Markscheme

November 2022

Information technology in a global society

Standard level

Paper 1

16 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.

1.   Virtual learning environments

(a)   (i)   Identify **two** hardware devices that a university lecturer could use to record
a lecture.   [2]

Answers may include:
- PC/laptop/cellphone
- Microphone
- Webcam / video recording device
- Audio interface

Award [1] for identifying each hardware device up to [2].

(ii)   Identify the steps that a university lecturer may use to upload course
material to the virtual learning environment (VLE).   [4]

Answers may include:
- Convert the recording into the correct format for uploading (compress if needed).
- Enter URL of VLE landing page / access bookmark / open the university website on a browser.
- Go to the login option.
- Provide login credentials / user ID and password.
- Open the platform (VLE).
- Use drop down menus to select course.
- Upload the course material / drag file from local computer or cloud to the location.

Award [1] for identifying each step up to [4].

(b)   The university needs to choose between open-source software and proprietary software to develop the virtual learning environment (VLE).

Analyse these two options.   [6]

Using open-source software:
- Open-source software is often free or low-cost, may allow the university to acquire more software within a limited budget/may suit budget constraints.
- Open-source community is very active and is continually making updates which may be a more efficient mechanism than the staged releases by proprietary software companies.
- The open-source community can often provide immediate help with any software problems.
- Open-source software can be changed or customized to suit the university requirements.
- The source code is available for programmers to modify.
- Open-source software may not have all the options/features needed by the university.
- Using open-source software for the VLE may require hiring more programming staff to upgrade the software.
- Is the open-source software secure?
- The open-source software can be personalized to the university's needs

Using proprietary software:
- Proprietary software includes safeguards such as guarantees / warranties. (support is a new point and is included at the end).
- Most proprietary software can be fully customized to suit the university requirements.
- Companies that provide proprietary software generally provide frequent security updates/patches as they have a vested interest in keeping their product secure.
- The user interface may be a more familiar design as the software is considered as part of a whole package.
- Proprietary software may have a greater range of features/options than open-source software.
- Proprietary software may demand a higher level of investment by the university.
- Manufacturers of proprietary software can provide support and assistance to the company.

Marks	Level descriptor
[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 the use of open source and proprietary software. There is some use of appropriate ITGS terminology in the response.*
[5–6]	*A balanced and detailed analysis of the issues related to the use of open source and proprietary software. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response.*

(c)   Students are in the process of selecting a university to complete their degree. They have two options:

- **Option 1**: A traditional university using face-to-face environments.
- **Option 2**: A university only offering online courses using a virtual learning environment (VLE) platform.

Evaluate these two options.   [8]

Answer may include:

Reasons for opting for face-to-face learning
- Students can focus better in F2F environment, learning from home may have distractions.
- Access to resources – students will have better access to resources, e.g. laboratories, library, sports facility, etc.
- Face-to-face learning may be more effective in organizing students and their studies.
- Improve social and interpersonal skills – students may have greater bonding in F2F environment -they will have the ability to interact with professors and students in class physically.
- Students may have better learning opportunities-they can get instant answers, can create a better network with fellow students, the professors.
- the degree earned in F2F environment may carry more value than VLE.
- Unlike VLE, it is easier to enforce compulsory attendance in F2F environment – students are more likely to succeed when they attend classes consistently.
- It is not necessary to have the technology at home.

Reasons for opting for online learning
- Greater access to university courses overseas or in other states as they can study from home.
- Students will have greater flexibility – they can learn at their own pace, in their own time ensuring that they understand each topic before moving on. But this requires motivation and good organizational skills. Can repeat the videos as many times as you want.
- Professors can track students' progress more efficiently using the content access logs and provide more personalized support to them – implies professors are given time to do this.
- University can restrict the availability of any activity, resource or course section according to conditions such as date, grade obtained, group or other activity completion. This may need to be flexible to allow for special cases.
- Learning through VLE would mean that learners can look after their families or work while studying as study can be done at a time that suits them.
- There may be opportunities to collaborate with other students from different countries allowing a global perspective.
- Less expensive – no need for traveling, hostel fees, etc.
- Students will be able to build better organizational skills – but some students may find this challenging.
- Good option for those with physical needs.

