

# Cambridge International AS & A Level

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**INFORMATION TECHNOLOGY****9626/32**

Paper 3 Advanced Theory

**February/March 2024****MARK SCHEME**

Maximum Mark: 70

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**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 February/March 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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This document consists of **10** printed pages.

**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 to be used for marking:**

- Full annotation is required using those annotations shown here. A few others are available but these are the essential ones.
- Ticks shown on response must equal the marks given – and vice versa.

<b>Annotation</b>	<b>Name</b>	<b>Reason/comments</b>
	<b>Tick</b>	Placed next/close to a correct point that has been awarded a mark. The number of ticks must equal the number of marks given – and, conversely, the number of marks must equal the number of ticks shown.
	<b>Cross</b>	Placed next/close to an incorrect/wrong point.
	<b>Too vague</b>	Placed next a point considered not good enough to be awarded a mark.
	<b>Benefit of the doubt</b>	Placed next a point considered just good enough to be awarded a mark. It shows that the examiner has considered the point carefully and given a mark despite the point not being exactly as required. Use of BOD also requires a TICK next to it. Only ticks indicate awarded marks, BOD is an additional note that helps reviewers of the marking.
	<b>Seen</b>	Placed on blank pages to show they have been seen. Placed on all blank responses to show they have been seen and there is nothing there.
	<b>Read</b>	Placed at the end of response to show that the whole response has been read if no other annotations are relevant/used. Use this if you have e.g. stopped marking in the middle of a (long) response because e.g. the max marks have been awarded. It is most useful on additional pages/answers sheets. It indicates to supervisors/checkers that you have read the <b>whole</b> response.
	<b>Repeat</b>	Placed next a point considered to be the same as a point already awarded.  Placed next a point considered to be repeating the question.
	<b>Caret</b>	Placed next a point considered to be missing a vital piece of information so is not awarded a mark.
	<b>Not answered (the) question</b>	Used for responses that clearly do not answer the question.
	<b>MAX</b>	Used to indicate that the maximum mark for the response has been awarded. Place after the last tick i.e. where the maximum was reached.

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1	<p><b>Six</b> from e.g.:</p> <ul style="list-style-type: none"> <li>Used to bootstrap other wireless connections/Wi-Fi/Bluetooth (by exchanging setup credentials)</li> <li>Used in games to customise objects/figures/characters (with e.g. personal data/enter online games)</li> <li>Used in tags to automatically program/amend settings/command smartphones to carry out tasks/access a website</li> <li>Used as identity tags/documentation in e.g. passports/ID cards</li> <li>Used in access/login cards/car key systems</li> <li>Used in social networking to share contacts/images/messages</li> <li>Used in contactless payment systems in mobile devices/smartphones.</li> </ul>	6

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)	<p><b>Two</b> from:</p> <ul style="list-style-type: none"> <li>Used to <u>exit/break out of</u> a switch/loop</li> <li>When exiting a loop the code in the switch/loop stops</li> <li>Any code outside/after a switch/loop is then executed.</li> </ul>	2
2(b)	<p><b>Two</b> from:</p> <ul style="list-style-type: none"> <li>Functions are (JavaScript) objects with properties</li> <li>Declared/initiated by the function statement</li> <li>Used to save a section of code for later/repeated use</li> <li>Set of statements (in JS code) that perform a task/calculation (1<sup>st</sup>)           <ul style="list-style-type: none"> <li>Must have/with input/return output (1)</li> </ul> </li> <li>(Only) invoked/executed/run when called/invoked by other code.</li> </ul>	2
2(c)	<p><b>Two</b> from:</p> <ul style="list-style-type: none"> <li>Used to explain (JavaScript) code</li> <li>Used to stop/prevent code being executed (when testing alternative code)</li> <li>Used to make code more understandable/allows (future) programmers to follow/debug/understand code</li> <li>Single line comments begin with //</li> <li>Multi line comments begin with /* and end with */</li> </ul>	2

