Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

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Digital society

Standard level

Paper 1

15 pages

1. Synthetic voices

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

Answers may include:
- A structured collection of data (e.g. contains primary and secondary keys, distributed across fields and records, etc.).
- Consists of one or more (related) tables.
- Data bases can be queried/reports generated.
- It provides data security.

*Award **[1]** for identifying each characteristic of a database up to **[2]**.*

(ii) Identify **two** ways in which the integrity of the data in a database can be maintained. [2]

Answers may include:
- removing redundant data / database normalization.
- Using data validation and verification.
- Keep an audit trail.
- Back up data.

*Award **[1]** for identifying each way the integrity of the data in the database can be maintained up to **[2]**.*

(iii) Identify **two** characteristics of a neural network**.** [2]

Answers may include:
- They are made up of nodes (or neurons) organized in layers.
- Has an input, hidden and output layer.
- Replicates the way the human brain works.
- A form of machine learning.

*Award **[1]** for identifying each characteristic of a neural network up to **[2]**.*

(b) (i) Explain **two** reasons why it may be difficult to clone a person's voice. [4]

Answers may include:

- There may not be enough examples of the person's voice.
- So, it may not be possible to find examples to enable the synthetic voice.

- There may be pronunciation errors.
- Pronunciation errors in the original recordings may lead to an inconsistent voice model that could replicate these errors.

- Quality of voice recordings may be poor
- Low-quality recordings may have background noise, distortion, or poor clarity, making it difficult for the voice cloning system to accurately capture and model the voice nuances.

- The voice being cloned may have features such as a dialect/accent
- Accents add another layer of complexity to voice cloning because they affect intonation, vowel sounds, and speech rhythm.

- Voice biometric patterns / tone of voice vary depending on emotions, contexts and media used to communicate
- If the model isn't exposed to different tones, it might generate speech that lacks appropriate expressiveness or overemphasizes certain aspects of speech incorrectly.

*Award **[1]** for identifying a reason why it may be difficult to clone a person's voice and **[1]** for a development of that reason up to **[2]**.*

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

(ii) Explain **one** way of verifying that the synthetic voice produced by voice cloning software is that of the famous person. [2]

Answers may include:

- Allowing the different version of the famous person's voice to be compared / Which allows an informed decision to be made about its authenticity.
- Particular phrases spoken by the famous person to be authenticated

*Award **[1]** for identifying how a voice can be authenticated as being of the person it is claimed to be and **[1]** for a development up to **[2]**.*

(c) Discuss whether it is acceptable for a movie production company to use dialogue generated by voice cloning software from an actor who has not been involved in the production of the movie. [8]

Answers may include:

Is acceptable if:

- The performer has given consent for his/her voice to be used (expression, ethics)
- The movie production company owns the IP of the person's voice (ethics)
- The use of the cloned voice is for the greater good (ethics)
- The performer whose voice has been used has been given credit (ethics) (identity)
- The performer has been dead for a long enough period so that copyright and IP laws are not invoked (ethics).

Is not acceptable:

- The performer has not given consent for their voice to be used (ethics).
- The use of the voice may present an opinion that is not supported by the person (expression, ethics) - obligations to accurately represent opinions of past people (change)
- The voice may be used maliciously (ethics) - to exercise power (power)

Please use part c markband on page 15.

2. Experimental earbuds for detecting infections

(a) (i) Identify **two** sensors needed for the earbuds to collect data. [2]

Answers may include:
- Temperature sensors.
- Moisture sensors.
- Sound sensors / Microphone.
- Proximity sensors.

*Award **[1]** for identifying each sensor up to **[2]***

(ii) Identify **two** ways in which data can be shared between the earbuds and the app. [2]

Answers may include:
- Bluetooth.
- WiFi.
- Near field communication (NFC).

*Award **[1]** for identifying each way data can be shared between the ear pod and the app up to **[2]**.*

(iii) Identify **two** characteristics of an algorithm. [2]

Answers may include:
- A step-by-step sequence of instructions.
- Unambiguous.
- Well defined inputs and/or outputs.
- Finite (number of steps).
- Feasible.

Do not accept 'well defined' on its own.

*Award **[1]** for identifying each characteristic of an algorithm up to **[2]**.*

(b) Explain **three** concerns about the algorithms used in the earbuds. [6]

Answers may include:

- Algorithmic bias / fairness.
- Will the algorithms lead to more accurate results for one section of the population compared to others.

- Algorithmic accountability.
- Should a problem be linked to the performance of the Tekunoroji, who will be accountable.

