

Markscheme

May 2016

**Information technology
in a global society**

Higher level

Paper 1

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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. Public access to art museum databases

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** different types of field that can be included in a database.

[2]

Answers may include:

- different data types eg
 - currency
 - date/time
 - text/short text
 - memo
 - varchar
 - Boolean (accept Yes/No)
 - hyperlinks
 - attachments to files (OLE object)
 - number
 - calculated (accept Computed)
 - lookup
 - object (accept Image)
 - dropdown.
- field names from the museum database (eg first name of artist, last name of artist, nationality, type of work, year of creation, dimensions of work etc).

*Accept **two** different data types, **two** different field names or **one** of each.*

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

(ii) Describe **two** characteristics of Creative Commons licensing.

[4]

Answers may include:

- users can recognize that information is under Creative Commons licensing because it has the CC logo and there are several variations of the logo so users will immediately know what they are allowed to do with the information



- examples of CC logos:
- offers the licenser multiples choices controlling what users can and cannot do with their work
- provides a “machine readable” version of the license
- licensors retain the copyright for their work
- it is automatic; this means that if a person wants to use digital content that is under the Creative Commons license they do not need to contact the person unless they want to give it a different use to what is allowed
- users can redistribute the digital content as long as they respect the Creative Commons conditions
- every Creative Commons license is valid around the world and lasts as long as applicable copyright lasts.
- the CC0 license allows creators to waive all rights and place a work in the public domain
- attribution / BY (must credit/acknowledge the original creator)
- shareAlike / SA (new creations based on the work must be licensed under identical terms)
- noDerivs / ND (creations must be passed along unchanged and in whole)
- nonCommercial / NC (creations can be built on but can only be used non-commercially).

Do not accept answers that refer to copyright in generic terms. Must explicitly focus on Creative Commons licensing.

*Award **[1]** for each characteristics of Creative Commons licensing identified, and an additional **[1]** for an appropriate development of that characteristic.*

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

*Award a maximum of **[4]** for the response.*

- (b) Previously the information in the museum’s database was only accessible to people working at the museum. Any changes will have implications for the museum’s IT department.

Analyse the implications for a museum’s IT department of allowing public access to selected information in the museum’s database.

[6]

Answers may include:

- provide support designed for the public
- increase security to protect the data
- create different levels of access / authorisation for groups of user (eg museum staff have edit capability, public users have view-only access etc)
- make sure that the infrastructure can handle many more users accessing the database
- hire new IT personal (eg for the helpdesk, installation of security software, increased need to maintain systems etc)
- more IT investment (eg upgraded servers to cope with increased traffic; scanning technology to digitise images, documents or artworks; increase in bandwidth from ISP; etc)
- design / construct / commission new web pages to allow public to search/query the database and view results.

[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 museum’s IT department. The response is theoretical.*

[3–4]: *A description or partial examination with some knowledge and understanding of the implications for museum’s IT departments of allowing public access to information in the museums’ databases. Some use of appropriate terminology relating to the topic. Some reference is made to the scenario in the stimulus material.*

[5–6]: *A thorough examination with a detailed knowledge and understanding of the implications for museum’s IT departments of allowing public access to information in the museums’ databases. An examination that uses appropriate ITGS terminology. Explicit and relevant references are made to the scenario in the stimulus material.*

- (c) People who use the museum database are sharing the reports they create via blogs, social media and collaborative documents. For example, reports may show that the museum prefers artworks from artists of a specific gender, or show the differences in the frequency of loans of certain collections, or even the budget assigned for restoration and maintenance of certain museum pieces.

Discuss the advantages and disadvantages for the museums' managers of providing public access to the museum database.

[8]

Answers may include:

Advantages for the museum of sharing the database

- people who analyze the data may come to conclusions that will make the museum investigate certain areas
- museums will show they have nothing to hide as they are not scared to show their data
- data sharing can disseminate information to a diverse range of users, increasing the museum's global appeal (*eg* artists may want their work to be included in the museum collection and in the database)
- increases awareness of / interest in the museums' collections
- public analysis of the data might result in new projects for the museum.

Disadvantages for the museum of sharing the database

- there may be mistakes in the database and the users may produce very critical reports in blogs, collaborate documents and on social media, creating a bad image for the museum
- museums need to be very careful not to disclose information that should not be available to the public for valid reasons (*eg* issues relating to copyright, security, privacy *etc*)
- museums will need to invest in IT resources (*eg* hardware, software and human resources) to create, maintain and share these databases.

