Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

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Information technology in a global society

Standard level

Paper 1

18 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 all other cases where a question asks for a certain number of facts *eg* "describe two kinds", mark the **first two** correct answers. This could include two descriptions, one description and one identification, or two identifications.

It should be recognized that, given time constraints, answers for part (c) questions are likely to include a much narrower range of issues and concepts than identified in the markband. There is no "correct" answer. Examiners must be prepared to award full marks to answers which synthesize and evaluate even if they do not examine all the stimulus material.

1. Streaming media in education

(a) (i) State **two** video file types. **[2]**

Answers may include:
- .mp4
- .avi
- .flv (or similar flash video types)
- .m4v
- .mov
- .mpeg/.mpg
- mkv
- .wmv
- .webm.

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

(ii) Outline **one** difference between streaming and downloading videos. **[2]**

Answers may include:
- streaming video is content sent in compressed form over the internet and displayed by the viewer in real time / downloaded videos are stored on a local device and played later
- streaming video can start to be played as soon as sufficient data arrives / downloaded videos must finish downloading before they can be played
- streaming video requires a network connection to be maintained throughout the playing / downloaded video can be stored for offline playback
- streaming videos may pause or stutter if the bandwidth/data transfer rate is too low / downloaded videos are more likely to play without interruption from the hard disk
- downloaded videos occupy storage space on the local device / streaming videos are only stored temporarily while they are being played.

*Award **[1]** for identifying a difference for either streaming or downloading videos with an implied reference to the other.*

*Award up to a maximum of **[2]** for an outline of a difference between streaming and downloading videos that explicitly refers to both methods of watching videos.*

(iii) Identify **two** situations where streaming the video is not possible. **[2]**

Answers may include:
- low bandwidth
- media player/file type is not compatible
- firewall blocks file type or pop-up window
- videos are offline and cannot be accessed
- copyright laws (*eg* cannot play in certain countries)
- web browser lacks necessary plugin/extension
- no or intermittent internet connection.

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

(b) (i) Explain **one** advantage for the student when the video is compressed. **[2]**

Answers may include:
- smaller file size, more data can be stored in the same storage space
- takes less disk space on student computer
- quicker loading time requires less available bandwidth to transfer
- less data to transfer reduces data consumption/less cost.

*Award **[1]** for the advantage identified and an additional **[1]** for the explanation of that advantage.*

(ii) Explain **one** disadvantage for the teacher of compressing a video before uploading to the cloud hosting site. **[2]**

Answers may include:
- prior knowledge required how to compress, may not know how to do this so:
  - errors may occur during compression
  - can be time consuming
- lossy compression reduces video quality, may impact the effectiveness/usefulness of the video as a teaching resource.

*Award **[1]** for the disadvantage identified and an additional **[1]** for the explanation of that disadvantage.*

(iii) Explain **one** reason why data compression is used when transferring a video file online. **[2]**

Answers may include:
- compression reduces the size of the file which saves time when uploading/downloading the file
- the compression reduces the size of the file which makes file transfer faster/requires less bandwidth
- gets rid of redundancy.

*Award **[1]** for the reason identified and an additional **[1]** for the explanation why data compression is used.*

(c) The school is in the process of deciding where teachers will host these videos. There are two options:
- on an external site, such as YouTube
- on the school server.

Evaluate both options. **[8]**

Answers may include:

YouTube – Advantages
- no hosting fees
- large audience
- easy to embed on other websites
- fast and reliable servers
- videos are searchable within site
- student can view related videos and become more familiar with the concepts.

YouTube – Disadvantages
- ads – can be disruptive
- do not have full control over your videos
- people can download your videos without permission
- students can be distracted by the other videos on YouTube
- videos uploaded to YouTube are compressed by default. Can lead to a loss of quality.

School server – Advantages
- have full control over your own videos
- preserves copyright
- full control over design of video player
- no ads
- traffic stays on your own website.

School server – Disadvantages
- costs for servers and maintenance
- can slow network bandwidth
- knowledge of coding required
- slow playing videos
- technical faults/crashes may take a long time to resolve (less staff/resources than YouTube).

In part (c) 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 18.

