

MARKSCHEME

May 2007

INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Higher Level

Paper 2

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Within a question where a number of answers are specified, examiners should only mark up to that number. Any further answers should be ignored.

Area of Impact: Business and Employment

1. (a) **Identify *two* other physical characteristics, other than fingerprints, that are currently used in biometric systems.** **[2 marks]**

Answers may include:

- hand geometry
- eye/iris/retina scanning
- voice recognition
- facial pattern recognition
- blood vessel patterns on the hand.

Examiners should be aware that candidates may take a different approach, which if appropriate should be fully rewarded. If in doubt, check with your team leader.

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

- (b) **With reference to the information technology (IT) that underpins biometrics, describe the process of biometric authentication.** **[4 marks]**

[1-2 marks]

Description of first scanning and storing in database

- *biometric feature is **initially scanned***
- *scanned features are **stored in database** together with other personal information.*

[3-4 marks]

Description of scanning when in need to authenticate and then matching to features stored in database

- *biometric feature is **re-scanned** when person needs to be authenticated*
- *scanned feature is **matched** with information in database and if a match then it is authenticated, if no match then it is rejected.*

- (c) **Explain why biometric options for payments at retail stores could be considered better than credit card signatures when authenticating the user.**

[4 marks]

Sample answer:

“Credit card signatures are open to much fraud. Individuals often lose their credit card, or have it skimmed or stolen. Criminals, who get hold of the credit card, are able to forge the signature. Some criminals don’t even bother to forge the signature as sales people often do not check the signature and, if they do, are often unwilling to confront the card-holder if they have concerns about the signature. Biometrics is considered much more reliable in determining the identity of the card-user. With fingerprint recognition considered about 99% accurate, both customers and shopkeepers feel safe using the system. Signatures are not good at proving the identity of the user – biometrics are.”

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[1-2 marks]

Describes advantages or disadvantages of biometrics and/or credit card when used for authentication.

[3-4 marks]

Balanced comparison of biometrics and credit card with a reason at top end of the band.

- (d) **Discuss the concerns that people might have with the widespread use of biometric technology by several retail stores and different institutions.**

[10 marks]

Answers may include:

- identity theft – if the original templates, such as high resolution images of fingerprints, were stolen, they could potentially be used by criminals in an attempt to steal a person’s identity
- physical concerns – some people believe that certain biometric technology can cause physical harm or discomfort. Iris/retina scanning may not always be clean, possibly leading to eye disease. People feel very sensitive and protective about their eyes
- privacy – there may be concerns that personal information taken through biometric methods, could be sold to other organizations without the individual’s consent or knowledge. The information could be used for a multitude of purposes other than the one for which it was initially intended. This is known as function creep
- erosion of civil liberties – many people believe that a person’s anonymity is a fundamental right. If people are forced to use biometric options, for an ID card for example, the ‘state’ would be intruding into our private lives, with the potential to have control over our everyday activities
- cost to citizens travelling. Biometric passports will cost much more to produce and maintain the records than traditional passport / cost passed onto customers due to cost of devices in the shops
- time taken to register with each new retail store that uses biometrics
- cultural diversity: some cultures/religions do not accept the use of body features being scanned/seen in public e.g. Muslims and facial features
- reliability – any biometric system is only as good as the initial enrolment system. If someone is improperly registered as a legitimate user, because the initial identification process is flawed, then the whole system is fundamentally flawed. While some biometric applications, like finger recognition, are considered reliable, other options are not and can have an error rate as high as 40%
- policies and standards – unless appropriate policies, standards and laws are developed and enforced, the system is likely to be abused
- integrity – biometric data, like any IT data, will lack integrity when it has been changed accidentally or tampered with. Because there is human input in the processes problems could occur.

N.B. Accept examples relating to any reasonable institution or organization, including governments.

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A range of concerns are expected to be discussed.