Impacts that may be positive or negative

- availability of online information (either provided by the museum or via blogs and social networks) may impact the number of visitors to the physical museum.

Responses must relate to the museums / museums' managers.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 29.

2. Online learning on your own device

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) The distance learning programme requires that each student spends three hours a week on online activities.

Identify **three** online activities that the university course could use as part of the distance learning programme.

[3]

Answers may include:

- discussion forum
- online lectures / instructional videos / podcasts / presentations
- online evaluation/online quiz
- chat feature for communicating with other participants or faculty
- video conference
- online collaborative project eg glossary/database/wiki
- learning games
- interactive simulations / experiments.
- reading online versions of documents/ebooks/information specified by the university.

Do not accept “use VLE” as this is given in the question stem (eg Moodle, Google Classroom, Blackboard, Sakai etc).

*Award **[1]** for any of the online activities identified above up to a maximum of **[3]**.*

- (ii) Students have to prepare work that will be assessed by the professors at the university. Much of this work will be done in groups, and group members may be located in different countries.

Identify **three** different IT tools that could be used by students to complete their group work.

[3]

Answers may include:

- email
- collaborative online documents (Google docs)
- video conferencing tools (eg Skype, Google Hangouts etc)
- group text chat tools (eg Facebook chat)
- mind mapping tools
- group whiteboard or the equivalent
- collaborative online environment (wiki)
- collaborative file sharing tools (eg Dropbox, OneDrive, Google Drive, Box, Amazon Cloud Drive, etc)
- tools for reading online versions of documents/ebooks.

Do not accept reference to hardware alone without reference to a software tool / app.

*Award **[1]** for any of the different online tools identified above up to a maximum of **[3]**.*

- (b) On the final degree certificate, Mountains University is required to state whether the course was either:
- an online course
 - a course completed by attending class at the university.

Analyse the impact of this statement for the student when using the degree certificate to apply for a job.

[6]

Answers may include:

Positive considerations of an online course

- the student is a person who is able to manage time and work independently
- the student has been working and studying juggling time and commitments
- the student is interested in moving forward and learning new things even while having other commitments
- the student may have had different experiences by collaborating with students in different parts of the UK and the world
- the student will have developed more skills in using online tools for collaborating with others which may be a consideration for the future employer.

Negative considerations of an online course

- employer might feel that the course may not have the rigour of when a student attends a course at the university
- employers unfamiliar with online degrees often have negative perceptions of the quality of the degree
- employer might doubt the validity of the work done by the student to get the diploma
- countries where the employer is based might not grant work permits/visas as online degrees are not endorsed/accepted.

Positive considerations of an attended course

- employers are familiar with university degree programs and have a better understanding of the student's degree
- employers will recognize that students will have more face-to-face interactions with other students and the faculty in their courses than in online programmes.

Negative considerations of an attended course

- the student may have attended a local university where most of the students come from a small geographical region. They may not have had the opportunity to interact with students from other parts of the world.

[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 Mountains University. The response is theoretical.

[3–4]: A description or partial analysis with limited knowledge and/or understanding of the implications for students who have completed online courses. Some use of appropriate terminology relating to the topic. Some reference is made to the scenario in the stimulus material.

[5–6]: A thorough examination with a detailed knowledge and understanding of the implications for students who have completed online courses. An analysis that uses appropriate ITGS terminology. Explicit and relevant references are made to the scenario in the stimulus material.

- (c) Some professors at Mountains University have been working with schools in the area as consultants on the use of online activities for education. Some of the local schools have a number of mobile equipment carts that may be pushed to the different classrooms when needed. However the number of devices available is not enough for the number of students in the school. Mountains University is recommending that, instead of purchasing more devices, schools should ask students to bring their own mobile devices or laptops to school as part of a Bring Your Own Device (BYOD) scheme.

Discuss the implications for a school of implementing a BYOD scheme.