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 on page 16.

2.   The use of simulators to train military personnel

(a)   (i)   Identify **two** file formats that could be used to save an image in the
simulator.   [2]

Answers may include:
- JPEG (or JPG) / joint photographic experts group
- PNG / portable network graphics
- GIF / graphics interchange format
- TIFF / tagged image file format
- PSD / Photoshop document
- RAW / raw image formats

*Award **[1]** for each file format identified up to **[2]**.*

(ii)   Define the term *image resolution*.   [2]

Answers may include:
- The density of the pixels in the image / the number/amount of dots, or pixels per inch.
- Resolution is measured in pixels per inch (PPI) or dots per inch (DPI).
- The sharpness and clarity of an image (the higher the number of pixels, the greater the resolution).

Quality – only accept if it is related to resolution.

*Award **[1]** for identifying each appropriate statement up to **[2]**.*

(iii)   Identify **two** biometric authentication methods that could be used to access
the simulator.   [2]

Answers may include:
- Fingerprints.
- Facial recognition.
- Voice recognition.
- Iris recognition.
- Retina scan / Eye scan.

*Award **[1]** for identifying each appropriate authentication method up to **[2]**.*

(b)   (i)   Distinguish between a model and a simulation.   [2]

Answers may include:
- A model is a simplification of the key characteristics, behaviours and functions of the selected system or process.
- A model is based on the algorithms and equations used to capture the behaviour of the system being modelled.
- A model is used to ask 'what if' questions.
- A model is a 'representation' of a real-life object/system.

- A simulation is the actual running of the program that contains these equations or algorithms.
- A simulation, therefore, is the process of running a model / in a simulation, models can be used to study existing or proposed characteristics of a system.
- Simulation takes user input to simulate a situation – to run through various scenarios.

*Award **[1]** for identifying each difference between a model and a simulation, up to **[2]**.*

(ii)   Explain why the quality of user documentation is important for the success of the simulator.   [4]

Answers may include:
- Good user documentation will make information easily accessible.
- The details included in user documentation may explain the functionality of the simulator to the users. / It helps them have the best product experience.
- It may prevent equipment from being damaged through incorrect use
- It may simplify the understanding of the simulator to new users who can learn to use the simulator quickly.
- It can cut support costs / less dependency on the developer's direct support.
- It may help the users troubleshoot certain common operational issues related to the simulator. / FAQs included in user documentation may have answers to most common issues faced by the users.

Marks	Level descriptor
[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 how the quality of user documentation can affect the success of implementation of the newly proposed system. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material.*
[3–4]	*An explanation of how the quality of user documentation can affect the success of implementation of the newly proposed system. 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 using simulators for training soldiers outweigh the concerns? [8]

Answers may include:

Benefits of using simulators in the training process
- Cost-effective and time-saving.
- It can avoid danger and loss of life / safe environment to learn in / soldiers can be placed into a risk-free environment, which will let them safely carry out any combat drills without any harm.
- Highly immersive experience – VR/AR / Conditions can be varied and outcomes investigated.
- Soldiers can experience a variety of environments and scenarios, e.g. changes in terrain/changes in weather conditions.
- Progress can be measured objectively / soldiers' training performance can be recorded digitally for further analysis or training purposes.
- Simulations can be slowed down to study a soldier's behaviour more closely.
- Simulators allow soldiers to experience any type of vehicle in a far more immersive and realistic way.
- Soldiers can navigate environments native to any part of the world.

Concerns associated with the use of simulators in the training process
- Simulations are not always able to completely recreate real-life situations.
- Use of VR/AR may cause eye strain.
- To simulate a scenario, a thorough understanding is needed and an awareness of all the factors involved. This relies on developers being given complete and accurate data.
- The developer may not be able to visualize real war like situation and may miss out important considerations.
- Simulators can be very expensive and require constant updates and maintenance.
- Trainees need to be trained on how to use the software and/or hardware and this takes up time and costs money.
- No real consequences for mistakes may result in trainees underperforming and not being fully engaged in the training, thus producing inaccurate results.

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 on page 16.