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3	<p><b>Six from:</b>  <b>One for at least four correctly identified stages:</b></p> <ul style="list-style-type: none"> <li>• List of stages i.e. Initiation, Planning, Documentation, Development, Support/maintenance</li> </ul> <p>Max <b>two</b> valid descriptions of activity in INITIATION e.g.</p> <ul style="list-style-type: none"> <li>• Create idea/vision for project</li> <li>• Discuss return on investment (ROI)</li> <li>• Identify team members are identified</li> <li>• Determine time/resources that are needed</li> <li>• Carry out feasibility study carried out/ determine if the project can be done</li> </ul> <p>Max <b>two</b> valid descriptions of activity in PLANNING by e.g.</p> <ul style="list-style-type: none"> <li>• Developers working with client/stakeholders/end-users</li> <li>• Specifications are written e.g. User/system/requirement specifications</li> <li>• Risks are considered/estimated</li> <li>• Product features are determined</li> </ul> <p>Max <b>two</b> valid descriptions of activity in DEVELOPMENT e.g.:</p> <ul style="list-style-type: none"> <li>• Development based on specifications</li> <li>• Occurs in sprints/iterations/incremental phases</li> <li>• Working software available at end of this phase</li> <li>• Working software has minimal functionality which will be built on in each sprint</li> <li>• Each iteration is tested</li> </ul> <p>Max <b>two</b> valid descriptions of activity in DOCUMENTATION e.g.:</p> <ul style="list-style-type: none"> <li>• Production of user documentation</li> <li>• Deployment to end-users</li> <li>• Handover with training to end-users</li> <li>• Software monitored for errors/problems</li> </ul> <p>Max <b>two</b> valid descriptions of activity in SUPPORT/MAINTENANCE e.g.:</p> <ul style="list-style-type: none"> <li>• Software withdrawn/decommissioned/end-of-life</li> <li>• Support for software stops</li> <li>• End-users notified of impending withdrawal of software</li> <li>• Software replaced by new release/version.</li> </ul>	<b>6</b>

Question	Answer	Marks
4	<p><b>Six</b> from:</p> <ul style="list-style-type: none"> <li>• (Lossy) compression of images reduces the amount data needed to represent the image while allowing the image to be reconstructed</li> <li>• (Lossy) compression of images reduces the file size</li> <li>• allows more images to be stored within a fixed amount of disk space/computer storage</li> <li>• allows transfer of (whole) image over networks/internet to be completed faster/in shorter space of time</li> <li>• image to be attached to email message without exceeding ISP max file size limit</li> <li>• allows image to be posted on social media sites which are optimised for mobile devices/data transfer over mobile communication systems</li> <li>• no fear of unauthorised use/stolen because image is degraded/has compression artefacts/effects (of lossy) compression/smaller file size allows commercial/copyright images to be posted on social media/web sites without</li> <li>• better user experience/not discouraging viewers (by reducing loading time of web pages)</li> <li>• Compression artefacts can be used by artists to enhance the visual impact of images.</li> </ul>	6

Question	Answer	Marks
5(a)	<p><b>Three</b> from: <i>Max three from:</i></p> <ul style="list-style-type: none"> <li>• (Orientation) is a camera property that is set in a keyframe</li> <li>• Surface sets the target for the camera on the object surface</li> <li>• Provides a sense of gravity for the object</li> <li>• Space sets the target for the camera at the centre of the object.</li> </ul> <p><b>OR</b></p> <p><i>May be interpreted as ‘rotation which is a layer property’</i> <i>Max three from:</i></p> <ul style="list-style-type: none"> <li>• Sets the x, y, and z rotation angles around a fixed point (the origin) in a layer</li> <li>• (Rotation) around the x-axis is the roll, yaw, angle.</li> <li>• (Rotation) around the y-axis is the inclination, pitch, angle.</li> <li>• (Rotation) around the z-axis is the azimuth, heading, angle.</li> </ul>	3
5(b)	<p><b>Three</b> from:</p> <ul style="list-style-type: none"> <li>• (Sets the visibility of the objects/layers so) other layers in the display can be seen underneath.</li> <li>• Can be set to different percentages (of transparency-opacity) to change the visibility of layers underneath</li> <li>• Adjusted in keyframes to affect following frames</li> <li>• Can be adjusted so that some colours are removed/green screen effects</li> <li>• Can set a ‘transparency track’ in keyframes so transparency-opacity percentage changes between keyframes.</li> </ul>	3

