



Cambridge International AS & A Level

INFORMATION TECHNOLOGY

9626/32

Paper 3 Advanced Theory

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MARK SCHEME

Maximum Mark: 70

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 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **13** 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 descriptors 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.

Question	Answer	Marks
1(a)	<p>Four from:</p> <ul style="list-style-type: none"> • No user authentication is required/card can be used anonymously <ul style="list-style-type: none"> – because value/money is stored on the card. • No cost/cost overhead to the merchant <ul style="list-style-type: none"> – because no fees are payable to issuer • Merchant receives the money (value) immediately (1st) <ul style="list-style-type: none"> – as value is transferred direct from card to merchant (account) – transaction is the same as exchanging physical currency • No connection to bank required/no telecommunication system/network connections needed <ul style="list-style-type: none"> – transactions are processed offline – so can be used in remote/standalone locations (where network connections are difficult to set up) • Can be used/customised/in closed or semi-closed loop/prepaid situations to restrict payment to specific merchants (e.g. a transit/bus/rail system or as gift cards) (1st) <ul style="list-style-type: none"> – so customers have to use that merchant/cannot pay for goods/services elsewhere – Issuer may gain financially if card is not used by set date/may set expiry date on use of card • Increased security (c.f. credit or bank cards) for user data if card is lost (1st) <ul style="list-style-type: none"> – there is no risk to user bank account details – as only value of card is lost • No limits on movement of money on stored value cards between countries/no need to declare stored value cards at customs on entry/exit from countries • Transactions can be very quick <ul style="list-style-type: none"> – because no authentication is of user is required – less time than ‘juggling’/sorting cash • No need to carry cash/so easier to carry/more portable (than large amounts of cash) • User is safer/less likely to be robbed/easier to conceal. 	4
1(b)	<p>Two from:</p> <ul style="list-style-type: none"> • User loses monetary value on card if card is damaged/lost/stolen/if not used before the expiry date/if full value of card not redeemed (e.g. 1 cent/penny/rupee left)/if issuing company goes out of business • Accepted (only) for low value transactions (usually) (to avoid fraud/illegal financial activities (e.g. money laundering)) • Monetary value on cards is (usually) low (as cards are not linked to user accounts so can be used anonymously if lost/stolen) • Cards are not (usually) transferable between issuing companies/businesses • No cap on charges because user is not identified/card is not linked to an account. 	2

Question	Answer	Marks
2(a)	<p>Two from:</p> <ul style="list-style-type: none"> • To define/specify the <u>start and end</u> point of a movement (of the objects) • To define/specify the movement (of the objects) (1st) <ul style="list-style-type: none"> – that the viewer will see (1) • To define/specify the timing of the movement (1st) <ul style="list-style-type: none"> – by the position of the key frame in a sequence of frames (1). 	2
2(b)	<p>Four from:</p> <ul style="list-style-type: none"> • (Property key frame explicitly) defines/specifies the (one or more) properties/parameters of an object in a frame • (Objects properties) can be edited/changed/amended (within a property key frame) • (Property key frames) can be used to create in-between (tween) frames without the need to draw each frame individually • Can be used (as 'roving' property key frames) • Used to ensure that the speed of motion is consistent between frames/throughout a tween • Used to alter/amend/adjust the speed of motion at beginning and end of tween sequence so that it appears more realistic between frames/throughout a tween • Can be used to impose/add properties of one object onto other (1st) <ul style="list-style-type: none"> – by copying/placing property key frames in timelines/between sequences (1). 	4