[8]

Answers may include:

- school may be able to save on file storage space as students will be able to save their work on their own devices and continue to work outside school
- school may need to train IT support staff to know about the different types of devices available and their compatibility with the school infrastructure
- school will not need to spend money on buying, setting-up and maintaining student devices
- school would have to improve security/firewalls
- school would have to have clear policies for the use of student devices (*ie* antivirus software, use of the school network, required applications *etc*)
- school may be held responsible for damages / losses / theft *etc* of students' devices
- school may need to install more electricity sockets in classrooms to allow students to charge devices during lessons
- school may need to be improve bandwidth and Wi-Fi access to allow for a large number of devices to connect to the school network
- school may need to provide helpdesk support to solve students' IT issues (*ie* some activities may not run due to hardware or software limitations, not all students may have the same applications)
- school will have no control over applications and content on students' devices
- school will need to use software to control the access of the school network and internet from student devices (*eg* tracks which sites are accessed by specific devices, certain websites are blocked for student access)
- school will need to provide information to the teachers, students and parents about the implementation of the BYOD programme
- the school may need to provide training for the teachers so that students can effectively use their BYOD devices in lessons
- school will need to make provision (*eg* supply/maintain hardware) for those students who are unable to provide their own BYOD
- teachers at the school might incorporate e-learning more frequently in their classes as devices will always be available (*eg* no need to book a cart for a lesson; may improve the quality of teaching).

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 29.

3. Our interconnected world

Note to examiners.

- *Part a and part b questions are marked using ticks and annotations where appropriate*
- *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) Outline the difference between the internet and the World Wide Web. **[2]**

Answers may include:

- the internet is a global network of interconnected computers / a network of networks. The World Wide Web is software / a service that runs on the hardware of the internet and provides access to content / a collection of pages that can be accessed through hyperlinks / a way of accessing and sharing the information that is held on the Internet in webpages
- the World Wide Web uses the http protocol. This is only one of the many protocols used by the internet.

The response must make reference to both the internet and the World Wide Web. Do not award marks if only one is mentioned.

*Award **[1]** for identifying **one** characteristics of the internet and **[1]** for identifying **one** characteristic of the World Wide Web up to a maximum of **[2]**.*

- (ii) Identify **two** characteristics of a router. **[2]**

Answers may include:

- a router is a device that forwards data packets along networks
- a router is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP's network
- routers are located at gateways, the places where two or more networks connect
- determine the best path for forwarding the packets (using headers and forwarding tables)
- routers use protocols such as ICMP to communicate with each other and configure the best route between any two hosts
- provide network access through WIFI or ethernet cable (do not accept internet access as this is given in the stem)
- provide network security (eg password for WiFi access)
- assign IP addresses to the devices connected to it (via a built-in Dynamic Host Configuration Protocol (DHCP) server).

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

- (iii) Identify **two** pieces of information that the URL below provides about the site it connects to: <https://www.khanacademy.org/math>

[2]

Answers may include:

- it uses secure hypertext transmission
- https is the protocol (hypertext transfer protocol secure)
- www.khanacademy.org is the domain name (do not accept “Khan Academy”)
- org means non-profit organization (accept “organization”)
- math is the name of the file / folder / directory / path / resource.

*Award [1] for any **two** pieces of information that the URL below provides about the site it connects to: up to a maximum of [2].*

- (b) A group of university students has rented a house near a free hotspot that can be used from inside the house. Some of the students want to sign a contract with a local ISP so that they can have their own Wi-Fi in the house, while others want to continue using the free hotspot.

Analyse the advantages and disadvantages of home internet connections and hotspots.

[6]

Answers may include:

Private home internet connection

- secure with password
- may not be seen outside the house if the antenna is not radiating to the street/or if configured to be invisible
- connected directly to your ISP
- only used by the few users inside the house who know the password
- requires a monthly payment to the ISP / possible installation costs
- the public hotspot will still be available even if the home internet connection is down
- can get support from ISP.

Public hotspot

- no password, or public password is used
- may not be secure – information could be hacked / intercepted
- many simultaneous users, therefore speed/use of bandwidth could be an issue
- may have restrictions (eg connection time, downloading videos may be blocked, some services may not work such as VoIP).

Do not accept “free” as this is in the question stem.

[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 relative advantages and disadvantages of home internet connections and hotspots. The response is theoretical.*

[3–4]: *A description or partial analysis with limited knowledge and/or understanding of the relative advantages and disadvantages of home internet connections and hotspots. Some use of appropriate terminology relating to the topic. Some reference is made to the scenario in the stimulus material.*

[5–6]: *A thorough examination with a detailed knowledge and understanding of the relative advantages and disadvantages of home internet connections and hotspots. An analysis that uses appropriate ITGS terminology. Explicit and relevant references are made to the scenario in the stimulus material.*

- (c) Tim Berners-Lee, creator of the World Wide Web, believes that the ability to access and use the World Wide Web is necessary for the benefit of everyone across the world.

