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MARKSCHEME

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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Standard Level

Paper 2

21 pages

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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 to the terminology related to social and ethical impacts."

SECTION A

Area of impact: Business and employment

1.   **(a)   Identify** *two* **characteristics of a P2P network.**   *[2 marks]*

Answers may include:
- no server or client computers
- each computer is a node
- network used primarily for sharing files between the users.
- a direct link between two computers via an internet connection
- every computer acts as a client and a server.

Award [1 mark] for each characteristic up to a maximum of [2 marks].

(b)   Users of illegal P2P file sharing networks run the risk of downloading viruses. Describe *one* **indication that a computer has a virus and** *one* **preventative measure that a user can take to avoid viruses on their computer.**   *[4 marks]*

Answers may include:
Signs of a virus
- unusual actions on the computer screen or computer (*e.g.* message or image is displayed on the computer screen, unusual sound or music plays randomly)
- available memory is less than what should be available
- program or file is suddenly missing
- file problems (*e.g.* file size changes without explanation, file is corrupted)
- operating system runs much slower than usual
- warning appears from an anti-virus program.

Preventative measures
- no downloading of files from unknown sources
- no downloading of illegal files
- firewall
- using anti-virus software
- downloading current definitions for anti-virus software to keep it updated.

Award [1 mark] for one indication that a computer has a virus and award an additional [1 mark] for a description up to a maximum of [2 marks]. Award [1 mark] for one preventative measure that a user can take to avoid viruses on their computer and award an additional [1 mark] for a description up to a maximum of [2 marks].

(c)   **Explain *two* kinds of evidence that could have been presented in court to prove that copyrighted songs were offered by the woman using a P2P file sharing account.** *[4 marks]*

Answers may include:
- Internet service provider (ISP) provides the data log of the files transferred from the woman's computer using her TCP/IP number
- the police could have found evidence on the computer hard disk used by the woman indicating her P2P username and illegal music downloads
- evidence could have been presented from someone who downloaded music from the P2P user "tereastarr"
- evidence on the woman's computer hard disc of illegal music in a public folder which has been made available for sharing by other users.

Award [1 mark] for each kind of evidence that could have been presented in court to prove that copyrighted songs were offered by the woman using a P2P user account up to a maximum of [2 marks]. Award an additional [1 mark] for the development of each kind of evidence up to a maximum of [2 marks]. Mark the first two correct kinds of evidence identified.

(d) **A range of online solutions have been developed to provide customers with legal access to music files.**

To what extent have online solutions been made available to meet customers' needs? Use specific examples in your response.   *[10 marks]*

Answers may include:
- range of services are offered by web sites (e.g. collection of MP3 music, search functions, download/setup, help/support)
- online purchase - effective means for purchasing/downloading individual music titles from an online service (e.g. iTunes, Spotify)
- subscription-based model (e.g. Napster /Spotify a subscription charged and artists are paid each time their song is played)
- free download - download music made available by the artist for free (e.g. MySpace)
- easy access to purchase songs eg You Tube, in collaboration with Apple iTunes, is now including a link under its music videos to direct users to purchase the song from iTunes
- the iPhone app, Shazam tags a sound track that is playing, identifies the track and provides information for purchase via iTunes.

The specific examples may be analysed in the following manner:

Some customers feel that online solutions are not meeting their needs because
- some solutions are only available in certain countries
- some downloads are only available for approved players
- customers may be reluctant to give personal details
- many young people do not have access to credit cards which are required for payment
- costs of online purchase.

However others are moving towards legal downloads because:
- these sites have GUI which are easy to use
- most music is available
- even though there is a fee, music is still cheaper than purchasing in a shop
- there is no need to worry about viruses – viruses may be associated with some P2P file sharing
- reviews are often available
- it may be possible to try out songs before buying
- secure payment is possible
- songs are high quality
- it may be possible to purchase a single song as well as an album.

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

Please see generic markband information sheet on page 17.

SECTION B

Area of impact: Education

2.   **(a)   Identify *two* types of software licence a school may need to consider when purchasing the CD-ROMs.**   *[2 marks]*

Answers may include:
- multi-user licence
- single-user license for individual teachers using the Smartboard
- site licence
- educational licence (or academic licence)
- volume licence.

