N19/3/ITGSX/HP1/ENG/TZ0/XX/M

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Information technology in a global society

Higher level

Paper 1

22 pages

Critical Thinking – explanation, analysis and evaluation

These trigger words often signal critical thinking. The bold words are the key terms in the various criteria.
Explanation – *Because, as a result of, due to, therefore, consequently, for example*
Analysis – *Furthermore, additionally, however, but, conversely, likewise, in addition, on the other hand, whereas*
Evaluation – *My opinion, overall, although, despite, on balance, weighing up*

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.

Section A

1. Biometric authorization

Note to examiners:
- *All part (a) questions are marked using ticks and annotations where appropriate.*
- *Part (b) and part (c) are marked using markbands. Use annotations and text comments to provide a rationale behind the marks you awarded.* ***Do not use ticks****.*

(a) (i) Identify **two** fields that could be in the *Employee* table of the database. **[2]**

Answers may include:
- First name
- Surname
- ID number
- Gender / sex
- Phone number
- Date of birth
- Manager's name
- Position
- Department e-mail.

Award ***[1]*** *for identifying each appropriate field up to maximum of* ***[2]****.*

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

Answers may include:
- more than one linked table/entity
- primary key fields linked to foreign key fields
- each record is unique
- eliminates data redundancy
- is a smaller file than a flatfile database.

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

(iii) Identify **two** methods that could be used to ensure that the data input to the database is accurate. **[2]**

Answers may include:
- validation
- verification.

Award ***[1]*** *for identifying each method that can be used to ensure the data added into the database is accurate up to maximum of* ***[2]****.*

(b) As part of the implementation of the biometric authorization system, *Bright Creativa* has written a privacy policy.

Explain **three** features that *Bright Creativa* would need to include in a privacy policy linked to the company's biometric authorization system. **[6]**

Answers may include:

- The privacy policy will need to be easily understood/transparent.
- So employees are able to understand how their data will be collected, stored or who it may be shared with.

- The privacy policy must explain what data is being collected about them.
- And this data is intended to be used by the company.

- The privacy policy will need to explain that data will only be stored for as long as necessary / for the length of time the employee is with the company.
- And that appropriate measures have been taken to safeguard it from unauthorized access.

- If a data breach occurs, i.e. the data is compromised or stolen.
- The company must inform the users immediately.

*Award **[1]** for identifying a feature that Bright Creativa would need to include in a privacy policy and **[1]** for explaining why that feature should be included up to a maximum of **[2]**.*

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

(c) To what extent is the employees' improved access to company resources outweighed by their concerns about the level of surveillance by the company? **[8]**

Answers may include:

Advantages to the employee

- convenience, such as there is no need to carry ID cards to unlock doors
- there is no need to remember passwords to logon to the network, or to continuously change the password
- is likely to be more secure than relying on authentication techniques such as a username and password as it is harder to forge a fingerprint than remember a password
- may provide quicker access to resources
- they don't need to carry cash to buy items from the café.

Concerns of the employee may

- their performance could be monitored and performance ratings based on potentially information provided by the system
- monitoring may become covert surveillance which may be unethical, especially if the employees are not aware of the ways in which the information is used
- purchases are tracked and judgements might be made about them, for example, what foods they purchase
- the fingerprints may not always be reliable, for example if the employee cuts the finger that is used for biometric authentication, which means that a resource may not be accessible
- logging on to each resource using biometric identification may be time consuming and lead to inefficient working practices.

Please see generic markband information sheet on page 22.

2. Wildfire modelling

Note to examiners:
- *All part (a) questions are marked using ticks and annotations where appropriate.*
- *Part (b) and part (c) are marked using markbands. Use annotations and text comments to provide a rationale behind the marks you awarded.* ***Do not use ticks****.*

(a) (i) Identify **two** stages of the product development life cycle (PDLC). **[2]**

Answers may include:
- investigation of existing system
- feasibility study
- requirement Specification
- project schedule
- product Design
- product development
- prototyping
- technical documentation
- client and end-user evaluation
- testing and debugging.