<i>Level 0</i>	<i>0 marks</i>	<i>Inappropriate answer.</i>
<i>Level 1</i>	<i>1-2 marks</i>	<i>A brief and generalized response with very little knowledge and understanding of IT issues. Very little use of IT terms.</i>
<i>Level 2</i>	<i>3-5 marks</i>	<i>Some knowledge and understanding of IT issues, although a tendency toward fragmentary, irrelevant, ‘common sense’ points at the bottom of the band. Basic use of IT terms. A description that has a basic sense of structure, but it is not sustained throughout the answer. (DESCRIPTION)</i>
<i>Level 3</i>	<i>6-7 marks</i>	<i>A secure knowledge and understanding of IT issues. Appropriate use of IT terms. A clear and coherent examination that may be unbalanced. An understanding of the way IT facts and ideas are related at the top end of the band. (EXAMINATION)</i>
<i>Level 4</i>	<i>8-10 marks</i>	<i>Very good knowledge and understanding of IT issues. Good use of IT terms throughout the response. A detailed and balanced discussion. Clear understanding of the way IT facts and ideas are related. Opinions and/or conclusions, albeit tentative, are provided and are well supported at the top end of the band. (OPINION)</i>

Area of Impact: Arts, Entertainment and Leisure

2. (a) **Define the term MP3.** **[2 marks]**

Sample answer:

“MP3 stands for MPEG – Audio Layer 3. It is an audio compression format that allows files to be downloaded from the internet. It discards audio signals that the human brain cannot hear (“lossy” method), and then compresses the remaining audio signal.”

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Award [1 mark] for identifying that it is a file format/audio encoding and [1 additional mark] for mentioning file compression.

- (b) **Describe two tasks a user can perform with digital jukebox software.** **[4 marks]**

Answers may include:

- download music to an iPod
- organize and sort music collection
- create a list of music to play (playlist)
- change file formats
- view digital photos on the screen
- random selection (“shuffle”)
- burn play list to CD
- play music/radio/video on computer
- subscribe to podcast for automatic updates
- add descriptive text/edit/add title/author
- control quality and size of imported files
- import music from CD
- access iTunes store, buy music and download to iTunes library.

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Award [1 mark] for each task identified up to a maximum of [2 marks]. Award [1 additional mark] for the description of each task up to a maximum of [2 additional marks].

(c) **Explain the implication of bit rate when downloading music.**

[4 marks]

Bit rates refer to the number of data bits required per second of audio.

The higher the bit rate:

- the better the quality
- the more space the file requires and
- the more time it takes to transfer.

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[1-2 marks]

- *Bit rate affects the time it takes to download a file.*
- *The higher the bit rate then the file will be larger.*

[3-4 marks]

Reasons why large files may take more time to download taking into consideration other factors such a quality of modem, internet connection, processor speed of computer.

OR

Bit rate can be defined as:

“the ratio of the number of pieces of information that are transferred between devices in a specified amount of time, typically one second”

[1-2 marks]

- *Bit rates affect the time it takes to download a file.*
- *The higher the bit rate the quicker the data will be downloaded.*

[3-4 marks]

The bit rate may be affected by other factors, such as quality of modem, internet connection, processor, speed of computer.

(d) Evaluate the impact digital audio players have had on the music industry. [10 marks]

Answers may include:

- it has enabled easy and cheap access to a vast amount of music
- new artists and their music may be promoted/music of new artists may be produced and reproduced to be shared between audio player users
- new business models are being developed for online business with music files
- the development of anti-piracy software to prevent unauthorised copying of MP3 files
- less sales because easier to make illegal copies of commercial songs/people carrying devices may surreptitiously steal music files from computers available
- less music being written because of loss of income to musicians and the music industry
- changes to laws to protect the copyright holders of the music.