Question	Answer	Marks
3	<p><i>Analyse: examine in detail to show meaning, identify elements and the relationship between them</i></p> <p>Six from:</p> <ul style="list-style-type: none"> • (The two methods are) <u>lossless compression and lossy compression</u> <p>Max 4 from:</p> <p><i>Lossless:</i></p> <ul style="list-style-type: none"> • All image information is stored exactly/no image information is removed • Image is/can be recreated perfectly/with no difference from the original • Works well with images which have large areas/blocks of same/similar pixels/colours (1st) <ul style="list-style-type: none"> – because only need to store data for one pixel and how many pixels are required (1) • No loss of quality • Program/algorithms can reconstruct original/replace pixels lost by compression from the stored data <p>Max 4 from:</p> <p><i>Lossy:</i></p> <ul style="list-style-type: none"> • Images are degraded/reduced in quality/blurred/pixelated/blocky • Information is lost during compression and is not/cannot be replaced • Program/algorithm compresses/removes areas with low detail more than areas of high detail (1st) <ul style="list-style-type: none"> – so image is altered/changed from original (1) • Introduction of compression artefacts • Image quality is further degraded/reduced with repeated compression/decompression/saving and opening (1st) <ul style="list-style-type: none"> – because at each compression/decompression more image information is lost (1). <p>Max 4 for all lossless or for all lossy.</p>	6

Question	Answer	Marks
4(a)	<p>Three from:</p> <ul style="list-style-type: none"> • Base stations (in a cell/cellular subsystem) for (wireless) connection to end user • Core/central switched network for handling voice calls/text messages • Packet switched network for handling (mobile) data/internet traffic • Public switched telecommunications/telephone network for connection into the global telephone networks. 	3
4(b)	<p>Four from:</p> <ul style="list-style-type: none"> • Connections use (frequency/time/code) multiplex division to share frequencies • Spread spectrum technology is used to allow multiple connections on same (set of) frequencies • Multiple input and multiple output (MIMO) using multiple transmit/receive antenna to increase capacity/use of transmission channels/increased data flow • Antennae from base stations/towers can be/are directional to avoid interference from other towers/reflections • Adjacent cells use different frequencies from neighbouring cells • Connection/wireless frequencies are re-used by cells distant from each other to increase capacity (where ranges of frequencies are limited). 	4

Question	Answer	Marks
5(a)	<p>Two from:</p> <ul style="list-style-type: none"> • Connection may not be encrypted/not require a password/network key/passphrase • Eavesdroppers/interceptions are more difficult to prevent/discover/no physical/visible evidence of (unauthorised) connections/easier to intercept (than wired connections) • Access points can be 'spoofed'/created/copied/imitated by unauthorised users to capture wireless traffic • access points broadcast network ID (SSID) to public. 	2

Question	Answer	Marks
5(b)	<p>Six from:</p> <ul style="list-style-type: none"> • User selects Wi-Fi connection/WAP (from list of available connections) • Connection to a wireless access point (in a router) (1st) <ul style="list-style-type: none"> – Access point/(WAP)/router is connected/wired into the LAN/infrastructure mode of networking (1) • Uses radio waves/signal <ul style="list-style-type: none"> – frequencies in the 2.4 / 5 GHz range – to carry data packets/data packets modulated onto radio waves/signal/frequencies • Wi-Fi uses frames/packets similar to Ethernet/uses Wi-Fi protocols working at data link layer of TCP/IP/OSI protocol/network stacks (to carry data over the radio waves) • WAP sends beacon frames at intervals to announce its presence to smartphones/devices in vicinity/provide SSID/network parameters for connections • Smartphone sends authentication frame(s)/probe frames to WAP containing its identity requesting connection. • WAP responds with authentication frame(s) accepting/denying connection/requesting authentication credentials • User/automatic input of authentication credentials to establish security methods/encryption to be used for data exchange • WEP/WPA/WPA2 (and variants)/TKIP protocols/use of 128 / 256 key encryption during transmission used <ul style="list-style-type: none"> – to ensure data is secure/encrypted • Control frames /acknowledgement/request to send/clear to send frames/error control used between smartphone and WAP when sending/receiving data frames/maintain connection • User data encapsulated within data frames using Wi-Fi protocols/valid description of structure of Wi-Fi data frame/datagrams. 	6