Question	Answer	Marks										
6	<p><b>Six from:</b></p> <p>i.e. process, data store, data source, duplicate data source (the only ones in the syllabus), <b>also allow</b> arrow (and its purpose), and other valid DFD symbols.</p> <p><b>Symbols from the syllabus:</b></p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Purpose</th> </tr> </thead> <tbody> <tr> <td></td> <td>(Represents) a process</td> </tr> <tr> <td></td> <td>(Represents) a data store</td> </tr> <tr> <td></td> <td>(Represents) a data source or destination (inputs and outputs)</td> </tr> <tr> <td></td> <td>(Represents) a duplication data source or destination</td> </tr> </tbody> </table> <p>Max <b>three</b> for DFD Symbols, max <b>two</b> per symbol:</p> <ul style="list-style-type: none"> <li>• Drawing of DFD Symbol (1st) <ul style="list-style-type: none"> <li>– correct stated/statements of purpose <b>matched to the symbol</b> (1)</li> </ul> </li> </ul>	Symbol	Purpose		(Represents) a process		(Represents) a data store		(Represents) a data source or destination (inputs and outputs)		(Represents) a duplication data source or destination	6
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Question	Answer	Marks
7	<p><b>Six from:</b></p> <ul style="list-style-type: none"> <li>• Access control ensures that users are who they say they are/confirms the identity of the user/authenticates the user</li> <li>• Ensures users have the appropriate access to data</li> <li>• Provides selective access to data/company controls who has access to what data</li> <li>• distribution of data is controlled/known</li> <li>• (Company) managers/staff/IT staff/users know who has/can have/is allowed access and who is not allowed access</li> <li>• Can be adapted (automatically) in response to changing conditions/change of staff (1<sup>st</sup>) <ul style="list-style-type: none"> <li>– so that new employees can have access (1)</li> <li>– employees/staff who leave can no longer access data (1)</li> </ul> </li> <li>• Can be adapted (automatically) in response to data breaches/analysis of risks (1<sup>st</sup>) <ul style="list-style-type: none"> <li>– so that relevant employees/staff/users are isolated from the data (1)</li> </ul> </li> <li>• Access control can be based on attribute of user within company (1<sup>st</sup>) <ul style="list-style-type: none"> <li>– so that they can only access data appropriate for their job/task/role (1)</li> <li>– so that they can only access data depending on the location/time of access (1).</li> </ul> </li> </ul>	6

