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INFORMATION TECHNOLOGY **9626/33**

Paper 3 Advanced Theory **October/November 2024**

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.

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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.

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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.

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Mark scheme abbreviations

/ separates alternative words / phrases within a marking point
// separates alternative answers within a marking point
underline actual word given must be used by candidate (grammatical variants accepted)
max indicates the maximum number of marks that can be awarded
( ) the word / phrase in brackets is not required, but sets the context

Note: No marks are awarded for using brand names of software packages or hardware.

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Question	Answer	Marks
1(a)	(An object representing) a sequence of (any) characters.	**1**
1(b)	**One** from: • Enclosing the characters inside quotes • Use of keyword `newString` to create a string object.	**1**
1(c)(i)	**Two** from: • Use the + operator to join the two variables // use of `concat()` • Use additional + to place a space inside speech marks / quotes / inverted commas / `" "` in between the two variables • Declare variable `text3` • Ensure statement defining the new variable / `text3` is placed after the assigning of `text1` and `text2` • Ensure the statement terminates in a semi-colon / ; Max **one** for example: • `text3 = text1 + " " + text2;` OR: use of `concat()` method i.e.: • `text3 = text1.concat(" ", text2);`	**2**

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Question	Answer	Marks

1(c)(ii)	**Two** from:
	
	There are three methods for extracting a part of a string:
	
	Marks for:
	• identifying the keyword of the method
	• mark for describing that a start point and a corresponding end point/length is used to extract the characters
	
	One method, max **two** per method from:
	
	The methods are:
	• `use keyword`
	• `slice(start, end) // slice()`
	• `substring(start, end) // substring()`
	• `substr(start, length) // substr()`
	
	Allow other methods but syntax must be all correct.
		2

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Question	Answer	Marks
2	**Six** from: Max **one** for naming at least **two** from: • Abnormal / invalid / erroneous values • Invalid data format • Normal / valid data • Extreme / boundary data Max **six** from: • To see what error messages are produced • To test how system deals with unexpected data • To test how the system reacts to valid data / compare with expected results • Null data is used to test how the system reacts to / deals with / processes blank fields • Abnormal / invalid / erroneous values of data is used to test how the system deals with data that is unreasonable / invalid • Invalid data format is used to test how the system deals with / processes data that is not in the expected format • Normal / valid data to test how the system reacts / deals with / processes normal / expected data • Extreme / boundary data to test how the system reacts / deals with / processes data at the boundaries of acceptable data • Live / realistic data to test how the system reacts / deals with / processes actual data from a working system.	**6**

Question	Answer	Marks
3(a)	**One** from: • Degree of pixel intensity • Sum of intensity of red, green and blue pixels (in an image) divided by 3/average of all pixel / colour intensities • Is a relative / perceived quality of the intensity of an image / pixel • Degree of luminosity / light levels • Amount of energy output from a source compared background / another source.	**1**
3(b)	**One** from: • The difference between maximum and minimum intensity (of a pixel) / brightest and darkest pixels • Low contrast looks faded / details are hardly perceptible and high-contrast images are sharp / details are easy to perceive.	**1**

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Question	Answer	Marks
3(c)	**Two** from: • (Adjustment of) intensities of colours to render neutral / overall / other colours correctly • Primary colours / red, green and blue colours adjusted • White / grey balance used to adjust for different colour casts / artefacts caused by light conditions in (still / video) photography.	**2**
3(d)	**Two** from: • (Spots of) light on object when illuminated • With reference to the light source • Used for adjusting overall light levels • Give visual clues (1st) – of shape (of object) (1) – of location (of object) (1).	**2**

Question	Answer	Marks
4	**Six** from: • CMS used to ensure that different application / devices / operating systems display colours consistently / predictably • Colour is dependent on the device / monitor displaying the colour(s) • Scanner can produce image with RGB / colour values different from those used by a monitor • Different devices require different colour values sent to them to display the same colours • Colour values need to be transformed / adjusted / calibrated by algorithms / tables / software • Using colour profiles / mathematical representation of the 'colour space' of a device (1) not all transformations work for every device in same way (1) • CMS provide choice / selection of tools / algorithms / software to make the transformations • CMS allows re-use of graphics for different media / online and paper (with consistent / predictable colours) • CMS provides automatic / removes need for manual adjustment of colours when using different media / online and paper.	**6**

