Cambridge International AS & A Level

INFORMATION TECHNOLOGY **9626/32**

Paper 3 Advanced Theory **May/June 2021**

MARK SCHEME

Maximum Mark: 90

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.

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This document consists of **12** 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	**Six** from e.g.: Effective connection distance is limited Obstacles in between WAP and device can (further) reduce connectivity Affected by positioning of WAP/height above ground/type of antenna in use Affected by the presence of other wireless devices/mobile (cell) phones transmitting on the same/close frequencies Weather conditions affect the transmission of wireless signals Power output of device affects useable distance from WAP Lower bandwidth available compared to wired connections/wireless max 350Mbits/s but typically only 25Mbits/s c.f. wired at 1000Mbit/s Several devices sharing a WAP increases network congestion Security is based on encryption, which adds an overhead to TCP/IP packets/ processing Number of devices that can connect to a WAP is limited <u>Unsecured</u> WAP allows access to anyone within range/WAP connection is <u>less secure</u> than wired connections.	6

Question	Answer	Marks
2	**Five** from e.g. Use of built-in magnifier tools Use of implantable miniature automatic 'telescopes' to improve vision (in macular degeneration sufferers) to enlarge image over the retina Use of telescopic/automatic contact lenses to improve vision (in macular degeneration sufferers) Use of LED/sensor to monitor focus on retina Use of system to divert focus to other parts of retina Use of retinal prostheses to enhance vision when light sensitive cells in retina degenerate/are lost Use of artificial retina with computer chips on silicon implanted into retinal position Use of smart glasses using screens in front of eyes Vision-enhancing algorithms to produce higher definition 'video' Use of virtual reality/augmented reality systems/head-sets/goggles to immerse person in real world Dialogue user interfaces to control devices.	5

Question	Answer	Marks
3	**Six** from: Loss of (credit card) data of/associated with account/account number/details/ name of card holder/card number/expiration date/verification/card verification value, CVV code Merchant could use card details fraudulently Cardholder/Ferdinand is unaware of loss/does not report loss to the bank/card issuer 'Cardholder not present' transactions can be made using the details Unexpected repeat billing/merchant makes repeated charges to card Charges made to check account validity are not cancelled by merchant when full payment is made Directed to fake websites resulting in loss of data/description of pharming Fraud as a result/consequence of pharming Fake requests for personal data/description of phishing Fraud as a result/consequence of phishing Bank Identification number (BIN) attack/auto generation of range of similar/ sequential card numbers may allow charges to valid account numbers Ferdinand has used his credit card while connected to an unencrypted WiFi network, and it has been accessed by an unauthorised third party Physical theft of (credit) card occurs/has occurred Credit card details are stored by merchants and could be stolen, resulting in financial loss (to holder).	6

Question	Answer	Marks
4	*Evaluate: Discuss the importance of, weigh up the advantages and disadvantages, judge the effectiveness, weigh up your opinions.* **Six** from: *Advantages:* Encryption requires an encryption key so that stolen data cannot be understood by unauthorised persons/without encryption key so it stops data breaches Data can be sent via unsecured media as the data is itself secure/data is secure so it does not matter how it is stored/transmitted Data remains confidential because it can only be read by the intended recipient (who has the key to opening the data) and not by e.g. system administrators/other users Data security is separate/independent from the security of the device on which it is stored so it is not necessary to secure the device *Disadvantages:* Administration of encryption keys is time consuming for user so it may not always be done/used/may prevent other task If the encryption key is lost, then the data associated with it is lost because the data is not understandable/is unrecoverable Can be expensive in terms of systems to maintain encryption because systems must have the capacity and capability for tasks so need more processing power Requires more time/processing to exchange data because of the encryption/ decryption process Can be difficult to maintain compatibility with all applications/programs in use by company/user so requires more maintenance/updates IT departments may find encryption too complex to manage/administer so require specialised staff/training (Symmetric) encryption requires sharing of keys which can be insecure so needs time/effort/processing to carry out Symmetric keys have to distributed/generated every time so needs more processing power/increases time to prepare data. *Max 5 if all advantages or disadvantages.* *Must be a proper evaluation to obtain full marks.* *Max 4 marks if bullets/list of points.*	6

Question	Answer	Marks
5	**Six** from: *Benefits:* Funds are transferred more quickly than with other methods/wire transfer History of transactions/particulars of every transaction is recorded in detail Risk of loss/robbery of funds is reduced compared to other methods/no need to carry physical money Risk of fraud is reduced compared to other methods Lower transaction fees compared to other (non-cash) methods/credit cards/cheques User-friendly/easy to use/needs little training Widely accepted/used by many people/by public/companies Transactions can be carried out at any time Transactions can be carried out with ease/quicker across international borders/anywhere with internet connection No need to travel to purchase goods/enables eBusiness/no need to carry money around Automatic payments can be made without need for reminders/intervention by user *Drawbacks:* Amount of transaction may be limited by policy/funds available/laws regarding payment (across international borders) Risk of cyber-crime/hacking Lack of anonymity so subject to surveillance by authorities Lack of compatibility between e-payment systems may prevent transfer of funds Loss of power/system failure means no transfers can occur Fear/danger of loss of stored financial data resulting in fraud/financial loss Requires internet access/suitable devices. *Must be at least 1 of each for full marks.*	6

