td><td>1</td></tr>
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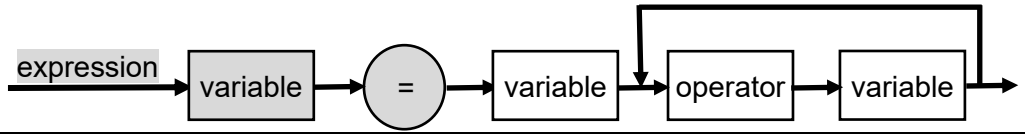
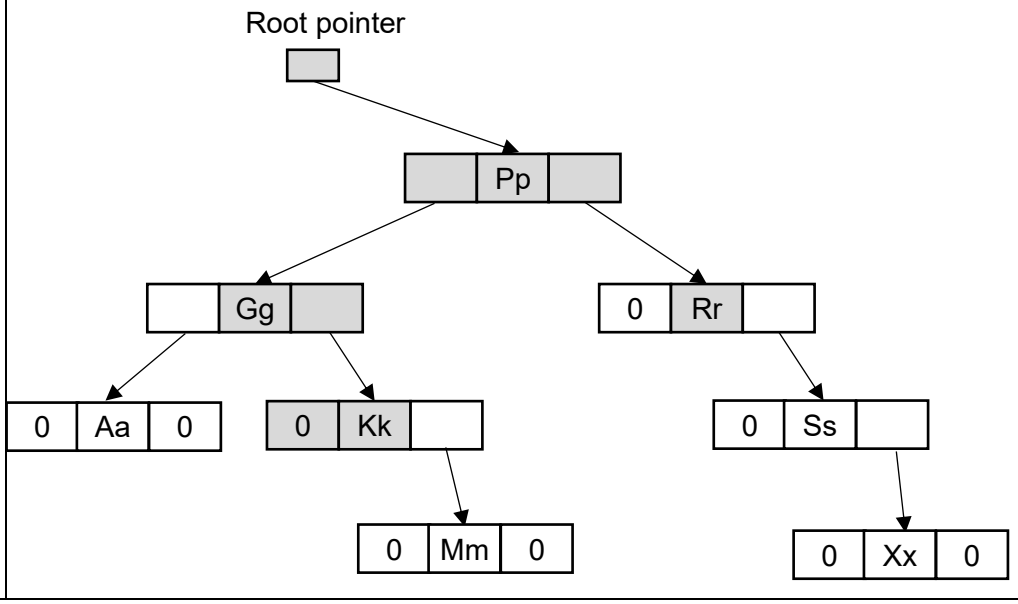
Question	Answer	Marks
7(c)	**One** mark for each mark point • Correct application of De Morgan's laws • Correct application of Idempotent, Distributive or Absorption laws • Correct application of Idempotent, Distributive or Absorption laws • Correct final answer $\overline{(A+B)}.\overline{(A.B+B.C)}$ $(\overline{A}.\overline{B}).(\overline{A}+\overline{B}+\overline{B}+\overline{C})$ DeMorgan's laws $(\overline{A}.\overline{B}).(\overline{A}+\overline{B}+\overline{C})$ Idempotent laws $(\overline{A}.\overline{A}+\overline{A}.\overline{B}+\overline{A}.\overline{C}).(\overline{B}.\overline{A}+\overline{B}.\overline{B}+\overline{B}.\overline{C})$ Distributive laws $(\overline{A}+\overline{A}.\overline{B}+\overline{A}.\overline{C}).(\overline{A}.\overline{B}+\overline{B}+\overline{B}.\overline{C})$ Idempotent laws $(\overline{A}+\overline{A}.\overline{C}).(\overline{B}+\overline{B}.\overline{C})$ Absorption laws $\overline{A}.\overline{B}$ // $\overline{A+B}$ Absorption laws / Final Answer	**4**

Question	Answer	Marks
8	**One** mark per mark point (**Max 4**) MP1 It is the first stage of compilation MP2 White space and comments are removed MP3 It takes modified source code and breaks it into a series of tokens MP4 Each token is categorised and assigned types MP5 Identifiers are stored in a symbol table MP6 If the lexical analyser finds invalid tokens, it generates an error MP7 Acceptable data from the lexical analyser passes to the syntax analyser	**4**