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<i>Level 0</i>	<i>0 marks</i>	<i>Inappropriate answer.</i>
<i>Level 1</i>	<i>1-2 marks</i>	<i>A brief and general answer. Very limited knowledge of IT theory. Very little or no reference to social implications. Significant errors and omissions of important information.</i>
<i>Level 2</i>	<i>3-5 marks</i>	<i>A limited, descriptive answer. Some knowledge of basic IT theory. Some reference to social issues. Some relevant terms explained. Some understanding of the ways facts or ideas may be related at the top of the band.</i>
<i>Level 3</i>	<i>6-7 marks</i>	<i>An understanding of the specific demands of the question. A coherent and logically structured answer. A sound knowledge of IT theory. Appropriate reference to social issues. An attempt to show underlying assumptions and important relationships at the top of the band.</i>
<i>Level 4</i>	<i>8-10 marks</i>	<i>Clear understanding of the specific demands of the question. A detailed, coherent and logically structured answer. Good knowledge of IT theory. Appropriate reference to social issues. Where appropriate, examples have been used. Evidence of appropriate evaluation, although it may be unbalanced at the lower end of the band. An appraisal is made at the top end of the band. No major errors.</i>

Area of Impact: Education/Science and the Environment

3. (a) **Define the term *data logging*.** **[2 marks]**

Answers may include:

- collection of physical data
- by sensors
- recording equipment/computer may be remote from data source
- A/D converter/interface may be needed to convert to digital data
- processing may be at a later stage
- takes place over regular/pre-set time intervals.

Examiners should be aware that candidates may take a different approach which, if appropriate, should be fully rewarded. If in doubt, check with your team leader.

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

- (b) **Describe *two* items of hardware needed to implement this data logging investigation, apart from the sensors and the server.** **[4 marks]**

Answers may include:

- monitor/screen – to view/present results
- keyboard/mouse – so results can be annotated or saved
- printer to print results/graph
- network hub
- analogue/digital converters – conversion of analogue data from sensor to digital data for a computer
- wireless access points/routers
- network cables
- network cards (NICs)
- client computers
- storage device *e.g.* hard disc on the server to store logged data
- wireless transmitter.

Examiners should be aware that candidates may take a different approach which, if appropriate, should be fully rewarded. If in doubt, check with your team leader.

Award [1 mark] for identifying each item of hardware up to a maximum of [2 marks]. Award [1 additional mark] for describing the nature of the item up to a maximum of [2 additional marks].

(c) Explain *two* reasons why in this case, data logging is a better way to conduct the investigation than taking measurements manually.

[4 marks]

- Data logging can be carried out 24/7.
- It can take measurements more frequently than a human experimenter, leading to more accurate results.
- The data collected is already in digital format, stored on a computer system so does not need to be transcribed. There is less chance of error.
- It can be processed using a variety of software techniques such as spreadsheets and database management systems.
- Saves person's time/cost of hiring someone/student time away from lessons.
- Data logging is more reliable than manual measurements.
- There is no chance of human bias.

[1 mark]

A limited response that indicates very little understanding of data logging. One reason given.

[2 marks]

The description clearly presents the characteristics of data logging.

[3 marks]

Two reasons described with one being clearly presented.

[4 marks]

A clear, coherent and precise description of data logging with detailed reason why data logging is better than manual.

- (d) **Discuss how the school could make use of other sensors and other data logging investigations to improve its working environment.**

[10 marks]

Other sensors could include:

- temperature sensors to monitor for comfortable working temperature as school might be too hot in summer/cold in winter
- light sensors to monitor for comfort using computers
- movement sensors to monitor crowding
- smell sensor to detect chemical gases in labs which would create an unpleasant/difficult work environment
- humidity sensor to prevent unpleasant work conditions due to high/low humidity.

Answers may include a discussion on:

- suitable sampling intervals
- suitable sampling periods
- suitable locations of sensors
- storage of data
- processing of data
- presentation of results/findings
- reasons of using computers rather than manual methods
 - immediate responses
 - more efficient if reliable and cost effective
 - accurate adjustments
 - improved work environment
 - eliminates the need for people
- problems using computers rather than manual methods
 - cost of equipment
 - reliability of equipment.