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
8	<p><b>Eight</b> from:</p> <p><b>One</b> for</p> <ul style="list-style-type: none"> <li>valid description of cryptocurrency e.g.: a digital currency in which transactions are verified and recorded by a decentralised system using cryptography</li> </ul> <p><b>Benefits:</b> Max <b>six</b> from:</p> <ul style="list-style-type: none"> <li>Cannot be counterfeited so is not devalued by forgers</li> <li>Transactions cannot be reversed by the sender for arbitrary reasons/without consent/assistance of recipient</li> <li>Transactions can be anonymous so finances cannot be tracked/traced</li> <li>Cost-effective option for immigrants who have left their homes to find work and wish to send payments to their families in other countries</li> <li>Requires a private key/cryptographic password unique to each user for access so central government/organisation/corporation/bank cannot seize/freeze assets</li> <li>Unaffected by government defaults on loans/bank collapses</li> <li>Uses a “push” model prompting cryptocurrency holder to send exactly the amount to the seller without any other form of information</li> <li>Not bound by exchange rates so no cost when transferring between countries</li> <li>No need to change currency for transactions between countries</li> <li>No transaction charges resulting in lower costs to senders/recipients</li> <li>Transactions take place at the same speed regardless of where the sender and receiver are located.</li> </ul> <p><b>Drawbacks:</b> Max <b>six</b> from:</p> <ul style="list-style-type: none"> <li>Not backed by a government/central bank so subject to risks e.g. price volatility and regulatory intervention</li> <li>Risk of centralised intervention/not be legal in some countries</li> <li>Subject to volatility/significant price swings (as markets develop)/can lose a lot money quickly</li> <li>Small part of the global financial ecosystem so few retailers/organisations accept it</li> <li>Cannot easily be converted into cash/hard currency</li> <li>Some governments have banned the use of cryptocurrencies</li> <li>Risk of software errors affecting the chains leading to roll back/loss of transactions/value</li> <li>Significant contribution to climate change due to power consumption.</li> </ul> <p>Max <b>six</b> if bullets/list of points.</p>	<b>8</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
9	<p><b>Six from:</b></p> <ul style="list-style-type: none"> <li>• (Bot/malware/software application) installed on system without knowledge of owner/user</li> <li>• Bots set up as clients on system to communicate with controller device (on another device/peer-to-peer )</li> <li>• Use internet to communicate with remote server</li> <li>• Can execute/run other malware to access files/gather data and send back to controller</li> <li>• Can carry out Denial-of-Service (DoS) attacks on servers/preventing legitimate use of files/data/services</li> <li>• Can send (spam/unwanted/fraudulent) disguised emails from infected devices/zombie computing devices with attached data/files/request for login credentials/financial details which can be used to gain access to system</li> <li>• Can distribute/direct spyware to gather user credentials/details/data and send to controller</li> <li>• Can use system resources and reduce its performance</li> <li>• Can compromise legitimate file/data storage systems so that data/files are damaged/lost.</li> </ul>	<b>6</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
10	<p><b>Six from:</b></p> <ul style="list-style-type: none"> <li>• Carried out by the developers on the development site</li> <li>• Carry out review of the requirements specification</li> <li>• Carry out review of the design specification</li> <li>• Create/develop full test plans</li> <li>• Create/source test data</li> <li>• Carry out the test plan(s)</li> <li>• Record/log errors/defects/problems discovered during testing</li> <li>• Determine the cause of errors/defects/problems</li> <li>• Correct errors/defects/problems</li> <li>• Retest/repeat testing/iterative testing until errors/defects/problems are fixed/solved</li> <li>• Uses both white <u>and</u> black box testing.</li> </ul>	<b>6</b>

Question	Answer	Marks
11	<p><b>Eight available.</b></p> <p><b>One</b> from:</p> <ul style="list-style-type: none"> <li>• Valid definition of virtual server e.g. virtualisation/emulation/software instance(s) of (different/multiple) (network) servers running on the same physical hardware of a server.</li> </ul> <p><b>Max six</b> from:</p> <p><i>Benefits:</i></p> <ul style="list-style-type: none"> <li>• Companies can move their web hosting from own local physical servers to cloud-based virtual-servers           <ul style="list-style-type: none"> <li>– reducing their costs/maintenance/use of space</li> </ul> </li> <li>• Physical hardware requirements are reduced as components/physical hardware shared by many virtual servers with reduction in costs/use of physical space/ maintenance</li> <li>• Set up/duplication/deployment of virtual servers is faster as physical hardware is already running/available/configured</li> <li>• Reduced down time taken for updates/upgrades in server/website software/hardware as new version can be set up and switched into use without interfering with old version</li> <li>• Backup/copying/restoration from failure of virtual servers/switching to backup/use of image-based backups is quicker/easier than restoring a physical server as physical hardware is already available/no time taken for restoring from tapes/disks</li> </ul> <p><b>Max six</b> from:</p> <p><i>Drawbacks:</i></p> <ul style="list-style-type: none"> <li>• Data/web accounts may be at greater security risk due to sharing of hardware</li> <li>• High power computing requirements to run all virtual servers at peak performance else user experience is not optimal</li> <li>• Failure of physical component/hardware affects all virtual servers so hosted websites are all offline</li> <li>• Larger data storage facilities required as every virtual server is self-contained and has to have all OS/software for its exclusive use</li> <li>• Larger RAM requirement as each virtual server runs in/must have its own separate memory allocation</li> <li>• High bandwidth connections required to service all virtual servers at optimal performance levels.</li> </ul> <p><i>Max six if bullets/list of points.</i></p>	<b>8</b>