Award ***[1]*** *for identifying each stage of the product development life cycle (PDLC) up to maximum of* ***[2]****.*

(ii) Identify **two** methods that could be used to train the staff to use the new modelling system. **[2]**

Answers may include:
- video tutorials
- "how to" guides
- face-to-face training
- online training courses.

Award ***[1]*** *for identifying each method that could be used to train the staff to use the new modelling system up to maximum of* ***[2]****.*

(iii) Identify **two** measurements that could be taken by the weather sensors in the Kinakora National Park. **[2]**

Answers may include:
- air temperature
- wind speed
- wind direction
- humidity
- the amount of precipitation
- ground temperature.

Award ***[1]*** *for identifying each measurement that could be taken by the weather sensors in the Kinakora National Park up to maximum of* ***[2]****.*

(b) Two methods for informing tourists about wildfires in Kinakora National Park are:
- Short Message Service (SMS) texting/text messaging
- Posting information on the Kinakora National Park website.

Analyse these **two** methods. **[6]**

Answers may include:
Advantages of using SMS texting
- easy to use
- information is pushed out to the tourists
- not dependent on internet access
- cheap
- low tech / can be done from very old hardware
- faster than posting information in a website / synchronous.

Disadvantages of using SMS texting
- tourists need phone reception to get the message
- the national park needs all tourists' phone numbers to ensure all tourists can access this information
- data needs to be stored (phone numbers) so an appropriate privacy policy needs to be in place
- there is no guarantee the message has got through
- some tourist might not have their phone
- batteries can run out.

Advantages of using the Kinakora National Park website
- the information can use graphics/maps
- it is not necessary to collect/store tourists' phone numbers.

Disadvantages of using the Kinakora National Park website
- tourists need to visit the website to get information
- tourist may not have web access
- visually impaired visitors might not get the information.

Note: Many of the advantages of SMS text are automatically disadvantages of the Kinakora National Park website or vice versa.

[0]
No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.

[1–2]
A limited response that indicates very little understanding of the topic or the reason is not clear. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.

[3–4]
A description, unbalanced or partial analysis of the issues related to using SMS texting or the Kinakora National Park website. There is some use of appropriate ITGS terminology in the response.

[5–6]
A balanced and detailed analysis of the relative advantages and disadvantages of using SMS texting or the Kinakora National Park website. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response.

(c) Evaluate Kinakora National Park's decision to use computer modelling to develop strategies for dealing with wildfires. **[8]**

Answers may include:

Advantages of using computer models to develop strategies to deal with wildfires

- many different scenarios can be tried out before a final strategy is determined
- dangerous situations can be tried without the risk to human life
- possible fires can be predicted, and strategies can be defined to deal with them
- the development of the model may lead to a greater understanding of the factors that influence the start and spread of forest fires; for example, fires starting in similar circumstances may not always follow same pattern
- models may be revised as the nature of forest fires evolves, for example, as a result of drier conditions, hotter summer temperatures
- models can be used for training.

Disadvantages of using computer models to develop strategies to deal with wildfires

- the data that is being input / data must be reliable / GIGO
- the model is a simplification of a real situation and there may be factors that it is not possible to consider
- expensive to develop a model/ requires large amount of processing power and this may not be an effective use of resources
- the conditions in the national park may evolve more quickly than the model is able to which may lead to predictions not being as accurate as expected.

Please see generic markband information sheet on page 22.

3. Online learning

Note to examiners:
- *All part (a) questions are marked using ticks and annotations where appropriate.*
- *Part (b) and part (c) are marked using markbands. Use annotations and text comments to provide a rationale behind the marks you awarded.* ***Do not use ticks****.*

(a) (i) Identify **two** ways that the *TailorEd* system could provide feedback to the students. **[2]**

Answers may include:
- graphics/text on the screen
- sent by email to the student
- haptic feedback on correct answers in a mobile version
- notifications in a mobile app
- by awarding badges
- chat/chatbot.