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

(b)   Describe *two* software considerations that must be taken into account when developing *Project X* animated books.   *[4 marks]*

Answers may include:
- software compatibility with most computer systems – to provide compatibility with the operating system and hardware computer systems commonly used in schools (i.e. RAM requirements to run animations/multimedia, screen resolution to display images), do not accept storage or the need to install applications
- new technologies – to address emerging software trends and technologies
- loading time – to address how long it will take for multimedia to load
- ease of use – to ensure the programs are easy for children to use
- ease of setup – easy for schools to install or set up
- content – appeals to the interest of the students.

Award [1 mark] for identifying each software consideration when developing Project X animated books up to a maximum of [2 marks]. Award an additional [1 mark] for the relevant description up to a maximum of [2 marks]. Accept only responses relating to development.

(c) **Interactive multimedia productions are often stored as compressed files to reduce storage space. Explain *two* disadvantages of using data compression for this purpose.** *[4 marks]*

Answers may include:
- reduced quality of images / lower resolution
- extra costs to encode and decode data
- the amount of time it takes to encode/decode may interrupt real-time process
- lossy compression – gives smaller file size, but the end product may be inferior to the original in some ways.

Award [1 mark] for each disadvantage of using data compression for the purpose of reducing storage space up to a maximum of [2 marks]. Award an additional [1 mark] for the development of each disadvantage up to a maximum of [2 marks]. Mark the first two correct disadvantages identified.

(d) **The head of a primary school has decided to invest in *Project X* technology rather than in sets of printed reading books. Evaluate this decision.** *[10 marks]*

Answers may include:
Arguments in favour of *Project X* CD-ROMs
- CD-ROMs engage the students – capture their attention with audio and video
- students can hear stories read aloud – not just see text
- can support children's writing – encouraging them to write as well as read
- CD-ROMs are interactive, fun and entertaining
- encourages computer literacy amongst the children – some children may not have access to a computer at home, develops new IT skills
- requires teachers to become more computer literate (i.e. using CD-ROMS, Smartboards, laptops).

Arguments in favour of sets of printed reading books
- school does not need to invest in computers
- schools already have the ergonomic conditions for reading books. Schools possibly face additional cost to comply with ergonomic considerations when using laptops (i.e. desks, chairs, lighting)
- technical assistance is not required – as needed by computer programs
- close supervision during use is not required when using books as is required with laptops and CD-ROMs e.g. avoid damage to the CD-ROMs or laptops
- books are portable – can be used anywhere without the need of a computer
- equality of access – not all students have a computer to access the CD-ROMs at home
- children who use *Project X* CD-ROMs in school may be less inclined to read books
- costs may be involved in training teachers (i.e. use of Smartboards, using the features of the *Project X* CD-ROMs
- books are more durable and accessible (i.e. CD-ROMs can get scratched, CD-ROMS require a laptop and be mounted for use)
- some students may prefer books over using laptops (i.e. can take books home, books are always accessible).

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

Please see generic markband information sheet on page 21

Area of impact: Health

3.   (a)   **Identify *two* characteristics of ASCII.**   *[2 marks]*

Answers may include:
- american standard code for information interchange
- binary code that represents characters
- alphabetical, numerical or special characters represented by strings of 0s and 1s
- most common format for text files
- ASCII represents characters in 8 bits
- ASCII was created to represent the characters used in the English Language. Special characters in other languages can be represented by extending ASCII codes.

Award [1 mark] for each characteristic up to a maximum of [2 marks].

(b)   **Describe the steps by which *Google Flu Trends* could associate flu-related keywords entered by users within the United States to the occurrence of flu in the various regions.**   *[4 marks]*

Answers may include:
- individuals search for flu-related words
- the location of the user is identified by the TCP/IP number of their computer
- an algorithm is used to identify the search words associated with flu-related keywords
- the number of search queries are counted and recorded for each region in a database
- graphs are created from the data collected from each region
- estimates are generated from this data about how much flu is circulating in various regions of the United States
- the results from the data collected by *Google Flu Trends* from each of the regions is compared to the data collected by health agencies.

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

[2–3 marks]
A reasonable description that describes some of the steps, although the answer may lack appropriate reasoning at the lower end of the band.