2. Headcams

(a) (i) Define “cloud computing”. **[2]**

Answers may include:
- distributed computers over a network
- use of servers on the internet to store, manage, and process data
- virtual servers on the internet
- storing and accessing data and programs on the internet instead of your computer’s hard drive
- examples such as iCloud.

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

(ii) Identify **two** benefits of using a relational database instead of a flat-file database. **[2]**

Answers may include:
- data is stored once
- avoids duplicated data
- easier to modify multiple records
- better data integrity/data is less likely to be inconsistent.

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

(iii) Outline **one** disadvantage if the videos captured by the police were only stored in the cloud. **[2]**

Answers may include:
- access – cannot access data if no internet connection
- privacy – data ownership, information could be accessed by others
- security – information could be hacked
- costs – storage, could be expensive.

*Award **[1]** for any of the points identified above and **[1]** for an additional development of that point up to a maximum of **[2]**.*

(b) The data collected from the headcams is stored in its data centres. The police department is concerned about the environmental effects of these data centres.

Explain **three** environmental concerns that may result from data centres. **[6]**

Answers may include:

- consume vast amounts of energy to run the data centres, much wasted energy
- use more metals, plastics and other materials which contribute to waste
- waste cause increased pollution, harmful to environment
- most data centres require volumes of water for cooling
- generators used emit exhaust that can be harmful to environment.

*Award **[1]** for **each** environmental concern identified and **[1]** for the development of the environmental concern identified up to a maximum of **[2]**.*

*Mark as **[2 + 2 + 2]**.*

(c) Discuss whether the benefits to the police department of using video headcams are more important than the citizens' concerns about the misuse of the video recordings. **[8]**

Answers may include:

Concerns

- security – information may be hacked
- privacy – who has access to the data recordings, does the information about citizens provided infringe on their right to privacy
- privacy – interviews of a sensitive nature may be recorded (*ie* assault victim, informants, *etc*)
- anonymity – does the information remove a citizen's anonymity. Can this information be used against a citizen if their anonymity is compromised?
- selective recording – cameras may only be turned on when it helps the officers.

Benefits

- videos keep police better informed than text or images so they can better protect citizens
- holding all accountable by providing additional evidence
- modifies police behavior, if they know they are being recorded on video
- video can be used and review to help solve crimes
- allows senior officers to see what their subordinates are doing
- allows other officers to monitor the situation and respond if needed.

In part (c) 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 18.

3. Next Generation Cane

(a) (i) State **two** items of data that Joe must enter into the navigation software on the PC to guide Carol to the supermarket. **[2]**

Answers may include:
- address of starting location/Carol's location
- address of final destination, or GPS coordinates of final destination/supermarket.

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

(ii) After Joe has input the data identify the steps used by the GPS system to guide Carol to the supermarket. **[4]**

Answers may include:
- data from PC is sent to the cane
- GPS analyses radio signals from satellites
- it calculates the distance to the satellites from the time the signal takes to arrive
- three satellites will be used to calculate the cane's exact location (mathematical process called trilateration)
- GPS updates the user's position as she moves
- arrows light on cane show direction to walk.

*Award **[1]** for any four of the above points up to a maximum of **[4]**.*

(b) The product development life cycle (PDLC) was used to ensure that the original design for the Next Generation Cane met the needs of the end user. Three of the PDLC stages are:
- investigation of existing system
- feasibility study
- requirements specifications.

Explain how each of these three stages of the PDLC were used to contribute to the successful development of the Next Generation Cane. **[6]**

Answers may include:
- **Investigation of existing system** – look at current situation for existing canes, prepared a proposal with expectations and project ideas for a new cane
- **Feasibility study** – look at proposal for the new cane with regards to several areas: economic – cost-benefit analysis for new cane, technical – look at existing technology and resources available, social – would the new cane be acceptable to use for the end user
- **Requirements specifications** – gather, analyse and validate specifying requirements for a new cane (*eg* what the cane must be able to do, what features it should have).

*Award up to **[2]** for each stage fully explained up to a maximum of **[6]**.*
*Award **[1]** for each partial explanation.*
*Mark as **[2 + 2 + 2]**.*

(c) Fujitsu is planning to make future improvements to the cane, such as adding a camera and audio commands.