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<i>Level 0</i>	<i>0 marks</i>	<i>Inappropriate answer.</i>
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<i>Level 2</i>	<i>3-5 marks</i>	<i>Some knowledge and understanding of IT issues, although a tendency toward fragmentary, irrelevant, “common sense” points at the bottom of the band. Basic use of IT terms. A description that has a basic sense of structure, but it is not sustained throughout the answer.</i>
<i>Level 3</i>	<i>6-7 marks</i>	<i>A secure knowledge and understanding of IT issues. Appropriate use of IT terms. A clear and coherent examination that may be unbalanced. An understanding of the way IT facts and ideas are related at the top end of the band.</i>
<i>Level 4</i>	<i>8-10 marks</i>	<i>Very good knowledge and understanding of IT issues. Good use of IT terms throughout the response. A detailed and balanced discussion. Clear understanding of the way IT facts and ideas are related. Opinions and/or conclusions, albeit tentative, are provided and are well supported at the top end of the band.</i>

Area of Impact: Health/Politics and government

4. (a) **Define the terms *data integrity* and *data security*.** **[2 marks]**

Answers may include:

- data integrity refers to the truth or validity of the data exactly as it was last saved
- data security refers to the protection of information from unauthorized access and malicious acts.

Examiners should be aware that candidates may take a different approach which, if appropriate, should be fully rewarded. If in doubt, check with your team leader.

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

- (b) **Describe how an integrated/centralized medical database system improves the integrity *and* security of data compared with distributed independent databases.** **[4 marks]**

Answers may include:

integrity

- single copy of data stored means it is easier to check for errors
- updated centrally (in one place) and description.

security

- data held centrally so can be properly supervised / physically protected and description
- different users get different access rights and description
- easy to back up from single source and description.

Examiners should be aware that candidates may take a different approach which, if appropriate, should be fully rewarded. If in doubt, check with your team leader.

Award [1 mark] for one relevant integrity point identified plus [1 mark] for description.

Award [1 additional mark] for one relevant security point identified plus [1 mark] for description.

- (c) **Explain how the integrated database system could make use of private key / public key encryption in order to safeguard patients' data.**

[4 marks]

Some possible answers may include:

- Encryption is the transformation of data so that it cannot be read by anyone except the intended recipient.
- A key is an item of data that determines the form of the encryption.
- When data is being transmitted, it is encrypted using a public key that is known to anyone.
- It cannot be decrypted with the public key, but only with a private key that only the recipient has so anyone else who intercepts the data will not be able to decrypt it.

[1 mark]

A limited response that indicates very little understanding of encryption.

[2-3 marks]

A description that clearly presents the mechanism of encryption, but fails correctly to address the issue of keys at the lower end of the band.

[4 marks]

A clear, coherent and precise description of the encryption and decryption mechanism with detailed explanation of how public and private keys work.

- (d) **Discuss the possible issues to be considered by patients when they decide to “opt in” or “opt out” of the electronic records service proposed by the National Health Service.**

[10 marks]

Answers may include:

Reasons for “opting in”

- The centralized electronic records service will improve the quality of care and efficiency – there is much easier and quicker access of patient data for doctors and other approved medical practitioners, who can respond appropriately.
- It could save lives – vital patient information such as allergies, blood type and pre-existing medical conditions could be accessed, in the case of a medical emergency, very quickly. Armed with this information, doctors/ambulance officers/hospital staff are able to act promptly, potentially saving someone’s life.
- Security – it is easier to maintain appropriate standards and security for one database management system compared with many disparate databases.

Reasons for “opting out”

- Network failure – where there is a complete or partial failure of a component or components of a network because of malfunction or natural or human-caused disasters. This means all medical information throughout the country could be unavailable for significant periods of time, putting the health, or even life, of patients in jeopardy.
- Privacy concerns – medical information on patients could include some very personal and confidential information. If this information was to get out into the public domain there is the potential for this information to be used to harm individuals. Who really owns the data – is it the patient or the NHS?
- Access concerns – individuals have legitimate concerns about who has access to information. For example, there is the fear that employers might have access to personal information about their employees and then based on this information deny employment or job advancement / Insurance companies may refuse coverage to people who choose not to be part of the electronic records service.

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