[4 marks]
Clear, detailed and balanced steps by which Google Flu Trends *associates flu-related words.*

(c) **Explain why an Internet search engine would get different results when**
skin cancer (without quotation marks) is entered and when _"skin cancer"_
(with quotation marks) is entered.   *[4 marks]*

Answers may include:
- quotation marks narrow search – uses exact phrasing
- no quotation marks – result may contain results with either word or both words
- *skin cancer* returns results with *skin* or *cancer* or both, whereas *"skin cancer"* returns only results where the words *"skin cancer"* appear together like one word
- Boolean search operators – AND, OR and NOT assist in narrowing searches.

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

[2–3 marks]
A reasonable description, although the answer may lack appropriate reasoning at the lower end of the band.

[4 marks]
A clear, detailed explanation of the issue with reasons. For this band, there must be at least two reasons mentioned and reference to terms such as Boolean, or exact phrasing.

(d)   To what extent should analysis tools such as *Google Flu Trends* be used as the main providers of information for governments and health organizations in planning resources to manage illnesses?   *[10 marks]*

Answers may include:
- it can provide updated information regularly
- the data can be broken down by geographical location
- it can be used to compare larger populations
- provides quicker access to data – instant access allows for quicker analysis
- algorithms could be used to detect anomalies and conspirators who try to manipulate data
- provides healthcare workers with an early-warning system for flu outbreaks
- data collected may not be accurate (i.e. some people who are ill do not use the internet, botnet could be used to spoof data)
- need to ensure aggregate search data about flu outbreaks cannot be used to identify the people who provided the information
- analysis possible using large data sets
- *Google Flu Trends* may provide data different from doctors because many people who have the flu may not go to the doctor, but search in Google for information about their illness
- *Google Flu Trends* only provides an analysis from using Google searches and does not take into account persons who use other search engines.

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

Please see generic markband information sheet on page 21

Area of impact: Arts, entertainment and leisure

4. (a) **Identify *two* hardware requirements that are needed by the student on their computer in order to watch these 3D videos online.**   *[2 marks]*

Answers may include:
- graphics card
- audio card
- speaker or earphones
- sufficient processing speed
- 3D computer monitor
- sufficient RAM.

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

(b) **Sarah's guitar lessons with Carlos are carried out in real-time via videoconferencing.**

(i) **Define the term *videoconferencing.***   *[2 marks]*

Answers may include:
- technologies that allow two or more locations to interact via two-way video and audio transmissions simultaneously
- integration of audio, video and devices for the simultaneous communication of two or more persons who are connected by a telecommunication line
- conducting a conference between two or more people at different sites by using computer networks to transmit audio and video data.

Award [1 mark] for each point up to a maximum of [2 marks].

(ii) **Describe *one* technical limitation in using real-time videoconferencing.**   *[2 marks]*

Answers may include:
- audio and video – limitation on quality that can be achieved
- limitations on access (i.e. bandwidth, reliability of the internet connection)
- processing power of individual computers
- real-time videoconferencing transmissions may vary (i.e. internet fluctuations).

Award [1 mark] for identifying a limitation and award [1 mark] for the relevant description up to a maximum of [2 marks].

(c)   **Carlos wants to upload his pre-recorded videos to an online video hosting site such as *YouTube*, but he has no idea how to do this. Explain *two* IT-based strategies that he could use to learn how this is done.**   *[4 marks]*

Answers may include:
- online video – watch an online "how to" video to learn how to add his videos
- web sites – web sites with instructions how to upload to *YouTube*
- interactive lessons – step-by-step instructions how to complete the task
- help menu – using the *YouTube* help menu to seek assistance
- videoconferencing – contacting someone knowledgeable who can provide step-by-step instructions how to complete the task
- forums, chatrooms – posting a question asking for step-by-step instructions how complete the task
- remote access to the user's computer by someone who can demonstrate the step-by-step process
- use a wizard to guide the process of completing the task.

Award [1 mark] for each IT-based strategy that Carlos could use to learn how to upload his videos to a video hosting site up to a maximum of [2 marks]. Award an additional [1 mark] for the development of each strategy up to a maximum of [2 marks]. Mark the first two correct strategies identified.

