Cambridge International AS & A Level

INFORMATION TECHNOLOGY **9626/32**

Paper 3 Advanced Theory **May/June 2023**

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 May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **12** printed pages.

[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 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.

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.

Annotation	Name	Reason/comments
Tick ✔	**Tick**	Placed next/close to a correct point that has been awarded a mark. The number of ticks must equal the number of marks give – and, conversely, the number of marks must equal the number of ticks shown.
Cross ✗	**Cross**	Placed next/close to an incorrect/wrong point.
TV	**Too vague**	Placed next a point considered not good enough to be awarded a mark. Placed at the end of response to show that the whole response has been read.
BOD	**Benefit of the doubt**	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.
SEEN	**Seen**	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.
REP	**Repeat**	Placed next a point considered to be the same as a point already awarded. Placed next a point considered to be repeating the question.
λ	**Caret**	Placed next a point considered to be missing a vital piece of information so is not awarded a mark.
NAQ	**Not answered (the) question**	Used for responses that clearly do not answer the question.
MAX	**MAX**	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.

Question	Answer	Marks
1(a)	**Four from:** • If … else allows different actions to occur as a condition/number is examined/evaluated • If the condition is TRUE an action is taken but/and/else • If the condition is FALSE another (different) action is taken • produce a Boolean result/ • Number is stored in variable/declared variable • Comparison operators/equal/not equal/greater than/less than to test value of variable/number with pre-set/16 condition • (Statement used to provide) message if condition is TRUE • (ELSE statement used to provide) message if condition is FALSE.	**4**
1(b)	**Three from:** • Reduces code to a single statement to make code/more efficient/execute faster/load quicker/take up less storage space • Code is less complex/easier to follow/understand (by programmers)/easier to wite/faster to write/simpler/less repetitive coding • Code is easier to debug/error check/less chance of error • Can run multiple operations with code that is easier to follow/understand.	**3**

Question	Answer	Marks
2	**Eight from:** *Similarities:* • Both are (networking devices) used in LANs • Both use/direct/handle packets of data • Both can have multiple data ports (to connect to different networks) • Both can connect to multiple devices • Both can send data to specific devices • Both can provide high transmission speeds/rates/bandwidth • Both can work in full duplex mode • Both can work in broadcast, unicast and multicast mode. *Differences:* • Routers are used in WANs and LANs whereas switches are used only in LANs • Routers connect two or more networks whereas L2 switches connect nodes in same network/L3 switches can connect two networks • Routers can connect devices to internet whereas switches cannot • Routers cannot/do not use/direct data frames whereas (Layer 3) switches can use/direct data frames as well as packets • Routers work at the network layer (Layer 3) while switches work at the Data Link Layer (Layer 2) (of OSI model) • Routers work with IP addresses/switches work with MAC addresses • Routers can dynamically adapt/change/use adaptive routing to change paths for packets (whereas switches cannot) • Routers can function as network address translations (NAT)/switches cannot carry out NAT • Routers carry out routing decisions between different networks faster than (L3)-switches whereas in a LAN a (L3)-switch is faster than a router for connecting segments/nodes • Router ports have own broadcast domain whereas all ports on switches have same broadcast domain • Routers store routing information/data in routing tables as IP addresses whereas switches store data in a content addressable memory table (CAM) with MAC addresses • Routers may contain WAPs in same physical unit/box whereas switches are usually in wired/cabled networks only • Routers work (mostly) with packet switching whereas switches can be configured for circuits, message and packet switching. ***Must be at least two similarities and two differences for full marks.***	8

Question	Answer	Marks
3(a)(i)	**Two from:** • Encryption of data (is (end-to-end) between application/software/apps) • Creates a (secure) link • Uses client server model • Connects application/program/app/terminal with a (remote) server • Works at application layer of TCP/IP/OSI protocol suites • (Uses authentication with) automatically created (private/public) keys (to provide encryption of data) • (Provides encryption) so that observer/interceptor cannot understand/not make sense of the data.	**2**
3(a)(ii)	**Two from:** • Exchange of keys at start of session/digital certificates are used for authentication/pre-shared keys (to be used) are negotiated/established at start of session • All data (that is exchanged) during session is encrypted using the agreed keys • Different sets of keys are used (for data encryption) for different sessions • Can support (both) pre-shared key/private and public key encryption of data so that the data is not understandable without the keys • Works at Internet layer of protocol suites/stacks so encryption is at device level/supports VPNs.	**2**
3(b)	**Two from:** • Data/login details is/are not encrypted by default/automatically • Data is in plain text so analysing/capturing network traffic by eavesdroppers/interceptors/unauthorised viewers can allow them to understand the data • Connections are not authenticated • Anyone/unauthorised users/devices may connect/create links/connections without being challenged/alerts generated • Unauthorised connections may be used to gather information/data/passwords and these can be used access confidential/personal/financial data/all data • (Anyone who knows the login details) can be used to change configuration/rules/allow access to prohibited areas by intruders/unauthorised users.	**2**