Award ***[1]*** *for identifying each way the* TailorEd *system could provide feedback to the students up to maximum of* ***[2]****.*

(ii) Identify **two** ways that the data collected about students' academic progress could be used by *TailorEd*. **[2]**

Answers may include:
- to send students advertisements of relevant educational material
- to ascertain the effectiveness of the lessons
- to adapt the tasks to the students' abilities
- to offer tutoring if students fail a particular unit
- to share with universities and aid candidate selection
- to give opportunities to high scoring students
- to keep parents informed.

Award ***[1]*** *for identifying each way the data collected about students' academic progress could be used by* TailorEd *up to maximum of* ***[2]****.*

(iii) Outline how a firewall functions. **[2]**

Answers may include:
- monitors incoming and outgoing traffic
- acts like a filter between the computer and the Internet
- blocks specific ports / IP addresses / protocols / words or phrases
- either allows traffic to pass through the firewall or not based on a set of predetermined rules.

Award ***[1]*** *for identifying the basic function of a firewall and* ***[1]*** *for a development of the initial idea up to maximum of* ***[2]****.*

(b) There are two possible methods for ensuring students use the *TailorEd* online learning system responsibly. They are:
- Restrict access to sites that may be considered inappropriate.
- Educate the students about acceptable use.

Analyse these **two** options. **[6]**

Answers may include:
Reasons for restricting access to sites that may be considered inappropriate
- to stop students going to websites they shouldn't
- to ensure the schools bandwidth is used for education rather than for other purposes
- to protect students from dangers on the web / some inappropriate sites appear without warning and they are hard to avoid
- parents may be happier knowing the filtering technology is in place as it will restrict access for younger students who cannot filter for themselves.

Reasons for educating students about acceptable use
- the students learn to take responsibility for their actions as this will be a skill they will need outside of school
- students will always find ways to circumvent the filters applied by the school
- who decides what will be blocked? Learning may be constricted by the use of a white list.

[0]
No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.

[1–2]
A limited response that indicates very little understanding of the topic or the reason is not clear. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.

[3–4]
A description, unbalanced or partial analysis of the decision whether to either restrict access to certain websites or to educate the students about using the platform in an acceptable manner. There is some use of appropriate ITGS terminology in the response.

[5–6]
A balanced and detailed analysis of the decision whether to either restrict access to certain websites or to educate the students about using the platform in an acceptable manner. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response.

(c) To what extent do the benefits of collecting students' progress data outweigh the concerns of the students, teachers and parents? **[8]**

Answers may include:

Benefits of collecting students' progress data

- the data collected can be tailored to provide more individualized learning for the student
- the student's progress can be reported back to the teacher/parent on a more regular basis and in a more standardized format
- the school is able to use the data to identify trends and patterns that may not be immediately obvious and use this data driven approach to improve the performance of its teachers and students
- this information can be used by students when applying for jobs or even for further education.

Concerns of the students, teachers and parents

- they may not know what data is being collected, stored and/or disseminated
- they may not know the degree to which the identity of the student is anonymized
- there may be a purely data driven approach to the use of the student data which may lead to a narrowing of the teaching to ensure short term targets are met at the expense of the whole learning experience
- large amounts of teachers' time may be taken up with the collection and entering of this data into the TailorEd database
- the cost of purchasing the TailorEd system may not be cost-effective as it may involve staff training costs or the employment of staff to enter the data.

Please see generic markband information sheet on page 22.

Section B

4. Neural networks are changing surveillance

Note to examiners:
- *All part (a) questions are marked using ticks and annotations where appropriate.*
- *Part (b) and part (c) are marked using markbands. Use annotations and text comments to provide a rationale behind the marks you awarded.* ***Do not use ticks****.*

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

Answers may include:
- learns from new data/input
- can improve on its mistakes
- can perform new tasks after processing the data
- can react to new inputs it has not encountered before
- searches through data for patterns and adjusts accordingly
- built on examination of large amounts of data
- builds a general model from the training examples.