(d) **In recent years, advances in 3D technology and significant increases in the processing capability of computers have seen greater numbers of people adopting these technologies.**

To what extent do you agree with the statement that "the development of interactive online learning environments will never satisfactorily replace face-to-face contact"? *[10 marks]*

Answers may include:

Interactive online learning
- distance education – will enable students to learn from various remote places
- flexibility – can learn anytime, anywhere
- more choice – students will have more courses to choose from
- can be recorded and replayed
- online courses are time consuming to create for teachers
- quality of audio/video may not be adequate
- technical requirements are greater – students need Internet, computer and web cam
- scheduling might be difficult with different time zones.
- some students have difficulty using interactive online learning environments.

Face-to-face
- class sizes are smaller – easier to know others on the course
- direct interaction – meeting people face-to-face / socialization / learning activities involving face-to-face interaction
- teacher directly responsible for class instruction
- have to travel to a specific location
- limited to people from a geographical area
- not subject to the technical difficulties that may be involved in interactive online learning environments.

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

Please see generic markband information sheet on page 21

Area of impact: Science and the environment

5. **(a)** **Identify** *two* **input devices that are required in order for Jules to interact with a real person.**   *[2 marks]*

Answers may include:
- microphone
- digital video camera or web cam
- camera.

Award [1 mark] for each input device up to a maximum of [2 marks].

(b) **Describe the steps that Jules would take in order to follow the movement of the person talking to him.**   *[4 marks]*

Answers may include:
- capture the initial image of the person with the web cam/robot (sensors) captures image
- use facial recognition software to determine the parts of the face to be tracked (reference points) / identify parts of the face (eg eyes for eye contact)
- record an initial position (*i.e.* t0), of the face to be tracked/set the position of the human in relation to robot's own position
- record time lapse intervals
- capture another image at a second position (*i.e.* t1)
- determine the location of the reference points
- compare new position of reference points (t1), with the initial position (t0)
- if position is the same as before, then no movement is detected and there is no adjustment
- if position changes, movement is detected and robot adjusts to the movement
- changing voice frequency may assist in determining the person's position
- calculate the rotation to move Jules' head
- actuators/mechanical devices rotate robot's head the required distance
- loop/repeat the process.

Ref: http://mail.isr.uc.pt/~mrl/admin/upload/Paper_EPIA07-LNCS.pdf

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

(d) **Jules may have difficulty understanding a sentence in a conversation with a human. Explain why this could happen.** *[4 marks]*

Answers may include:
- vocabulary used in the sentence is unknown to the robot (reason: word is not in its internal language database)
- unusual grammar or sentence structure (reason: may be limited by Jules' ability to eg analyse context)
- accent or dialect making the words sound different (reason: robot has not been trained to recognise that person's voice)
- idiomatic expression was used
- Unclear/inaudible speech (reason: captured voice unclear then converted to digital sound files which can't be matched)
- Background noise/interference may mask human voice input
- linguistic differences - words may have different meaning depending of the context.

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

[2–3 marks]
A reasonable description of the difficulties that Jules has in understanding a sentence in a conversation with a human. The answer may be unbalanced and lack appropriate reasoning at the lower end of the band.

[4 marks]
A clear, detailed and balanced explanation of why Jules may have difficulty understanding a sentence in a conversation with a human.

(d) The organizers of an important tennis tournament are considering using a robot similar to Jules, named Tennis-Umpire, for the purpose of umpiring some of the games. This robot, which remains seated throughout the match, uses its own cameras to analyse the game and then communicates its decisions to the human spectators using speech.

Evaluate whether the organizers should go ahead with this decision to replace human umpires with robotic umpires such as Tennis-Umpire. *[10 marks]*

Answers may include:

Positive
- robot would consistently determine the outcome of each play – eliminates variation in human reaction
- robot is not affected by physical conditions (*e.g.* tiredness, weather, crowd reaction)
- robot is not biased – a human umpire may have a preference towards a particular player winning, or according to recent studies, tennis umpires are more likely to make mistakes when they call balls "out" than when they call them "in", these errors are a result of the way the human brain processes visual information about motion.