To what extent do you agree with this statement?

[8]

Answers may include:

Possible points in support of statement:

- access provides economic opportunities (eg providing access to information, connecting people to businesses in other geographical locations, and opening up new markets for products and produce, learning from profitable business practices and models used in other locations, etc)
- access can provide educational opportunities that may not be available otherwise (eg access to affordable online university courses, collaboration between students located in different geographical regions, access to information world wide on any topic etc)
- telemedicine can help provide healthcare in underserved areas
- may save lives, eg access to information about weather, flood warnings etc
- access to social networks (Facebook, Instagram, etc) to connect with friends family, job opportunities.

Possible points against statement:

- access is not enough for people who lack the education or skills to make use of the web
- not a 'priority' for people who lack basic food/water. Providing access may divert funds etc away from more pressing needs
- may expose people to security/privacy risks that otherwise they would not be vulnerable to (eg cybercrime)
- access to the internet varies due to costs and quality of infrastructure
- access to the internet may be affected by non-technical tasks such as censorship
- access raises issues of cyberbullying/harassment?
- has the use of the web led to an improvement in human well-being?
- having access may lead to spending too much time on the WWW, which may cause concerns
- greater access to electronic information could lead to events such as copyright infringement and plagiarism
- in practice not everyone has access to the internet which may tend to increase rather than reduce inequality of benefit.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 29.

Section B

4. A computer has graded my essay!

Note to examiners.

- *Part a and part b questions are marked using ticks and annotations where appropriate*
- *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:

- built on examination of large amounts of data
- learns from examples
- able to react to new inputs.

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

- (ii) Define “natural language”. [2]

Answers may include:

- based on the interaction between the language used by humans and how they are interpreted by computers
- refers to human language in contrast to artificial languages such as computer languages
- has evolved in human society over time, not constructed.

Second mark could be examples such as Hindi, Swahili, French, but this must be an illustration of one of the above points

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

- (iii) Define “algorithm”. [2]

Answers may include:

- step by step instructions for performing an action or solving a problem
- set of rules that that precisely define a sequence of operations
- use by computers to process data
- order of the steps is important
- often includes decision trees.

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

- (b) (i) Machine learning software often relies on neural networks. Explain why neural networks are particularly useful for machine learning. [4]

Answers may include:

- neural networks attempt to imitate the connections in the human brain
- neural networks require training before they become useful
- neural networks learn by trial and error
- machine learning requires the software to learn from experience.

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

[1]: A limited response that indicate very little understanding of neural networks and/or machine learning.

[2–3]: A reasonable description of the relationship between neural networks and machine learning that include some relevant examples within the response. There is some use of appropriate ITGS terminology.

[4]: A clear, detailed explanation of the relationship between neural networks and machine learning. Relevant examples are used throughout the response. There is appropriate ITGS terminology throughout the response.

- (ii) Distinguish between fuzzy logic and inference rules. [2]

Answers may include:

Fuzzy Logic

- degrees of truth
- not True/false.

Inference Rules

- formulated by premises/arguments
- if/then
- infers a conclusion.

Award **[1]** for a response that identifies either the nature of machine language or natural language.

Award **[2]** for a response that covers both the nature of machine language **and** natural language.

- (c) The teachers at Colegio del Lago Amplio (CLA) are considering whether to use the essay evaluating software to give students feedback on each draft of their essays, as well as grading them.

Discuss the advantages and disadvantages of using essay evaluating software to give students feedback on how to improve their essays.

[8]

Answers may include:

Benefits of software providing advice to students

- teachers will be able to see and understand the students' process as they created the final draft so they will be able to better help students improve
- students can see what score they might receive on the work so they can improve it
- students receive instant feedback on their work so they can keep improving
- students can submit their essays as many times as they like
- some students are more comfortable getting advice from a computer rather than from the teacher
- the computer does not get tired, it is endlessly patient.