Award ***[1]*** *for identifying each characteristic of machine learning up to maximum of* ***[2]****.*

(ii) Outline **one** reason why neural networks may be used for the processing of data from devices such as surveillance cameras. **[2]**

Answers may include:
- can interpret information that doesn't follow expected patterns
- can make generalizations and inferences
- can reveal hidden relationships
- can process large amounts of data at a faster and more reliable rate than when using humans.

Award ***[1]*** *for identifying a reason why neural networks are beneficial to the processing of data and* ***[1]*** *for a development of that reason up to maximum of* ***[2]****.*

(iii) Outline how pattern recognition works. **[2]**

Answers may include:
- images are stored in a database
- a new image is input
- defining features of the new image are identified
- the new image is compared to the images in a database
- if the image approximates to one of the images in the database it is recognized.

Award ***[1]*** *for identifying each aspect of how pattern recognition functions up to maximum of* ***[2]****.*

(b) Explain why an agile project management methodology would be used in the development of the new AI surveillance camera system. **[6]**

Answers may include:
Reasons for using an agile project management methodology include

- regular testing of the development of the AI system will be able to pinpoint potential issues when they arise rather than waiting for a particular milestone to be reached
- the developments in AI may lead to revisions being necessary to the scope and nature of the project throughout its course
- changes in legislation linked to data collection may require the nature of the project to change during its course
- the client is involved throughout the development of the project, who help with customer satisfaction
- there would be less risk as this methodology would eliminate project failure
- use of prototypes would help make revisions easier
- agile supports teamwork and collaborate
- agile prioritizes workflow, creating a more efficient process
- lots of opportunity for feedback enabling the system to be revised during development.

[0]
No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.

[1–2]
A limited response that indicates very little understanding of the topic or the reason is not clear. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical and descriptive.

[3–4]
A superficial explanation of why the agile method would be used to develop this software. There is some use of appropriate ITGS terminology in the response.

[5–6]
A detailed explanation of why the agile method would be used to develop this software. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response.

(c) To what extent should pattern recognition in AI systems be trusted to make decisions about sending real-time alerts to the police? **[8]**

Answers may include:

Reasons why pattern recognition in AI systems should be trusted to make decisions about sending real-time alerts to police

- it can analyse large amounts of data so police decisions will be based on greater information
- can provide more information to police to assist them in carrying out their job
- standard response to dangers can eliminate human error, such as panic responses or ill-judged responses
- there is less chance of not noticing a dangerous situation, whereas humans can get distracted
- the AI system can react faster than a human to suspicious circumstances.

Reasons why pattern recognition in AI systems should not be trusted to make decisions about sending real-time alerts to police

- unlike humans, the AI system cannot make decisions based on ethical criteria
- creating rules that take into account all of the possible ethical dilemmas may not be possible and cannot always determine right from wrong
- if an unsupervised learning is used, the AI may self-learn and arrive at decisions that may not be appropriate
- the AI could become unreliable due to a glitch in the system
- there might be a new situation never anticipated by the AI system
- there is the problem of accountability. At what point can the AI system, or the programmers etc be held accountable for an error.

Please see generic markband information sheet on page 22.

5. Automated medical image analysis

Note to examiners.
- *All part (a) questions are marked using ticks and annotations where appropriate*
- *Part (b) and part (c) are marked using markbands. Use annotations and text comments to provide a rationale behind the marks you awarded.* ***Do not use ticks****.*

(a) (i) Identify **two** features of a legacy system. **[2]**

Answers may include:
- based on "old" technology such as desktop computers
- uses previous versions of software that may not be compatible with currently used version / are not backwardly compatible
- may include hardware that is no longer supported by manufacturers or suppliers
- may include hardware that is expensive to maintain due to availability of parts/expertise.