- Erosion and/or loss of human judgment.
- Will the use of algorithms to diagnose medical conditions lead to a reduction of the expertise of professionals in this field.

- Is there transparency linked to the algorithms.
- So that a medical professional can understand how the algorithms have led the Tekunoroji to a particular diagnosis.

- Inaccuracy of algorithms.
- Will produce errors in diagnoses.

*Award **[1]** for identifying a reason why concerns have been raised about the algorithms used in the ear pods and **[1]** for a development of that reason up to **[2]**.*

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

(c) Evaluate the impacts that wearable devices may have when used for medical diagnostics and care. [8]

Answers may include:

Positive impacts

- Patients will be able to keep abreast of their vital signs / medical condition 24/7 (systems).
- This can lead to them having less need to go to the doctors or to use valuable health resources if the condition is not serious.
- All the historical data may be captured (systems).
- The data will be more comprehensive than if it is only collected in a consultation with a doctor (systems).
- Which may mean it is easier to spot trends / abnormalities (systems).
- Might allow users to better manage illnesses which can be controlled.
- Saves time and money on prior medical studies for diagnosis.

Negative Impacts

- The app might suggest treatments which are not appropriate if the user's symptoms do not match the 'average' symptoms for a particular condition (systems, ethics).
- Users of the wearable devices may become fixated by it, which could have negative effects (white coat syndrome) (expression, values).
- May be unreliable - may be lost or damaged or experience software bugs which make them unreliable (systems).
- Technology in wearable devices may not provide accurate enough readings for medical use (systems).
- The user may not want to use the EarPods because they are worried about what might happen to the data which the wearable devices generate i.e. could be sold to or shared with third parties / used against them by insurance companies or potential employers etc. (systems, ethics).
- Current data may not be very saleable but wearable devices could be developed to take other readings in the future (ethics).
- Negative impact on medical profession if wearer becomes fixated on data and continually going to doctor (systems, values).

Please use part c markband on page 15.

3. Smart glasses help police track criminals

(a) (i) Identify **two** appropriate uses of the smart glasses in policing. [2]

Answers may include:
- See if individual is a known criminal / potentially dangerous
- See if individual has any outstanding fines / warrants

*Award **[1]** for each appropriate use of the smart glasses identified up to **[2]**.*

(ii) Identify the steps in the process by which facial recognition software can help the police identify a person. [4]

Answers may include:
- Smart glasses have an inbuilt camera which captures an image of the person's face.
- The image is sent to the central police server using wireless technology
- The image is compared with the images in the police database.
- If a match is found the person's information is sent back to the police officer
- If no match is found the police officer is informed that the person is not in the database

Do not accept responses about image comparison if they do not mention a database or a police server or anything similar.

*Award **[1]** for identifying each step of how facial recognition software identifies a person up to **[4]**.*

(b) Data about citizens is captured by the smart glasses and is added to the police database.

To ensure this data is not misused, policies are required for data collection, data storage and any data sharing.

(i) Explain **one** policy that is required for the ethical **collection** of citizens' data. [2]

Answers may include:
- the data is collected consistently
- and the method of collection meets the relevant legislation.
- Citizens are aware of the use of smart glasses by police

*Award **[1]** for identifying a way how the police can ensure data is collected ethically and **[1]** for a development of that way up to **[2]**.*

(ii) Explain **one** policy that is required for the ethical **storage** of citizens' data. [2]

Answers may include:
- ensure that data is stored securely (in transit/on the server).
- and there is a named person who is responsible / accountable for the security of data storage.

- set strict limitations and rules on who has access to stored data.
- so that data security/privacy of citizens is respected.

.
- make it clear to the citizens how long the data can be stored
- and this will comply with the law / will not be longer than necessary.

*Award **[1]** for identifying a way how the police can ensure data is stored appropriately and **[1]** for a development of that way up to **[2]**.*

(iii) Explain **one** policy that is required for the ethical **sharing** of citizens' data. [2]

Answers may include:
- data about a citizen is only shared with their consent
- and the sharing of the data does not break any data sharing guidelines / regulations / laws.

- exchange of data must be carried out exclusively between the police and the police server, or with another authorized person or institution (such as the government).
- To keep the privacy of the citizen.