To what extent will these further improvements to the functionality of the Next Generation Cane also lead to increasing benefits for Carol and her family? **[8]**

Answers may include:

- accessibility – easier to navigate with added features
- audio commands – would make it easier if visual impairment develops/becomes more profound
- safety – elderly do not have to look down to see arrows to guide then, they can listen to commands and not risk looking away from where they are walking
- can program more features on the cane
- camera – family can see where she is going/where she has been
- she can document outings with camera.

In part (c) 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 18.

4. Bitcoin

(a) (i) Define the term "open source software". **[2]**

Answers may include:
- original source code is freely available
- license which allows users to view/copy/modify code
- license includes source code
- may be redistributed and modified.

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

(ii) Describe **one** advantage to the retailer of using Bitcoins as a form of payment. **[2]**

Answers may include:
- easy to carry around large amounts of money
- payments are fast, 24/7
- secure – uses public/private key encryption
- security – no personal data is stored in a database, prevents identity theft
- cost per transaction – no/low fees
- can be backed up – ensures safety of money
- no third-party involvement (*eg* banks)/reduces bank charges, account costs etc.

*Award **[1]** for one advantage identified and an additional **[1]** for an explanation of it up to a maximum of **[2]**.*

(iii) Describe **one** disadvantage to the retailer of using Bitcoins as a form of payment. **[2]**

Answers may include:
- cannot be recovered if lost or hacked
- hard to trade, not widely accepted everywhere
- training – learning curve how to use Bitcoins
- conversion to currency (dollar/euro/peso etc.) can be difficult/time-consuming.

*Award **[1]** for one disadvantage identified and an additional **[1]** for an explanation of it up to a maximum of **[2]**.*

(b) (i) Distinguish between privacy and anonymity. **[4]**

Answers may include:
Privacy
- keeping specific information about a known person from others
- having the ability to control information a person reveals about themselves
- having the ability to control who can access your information.

Anonymity
- when you want others to see information about a person, but not who owns it
- disguising the identity of the person whose information is being used
- allowing a person to function online without revealing who they are.

*Award **[1]** for defining or identifying the key characteristic of privacy and anonymity up to a maximum of **[2]** and **[1]** for a development of each. Mark as **[2 + 2]** or **[3 + 1]**.*

(ii) Explain **one** reason why Bitcoin makes use of private key and public key encryption. **[2]**

Answers may include:
- more secure – every Bitcoin address has a matching private key (saved in the wallet file) of user
- private keys can be kept in computer files
- secure – it is impossible to determine a private key from corresponding public key.

*Award **[1]** for the reason identified and an additional **[1]** for the explanation why Bitcoin uses key encryption.*

(c) To what extent is it acceptable to use a P2P network rather than centralized servers supported by a system administrator to manage data such as Bitcoin transactions? **[8]**

Answers may include:

- easy to install and configure the computers on a P2P network
- content and information is easily shared by all the peers on the network
- P2P is more reliable as central dependency is eliminated, failure of one peer does not affect the functioning of other peers – no server to crash
- no need for full-time System Administrator, every user is the administrator of his machine – users can control their shared resources
- cost of building and maintaining P2P network is less expensive – no server required
- no tracking on transactions or data monitoring
- does not store personal information in a database
- P2P avoids data redundancy as when each peer updates data, it is available across the network. Centralized servers may have outdated/unreliable data stored
- security of data on a P2P network is dependent on the security of each peer and may be low/variable. Centralized servers may be kept secure by system administrator.

In part (c) 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 18.

5. LOKI bracelet

(a) (i) Identify **two** characteristics of Bluetooth. **[2]**

Answers may include:
- short range wireless technology
- radio frequencies
- range of 33 feet
- detects other wireless signals and avoids those frequencies
- low energy consumption
- data transfer rate of up to 25 MB/s
- one bluetooth device can pair with multiple other devices simultaneously (maximum number quoted varies but generally 8/10).