Award ***[1]*** *for identifying each characteristic of a legacy system up to maximum of* ***[2]****.*

(ii) Identify **two** reasons why a feasibility study is used during project development. **[2]**

Answers may include:
- look at requirements specification to see if it is achievable
- look at costs to see if it is affordable
- see if benefits outweigh the costs
- decide how soon it is needed
- decide if the users need training
- to take into account the total amount of time it will take to implement and design the new system
- examine whether it is technically feasible
- look at drawbacks
- look at alternative solutions.

Award ***[1]*** *for identifying each reason why a feasibility study is used up to maximum of* ***[2]****.*

(iii) Identify **two** stakeholders that the information systems manager should consult in the initial investigation. **[2]**

Answers may include:
- doctors
- hospital managers
- hospital owners
- project managers
- technicians/computer personnel.

Award ***[1]*** *for identifying each stakeholder the information systems manager should consult in the initial investigation is used up to maximum of* ***[2]****.*

(b) Two changeover methods that could be used for the introduction of the new AI system are:
- Direct changeover
- Phased changeover.

Analyse these **two** changeover methods. **[6]**

Answers may include:

Direct changeover
- there is a faster changeover, so new system is up and running immediately
- may be less confusing for staff as they have only one system to understand
- will remove the issues of compatibility between the two systems that may occur with a phased changeover
- training would be needed before the implementation a new AI system
- there is a high risk of data loss if something goes wrong, and reverting back to the old system is impossible.

Phased changeover
- may provide time for staff to learn the new system (training) while the original system is used in parallel
- may give time to appraise the new system as it is implemented which is not possible with direct changeover as implementation is done in smaller "chunks"
- may be possible to revert back to old system as changes may be less
- allows closer monitoring of new system as each phase of the implementation can be thoroughly evaluated before the next stage.
- lower risk of data loss when introducing a new AI system
- it would take longer to implement using a phased changeover method.

[0]
No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.

[1–2]
A limited response that indicates very little understanding of the topic or the reason is not clear. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.

[3–4]
A description, unbalanced or partial analysis of whether a direct changeover or a phased changeover should be used. There is some use of appropriate ITGS terminology in the response.

[5–6]
A balanced and detailed analysis of the relative advantages and disadvantages of whether a whether a direct changeover or a phased changeover should be used. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response.

(c) Joelstraat Hospital currently bases the diagnoses of patients' illnesses on:
- Information provided by the expert system
- Discussions between the doctors and the patients.

The new AI system will be a significant improvement over the current expert system.

To what extent should the diagnosis of patients' illnesses be based on the information provided by the AI system? **[8]**

Answers may include:

Reasons for basing the diagnosis of the patients on the recommendations of the AI system
- may be used to improve the throughflow of patients as the diagnoses could be linked to non-serious cases only
- may provide a second opinion that a medical professional can use as the basis for making a decision
- may act as a method of allocating less urgent patients to nurses and leaving the more serious conditions to doctors.

Reasons for not basing the diagnosis of the patients on the recommendations of the AI system
- the accuracy of the diagnosis will depend on the quality/volume/range of data available in the AI system
- the AI system may contain bugs
- the AI system does not take into account the medical history of the patient
- cannot make decisions based on ethical criteria
- might be a new situation never anticipated, therefore difficult for AI system to properly analyze
- raises issues linked to accountability if there are problems that emerge as a result of an incorrect diagnosis.

Please see generic markband information sheet on page 22.

6. Robotic mops

Note to examiners.
- *All part (a) questions are marked using ticks and annotations where appropriate*
- *Part (b) and part (c) are marked using markbands. Use annotations and text comments to provide a rationale behind the marks you awarded.* ***Do not use ticks****.*

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

Answers may include:
- a machine that can be programmed
- a machine that can do specific tasks
- a machine or device that operates automatically or by remote control
- a machine that can be programmed
- a machine that can carry out a series of complex tasks
- will always work through the process in the same order
- uses sensors.