*Award **[1]** for identifying a way how the police can ensure data is shared ethically and **[1]** for a development of that way up to **[2]**.*

(c) Discuss the advantages **and** disadvantages of using smart glasses that can recognize faces in law enforcement. [8]

Answers may include:

Advantages

- Nothing to hide, nothing to fear (power)
- Increase confidence in law enforcement agencies (systems)
- Greater efficiency in policing (systems)
- May act as a deterrent and lead to a reduction in crime (systems)

Disadvantages

- Could compromise the privacy of citizens (ethics)
- May raise concerns about surveillance (power, ethics)
- The software may be prone to algorithmic bias (systems, values)
- The system may not be reliable, which may undermine confidence in it (systems)
- Individuals who wish to remain anonymous for non-criminal reasons may have their identity revealed (identity)

Please use part c markband on page 15.

4. Equal access to the internet

(a) (i) Identify **two** services provided by an internet service provider (ISP). [2]

Answers may include:
- E-mail.
- Domain hosting.
- Web services
- Chat.
- Text messaging.
- File sharing.
- Online messaging.
- Video conferencing.
- Network maintenance and technical support.
- VoIP services.
- Streaming service.
- Broadband service.

Do not accept references to physical connections, or generic responses such as internet service or similar.

*Award **[1]** for identifying each service provided by an internet service provider up to **[2]**.*

(ii) Identify **two** characteristics of bandwidth. [2]

Answers may include:
- Quantity of data that can be transferred in a given time by a network.
- Is measured in MB/s (or other data units if they can be converted).

*Award **[1]** for identifying each characteristic of bandwidth up to **[2]**.*

(iii) Identify **two** features of a virtual private network (VPN). [2]

Answers may include:
- Is a secure connection.
- Is routed via an encrypted virtual tunnel.
- Masks the user's IP address/location.
- Safeguards the user's privacy on a public network.

*Award **[1]** for identifying each feature of a virtual private network (VPN) up to **[2]**.*

(b) (i) Explain **two** reasons why EC University decided to monitor the internet usage of its students. [4]

Answers may include:
- They believe students may be viewing / posting at inappropriate/offensive content.
- Which may have a negative effect on their well-being.

- If the network is not performing as it should.
- Is this a result of a technical issue or one where it is not being used appropriately.

- Misuse of the network, using it for non-educational purposes.
- Harms its performance.

- If teaching and learning is adversely affected.
- It will have an impact on students' education..

Accept examples and award [1] if the problem has been identified.

*Award **[1]** for identifying a reason why the university decided to monitor the internet usage of its students and **[1]** for a development of that way up to **[2]**.*

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

(ii) Explain **one** measure, **other than** limiting the bandwidth, that EC University could take to manage the bandwidth. [2]

Answers may include:
- *Traffic on the network could be prioritized.*
- *This may mean prioritizing specified file formats (such as Word) / small files over larger files / certain users / work that is considered business critical or sensitive.*

- *Certain sites could be blocked eg*
- *Limit access to "popular" websites unneeded for university educational purposes*

*Award **[1]** for identifying a measure that EC University could take to manage the bandwidth and **[1]** for a development of that way up to **[2]**.*

(c) Discuss whether EC University should introduce a premium service that allows students and staff who pay an additional fee to have increased bandwidth. [8]

Answers may include:

Should be used

- Will ensure that business critical work can be completed on time (systems)
- Will improve the quality of teaching and learning if payment can be used as a way to increase priority of specified resources (values)
- May enable scarce resources to be used more efficiently as it may make staff and students think about / reflect on their internet behaviour (systems)
- Reflects the current situation rather than the utopian vision of the founders of the web (change)

Should not be used

- May exacerbate the digital divide (power) (values & ethics)
- Goes against the guiding principles of the web such as net neutrality / democratisation of the web (ethics)
- Suggests that although all network traffic is equal, some is more equal than others (power).
- Students and staff may think this is a form of surveillance (power, ethics)
- May go against Net Neutrality (ethics).

Please use part c markband on page 15.

Paper 1, Part c markband.

Paper 1 part (c)	
Marks	**Level descriptor**
0	• The work does not reach a standard described by the descriptors below.
1–2	• The response shows limited understanding of the demands of the question. • There is limited relevant knowledge. The response is descriptive and consists mostly of unsupported generalizations. • The response has limited organization or is only a list of items.
3–4	• The response shows some understanding of the demands of the question. • Some relevant knowledge is demonstrated, but this is not always accurate and may not be used appropriately or effectively. The response moves beyond description to include some analysis, but this is not always sustained or effective. • The response is partially organized.
5–6	• The response shows adequate understanding of the demands of the question. • The response demonstrates adequate and effective analysis supported with relevant and accurate knowledge. • The response is adequately organized.
7–8	• The response is focused and demonstrates an in-depth understanding of the demands of the question. • The response demonstrates evaluation and synthesis that is effectively and consistently supported with relevant and accurate knowledge. • The response is well-structured and effectively organized.