Disadvantages of software providing advice to students

- the software cannot really understand the meaning of the students' work
- software cannot deal with metaphors and other aspects of creative writing
- software cannot evaluate the quality of the students' idea
- student writing will become more formulaic/mechanized and less original
- grammar and spell checks are already included in word processing software and these features are not needed in the software.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 29.

5. Better Than Ever Health Clinics (BTEHC)

Note to examiners.

- *Part a and part b questions are marked using ticks and annotations where appropriate*
- *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) Mr Singh, as IS manager, is responsible for incident management.

Identify **two** steps that could be taken to manage an incident in this system. [2]

Answers may include:

- identify nature of the incident (unplanned service interruption)
- track incidents that occur (log, report)
- investigate the incident
- determine how serious the incident is
- primary goal is to restore normal service as soon as possible.

Award [1] for each point identified above up to a maximum of [2].

(ii) Mr Singh's major responsibility will be the maintenance of the information system.

State **two** elements of the maintenance phase of the system development life cycle (SDLC). [2]

Answers may include:

- periodic evaluation of system
- repairing system
- updating software
- testing to see if the system functions properly after the update
- bug fixing
- security patches
- deployment of new feature(s).

Award [1] for each element stated up to a maximum of [2].

- (iii) Describe **one** business task that can be performed using one specific type of business software.

[2]

Answers may include:

- accounting eg keeping track of expenses and income with a spreadsheet
- inventory of equipment with database/relational database
- managing orders for supplies with a database/relational database
- managing appointments with a database/relational database or spreadsheet
- project management to organize the tasks involved in the project.

The description of the task must include how the information system is used.

*Award [1] for identifying **one** task and software up to a maximum of [1].
Award an additional [1] for a description of the task and use of the software up to a maximum of [1].*

- (b) The software developer has provided Mr Singh with information from the modelling systems they used during development. This included an entity relationship diagram (ERD) and a data flow diagram.

- (i) Distinguish between an ERD and a data flow diagram.

[2]

Answers may include:

ERD diagram

- used during product design for data modeling
- visual representations of the relationships between groups of data
- identifies the characteristics of the entities
- entities are types of data.

Data flow diagram

- visualizes the flow of data through an information system
- does not show types of relationships between types of data
- shows type of input and output
- shows where the data will be stored
- shows where the data will come from and go to.

*Award [1] for a response that identifies either the nature of an ERD **or** of a data flow diagram.*

Award [2] for a response that covers both ideas, an entity relationship diagram (ERD) and a data flow diagram.

- (ii) Mr Singh will be in charge when it is time to phase out the current information system. Explain **two** reasons why this information system will need to be phased out. **[4]**

Answers may include:

- the current system may no longer be compatible with the existing system or the changes required to make it compatible will be too great
- the current system may not have the capacity to deal with the requirements of the expanded business and it will not be possible to upgrade it.

Award [1] for the identification of a reason, and an additional [1] for the explanation of that reason.

Mark as [2 + 2].

Award a maximum of [4] for the question.

- (c) The BTEHC staff need quick and easy access to the customers' data, but the clinic's customers want their data to be secure and private.

To what extent is it possible to create specific policies that can address the potential conflict between the security and privacy of customer data, and the ease with which the clinic's staff can access this data? **[8]**

Policies that may be discussed:

- responsible use – what particular employees should and should not do
- security – policies that control access both within and without the organization
- back up – policies that prevent loss of data
- privacy – policies that ensure employee and customer privacy
- levels of access – Authenticating the user
- encryption policies
- schedule for updating software.

Other considerations may include:

- staff training and education about managing sensitive information
- decisions made by Mr Singh whether to share data from “Better Than Ever Physical Therapy Clinics, Singapore”.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 29.

6. Upgrading Weston Bank’s information system

Note to examiners.

- Part a and part b questions are marked using ticks and annotations where appropriate
- 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** items that would be included in a feasibility study. [2]

Answers may include:

- evaluates the project’s likelihood of success
- cost of the new system
- staff training needed
- new hardware that may need to be purchased
- benefits of the new system vs the current system
- evaluate potential negative impacts of the new system.

Award [1] for each item stated up to a maximum of [2].

- (ii) Identify **two** kinds of failure that could arise if employees of Weston Bank are not adequately trained to use the new information system. [2]

Answers may include:

- system will not provide the expected benefits
- end users will make errors that could have been prevented
- important tasks will not be done correctly
- implementation of the system will be slow because end users do not know how to use it
- the bank may lose money and may lose customers because of poor reputation.

