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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Standard Level

Paper 2

22 pages

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 to the terminology related to social and ethical impacts."

SECTION A

Area of Impact: Business and Employment

1. (a) Identify *two* components of the thin client computer that are needed to enable it to be part of a network. ***[2 marks]***

Answers may include:
- Network Interface Card (NIC) is a card (circuit board) inserted into each network station (PC/workstation/server) to allow communication with other stations
- Ethernet card
- client software
- wireless network card.

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

(b) Describe *two* features of a client/server network. ***[4 marks]***

Answers may include:
- network in which one or more computers act as a server
- servers provide access to hardware, software and other resources on the network
- servers may provide a centralized storage area for data and programs.
- network where clients are the user machines that are connected to the server
- client computers may perform some or all of the application processing
- client computers request access to the server to use the hardware devices in the network
- client computers may request access to data and programs stored in the server
- servers can log the activities of users at client machines
- servers provide/manage access rights/access levels to users (to use/install/erase – data or programs).

For the first two descriptions.
*Award **[1 mark]** for identifying one feature of a client/server network and **[1 additional mark]** for the development of the initial feature identified.*

(c) Explain why a change to a thin-client approach could be beneficial for the call centre. ***[4 marks]***

Answers may include:

- Computers without hard disks and without having to do the processing should be cheaper. Providing a consultant with one of these computers should cost less than buying a conventional PC with hard disk and processing capabilities.
- Maintenance of computers in the different centers should be reduced as these new computers have no hard disk and therefore there is no need to install software.
- Data is secure: as all data and information is kept on the server these computers do not hold any company data, minimizing the risk of having data stolen. If the consultant takes the computer home and shares it with others this will not be possible as this computer may only be used to connect to the company.
- Portable: can be carried easily as they are made to be small and light allowing consultants to take them and work anywhere as long as they have access to the main server. This would allow consultants to be available at more times and continue with their office work being more productive.
- Thin-client computers are smaller because they have no hard disks therefore occupy less space, smaller furniture may be used and more people can work at the call centre.
- Thin-client computers have less parts and therefore less possibilities of hardware failure.
- Less energy consumption. Dedicated thin-client hardware has much lower energy consumption than typical thick-client PCs. This not only reduces energy costs but may mean that in some cases air-conditioning systems are not required or need not be upgraded which can be a significant cost saving and contribute to achieving energy saving targets.
- Lower noise. Thin-clients do not need internal fans to cool components so make no noise. This can create a more pleasant and productive working environment.

[1 mark]
A limited response that indicates very little understanding of what the benefits would be.

[2–3 marks]
A reasonable description of the benefits a thin client approach would bring to the call centre, although the answer may be unbalanced and lack appropriate reasoning at the bottom end of the band.

[4 marks]
A clear, detailed and precise description of the benefits of a thin client approach for the call centre with clear reasons of why it is better than any other system.

(d) Evaluate the usefulness of information collected from network monitoring systems to assess the productivity of employees. ***[10 marks]***

Answers may include:

- monitoring software can be used to record login and logout times to produce a report with total and average working times
- monitoring software can be used to track any Internet activity – identify pages visited, frequency, and any activity on the web site
- printer monitoring – software can track local and network printers, documents printed, number of copies, number of pages
- keyboard and mouse usage – this software can keep a record of computer activity
- recording of calls – a database of calls related to a database of clients/call center operator where all calls are recorded
- employers can identify less productive employees to train them, follow up some problems between staff, look after health problems or replace them.

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 22.

SECTION B

Area of Impact: Education

2. (a) Identify *two* ways data collected during the day may be entered into the laptop computer. ***[2 marks]***

Answers may include:

- typing data directly into the computer
- transferring data from data logging devices using infrared ports or cables
- transferring pictures from their digital cameras using cables or memory sticks
- transferring data from equipment using Bluetooth technology.

*Award **[1 mark]** for any one of the above ways identified up to a maximum of **[2 marks]**.*

(b) Students use a spreadsheet to show some of their results. Describe *two* ways a spreadsheet can be used to analyse the results obtained during their activities. ***[4 marks]***

Answers may include:

- Easy to create tables to show results – numbers and text can be given appropriate formats and be presented in an organized and clear way in table form.
- Different formulas/functions can be used to calculate/estimate results – spreadsheets can calculate with direct calculations from data entered in their cells or may use a function wizard to help find an appropriate function to present the desired results.
- Data can be represented as graphs – spreadsheets will provide different types of graphs to show numbers, and they are visually more effective than tables with numbers.
- Some of the data may be changed and using the formula provided the results might change ("what if…? scenarios") **–** students may make assumptions and try different values – the spreadsheet will calculate the results and students can compare them.
- Tables may be designed and formulas entered previously with the help of a teacher to make sure no mistakes are made **–** data can then be entered and changed and results will always follow the correct assumptions without calculation mistakes.
- Data may be transferred to other programs – data may then be included in printed reports, graphical presentations, or databases.

