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MARKSCHEME

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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Higher Level

Paper 2

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Examiners should be aware that in some cases, candidates may take a different approach, which if appropriate should be rewarded. If in doubt check with your Team Leader.

In the case of an "identify" question read all answers and mark positively up to the maximum marks. Disregard incorrect answers. In the case of a "describe" question, which asks for a certain number of facts *e.g.* "describe two kinds", mark the **first two** correct answers. This could include two descriptions, one description and one identification, or two identifications.

"ITGS terminology refers to both the IT technical terminology and the terminology related to social and ethical impacts."

Area of Impact: Business and Employment / Health

**1.	(a)	Define the term *VPN*.**					*[2 marks]*

Answers may include:
● Virtual Private Network
● connects an employee at home to the company server
● uses a public Internet connection
● creates a secure connection / encryption is used to secure data from unauthorized access / passwords are used to secure the VPN.

Award [1 mark] for any of the above points up to a maximum of [2 marks].

**(b)	People with limited hand movements and those who are visually impaired may use voice recognition software to input data.**

Describe the process involved when the voice recognition software converts a spoken sentence to text on the screen.					*[4 marks]*

Answers may include:
● the user "trains" the software to recognize their particular speech pattern
● the user speaks into a microphone
● the speech (analogue) is converted to digital format (by the sound card)/an analogue to digital converter is used
● the software compares the input words with words in its inbuilt dictionary
● the best match is retrieved
● the computer may read back the text it has written (to check accuracy)
● the text is displayed on the screen
● the software takes into account the context of the words to determine the most likely output
● if words are not understood the user has the chance to add words to the dictionary.

Award [1 mark] for any four steps up to a maximum of [4 marks].

(c) **Explain how hardware and software can be adapted to assist users with *one* particular disability. Do not include voice recognition software.**   *[4 marks]*

N.B. candidates may treat hardware and software separately or suggest a device which combines hardware and software.

Answers may include:
Hardware (separate)
- mobility impairment – sticks worn on the head to control the cursor
- mobility impairment – electronic pointing devices enable cursor control through eye movements
- visual impairment – Braille printer
- visual impairment – Braille keyboard
- tongue-operated technology – sensors places inside the mouth transmit signals to a receiver and control the cursor.

Software (separate)
- mobility impairment – on-screen keyboards allow the user to select keys with a mouse, hand or joystick
- visual impairment – screen reader software to translate text and graphics to speech
- visual impairment – screen adjustments to software *e.g.* zoom, contrast controls
- motor disability – predictive text software 'guesses' the words and minimises the amount of typing.

Hardware/software (combined)
- dyslexia – an OCR scanning pen scans text to computer and screen-reading software translates the text to speech.

[1 mark]
A limited response that indicates very little understanding of the topic or the disability is not clear.

[2–3 marks]
A reasonable description of how hardware and software can be adapted, although the answer may be unbalanced and lack appropriate reasoning at the bottom end of the band.

[4 marks]
A clear, detailed and balanced explanation of both hardware and software giving reasons why they assist with the particular disability.

Do not award marks for voice recognition software. Do not award marks for solutions that do not relate to computer use.

(d) **Evaluate the use of adaptive technologies for both employers and disabled employees.** *[10 marks]*

Answers may include:
Employer benefits
- employers have access to skills/talents of disabled people (including disabled who cannot leave their homes)
- enhances company's public image
- employers feel they are contributing to society
- disabled people tend to be loyal and conscientious workers
- increased productivity of disabled workers.

Employer considerations
- there may be additional costs for special IT equipment/workstations
- are employers able to obtain government assistance to pay for specialized equipment?
- adaptive technologies may involve extra complications to hardware/cutting edge software may have more reliability issues than general hardware/software.

Disabled benefits
- sense of self-worth
- economic benefits from a salary rather than disability allowance
- opportunity to develop skills and careers
- social benefits of working with other people.

Disabled considerations
- will the employee have to contribute towards the cost of these technologies?
- time/difficulty to learn how to use the hardware/software
- negative reactions from co-workers who may perceive they are getting special treatment.

In part (d) of this question it is acceptable if there is more emphasis on the terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information sheet on page 16.