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Question	Answer	Marks
5	**Six** from e.g.: • The large software project is broken down into small development cycles called sprints, of e.g. two to four weeks (1) resulting in fast development of usable / working prototype (1) • Customer / client / user gets to see / use a working / minimal featured prototype (1) so can give feedback before the development is advanced / next app features are added (1) • Clear and achievable goals in sprints produce greater motivation / sense of achievement of developer / team workers (1) resulting in a better product (1) • Budgets for short-term / fixed goals / sprints are more predictable (1) resulting in greater control of finances (1) • Increased customer / client / user satisfaction (1) • due to more involvement during development (1) • Faster return-on-investment (ROI) for stakeholders (1st) – due to quicker / earlier (c.f. other methods) releases of app prototypes / iterations (1) • App can be adapted / amended / have features added / removed / improved more easily / quickly / with less work (1st) – in accordance with customer / client / user feedback (1) • App quality is improved (1st) – due to (more) frequent reviews (after each sprint) (1) • Collaboration between team workers / personnel is improved (1st) – due to short development sprints / not having to wait for major decisions to be made / focus on one aspect of app (1)	**6**

Question	Answer	Marks
6(a)	**Two** from e.g.: • Digital TV format with aspect ratio 16:9/widescreen • Horizontal screen resolution of c.4000 (4K UHD)/8000 (8K UHD) pixels • Increased (v. HD) dynamic range/colour space/gamut • Incorporates surround sound/22.1 audio system.	**2**

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Question	Answer	Marks
6(b)	**Four** from e.g.: • Increased carbon emissions c.f. SD screens during production • Increase in production of (potent) 'greenhouse gases' / nitrogen trifluoride during manufacture of flat screen / OLED / LED / LCD screens • Increase in redundant / discarded devices / TV sets / routers (as users upgrade) into landfill • Increase in pollution levels from discarded / leaching of components / chemicals from discarded devices / TVs / routers • Increase in power demand by TV set / communications systems during use • Increase in carbon emissions (up to x10 c.f. SD) during when used for streaming video in HD / UHD • Increase in environmental disturbance (e.g. more construction) to provide necessary infrastructure • Increase in bandwidth required for UHD (note for STM (rec. min bandwidth is 22 to 23 Mbit/s) so need more power / replacement fibre/routers.	**4**

Question	Answer	Marks
7(a)(i)	(To represent the) <u>output of multiple</u> documents.	**1**
7(a)(ii)	(To represent a) magnetic disk file.	**1**

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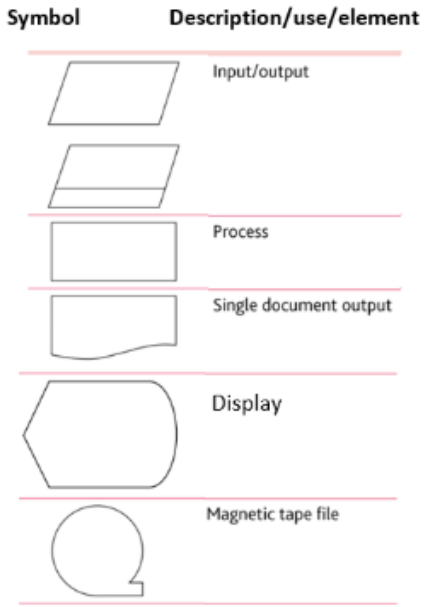
Question	Answer	Marks
7(b)	**One** symbol from: **Two** marks awarded for: • drawing of system flowchart symbol 1 mark • description of drawn symbol 1 mark Description must tally with drawing for second mark. *These are from the syllabus:*  Allow other valid alternative symbols.	**2**

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Question	Answer	Marks
8	*Command word: Discuss: write about issue(s) or topic(s) in depth in a structured way.* **Eight** from e.g.: • Data mining allows businesses to collect reliable information for use in marketing research (1) to determine the products that interest customers (1) and then make those products available (1) • Helps businesses find patterns in their data (1) to evaluate their own policies and procedures for effectiveness (1) • Can be used to find correlations between products/consumers/suppliers (1) to help identify trends that might not have been previously identified before (1) to help make more accurate predictions/target marketing (1) to help make informed decisions/better decision-making based on trends within large quantities of data (1) • Can be used to detect fraud/risks (1) that may not be apparent through traditional data analysis (1) • Can be used to discover trends/patterns in customer buying habits (1) which can be used to suggest products/advertise/target products at specific demographics (1) • Data mining tools are complex/difficult to use (1) so specialised staff are required/needs to be outsourced (1) which increases costs/can be expensive (1) • Inaccurate information may be produced (1) where data is incomplete/from inaccurate sources (1) resulting in inaccurate predictions/poor decisions being made (1) • Privacy of individuals cannot be guaranteed/data may not be completely anonymised (1) so personal/private data of individuals may be exposed/individuals may be identified (1) • Accuracy/effectiveness dependent on size of databases (1) so businesses have to share data with others (1) • Can be expensive and costs may exceed the benefits/increased profits for some/small businesses.	**8**