*Award **[1 mark]** for identifying each way up to **[2 marks]**.*

*Award **[1 mark]** for each relevant description of how the spreadsheet is used to analyse results up to **[2 marks]**.*

(c) Once students return from their trip they have to report back to their class showing their findings and what they have learned. Explain *one* advantage of using a word processor and *one* advantage of using presentation software to report about the work done during their field trip. ***[4 marks]***

Answers may include:

Word processor

- word processor can be used to type and print reports showing pictures and be displayed in panels around the school auditorium – audience can walk around and read the reports at their own pace, concentrating on what interests them most – printed material could be kept on display after the presentation day and other people may come and look at it
- printed reports can include extensive analysis of data produced by other programs
- word processed documents can be saved as PDF to be shared
- word processed documents can be distributed to the rest of the class and parents to inform about the results of the field trip
- reports of different students may be easily joined into one word processed document.

Presentation software

- a presentation program allows the presenter to guide the audience through points he/she thinks are most important
- a presentation program may include videos and sound (music or interviews/opinions)
- a presentation may be presented on a large screen and be very impressive for the audience
- may include links to web sites which may be used by the presenter if needed during the presentation.

[1 mark]

A limited response that indicates very little understanding of the topic.

[2–3 marks]

A reasonable description of an advantage of using a word processor and an advantage of using presentation software although the answer may lack appropriate reasoning at the bottom end of the band. ***[2 marks]*** *for one advantage for each identified or one advantage described.* ***[3 marks]*** *for two advantages (one for WP and one for Presentation software) described.*

[4 marks]

A clear, detailed explanation, giving reasons for both advantages.

(d) Taking school IT equipment such as laptops, digital computers, data logging devices and sensors to a field trip causes some concerns for the school and teachers. To what extent are these concerns outweighed by the educational advantages for the students? ***[10 marks]***

Answers may include:

Concerns

- school may have to invest and buy equipment that can be taken outside school for a week without leaving the students that stay in school without it
- school/teachers may be worried about the security of the equipment/risks of them being damaged
- school may have to negotiate a new insurance policy for equipment that may be expensive
- school may be worried that a group of students carrying expensive equipment may be target of theft *en route*
- teachers may have to change the way they work/ask for results and expect different types of results from students
- teachers may have to receive training in the use and (maybe) problem solving techniques on the use of the equipment
- teachers may have to prepare alternatives in case the equipment fails thus resulting in having to prepare double the amount of work.

Advantages

- students will not lose time writing in reports manually
- the risk of losing papers or handing in work with poor presentation will be lower as all results will be in the computer and not on paper
- the level of analysis/work may be different, allowing creative students to provide new ideas
- this can be used as an incentive for students to prepare material and provide results presented in several ways
- school may use this as a promotion/image tool to promote the school as a modern, IT teaching environment
- teachers will not have to prepare, print and carry individual booklets for students to fill in the answers
- teachers will not have to read through papers that may get dirty because of the weather, in bad handwriting, instead they will receive printed results or read them directly from the computer
- material may be almost ready to set up on the school web site and show to parents soon after they return
- the use of IT equipment may encourage some students to do the work because they like to use the equipment
- students will learn how to use IT equipment that may be useful later.

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 22.

Area of Impact: Health

3. (a) Identify *two* hardware features of a PDA. ***[2 marks]***

Answers may include:

Hardware
- touchscreens
- infrared port for communications/wireless communication device
- digital photo camera
- pen to use over the touch screen
- wireless receiver
- keyboard
- screen (no need to be touchscreen)
- memory cards / non-volatile flash memory.

*Award **[1 mark]** for each hardware feature identified up to a maximum of **[2 marks]**.*

(b) Describe *two* ways the new hospital wireless system can be protected from intrusion. ***[4 marks]***

Answers may include:
- use login and password to be able to access the system
- use firewalls to detect intruders
- encrypt files and e-mails
- hire an external company with specialists in intrusion detection systems to scan the system continuously
- biometrics – finger print/iris/retina/face recognition to identify user
- MAC address filtering
- Wi-Fi Protected Access (WPA)
- Wireless Equivalent Privacy (WEP)
- use an updated scanner for worms/virus/malware/spyware
- set up the operating system to automatically download updates/patches.

*Award **[1 mark]** for each way identified up to **[2 marks]**. Award **[1 mark]** for the relevant description up to **[2 marks]**.*

(c) Explain *one* advantage and *one* disadvantage of the introduction of these *BlackBerry*® devices in the hospital. ***[4 marks]***

Answers may include:

Advantages

- Doctors can reply to messages from the cafeteria, or even from another patient's room and responses would be fast instead of having to wait for the doctor to find a phone or walk to the ICU unit.
- By e-mailing messages to doctors there will always be a record of what was required/suggested. These records can be used to update patients files, to study events or to improve healthcare.
- These devices could be used to access patients' records to retrieve information or update information with recent events. This would be faster than asking for a file or walking to the record keeping office, or printing a sheet and waiting for it to be filed.
- They could also be used to access remote databases/hospital databases of medicines to look for specific instructions/side effects/similar drugs. This could improve the service, avoid having to waste time looking through paper files, or finding a computer to access the databases. Patients could receive the alternatives faster.
- They could be used to write prescriptions and send them to the pharmacy or to be printed for patient. Would provide a faster and more efficient system for patients and families and avoid mistakes when ideas are dictated to nurses and copied to paper.
- They may also be used as mobile phones by staff without having to look for one – they will have it available if the emergency does not allow for time to read/write an e-mail message.
- Wireless signal/link is not available from outside the hospital – bypassers should not be able to hang onto this wireless connection and access hospital information.