Award ***[1]*** *for identifying a characteristic of a robot equal or similar to the first bullet point*
Award an additional mark for identifying any other characteristic of a robot, provided the first bullet point (or similar idea) has been mentioned in the answer, up to maximum of ***[2]****.*

(ii) The FluffyMopa is fitted with a proximity sensor that uses ultrasound to avoid collisions with walls and furniture. Identify the steps that the FluffyMopa would take to prevent collisions occurring. **[4]**

Answers may include:
- sound emitted from the FluffyMopa
- sound hits object and is reflected back to the sensor on the FluffyMopa
- the FluffyMopa calculates the time taken to receive the sound
- the FluffyMopa calculates the distance from the object
- if the distance is less than (or equal to) the value permitted the FluffyMopa stops
- if the distance is greater than the value permitted the FluffyMopa continues in the same direction.

Award ***[1]*** *for identifying each step that the FluffyMopa uses to avoid collisions up to maximum of* ***[4]****.*

(b) (i) Distinguish between a Gantt chart and a Pert chart. **[2]**

Answers may include:
- a Gantt chart indicates a simple visualization of a project schedule
- a Gantt chart looks like a bar chart
- a Gantt chart is easier to change
- a Pert chart shows the project dependencies and is more complex than a Gantt chart
- a Pert chart has nodes representing events
- nodes are connected by arrows showing the sequence of tasks
- a Pert chart shows the critical path
- Pert charts can be difficult to interpret.

*Award **[1]** for a basic definition of the Gantt chart and the Pert chart and **[1]** for clearly indicating a difference between the two charts up to maximum of **[2]**.*

(ii) Explain why alpha and beta testing would be necessary for the development of the FM2. **[4]**

Answers may include:

Reasons why Alpha testing is necessary
- can debug programming at initial phase, before the new FM2 is released
- the FM2 mop would go through step-by-step process to ensure that it works completely
- it would identify possible issues with the FM2 mop before releasing the full-working model.

Reasons why Beta testing is necessary
- tests the working FM2 model before full scale manufacturing commences
- performed by users of the software application to find errors before final distribution
- reduces product FM2 failure risks and provides increased quality of the FM2 mop
- the final test before manufacturing the mass product for customers
- gives direct feedback from customers about the FM2 mop improvements
- helps to tests the FM2 mop product in real time environment.

*Award **[1]** for identifying a reason why alpha testing is necessary and **[1]** for explaining why that aspect should be included up to a maximum of **[2]**.*

*Award **[1]** for identifying a reason why beta testing is necessary and **[1]** for explaining why that aspect should be included up to a maximum of **[2]**.*

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

(c) During the development of the FM2, an app was created that could enable an owner of a FM2 to carry out the following tasks remotely:

- Check the quality of the cleaning using video footage from the FM2.
- Check the amount of charge remaining in the battery.
- Use natural language processing so that the owner can give instructions such as “OK Fluffy, clean the kitchen floor now”, or “Fluffy, return to the docking station to recharge”.

Discuss whether the FM2 should be developed to include these additional features. **[8]**

Advantages of developing the FM2 with the additional features

- would allow the FM2 to clean rooms more efficiently as it would not redo previously cleaned areas or may not clean areas that do not need to be cleaned / may allow the cleaning to be fine-tuned by determining high traffic areas
- will enable the owners to send the FM2 to a specific area/room in the house
- natural language will assist the elderly and the handicapped video footage would provide customers with information about cleaning performance.

Disadvantages of developing the FM2 with the additional features

- natural language processing may not be reliable enough to enable the FM2 to carry out these tasks
- potential misuse of information collected, who is authorized to access information / database can be hacked, leads to possible loss of personal data about home/floorplans
- the company would need to invest in IT resources to create, maintain and share this information
- if data is shared with 3rd parties, customers could receive unwanted ads or solicitations based on the data
- records customers lifestyle and daily patterns, can be used to predict habits
- information could be accessible to police, insurance companies
- the development of these additional functions may not be cost effective.

Please see generic markband information sheet on page 22.

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.*