Area of Impact: Science and the Environment

2. (a) **Define the following terms:**

(i) *terabyte*   *[1 mark]*

Answers may include:
- a measure of computer data storage capacity and is one thousand billion (1,099,511,627,776) bytes
- 1024 Gigabytes, (accept 1000 Gigabytes too)
- 1,099,511,627,776 bytes (or approximately one trillion bytes)
- 2 to the 40th power (1,099,511,627,776) bytes.

Award [1 mark] for any of the above.

(ii) *GPS.*   *[1 mark]*

Answers may include:
- Global Positioning System
- a receiver that calculates its absolute geographic position by determining its relative position to a set of at least three satellites
- a navigational system involving satellites and computers that can determine the latitude and longitude of a receiver on Earth.

Award [1 mark] for any of the above.

(b) **Describe the steps involved in capturing and storing the satellite image data that will be used to create the maps in *Google Earth*.** *[4 marks]*

Answers may include:
Capturing
- satellite receives position for new picture
- satellite sets speed and course and detects when it is in the position
- telescope in satellite focuses on the objective
- satellite takes the picture of one area or several pictures to capture a strip/with high resolution camera
- pictures of same area may be taken by different satellites (or cameras)
- a multi-lens camera may be used to create 3D views
- pictures are taken from different angles to create a 3D view
- sensors in satellite "camera" capture temperature (or electromagnetic radiation) in a strip
- analogue data is converted into digital form.

Preparing
- pictures of several strips are combined to form a mosaic
- data is sent to receiving computer on Earth.

Storing
- analogue data from analogue cameras are converted to digital form
- data is stored in a database
- data is stored in matrix form to create a larger image
- images are organized/sorted according to location.

Reference: http://qanda.encyclopedia.com/question/topographic-maps-created-aerial-and-satellite-photographs-78979.html

Award [1 mark] for any four steps up to a maximum of [4 marks].

(c) **The mobile phone, shown below, has GPS functionality and** *Google Maps* **installed. Explain how GPS technology and mapping software work together to allow the operator to find the way to a destination, for example Los Angeles Airport.** *[4 marks]*

Answers may include:
GPS technology
- the phone analyses radio signals from satellites
- it calculates the distance to the satellites from the time the signal takes to arrive
- three satellites will calculate its exact location
- a mathematical process called trilateration is used
- GPS updates the user's position as he moves.

Mapping software
- mapping software uses the GPS coordinates to determine the location on the map
- a search function enables a search for the airport
- the software database provides directions from your position to your destination.

[1 mark]
A limited response that indicates very little understanding of the topic.

[2–3 marks]
A reasonable description of how GPS technology and mapping software work, although the answer may be unbalanced and not explain how they work together at the bottom end of the band.

[4 marks]
A clear, detailed and balanced explanation of both technologies clearly showing how they work together.

(d) **There has been some concern that the resolution of images in *Google Earth* is too high, allowing access to detailed information about people and buildings. Due to complaints the *Google Earth* designers have made some of the locations blurred or of low resolution. To what extent is this decision to alter the maps at users' requests acceptable?** *[10 marks]*

Answers may include:
Positives
- this prevents breaches in national security where terrorists could locate sensitive military installations
- businesses or individuals may feel more secure if unauthorized people cannot view details of their workplaces or homes.

Negatives
- high resolution can help locate weapons and blurring may prevent this
- blurring certain parts of a map could make it more interesting to would-be attackers
- concerns arise if the integrity of the data is at stake
- concerns about who decides what is distorted or possibly changed
- widespread changes would negate all the benefits of *Google Earth*.

In part (d) of this question it is acceptable if there is more emphasis on the terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information sheet on page 16.

Area of Impact: Education / Politics and Government

3.   (a)   **Identify *two* input devices, apart from a mouse and keyboard, that would be useful in telelearning.** *[2 marks]*

Answers may include:
- microphone
- web cam
- scanner.

Award [1 mark] for any of the above devices up to a maximum of [2 marks].

(b)   **Describe *one* way in which VoIP (Voice over Internet Protocol) and *one* way in which e-mails could be used as part of a telelearning program.** *[4 marks]*

Answers may include:
Uses of VoIP
- meet with the teacher and discuss progress in the course
- give an oral presentation to the teacher for assessment purposes
- ask the teacher questions/gain help with difficult topics
- have a lesson with a language teacher to practise pronunciation and get feedback
- hold mock job interviews where the teacher pretends to be a prospective employer and student/prisoner answers interview questions.