Award [1] for each kind of failure identified up to a maximum of [2].

- (iii) Identify **two** actions that must be taken when the old system is phased out. [2]

Answers may include:

- obsolete software must be properly uninstalled
- data must be deleted properly to avoid unauthorized access
- old data must be archived for possible future reference
- check that all of the old data has been transferred accurately to the new system.

Award [1] for each action up to a maximum of [2].

- (b) Analyse the decision by the managers of Weston Bank to keep a legacy system running alongside the new information system.

[6]

Reasons to keep the legacy system:

- the legacy system provides functions the bank still needs
- some of the bank's clients can't use the new system
- the legacy system can be used to archive old data
- the legacy system needs to be used until it is certain that the new IT system functions properly.

Reasons to retire the legacy system:

- compatibility issues may occur between the legacy system and the new system
- legacy systems may be inefficient and consume more bandwidth etc
- security issues because legacy systems cannot be protected from new threats
- legacy systems often require outdated hardware
- programmers may no longer have the skills to maintain a legacy system
- it will be confusing for employees and clients to have to deal with both systems.

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

[1–2]: *A limited response that demonstrates minimal knowledge and understanding of legacy systems and uses little or no appropriate ITGS terminology. Minimal reference is made to Weston Bank.*

[3–4]: *A partial analysis, either lacking detail or balance, that demonstrates some knowledge and understanding of legacy systems. Some relevant examples are used within the response. There is some use of appropriate ITGS terminology in the response. Some reference is made to the scenario in the stimulus material.*

[5–6]: *A balanced and detailed analysis of the issue which demonstrates thorough knowledge and understanding of legacy systems. Relevant examples are used throughout the response. There is appropriate ITGS terminology in the response. Explicit and relevant references are made to the scenario in the stimulus material.*

- (c) Isabel De Souza believes that the individual skills and personalities of the team members and how they communicate with stakeholders are far more important than the project development/management method used (such as waterfall, agile, PRINCE2).

Her plan is to analyse the team members' skills and personalities. She will use this analysis to make changes to the team to make it as effective as possible.

Discuss the impact of her plan to focus on the skills and personalities of the team members, rather than on a specific project development/management method.

[8]

Issues that may be discussed:

- if missing a critical skill in a team, the product will not work well. This will slow down development
- if one team member is not a team player, this disrupts the whole team
- if the team is a dysfunctional group, members of the team may quit or want to be removed from the project
- poor communication between members of the team
- team needs to share a common vision
- size of team matters
- waterfall and agile set out a process/provide a framework for the completion of the project, but that is not enough to ensure success
- agile focuses on collaborating regularly with the client so the schedule becomes more important than the quality. This can create a backlog
- allows project manager to place employees in positions suited to them
- not focusing on a project management method could result in key steps or details being left out of the system development process.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 29.

7. Robotic watchmen

Note to examiners.

- Part a and part b questions are marked using ticks and annotations where appropriate
- 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** input devices the robotic watchman would need to be able to identify security problems. [2]

Answers may include:

- radar
- lidar
- camera
- electronic nose (smell sensor)
- audio sensor
- heat sensor
- motion sensor
- proximity sensor
- microphone.

Award [1] for each input device identified up to a maximum of [2].

- (ii) Define “voice recognition”. [2]

Answers may include:

Approach one:

- captures digital image of a person’s voice
- identifies specific points/nodes of the voice
- matches the pattern of the nodes to a database of voice recordings
- can be used as a biometric measurement
- since each voice has a different pattern, it can be used to identify a specific person.

Approach two:

- identifies what the speaker is saying
- voice is digitized
- voice is matched to words in a digital dictionary (uses digital patterns to identify the words)
- software can require training to understand a specific speaker
- or can have a limited set of words in its dictionary (ie “please say yes or no.”)
- can be used for direct voice input ie giving voice commands to a machine.

Note: students may take either one of the above approaches when answering this question.

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

- (iii) Define “robot”. [2]

Answers may include:

- mechanical device controlled by a computer that
 - interacts with the physical world
 - can be humanoid in appearance
 - can have a variety of output devices (tools, arms, etc) carries out series of complex actions
 - can be autonomous, semi-autonomous or automatic.

Award [1] for each characteristic of a robot up to a maximum of [2].