Question	Answer	Marks
6	**Eight** from: *Role:* Connects devices/routers/hubs/other switches together Allows connection of more than 1/extra devices into a single cable connection to another device Receive/process (IP) packets/frames from devices e.g. a laptop Receive/process (IP) packets/frames from intermediary devices/hub/switch Forward (IP) packets/frames to destination device. *Operation:* Operates at data link/layer 2/layer associated with interface of device/type of medium in use Creates table in memory/Content Addressable Memory/CAM of MAC addresses and ports of received network frames Examines/uses MAC address (not IP address) in Ethernet frame Compares with stored table of MAC addresses/ports Sends frame to known port/address Unknown frames are sent to all ports/addresses.	8

Question	Answer	Marks
7(a)	**Six** from: Localisation/adaptation of software application to local market/language of country Amend source code directly so that parameters and configurations are set for the target country Translation tools use parsers and filters to detect translatable strings Use of translation memory systems to reuse previous translations Quality assurance/check tools are built-in and used to check spelling/grammar Translate menus/instructions into local language Recognition of words/phrases that cannot be directly translated and application of appropriate synonym Adjust/translate (binary/support) files so that text is translated to local language Adjust/amend cultural background of software to local norms Adjust colours to local norms Adjust units of measurement to local usage Adjust (any) currency usage to local currency.	6
7(b)	**Two** from: Improves the consistency of text/terminology translation Reduces the time taken for translation by recycling any previous/recurring translations Improves the performance of human translators involved in the production of the game Reduces the need for human input.	2
7(c)	**One** from: Contextual errors may occur because computers cannot yet be programmed to fully understand the context of how a certain word or phrase is being used Localisation may not be perfect/accurate resulting in the target audience not understanding e.g. the instructions/meaning of clues/hints Security/confidentiality of game code may be compromised as translations may be stored the translation memory and become available to others.	1

Question	Answer	Marks
8(a)	**Three** from: Reader/scanning device to record the biometric factor being authenticated Software for converting the scanned biometric data into a standardised digital format Software for comparing the match points of the observed data with stored data Database to securely store biometric data for comparison Database to store student account data A payment system to transfer funds/debit account/credit school.	3

Question	Answer	Marks
8(b)	**Six** from: Student registers/is registered for a biometric program at the school by presenting valid identification Student scans (index) finger/iris/face/biometric parameter (using (school's) appropriate scanner/reader). The school's (finger) scanner/reader encrypts multiple point-to-point measurements of the fingerprint/iris/face/biometric parameter Student's biometric data and account information is stored in a (centralised) database. Student scans finger at the checkout with the school's electronic reader Software/reader compares the data from the new scan to the encrypted data in the database System locates the student in the database Checks that there is sufficient funds available Transaction approves/declined If approved, the funds are electronically transferred from the student's account to the merchant/school Receipt issued to student (if requested)/amount displayed on screen (to show cost)/indicates how much (money) has been spent/is left in account If declined, student is informed and notice printed/asked to retry.	**6**

Question	Answer	Marks
9(a)	**Three** from: Used when the requirements of the complete/whole system are clearly defined and understood Feedback from users can be early in the development process Some minor details can be allowed to/must evolve with time Allows (minor/small) additional/extra/required features to be added Builds on a basic/recognisable foundation Can divide final product into parts/modules Parts can be developed separately/combined at end Errors are easier to identify because testing and debugging can be done on each module Product must be on to the market/available to sell early New technology is being used Required skill set is not yet available/will be developed during project.	**3**
9(b)	**Three** from: To locate/discover errors in the logic/calculations/formulae (in the spreadsheet) To show errors in the logic/calculations/formulae (in the spreadsheet) To confirm that validation routines work as expected To confirm/verify/check that a given input/normal/extreme data produces the expected/correct result/output To check that the spreadsheet can deal with/respond to/reject/unusual/unexpected/abnormal inputs.	**3**