Question	Answer	Marks
4(a)	**Four from:** • Bluetooth is designed for use/used between two/up to 8 devices whereas Wi-Fi allows for multiple/many devices to be connected • Bluetooth does not (usually) use a central access point whereas Wi-Fi can use a central access point • Bluetooth is symmetrical/two devices whereas Wi-Fi is asymmetrical/one central access point to many remote devices • Bluetooth is restricted to short range connections whereas Wi-Fi can cover a wide/larger geographical area • Bluetooth is more affected/range reduced by obstacles/line-of-sight requirements than Wi-Fi connections • Bluetooth connections (by device) are simpler to establish/require simple/minimal setup whereas Wi-Fi requires negotiation/authentication credentials to be exchanged between devices • Bluetooth has lower bandwidth/data transfer rates than Wi-Fi • Bluetooth is less susceptible to (radio/electromagnetic) interference than Wi-Fi • Bluetooth is less secure than Wi-Fi • Bluetooth requires less power than Wi-Fi to exchange data.	4
4(b)	**Five from:** • Turn on/open Bluetooth on both devices • Ensure that the devices are in range/can detect/find each other • Set one device to search for available devices • Device is found/selected/responds/discoverable • Device requires a passcode/user response by e.g. pressing a button/key/passcode entered/default passcode sent • Passcode checked (by both devices)/connection/passcode confirmed on other device • Devices are paired • Frequencies/channels to use are decided.	5

Question	Answer	Marks
5	*Discuss: write about issue(s) or topic(s) in depth in a structured way.* **Eight from e.g.:** *Positive impacts of use* • Improves sense of belonging/well-being by connecting people separated by distance/circumstance • Reduces stress by providing entertainment/respite from other tasks/engaging with interesting topics • Improves quality of life/improves health by encouragement (from others/groups) to have healthy lifestyle e.g. giving up smoking/eating healthier/more exercise • Can empower individuals to make social changes by connection to others that start a movement/discussion/change in attitudes/awareness/views • Older/senior/isolated individuals can connect to families/keep in contact • Increase in their happiness/feeling of usefulness/involvement/reduces sense of isolation *Negative impacts of use* • Can increase incidence of depression/feeling/psychological disorders of lower worth/value when comparing lifestyle with that of others • Can increase feelings of jealousy when comparing with achievements/successes of others • Can trigger feelings of sadness/less satisfaction with life due to negative comparisons with others/lack of physical contact with others • (Increase in sedentary lifestyle due to lengthy use of computers) can lead to health problems • Can become addictive leading to e.g. withdrawal symptoms/social awkwardness/isolationism • Can lead to cyberbullying by individuals on others/of individuals by others. ***Max 6 marks if bullets/list of points.*** ***Must have at least two positive and two negative impacts for full marks.***	8

Question	Answer	Marks
6(a)	**Three from:** • Use a logical framework for defining/implementing network standards • Use a layered structure/architecture to describe/standardise the functions of protocols • Each layer only defines/describes a specific/set of function/only that function • Complex functionality is divided into simpler sections for easier understanding of network functionality • Existing standards are referenced by layers/functions of layers • Define standards/functionalities that allow manufacturers to create/produce devices/components that work with other manufacturers products.	3

Question	Answer	Marks
6(b)	**Three from**: • OSI model has seven layers whereas TCP/IP model has four/five layers/more layers in OSI model than in TCP/IP model • OSI functionality at application level has three separate layers to cover/include TCP/IP's one/single application layer application layer/application layer in TCP/IP is application+presentation+session layer of OSI model • OSI has separate physical and data link layers whereas TCP/IP originally combined these into one layer/Link layer • OSI network layer provides for both connection-oriented and connectionless links whereas TCP/IP network layer provides only for connectionless • OSI Transport layer provides only connection-oriented link whereas TCP/IP Transport layers provides for both connection-oriented and connectionless links • OSI Transport layer provides for a guarantee of the delivery of packets whereas TCP/IP Transport layer does not.	3