- (b) (i) Robots are likely to have difficulty deciding what changes or activities in a particular environment are normal and what might be a security threat.

Explain **one** reason why this is the case. [2]

Answers may include:

- robots lack the ability to make judgements about what they encounter
- robots cannot distinguish between normal aspects of the environment *ie* a chair out of place in an office late at night
- robots still have difficulty recognizing objects, *ie* differentiating between a person collapsed on the floor and a similarly shaped things such as a duffel bag.

Award [1] for the identification of a reason.

Award an additional [1] for the explanation of the reason.

- (ii) Secure Mall Inc is considering using androids rather than robotic watchmen to patrol a shopping mall. However, at the current time they are unable to function well enough to carry out this task.

Explain **two** challenges that need to be overcome in order to create an android that can do this job effectively. [4]

Answers may include:

- walking (bi-pedal locomotion) is very difficult, *ie* lacks balance, easily tipped over
- androids require more battery power
- androids are very expensive
- “uncanny valley” – a robot that is not quite human often makes people very uneasy
- robot hands are still not as dexterous as they need to be.

Award [1] for identifying a challenge up to a maximum of [2].

Award an additional [1] for the explanation of the reason up to a maximum of [2].

- (c) A shopping mall manager has to decide how to organize security for the mall at night. They can use either:
- human security guards and dogs in the mall
 - robotic watchmen who will communicate wirelessly with a small team of security staff.

Evaluate these **two** options.

[8]

Benefits of security robots:

- security is boring work – robots don't get bored
- security is dangerous – in this system humans face less risk
- robots can collect real-time data which can then be analysed
- robots can communicate more quickly with the security staff.

Disadvantages of security robots:

- fewer human watchmen needed, so loss of jobs
- loss of privacy as robots collect information
- mass surveillance may create community opposition
- humans can differentiate better if there is a security issue in the mall.

Benefits of humans and dogs:

- dogs sense of smell can help humans find threats
- both humans and dogs can move more flexibly and quickly than robots
- robots are easy to locate and avoid, humans could avoid detection more easily
- humans can differentiate better if there is a security issue in the mall.

Disadvantages of humans and dogs:

- humans can't collect and transmit as much information as the robots can
- both humans and dogs are at risk of harm in dangerous situations; a robot can be repaired or discarded
- costs of paying a larger number of humans than would be needed with robots
- both get tired or bored (affects ability to observe, react *etc*)
- humans and dogs need to be trained; robots come pre-trained.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 29.

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

Marks	Level descriptor
No marks	<ul style="list-style-type: none"> • <i>A response with no knowledge or understanding of the relevant ITGS issues and concepts.</i> • <i>A response that includes no appropriate ITGS terminology.</i>
Basic 1–2 marks	<ul style="list-style-type: none"> • <i>A response with minimal knowledge and understanding of the relevant ITGS issues and concepts.</i> • <i>A response that includes minimal use of appropriate ITGS terminology.</i> • <i>A response that has no evidence of judgments and/or conclusions.</i> • <i>No reference is made to the scenario in the stimulus material in the response.</i> • <i>The response may be no more than a list.</i>
Adequate 3–4 marks	<ul style="list-style-type: none"> • <i>A descriptive response with limited knowledge and/or understanding of the relevant ITGS issues and/or concepts.</i> • <i>A response that includes limited use of appropriate ITGS terminology.</i> • <i>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.</i> • <i>Implicit references are made to the scenario in the stimulus material in the response.</i>
Competent 5–6 marks	<ul style="list-style-type: none"> • <i>A response with knowledge and understanding of the relevant ITGS issues and/or concepts.</i> • <i>A response that uses ITGS terminology appropriately in places.</i> • <i>A response that includes conclusions and/or judgments that have limited support and are underpinned by a balanced analysis.</i> • <i>Explicit references to the scenario in the stimulus material are made at places in the response.</i>
Proficient 7–8 marks	<ul style="list-style-type: none"> • <i>A response with a detailed knowledge and understanding of the relevant ITGS issues and/or concepts.</i> • <i>A response that uses ITGS terminology appropriately throughout.</i> • <i>A response that includes conclusions and/or judgments that are well supported and underpinned by a balanced analysis.</i> • <i>Explicit references are made appropriately to the scenario in the stimulus material throughout the response.</i>