3.   Messaging apps*

(a)   (i)   Identify **two** disadvantages of a user's data being stored on their
             mobile device.   [2]

             Answer may include:
             • User may lose important data if the device malfunctions.
             • User may lose important data if the device is lost/stolen.
             • Privacy of user data if device is stolen.
             • User may lose important data in case of accidental deletion.
             • User may lose important data due to malware/virus.
             • Data may take up storage and reduce performance.

             Award [1] for identifying each appropriate disadvantage up to [2].

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

             Answer may include:
             • Encryption translates original data (plain text) into an alternate form
               (cipher text).
             • The encryption process uses an encryption algorithm.
             • Encryption keys have a predetermined length / longer keys are more
               difficult for an attacker to guess than shorter ones.
             • A key is used for encrypting and decrypting / to transform the cipher text
               back into the plaintext.
             • An asymmetric encryption, also known as public key encryption, uses
               two separate keys; a public key and a private key.
             • Even if encrypted data is intercepted, it cannot be used/read.

             Award [1] for identifying each characteristic of encrypted messages up to [2].

      (iii) Identify **one** advantage for *Tap2Talk* users of receiving notifications.   [1]

             Answer may include:
             • Notifications can keep users updated e.g. promotional offers, social
               media post by friends/relatives, emergency updates, news.
             • It reminds the user to visit the app.
             • Notifications can popup on screen even when the app is closed.
             • Notifications are generally free for users to receive.

             Award [1] for identifying an advantage of receiving notifications up to [1].

      (iv)   Identify **one** disadvantage for *Tap2Talk* users of receiving notifications.   [1]

             Answer may include:
             • Frequent notifications such as promotional messages may be irritating
               for users.
             • The notification may come at an awkward time for the user, for example,
               due to time zone differences.
             • The notifications often disappear after they have been accessed or
               phone is restarted / users may lose access to important notifications.

             *Note to examiners: Do not accept a disadvantage that people next to you can see
             notifications.*
             Award [1] for identifying a disadvantage of receiving notifications up to [1].

(b)   A number of *Tap2Talk* users are concerned about ticking a single check box to agree to the new terms of service and privacy policy (see **Figure 3**).

Explain why *Tap2Talk* users might be concerned about ticking a single check box
to agree to the new terms of service and privacy policy.   [6]

Answers may include:
- Users will just click the accept check box as it is quick and will not read the policy terms in detail.
- The language in the terms of conditions is so complex that users would not understand it.
- The terms and conditions can be very long and in a very small font size and users will not read the whole document.
- The user needs to use this service therefore they will agree to the terms and conditions almost regardless of what is included in them.
- An unticked checkbox may lead to the termination of services.
- Users know that the privacy policies in their country or region may be different from the company's country or the country where the data is stored.
- New terms of service and privacy policy are not clear or easy to understand
- There is not a validation method to check if the end user is the one accepting the new terms of service and privacy
- There is not a validation method in case terms are accepted by mistake (additional checkbox)
- If the user wants to change his decision during the process, there is no option to go back to previous conditions

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[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 the ticking a single check box to agree to the new terms of service and privacy policy. There is some use of appropriate ITGS terminology in the response.*
[5–6]	*A balanced and detailed analysis of the issues related to the ticking a single check box to agree to the new terms of service and privacy policy. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response.*

(c)   *Tap2Talk* has decided to share its users' data with a third party, *GlobalConnect*. This will mean that all user data, such as text messages, locational information and media, will be held in *GlobalConnect*'s database.

Discuss the impacts of this decision for *Tap2Talk* users.   [8]

Answer may include:

Advantages for the users
- They can enjoy highly personalized / targeted product suggestions.
- Locational information may let the company combine user's movements with information from other people and deliver services that benefit everyone.
- This may minimize marketing communications irrelevant to them.
- They can receive offers to help them save money on the things they buy often
- They may get recommendations to try something new.
- Users may have better backup capabilities – text message and media stored in *GlobalConnect*'s servers may help the user retrieve them if they are lost/deleted from their device.