Question	Answer	Marks
10	*Analyse: explain the main points or effectiveness in detail, identify their main characteristics, examine closely.* **Eight** from: (Pilot implementation is) when a small group of users/area uses a system before the system is fully introduced (to the whole region) Testing can be carried out before full implementation so errors/problems can be corrected at early stage Feedback can be obtained from real users and used to improve other/rest of implementation/installation Users can be trained on the pilot system/in local area before it is rolled out to all the areas Installation can be refined/revised at an early stage New methods/materials/techniques can be tried out without fully installing over whole area Successful methods/techniques can be 'scaled up' for the full installation Spreads the cost of installation/allows budgets to be determined/approved Risks can be managed easier/better as only one area is affected/can monitor before full implementation Results from small-scale installation may not successfully scale-up/be applicable to full installation Pilot may take a long time to complete/produce results so overall project/installation may be delayed Areas not chosen for the pilot installation may become disillusioned/resentful Choice of this method may indicate lack of confidence in whole installation/ability to complete whole installation. *Must be a proper analysis to obtain full marks.* *Must have expansions to be a proper analysis.* *Max 6 marks if bullets/list of points/characteristic.*	8

Question	Answer	Marks
11	*Evaluate: Discuss the importance of, weigh up the advantages and disadvantages, judge the effectiveness, weigh up your opinions.* **Six** from e.g.: *Advantages:* Use of passwords/PINs/login details/biometrics restricts access to computer system/folders/files Use of dongles/tokens/USB devices that must be attached/inserted to create one-time-passwords (OTP) prevent anyone other than carrier/owner from accessing data/device Tokens do not need network connection/OTP cannot be intercepted Physical barriers e.g. tethers on the equipment/locks on doors are cheap to install/use to impede intruders Use of security cameras/recording can cover wide area and provide deterrence/evidence of unauthorised entry Encryption protects contents of data from being understood but does not protect the data from being read/stolen/deleted Backup can restore stolen/deleted/damaged data but does not protect the original data from being damaged/deleted *Disadvantages:* Passwords can be forgotten, resulting in no access to system/data Sharing of passwords can result in unwanted access/loss/damage to system folders/files Tokens have limited number of uses for access Tokens cannot be used on other systems so have limited use/are effective in restricting access to other data/systems Keys can be pre-installed on tokens so manufacturers/supplier knows the keys Battery life of tokens can be limited Physical barriers e.g. tethers can be broken/removed/require constant attention/circumvented to be secure Security cameras must be watched all the time/watchers may be distracted. Must be at least one of each for full marks. 1 mark available for valid opinion/conclusion.	6

Question	Answer	Marks
12	*Analyse: explain the main points or effectiveness in detail, identify their main characteristics, examine closely.* **Six** from: *Max two from:* Bitmaps are made up of pixels Bitmap files are created from existing pixel data stored in an array in memory Thumbnails contain links to larger versions of same file/image memory Thumbnails are smaller versions (of same image so they display quickly) *Max six from:* Pixel values may be modified individually/large groups by software tools so can be quicker/easier/more effective than modifying small parts of vector images Photographic quality/range of contrast/brightness is achieved by increasing the data about each pixel/number of pixels whereas with vector images whole areas must be altered Files can be reduced in size using data compression methods allowing more to be stored on a device but this reduces/can reduce quality of image Bitmap files translate well/easily to dot-format/raster-based output devices/CRTs/printers Files can be very large especially if the image contains a large number of colours so take a long time to display/download/need progressive display techniques so viewer can see them quickly Data compression/decompression can introduce artefacts that 'spoil' the photographs Data compression/decompression can slow down the reading/rendering process and delay any display Bitmaps do not scale without the introduction of artefacts/pixellation/loss of data/resolution so can spoil the image Bitmaps can support transparency so can be used on any background. *Must be a proper analysis to obtain full marks.* *Must have expansions to be a proper analysis.* *Max 4 marks if bullets/list of points.*	6

Question	Answer	Marks
13	**Six** from: Infrared uses wavelengths shorter/higher frequencies than radio waves/uses 20 to 400 THz Bluetooth uses a radio frequency/2.4 GHz Infrared is less susceptible to interference from other devices Bluetooth can use multiple channels/spread spectrum technology Infra-red requires line of sight between devices/blocked by walls and objects/ Bluetooth signals can travel through walls/objects Infra-red is limited to c.10 m (depending on power of infrared source)/ Bluetooth signals can travel c. 20 m/further than infrared Infrared devices can only be used with one other device/Bluetooth devices can be paired with/used with up to 8 other devices Infrared (usually) requires use of proprietary/matching equipment/Bluetooth devices can (usually) be paired with any other Bluetooth device Bluetooth has much higher bandwidth than infra-red so can carry more data/Infra-red has limited bandwidth/limited to on/off pulses of data Bluetooth can be used to set up a personal area network(PAN)/peer-to-peer network but infra-red does not allow this.	**6**

Question	Answer	Marks
14(a)	A (contiguous) sequence of bits sent/received (serially) over a communications network.	**1**
14(b)	**Two** from: Real-time is from a live/happening now source/camera Real-time stream cannot be accessed at later date. On demand is from a pre-recorded video/file On demand can be streamed at any time/repeatedly.	**2**