[Source: adapted from http://physorg.com/news144328896.html, 4 July 2009]

Negative
- robot may not be able to follow the movement of the ball quickly enough, causing a delay in processing the call
- robots involve mechanical moving parts, there is a possibility of a problem in the physical functioning of the robot (necessitating replacement with another robot or human umpire).
- in a tennis game there are several other officials – one robot cannot call all of the plays (players may block the view, other umpires will be required with the ability to communicate with the Tennis-Umpire)
- robots can judge technical details of tennis (*e.g.* location of the tennis ball, applying the rules), but cannot judge human aspects of the game (*e.g.* inappropriate behaviour by players)
- job loss for current umpires
- cost of Tennis-Umpire including hardware, software, updates, maintenance, repairs – this will be offset by saving on salaries
- public (players/supporter) reaction to Tennis-Umpire may be negative – how do players dispute a decision?
- a robot is not programmed to anticipate the unexpected – eg if a supporter interrupts play by running onto the court a human umpire could request a replay.

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

Please see generic markband information sheet on page 21

Area of impact: Politics and government

6.   (a)   **Identify** *two* **IT-based methods of sending text messages simultaneously to a number of people.**   *[2 marks]*

Answers may include:
- *Twitter*
- SMS
- e-mail
- chatroom
- create a group in Facebook, create a text message, send the message to all members in the group.

Award [1 mark] for each method up to a maximum of [2 marks].

(b)   **Describe** *two* **types of information that would be held in a cookie by** *Twitter*.   *[4 marks]*

Answers may include:
- user ID – you do not have to type it in every time
- password – automatically inputs password
- user preferences – specific settings chosen by the user
- "signed-on" status – whether or not you are logged in or offline
- session tracking – what you have done or where you have been
- IP address – relates login information for a user to an IP address.

N.B. Cookies are used to understand how people visit the site and contain no personal information and are neither shared nor revealed to other sites other than the one that sent the cookie.
Do not award marks if references are made to information being shared or distributed from the user's hard drive.

Award [1 mark] for identifying each type of information up to a maximum of [2 marks]. Award an additional [1 mark] for the relevant description up to a maximum of [2 marks].

(c) **Explain how a location determined by cell (mobile) phone technology may be different from that determined by a Global Positioning System (GPS).** *[4 marks]*

Answers may include:
Cell (mobile) phone
- cell (mobile) phone tracking – phone must emit a roaming signal to contact a nearby antenna tower, but does not require an active call
- the technology of locating with a cell (mobile) phone is based on measuring power levels and antenna patterns
- cell (mobile) phones communicate wirelessly with one of the closest base stations, so if you know which base station the phone communicates with, you know that the phone is close to the respective base station
- GSM localization is then done by triangulation to locate the user/cell (mobile) phone on the basis of the strength of the signals.

GPS
- determines precise location
- the distance to the GPS satellites can be determined by estimating the amount of time it takes for their signals to reach the receiver; when the receiver estimates the distance to at least four GPS satellites, it can calculate its position in three dimensions
- uses triangulation to calculate the user's exact location
- a GPS receiver must be locked on to the signal of at least three satellites
- GPS receivers are accurate to approximately 15 metres.

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

[2–3 marks]
A reasonable description of how determining the location differs, although the answer may lack appropriate reasoning at the lower end of the band.

[4 marks]
A clear, detailed explanation (with reasons) of the way the two methods of determining locations differ.

(d) **Under certain circumstances, government authorities require organizations, such as *Twitter*, to provide them with information about individuals and data that has been collected from individuals' online activities. To what extent is this acceptable?** *[10 marks]*

Answers may include:
- government authorities are required to have a search warrant/court orders/ subpoenas
- data requested by government authorities is a matter of national security
- law enforcement agencies request information to identify or locate a suspect/fugitive/witness/missing person
- a crime has been committed and the data is relevant
- government authorities meet legal obligations to specify the purposes for which personal information is used
- government authorities collect and process appropriate personal information only to the extent that it is needed to fulfil operational needs or to comply with any legal requirements
- organizations ensure that the rights of people about whom information is held can be fully exercised under a country's data protection act
- organizations have taken appropriate technical and organizational security measures to safeguard personal information from unauthorized access
- organizations and government authorities ensure that personal information is not being transferred to third-party companies
- organizations have clearly stated the conditions in their online policy statements, under which they will provide information to government agencies.

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

Please see generic markband information sheet on page 21

Markband for all extended response questions.

Opinion discuss, evaluate 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 lower end 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 lower end of the band opinions, conclusions and/or judgment may be tentative.*

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