Uses of e-mails
- teachers can send course outlines/notes/reading lists/assignments to students
- students can send completed assignments to teachers for assessment purposes
- students can send questions to the teacher about class work/assessments.

Award [1 mark] for identifying a learning activity involving VoIP and [1 mark] for identifying a learning activity involving e-mail, up to a maximum of [2 marks]. Award [1 additional mark] for the description of each learning activity up to a maximum of [2 additional marks].

(c) **For security reasons the prison authorities do not want prisoners to have free access to the Internet and facilities such as e-mail.**

Explain how an Intranet could be used to give prisoners access to resources, yet still keep them isolated from the outside world. *[4 marks]*

Ways to access resources/people may include:
- resources (*e.g.* notes/videos/podcasts) are stored on the Intranet
- a home page on the Intranet has course outlines and resources for prisoners to download
- relevant web pages are mirrored on the Intranet
- Intranet pages incorporate forms allowing prisoners to contact their teachers
- a "drop-box" on the Intranet allowing prisoners to post their assignment work.

Means of isolating prisoners may include:
- email accounts are not given to prisoners and there is no access to Web mail
- the Intranet is on the prison's LAN which is not linked to the Internet
- prisoners do not have access to the Internet to search for web pages
- a firewall prevents unauthorized access from the outside – an accomplice can't emails to a prisoner or post files for prisoners to read
- the Intranet is on a separate server and prisoners have limited permissions/ access rights preventing changing of settings on the server
- all resources are uploaded by prison administrator/teacher as the Intranet runs on the prison's LAN.

[1 mark]
A limited response that indicates very little understanding of the topic.

[2–3 marks]
A reasonable description of how an Intranet could be used, although the answer may not explain how it isolates prisoners from the outside world at the bottom end of the band.

[4 marks]
A clear, detailed and balanced explanation of how an Intranet could be used explaining how it isolates prisoners from the outside world.

(d)   Evaluate the use of telelearning in prisons from the perspective of the government.   *[10 marks]*

Answers may include:
Benefits for the government
- upon release offenders will have a better chance of finding work instead of relying on social security benefits from the government
- rehabilitation is likely to be more successful and prisoners are less likely to return to crime. This improves crime prevention
- education can be more easily adapted to individual needs giving prisoners more satisfaction. This can result in prisoners who are happier and more cooperative with the administration
- cost benefits to the government as a teacher does not have to be on-site but can teach prisoners located in different places
- cost benefits as telelearning makes it easy for the teachers to share resources and materials
- government-employed instructors feel safer as they are not in the same room as prisoners
- the government can choose from a wider range of instructors who could be located overseas.

Consideration for the government
- cost considerations include the initial cost of the network and network management
- training considerations include the hiring or retraining of instructors who can use the telelearning materials
- training considerations include the need to teach prisoners basic IT concepts before they can undertake the courses
- if network security is weak a prisoner may make contact with someone outside/hacker might infiltrate the network jeopardising prison security.

N.B. answers must relate to the government.

In part (d) of this question it is acceptable if there is more emphasis on the terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information sheet on page 16.

Area of Impact: Arts, Entertainment and Leisure

4.   (a)   **Identify** *two* **IT features of a smart card.**   *[2 marks]*

- card with embedded microchip
- uses RFID technology
- when put into a reader it transfers data to a central computer
- it can be updated as information can be saved to it
- stores data/stores Cyclist_No.

Award [1 mark] for any of the above points up to a maximum of [2 marks].

(b)   **Describe the process to authenticate the cyclist when collecting a bike.**   *[4 marks]*

- the smart card is swiped in a card reader
- the cyclist types in a PIN
- when the cyclist types a PIN onto the keypad this is matched with the PIN stored in the chip on the smart card
- if the two numbers match the cyclist is authenticated/allocated a bike
- Cyclist_No on card is matched with Cyclist_No in table/user details are verified against the database.

Award [1 mark] for each point up to a maximum of [4 marks].