Question	Answer	Marks
9(a)	Variables must begin with a letter / not a digit	**1**
9(b)	`<operator> ::= + | - | * | / | ^`	**1**
9(c)	**One** mark per mark point MP1 Two variable boxes added to diagram MP2 One operator box added to diagram and all boxes in correct order MP3 Connections, arrows and return loop correctly added and no additional boxes or connections 	**3**

Question	Answer	Marks
9(d)	Answer must begin with a valid letter. It can then be followed by any number of valid digits and/or letters, as long as it is at least four characters in length. Example answer AC768	**1**

Question	Answer	Marks
10	**One** mark for identifying a protocol and **one** mark for stating its purpose MP1 Handshake protocol MP2 To establish a secure and reliable connection between two devices, systems or networks // Permits the web server and client to authenticate each other to make use of encryption algorithms MP3 Record protocol MP4 Provides a secure and reliable way to send and receive data over a network // To exchange records between the client and server // Responsible for securing application data end ensuring its integrity and authenticity during transmission // Encrypts and authenticates data exchanged between a client and a server // Deals with the format for data transmission.	**4**

Question	Answer	Marks
11(a)	**One** mark per mark point MP1 Any two nodes added correctly with correct data (Aa, Mm, Ss, Xx) MP2 Remaining two nodes added with correct data (Aa, Mm, Ss, Xx) and all nodes with connecting arrows starting from correct pointer boxes MP3 Correct null pointers (0) added throughout MP4 … with no entries in other pointer boxes and all nodes correctly positioned and connected. 	**4**

Question	Answer	Marks
11(b)	**One** mark for feature and **one** mark for example (**Max 2**) • Recursion is beneficial for algorithms when a problem naturally breaks down into smaller versions of itself. • … such as calculating a factorial / mathematical series / Fibonacci / compound interest / tree traversal / evaluation of RPN expressions.	**2**

Question	Answer	Marks
12(a)	**One** mark per mark point MP1 Two correct attributes (`DateOfBirth : Date`) and priority with a sensible name and integer data type MP2 `SetPatientID(…)` and `SetDoctorID(…)` seen MP3 … and appropriate parameters, with string data types MP4 `GetPatientID()` and `GetDateOfBirth()` seen MP5 Priority setter and getter fully correct with name matching Priority attribute, with appropriate parameter and correct data type. **Patient** PatientID : STRING Name : STRING **DateOfBirth : DATE** **Priority : INTEGER** DoctorID : STRING **SetPatientID(PatientNumber : STRING)** SetName(FullName : STRING) SetDateOfBirth(DOB : DATE) **SetPriority(Urgency : INTEGER)** **SetDoctorID(DocID : STRING)** **GetPatientID()** GetName() **GetDateOfBirth()** **GetPriority()** GetDoctorID()	**5**
12(b)(i)	Instance // instantiation	**1**
12(b)(ii)	**One** mark for each mark point MP1 Polymorphism is when methods with the same name are redefined / behave differently … MP2 … in derived / inherited classes / subclasses	**2**

Question	Answer	Marks

13	**One** mark for each correctly completed line
	
	`DECLARE Grade : StudentResult`
	`DECLARE Position : INTEGER`
	`OPENFILE "CurrentResults.dat" FOR RANDOM`
	`OPENFILE "StoredResults.dat" FOR RANDOM`
	`FOR Position ← 1 TO 50`
	`  SEEK "CurrentResults.dat", Position`
	`  GETRECORD "CurrentResults.dat", Grade`
	`  IF Grade.ExamGrade = "" THEN`
	`  Grade.ExamGrade ← "Missing grade"`
	`  ENDIF`
	`  SEEK "StoredResults.dat", Position`
	`  PUTRECORD "StoredResults.dat", Grade`
	`NEXT Position`
	`CLOSEFILE "CurrentResults.dat"`
	`CLOSEFILE "StoredResults.dat"`
		5