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

(ii) Identify the steps that are used by the LOKI to authenticate the user. **[4]**

Answers may include:
- ECG is initially scanned and the results are entered into the LOKI database
- when a user needs to be authenticated, their ECG is re-scanned
- user's ECG is saved on the LOKI
- user's ECG is compared with the user's ECG information in the database
- if there is a match, the user is authenticated/access granted
- if there is no match, the user access is denied.

*Award **[1]** for any four of the above points up to a maximum of **[4]**.*

(b) A home owner is considering changing his passwords in his smart home from text to biometric input, such as an ECG. Analyze this decision. **[6]**

Answers may include:

Text input

- easy for others to guess – date of birth, children and pets, telephone, *etc*
- hard to remember complex password, may need to write down
- a password may be stolen by someone who watches the owner entering it
- a password can be given to a friend to whom the password owner wants to grant a certain privilege
- takes time to type
- easy to change
- can be shared.

Biometric input

- cannot be stolen
- guarantees owner since biometric features are unique
- may give false positives/negatives
- do not have to remember a password
- do not have to carry an access device
- cannot be shared with others
- biometric features are immediately available, saves time
- may be faster than typing passwords.

***[1–2]**: A limited response that demonstrates minimal knowledge and understanding of the issues relating to the nature of passwords and biometric data used to access the devices in the smart home and uses little or no appropriate ITGS terminology.*

***[3–4]**: A partial analysis, either lacking detail or balance, that demonstrates some knowledge and understanding of the issues relating to the nature of passwords and biometric data used to access the devices in the smart home. Some relevant examples are used within the response. There is some use of appropriate ITGS terminology in the response.*

***[5–6]**: A balanced and detailed analysis of the issue which demonstrates thorough knowledge and understanding of the issues relating to the nature of passwords and biometric data used to access the devices in the smart home. Relevant examples are used throughout the response. There is appropriate ITGS terminology throughout the response.*

(c) Discuss whether the LOKI should be used as the sole control for smart devices in your smart home. **[8]**

Answers may include:

Advantages

- unique to user, cannot be shared
- saves time, easy to swipe
- do not need to bring keys with you
- automatically locks the door when you leave
- may be used to automatically turn-off devices or put them on standby when the user is not near, saving energy.

Disadvantages

- would not have backup access to home if device failed
- may give false positives, doors will not lock or will open accidentally
- can be damaged
- may stop working/get lost
- expensive to install
- difficult to give visitors access to home
- interference could cause it not to work properly
- all devices will need to have bluetooth enabled. May consume more power/shorten battery charge time.

In part (c) 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 18.

SL and HL paper 1 part (c) and HL paper 3 question 3 markband

Marks	***Level descriptor***
No marks	• *A response with no knowledge or understanding of the relevant ITGS issues and concepts.* • *A response that includes no appropriate ITGS terminology.*
Basic ***1–2 marks***	• *A response with minimal knowledge and understanding of the relevant ITGS issues and concepts.* • *A response that includes minimal use of appropriate ITGS terminology.* • *A response that has no evidence of judgments and/or conclusions.* • *No reference is made to the scenario in the stimulus material in the response.* • *The response may be no more than a list.*
Adequate ***3–4 marks***	• *A descriptive response with limited knowledge and/or understanding of the relevant ITGS issues and/or concepts.* • *A response that includes limited use of appropriate ITGS terminology.* • *A response that has evidence of conclusions and/or judgments that are no more than unsubstantiated statements. The analysis underpinning them may also be partial or unbalanced.* • *Implicit references are made to the scenario in the stimulus material in the response.*
Competent ***5–6 marks***	• *A response with knowledge and understanding of the relevant ITGS issues and/or concepts.* • *A response that uses ITGS terminology appropriately in places.* • *A response that includes conclusions and/or judgments that have limited support and are underpinned by a balanced analysis.* • *Explicit references to the scenario in the stimulus material are made at places in the response.*
Proficient ***7–8 marks***	• *A response with a detailed knowledge and understanding of the relevant ITGS issues and/or concepts.* • *A response that uses ITGS terminology appropriately throughout.* • *A response that includes conclusions and/or judgments that are well supported and underpinned by a balanced analysis.* • *Explicit references are made appropriately to the scenario in the stimulus material throughout the response.*