Disadvantages for the users
- The pictures, text messages, locational information stored in *GlobalConnect* database may be hacked and misused.
- They may be concerned about the breach of their personal data and the risks associated with identity theft.
- User may not be aware of how their data is going to be used by *GlobalConnect*.
- Users may be concerned about the confidentiality of their data, e.g. they may not be willing to disclose places of their visit to *GlobalConnect* or any third party company.
- Users will not be aware of data sharing agreements *GlobalConnect* has with other companies, and the potential impacts of their data being shared.

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 on page 16.

4.   Electronic health records in a hospital

(a)   (i)   Identify **two** features of a local area network (LAN).   [2]

Answers may include:
- Multiple computers connected together (LAN Definition).
- Those in LAN have unique IP addresses.
- Is limited to a small (geographical) area.
- Privately owned
- Allows data transmission and resource sharing
- Have high data transfer rates.
- Can be constructed with or without servers
- Every computer in LAN can communicate with any other computer on the network.

Award [1] for identifying each feature of a LAN up to [2]

(ii)   Identify **two** technologies used in a local area network (LAN).   [2]

Answers may include:
- Router
- Hub / Switch.
- **PC**/workstations
- Servers
- Firewall
- Network Interface Card (NIC)
- Connection types [accept one only]: optical fibre, cable, connectors, wireless technologies

Award [1] for identifying a network technology up to [2]

(iii)   Identify **two** disadvantages of using wireless connectivity in the hospital.   [2]

Answers may include:
- It is less secure / patients' sensitive data may be prone to hacking.
- May be unreliable.
- May be prone to interference.
- Latency / slower speed compared to wired networks
- May not cover all areas.
- Transmission of high resolution images and videos, e.g. MRI, X-ray, may be slow.

Award [1] for each disadvantage identified up to [2].

(b) (i) Distinguish between the identification of a user and the authentication of that user on a network. [2]

Answers may include:

Identification
- Identification – it is a form of access control which identifies who the user is.
- Users supply information to identify themselves, such as name, username, and user ID.
- Identification alone is not generally enough to grant access to the intended user.

Authentication
- Authentication is the process of validating an identity provided to a system / relates to the checks made to ensure the validity of a claimed identity.
- May be done by entering a password / number sent to cellphone.
- Authentication usually occurs after identification is complete, such as when you supply a password to support a username during the login process.
- Requires information only the person identified knows (e.g., security question, password) / something the person identified has (e.g., ID badge, a cryptographic key) / something the customer is (e.g., facial recognition, biometric data).

*Award **[1]** for each definition (identification and authentication) up to **[2]**.*

(ii) Explain why a relational database would be used to store the patients' data. [4]

Answers may include:
- Reduced data storage footprint, i.e. removes redundant data through normalization.
- Update anomalies – use of relational database may minimize the occurrence of update anomalies
- Data only needs to be updated in one place
- Scalability: new data may be added independent of existing records.
- Future modifications can be easily made.
- Ability to deal with larger datasets.
- Access can be restricted to individual tables, e.g. accounts department may not have access to private health data.

Marks	Level descriptor
[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 why a relational database would be used. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material.*
[3–4]	*An explanation of why a relational database would be used. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response.*

(c)   The state health department has proposed a plan to centralize patient records and connect all hospitals to create a state-wide electronic health record (EHR) system.

Discuss whether this state-wide EHR system should be developed.   [8]

Answers may include:

Advantages of a state-wide EHR system
- Providing accurate, up-to-date, and complete information about patients at the point of care eg if a patient of Philipedia Hospital becomes ill/has an accident when visiting another part of the state
- Enabling quick access to patient records across the state for more coordinated, efficient care.
- Enables the easy sharing of patient information with other clinicians who may not be located in the local hospital

Challenges associated with implementation of a state-wide EHR system
- May be very expensive to set up the state-wide EHR system.
- Organization and administrative time to get consents and agreements in place and signed by patients
- May require considerable amounts of time to transfer the patient's records to the new EHR system.
- There is more chance of unauthorized access using a WAN. If unauthorised access occurs this could pose considerable security risks for the patients.
- Training will be required for the hospital staff for them to get acquainted with the new system and use it efficiently.
- There may be unforeseen ethical / legal implications of sharing patient data via a WAN/VPN

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 on page 16.

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.*