(c) **When a bike is rented, information about the bike and cyclist are sent to the central database. With reference to the diagram below, explain the benefits of using a relational database instead of a flat-file database.** *[4 marks]*

Answers may include:
- in the relational database data about bikes, cyclists and rentals is stored in separate, linked tables
- a bike can be rented many times (BIKES to RENTALS is one-to-many); a cyclist can rent many bikes (CYCLISTS to RENTALS is one-to-many)
- in the relational database data redundancy/unnecessary duplication of data is avoided as data is stored once
- in the relational database less storage space is needed as data about bikes and cyclists is stored once and only the key fields are added to RENTALS
- in a flat-file database more storage space is needed as cyclist details and bike details would need to be added for each rental
- in the relational database data entry/editing is easier as changes to bikes and cyclists are updated in one place and these changes are reflected across the linked tables
- in a flat-file database data entry/editing is time consuming/error prone as cyclist details and bike details would need to be added for each rental
- in the relational database errors are less likely to occur during data entry/editing as data is not repeated
- in a flat-file database errors can occur due to repeated data.

[1 mark]
A limited response that indicates very little understanding of the topic.

[2–3 marks]
A reasonable description of the benefits of using a relational database, although the answer may lack appropriate reasoning and not refer to the diagram at the lower end of the band.

[4 marks]
A clear, detailed and balanced explanation of how the relational database design solves the problems found in a flat-file database.

(d) **Discuss the privacy *and* security concerns that could arise through the use of a database to record bike rentals.** *[10 marks]*

Answers may include:
Privacy
- records could be kept showing dates, times and locations resulting in monitoring a cyclist's whereabouts
- as personal details (address, phone number) are stored cyclists could be concerned about unauthorized access to this information
- cyclist details could be sold to third parties – cyclists could receive unwanted advertisements, *e.g.* for bike accessories.

Security
- if the smart card is lost and the data is not encrypted the PIN could be obtained. A bike could be stolen using this PIN and the legitimate user would be billed
- credit card details are stored on the database so the cyclist could be concerned about protection of the database from unauthorized access. Theft of credit card details could result in a hacker using this information to purchase goods.
- if the database is not secure/not backed up details of rentals/bikes/cyclists could be lost.

N.B. answers must relate to data. For instance security of the bike if left outside a shop would not be acceptable.

In part (d) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 16.

Markband for all extended response questions

Opinion discuss, evaluate, justify, recommend and to what extent	**0**	*No knowledge or understanding of IT issues and concepts or use of ITGS terminology.*
	1–2 marks	*A brief and generalized response with very little knowledge and understanding of IT issues and concepts with very little use of ITGS terminology.*

	3–5 marks	*A response that may include opinions, conclusions and/or judgments that are no more than unsubstantiated statements.*
		The response will largely take the form of a description with a limited use of ITGS terminology and some knowledge and/or understanding of IT issues and/or concepts.
		If no reference is made to the information in the stimulus material, award up to **[3 marks].**
		    At the top end of this band the description is sustained.
		    At the bottom of the band a tendency towards fragmentary, common sense points with very little use of ITGS terminology.

	6–8 marks	*A response that demonstrates opinions, conclusions and/or judgments that have limited support.*
		The response is a competent analysis that uses ITGS terminology appropriately. If there is no reference to ITGS terminology the candidate cannot access this markband.
		There is evidence that the response is linked to the information in the stimulus material.
		    At the top end of the band the response is balanced, the response is explicitly linked to the information in the stimulus material and there may be an attempt to evaluate it in the form of largely unsubstantiated comments. There is also evidence of clear and coherent connections between the IT issues.
		    At the lower end of the band the response may lack depth, be unbalanced or tend to be descriptive. There may be also implicit links to the information in the stimulus.

	9–10 marks	*A detailed and balanced (at least one argument in favour and one against) response that demonstrates opinions, conclusions and/or judgments that are well supported and a clear understanding of the way IT facts and ideas are related.* *Thorough knowledge and understanding of IT issues and concepts.* *Appropriate use of ITGS terminology and application to specific situations throughout the response.* **If there is no reference to ITGS terminology candidates cannot access this markband.** *The response is explicitly linked to the information in the stimulus material* *At the bottom end of the band opinions, conclusions and/or judgment may be tentative.*

"ITGS terminology refers to both the IT technical terminology and the terminology related to social and ethical impacts."