Disadvantages

- Expensive for hospitals – not only buying the devices but the installation of the wireless network.
- Logistically complicated for the hospital if doctors and nurses will need training to be able to use them.
- A policy needs to be well thought for insurance purposes in case the devices get lost.
- Some doctors may find the screen too small to write and communicate or work with files comfortably.
- May be a cause of distraction – doctors may use them to receive private communications/emails.
- Hospital and hospital personnel will not be able to work efficiently without them once their use has been established and they will need instant replacement if they break down.

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

[2–3 marks]
A reasonable description of one advantage and one disadvantage of the introduction of the devices although the answer may lack appropriate reasoning at the bottom end of the band. ***[2 marks]*** *for two advantages identified or one advantage described.* ***[3 marks]*** *for two advantages described.*

[4 marks]
A clear, detailed explanation giving reasons for the advantage and the disadvantage.

(d) Discuss the implications for the hospital if these *BlackBerry*® or similar devices were given to staff in all hospital areas. ***[10 marks]***

Answers may include:

- communication would be possible with all hospital staff no matter where they were located
- there would be no need to use the noisy paging system when calling for doctors or service providers
- some staff would have to receive training to be able to use these devices properly
- devices are small and can easily be stolen or get lost – policies of care and good use of equipment should be made available to all staff
- staff may feel that their privacy is being invaded if they are expected to answer every message they receive while they are in the hospital
- initial cost of acquiring devices for all the staff may be high
- there may be a fear of how long these devices will be useful before they need to be replaced with more modern devices
- installing a wireless network in the hospital implies installing greater security methods to avoid outsiders having access to hospital information systems.

Please ensure answers relate to the scenario and are not only about the use of normal/networked computers.

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 22.

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 22.

Area of Impact: Science and the Environment

5. (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 40^{th} 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 22.

Area of Impact: Politics and Government

6. (a) Identify *two* features of Optical Character Recognition. ***[2 marks]***

Answers may include:
- text/numbers are scanned/captured and stored in a computer
- images of text or numbers are translated into a form a computer can manipulate (*e.g.* ASCII)
- OCR software can read a scanned document/licence plate
- OCR software analyses the image and interprets the characters
- most OCR systems can recognize text in a variety of fonts and font sizes
- OCR will allow text to be edited after being translated.

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

(b) Describe *two* situations where the use of a wireless link between the camera and the network would not be possible. ***[4 marks]***

Answers may include:
- cameras installed in places where the antenna signal will be difficult to reach
- places where there is interference from other equipment (mobile phone antennas nearby, airports)
- risk of having hackers obtain the results of the surveillance
- if there is a power cut and network access points require electricity to function (or cameras are connected to the power supply).

*Award **[1 mark]** for identifying each situation up to **[2 marks]**.*
*Award **[1 mark]** for each relevant description of why the wireless link would not be possible up to **[2 marks]**.*

(c) Explain how this new expanded system will be able to detect unusual situations. ***[4 marks]***

Answers may include:

- an intelligent camera will be programmed to follow a pattern
- cameras will be programmed to detect a change in the expected pattern
- cameras may have microphones and be programmed to give an alert if noise is different from an accepted pattern
- cameras will be able to look and identify certain objects (guns, knives)
- comparing the patterns of flow of vehicles comparing to a database of information (changes in the patterns of traffic allow for changes in the frequency of traffic lights).

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

[2–3 marks]
A reasonable description of how the intelligent cameras work, although the answer may be unbalanced and lack appropriate reasoning at the bottom end of the band.

[4 marks]
A clear explanation of how the intelligent cameras work with clear reasons of how this enables it to detect unusual situations.

(d) To what extent are citizens' concerns about the expanded system outweighed by the benefits of it providing continuous information to the police department? ***[10 marks]***

Answers may include:

Advantages for the citizens

- traffic management control can be improved – this would provide less time used to travel in the city
- it may act as a deterrent so people will be better behaved in areas where cameras may be found
- it may be used as evidence if there is an incident and the cameras have kept images of the time/date required
- to capture pictures of faces and compare them with databases of criminals to find dangerous people to capture dangerous criminals when they come to the areas.

Risks of providing information

- information about whereabouts can be sold to third parties
- invasion of privacy as whereabouts and patterns of behaviour can be stored and known
- information can be obtained by intruders to the system if security measures are not appropriate
- information can be sold to third parties by corrupt members.

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 22.

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.*

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