Question	Answer	Marks
6(a)	<p>Four from:</p> <ul style="list-style-type: none"> • Loops through a block of code a number of times <ul style="list-style-type: none"> – depending on the outcome of testing a condition/counting a condition set in the code • Requires (at least/usually) three expressions/statements in the syntax <ul style="list-style-type: none"> – A declared variable/an expression to be evaluated (before each iteration) – Expression to be evaluated at start may be omitted/not always required/does not produce an error by JavaScript if omitted – Expression to be evaluated at end of each iteration/increment the value of the declared variable • Incrementing the variable at end of iteration/loop is optional • Loop continues until condition is met • Loop will/may continue forever if condition not met • If evaluate statement (which is expression 2) is omitted then a Break must be included to prevent loop going on forever <p>Allow 1 mark for a valid example.</p>	4
6(b)	<p>Two from:</p> <ul style="list-style-type: none"> • While loop tests condition at the beginning of the loop <ul style="list-style-type: none"> – whereas do while tests the condition at the end of the loop • While loop only executes the code block if condition is true <ul style="list-style-type: none"> – whereas do while executes the code block even if condition is false/test fails • Code block in while loop may never be executed <ul style="list-style-type: none"> – whereas code block in do while is always executed at least once. 	2

Question	Answer	Marks
7(a)	<ul style="list-style-type: none">(A new property may be added) by assigning it/declaring a value.	1
7(b)	Four from: <ul style="list-style-type: none">JS code enclosed in HTML for use/to run in web browserUse of the for...in loop (in JS)Define a variable (var/const) for storing the (iterated) propertiesSpecify the object to examined/iteratedEnclose the code to be interrogated within brackets/{ }Include code to count iterations of loop/code loops through/iterates through variable array of (stored) propertiesUse code to pass results/results passed to HTML for display by browser/valid example e.g. document.getElementById("xx").innerHTML = xx;use of console.log() to pass results to browser console accessed by user.	4

Question	Answer	Marks
8	<p><i>Evaluate: judge or calculate the quality, importance, amount, or value of something.</i></p> <p>Eight from:</p> <ul style="list-style-type: none"> • Pilot implementation is implementing the change in one centre before implementing the change in the remaining centres. <p>Max 6 from:</p> <p><i>For:</i></p> <ul style="list-style-type: none"> • Problems/issues in one facility can be addressed/fixed/dealt with before changeover in other centres <ul style="list-style-type: none"> – So reducing overall problems/issues/risk to data • Users have access to new system/user documentation and can assist others in its use <ul style="list-style-type: none"> – so reducing the burden/difficulties of using a new system in their work/can concentrate on primary task of patient care • Workload of IT team can be spread out over time • Software IT technicians are required to fully implement the new system • Disruption to the health care organisation is reduced (compared to other implementation methods) <ul style="list-style-type: none"> – so danger to/disruption to patient care is reduced/minimised • User feedback can be used to assist in training other users at different centres <ul style="list-style-type: none"> – so improving the user experience at the centres/fewer mistakes/less impact on patient care at different/other centres <p>Max 6 from:</p> <p><i>Against:</i></p> <ul style="list-style-type: none"> • The time taken for the full implementation/changeover is (very) long <ul style="list-style-type: none"> – so the full benefits of the new system are not realised immediately/can be a long time coming/available to all users/at all centres • The costs for the full implementation can be high <ul style="list-style-type: none"> – as IT services/technicians may have to be continually relocated/moving between centres to deal with e.g. issues that have different effects in different centres • Systems/interfaces in some centres will be changed before others <ul style="list-style-type: none"> – so compatibility issues/workarounds for connections/issues will have to be developed/implemented as and when necessary/may compromise data • Staff moving between centres are required to be familiar/use different interfaces/systems/be able to use two systems <ul style="list-style-type: none"> – so adding to their workload/increase in risk of error/mistakes • Motivation of IT team to complete changeover may decrease over long periods of time <ul style="list-style-type: none"> – leading to slowing of work/increase in errors/increase in duration of changeover. <p>Max 6 if all for or all against. Max 6 marks if bullets/list of points.</p>	8