Question	Answer	Marks
7	*Analyse: examine in detail to show meaning, identify elements and the relationship between them.* **Six from, e.g.:** • Risk(s) to monetary stability increase as the amount/value of digital currency in an economy increases… • …which may cause inflation/devaluation of base/traditional currency • Risks due to fraud/lack of control of economy are small if amount/value of digital currency in the economy is small/when most financial transactions are by traditional means • Price/value of digital currency is (very) volatile and great fluctuations lead to financial instability/a great rise followed by great crash in price imposes vast losses on buyers/sellers • Pensions/income is lost • Investment by organisations vital to economy/pension/healthcare in digital currency exposes them to risk of sudden financial loss • Risk of system-wide fraud if a group/organisation gained control of computing resources involved in electronic payments • Increase in crime/financial loss • Risk of erosion/undermining/circumvention of monetary controls set by governments to regulate economy • Rise in inflation/unemployment • Risk of fragmentation of economy if all digital currency/transactions were restricted to small numbers of users • Risk of move from traditional/base money to digital currency transactions… • …reducing the value of traditional currency • Risk of loss consumer protection/taxation income if transactions carried out using digital currency • Risk of money laundering/illegal payments • Transactions are anonymous/not tracked/recorded. ***Max 5 marks if bullets/list of points/characteristic.***	**6**

Question	Answer	Marks
8(a)	**Two from:** • The reliance of one project entity/task/activity upon another • Link between tasks (in a project) • Can be resource-based where e.g. not enough personnel/machinery/devices/space to carry out both task simultaneously/only one set of resources available • Can be logical-based where e.g. one task has to carried out before another/enables the start of next task e.g. create design before assembly/implementation before testing • Can be due to preferences of project manager for one task to be before another/one task to follow another e.g. create logo before slogan.	**2**

Question	Answer	Marks
8(b)	**Two from:** • A tangible/physical/intangible/logical output/goods/service/outcome • Created/produced as a result of a project • Created/produced from work/activity/task during a project • Must be a product agreed by internal/external stakeholder(s) • Must help to achieve the objectives of the project.	**2**
8(c)	**Two from:** • (Collection of) activities • Produces an outcome/deliverable/completes a project • Definable part/component/process (of a project) • Must be completed in a set time frame • Related single/complete units of work • Related (within a project) • Derived from/defined by the stated deliverables.	**2**

Question	Answer	Marks
9	**Six from:** • Stages are analysis, design, development <u>and</u> testing, implementation, documentation, evaluation, maintenance *(must name at least four/4 (anywhere) to get the mark – put a LNK on each and tick on the last one if 4, if not 4 put TV on last one)* • Each stage is/has to be completed before the next stage can begin/stages follow on from previous stage • Deliverables/products/outcomes from each stage are required for use in the next stage • Deliverables/outcomes/products of one stage can be used to revisit previous stage for amendment/alteration • Process can be/is iterative with (repeated) movement between adjacent stages until problems/issues/test results are resolved • Documentation from each stage is used to produce system/technical/user documentation • Evaluation/maintenance stages can result in revisiting the design stage to restart cycle/redevelop the product • Documentation from each stage is used to evaluate outcomes/deliverables against initial requirements.	**6**

Question	Answer	Marks
10	*Discuss: write about issue(s) or topic(s) in depth in a structured way* **Eight from, e.g.:** *Positive impacts:* • CAT can increase the speed of translation so that the documents/ research is … • … available faster for reference by the scientist • Translation is more consistent (compared to humans) because phrases/terms have already been translated (in previous documents) … • … so the information is more reliable • Document format becomes irrelevant so can be viewed/used in different software/applications/computer systems … • … so scientists can access it more readily • Technical terms are translated correctly more often as these are stored in databases … • … so scientists can be assured that they are being used correctly/in correct context • Documents can be (quickly/easily) shared amongst these with different languages … • … increases collaboration *Negative impacts:* • Contextual errors can occur when translating new research material … • … so it may not be fully understood by scientist/not make sense/can create errors in new research • All meanings/full connotations of terms may not be translated correctly … • … leading to misunderstanding/incomprehensibility of phrases/loss of usefulness of document/research • Localisations/dialects may not be (fully) translated … • … so some phrases may be misunderstood/incorrectly translated/rendered less useful/less meaningful • Repeated translations can result in loss of accuracy/inaccurate translations • Security can be compromised when documents phrases/content is stored/used in machine translation systems/compared against databases … • … leading to loss of confidentiality/economic loss/loss in lead/attribution/credit in research. ***Max 6 marks if bullets/list of points.*** ***Must be at least two positive and at least two negative impacts for full marks.***	8