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Question	Answer	Marks
9	**Six** from e.g.: • Requires extensive research into target audiences which increases costs • Targeting wrong audience reduces sales / lowers brand awareness • Requires uses of different / numerous social media platforms with customised advertising to target different / reach all audiences which can increase costs • Results of marketing need to be followed up / analysed to justify costs of social media marketing campaigns and this can be costly • Can be costly for small businesses due to need to advertise on multiple platforms / ROI can be low • Negative feedback can spread quickly which can reduce sales / cause resistance to product • Negative feedback cannot easily be removed / stays visible to all customers / is difficult to refute • Lack of engagement / failure to respond can lead to negative feedback that damages company reputation • Poor / inadequate / insensitive / inappropriate response can be seen by all and damage company image • Security of information depends on social media platform policies / actions / company data may not be secure • Company data / information may be used / sold by the social media platforms • Depends on availability of mobile communications / internet access / can only reach those with access.	**6**

Question	Answer	Marks
10(a)	**Two** from: • Computer generated imagery // images that are created by computers • For use in movies / TV programmes / commercials / games / simulators / art / printed media • 2D / 3D objects that can be animated / appear to move • Text / figures / objects / spaces / environments / background in which action is set • Create special effects / SFX.	**2**
10(b)(i)	**Two** from: • Manually painting images onto celluloid sheets • (Painting many images) each with a small amount of movement of objects • Photographing each individual cel on to film / video • Displaying each cel in sequence to produce illusion of movement.	**2**

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Question	Answer	Marks
10(b)(ii)	Two from: • Can reduce costs because (computer software / application has) replaced skilled / large teams of animators • (Computer software / application) can create sequences / complete animations in shorter time than hand-drawing • (Computer software / application) uses key frames can create sequences / complete animations with greater accuracy / realism of movements • Animations are always / already digital so (digital) photography is not required removing errors / inconsistences in images / cels.	**2**

Question	Answer	Marks
11(a)	**Two** from: Max **one** from: *Data manipulation:* • Changes appearance / format / layout but not the factual content of the data • Data manipulation is where logic / calculation is applied to give new data / information / results Max **one** from: *Data modification:* • Changes the factual content of (saved / stored) data / changed to have a different value • Data that is manipulated and then stored in the same place.	**2**

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Question	Answer	Marks
11(b)	*Command word: Evaluate judge or calculate the quality, importance, amount, or value of something.* **Eight** from: Max **six** from: *Biometrics:* • Use of biometrics / biometric authentication (1) for identification of user / access control (1) so that user can be uniquely identified (1) • Use of unique characteristics of individual such as iris patterns, fingerprints, face / hand geometry, movement (e.g. movement of mouse) stored as digital data (1) which can be compared with user during identification (1), but these must be measurable and easy / quick to check (1) • (Biometrics) are difficult to copy / forge / assign to others (1) so provide a high level of security (1) cannot be assigned to / used by others (1) • (Use of biometrics) can invade individual privacy (1) so may not be welcome in workplace / meet with resistance from public (1) Max **six** from: *Encryption:* • Use of encryption (1) scrambles data using a secret key / encryption code (1) so that it cannot be understood (1) so provides privacy / secrecy for the data (1) • Data can only be understood by those who have the key to decrypt the data (1) so can restrict the data to only those authorised to have access to it (1) • Encryption does not prevent data from being deleted (1) so data can still be lost (1) Max **six** from: *Access rights / permissions:* • Use of access rights / permissions (1) to control who has the right to access file (1) and can be at user level / individual users (1) so unauthorised users can be refused access to file (1) • Use of access control lists on individual files (1) specify which users / system resources can access file (1) • Can restrict access to specific devices (1) preventing unauthorised users from using own devices (1) Max **six** from: *Anti-malware / anti-virus software:* • Use of anti-malware / anti-virus software (1) to scan in real-time incoming files (1) to prevent installation of malware (1) that may delete / amend / modify / steal data / files (1) • Can scan stored files (1) to check for / remove malware (1) that may delete / amend / modify / steal data / files (1) • Must be regularly updated (1) to protect against evolving / new threats (1)	**8**

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Question	Answer	Marks
11(b)	Max **six** from: *Anti-spyware software:* • Use of anti-spyware software (1) to scan activities in real-time (1) to block / remove spyware to prevent data being collected for / sent to third parties / unauthorised users (1) • Monitor (in real-time) network traffic (1) for indications / signs of spyware activity (1) to prevent data being stolen / accessed by unauthorised users (1) • Must be regularly updated (1) to protect against evolving / new threats from spyware (1) **one** mark is available for a valid conclusion / judgement.	

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