Question	Answer	Marks
9	<p>Six from e.g.:</p> <ul style="list-style-type: none"> • Simple/no expertise required to set up and use by all employees/other businesses • Accessible at any time/anywhere/at home/while mobile that has a network/internet connection • Accessible from almost all computing devices so no specific/specialised hardware required • Provides real-time communications between employees/other businesses enabling fast responses to queries/issues (compared to e.g. email)/eliminates delays in communications • (May be) cheaper than using telephone systems for long-distance/international/lengthy conversations so saves money • Can keep/record of a conversation/messages for reference/archive/legal purposes • Less disruptive to employee workflow than telephone calls/can have several IM conversations simultaneously/less intrusive in meetings • Can increase productivity of employees who require immediate assistance/assist others/customers • Can be used alongside/as adjunct to video-conferencing • Can be used for group chats • Custom-written apps/software for IM can be more secure than e.g. email • Use of end-to-end encryption can make communications secure. 	6

Question	Answer	Marks
10	<p><i>Discuss: write about issue(s) or topic(s) in depth in a structured way</i></p> <p><i>One mark for valid description of a mail server:</i></p> <ul style="list-style-type: none"> • Mail server is a dedicated device/computer/server used for sending/receiving/storing/forwarding (email) messages <p>Six from:</p> <p>Max 4 from: <i>Advantages:</i></p> <ul style="list-style-type: none"> • Company can provide each employee with own/customised/business email address/account <ul style="list-style-type: none"> – which is used solely for company business • Additional departmental/service email accounts e.g. sales@/support@ can be provided at no extra cost • Company can control/manage email policy <ul style="list-style-type: none"> – so that only authorised people/employees can send/receive email on premises with company email/no unauthorised use of personal email accounts in company locations • Company emails can be archived/stored for later reference/use meet legal requirements for data protection/consumer protection • Company emails can be filtered/scanned for malware/spam <ul style="list-style-type: none"> – before being delivered to employee/can be scanned for malware before being sent • Employees can be allocated a quota/size of inbox for sending/receiving emails <p>Max 4 from: <i>Disadvantages:</i></p> <ul style="list-style-type: none"> • Mail servers require technical expertise/maintenance <ul style="list-style-type: none"> – which may be beyond/cost too much for small company • Mail servers are difficult/complex to set up/troubleshoot/maintain/configure • Cost of hardware/software/licencing to run the mail service may be excessive for small company • SMTP services/servers/sending of email from own server are (often) prohibited on ISP accounts <ul style="list-style-type: none"> – so extra costs/technical expertise for business internet access for small company • Difficult to stay off/avoid blacklists/block lists if mail server incorrectly configured (for example incorrect DNS listings) so emails may not be sent/arrive until resolved. <p>Max 4 for all advantages or all disadvantages Max 4 marks if bullets/list of points.</p>	6

Question	Answer	Marks
11	<p>Six from:</p> <p><i>Two types of maintenance from:</i></p> <ul style="list-style-type: none"> • Adaptive maintenance (1st) <ul style="list-style-type: none"> – (Modifies and) updates software after delivery to the users – In response to new/up-to-date technology/hardware/operating environment – In response to changes in industry/business requirements – In response to changes/amendments to regulations/legislation. • Preventative maintenance (1st) <ul style="list-style-type: none"> – (Modifies and) updates software after delivery to the users – To avoid/prevent/protect against possible problems/faults/errors that might occur in the future – To fix minor/insignificant/errors that do not affect function/cosmetic errors (but may become significant in the future) • Perfective maintenance (1st) <ul style="list-style-type: none"> – Enhances/improves/increases the performance (of software) after delivery/during the lifetime of the software – Enhances/improves/increases the usability/user experience of the software – Enhances/improves/increases the reliability/security of the software (to increase its life span) – Enhances/improves/increases the (ease of) maintenance of the software. 	6