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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Higher Level

Paper 1

27 pages

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. Analysis of external examination grades by an international school

(a) (i) Identify *two* characteristics of a CSV file. ***[2 marks]***

Answers may include:
- comma separated values
- a text file
- a file without formatting where data in a record is separated by commas
- a file that represents data in tabular form. Rows are represented by new lines and cells are separated by commas.

Note: do not accept firewall or anti-virus software.
*Award **[1 mark]** for each of the above up to a maximum of **[2 marks]**.*

(ii) Identify *two* reasons why the Oneto7 examination board would provide files in CSV format. ***[2 marks]***

Answers may include:
- a file format that is compatible with different spreadsheets and database formats
- a CSV file carries no formatting, only text, therefore the file size depends only on the quantity of data it contains, *ie* the CSV file will be smaller than a formatted file from any application
- CSV files are text files and can be opened with many applications, therefore can even transfer manually if needed.

*Award **[1 mark]** for each of the above up to a maximum of **[2 marks]**.*

(iii) Identify *two* characteristics of a "secure site". ***[2 marks]***

Answers may include:
- accessed using HTTPS – Hypertext Transfer Protocol Secure
- information sent to and from those sites cannot be accessed by anyone else (*ie* user needs to enter authentication information such as username and password in order to access the site)
- Secure Sockets Layer (SSL) provides encryption – preventing information from being read in transit
- Secure Sockets Layer (SSL) provides authentication (verifying that the site is who they claim to be).
- Secure sites display a padlock/lock symbol
- Secure sites use trusted certificates to check for authenticity

*Award **[1 mark]** for each of the above up to a maximum of **[2 marks]**.*

(b) Schools can use either spreadsheets or database software to analyse these exam results.

Analyse the use of these two software types for this purpose. ***[6 marks]***

Advantages of a database application in this scenario	Advantages of a spreadsheet in this scenario
• queries can be made and saved for future use • reports can use queries and produce nicely formatted printed reports to be used repeatedly • menus with buttons for the different needs may be prepared for the headmaster to use • database applications may share one database among many users simultaneously • a relational database allows several tables of data to be linked together in a way that may be transparent to the final user (the headmaster) • a database application may give the user (headmaster) access to results without giving access to make accidental changes.	• data in the form of tables can be clearly seen by all users • a user-friendly spreadsheet may allow the headmaster to produce his own analysis • spreadsheets may show data in graphs – a great variety of different types of graphs • some data may be extracted into a smaller set to be shared with others.

Disadvantages of a database application in this scenario	Disadvantages of a spreadsheet in this scenario
• its use may be complicated for the headmaster (outside the prepared menu) • may need preparation by an IT person before the headmaster can use it • cannot produce graphs.	• headmaster would need to know how to use the spreadsheet • unless macros are used, each type of result needs to be obtained when needed. • where large amount of information is stored in a spreadsheet, it is difficult to analyse and display the results.

[1–2 marks]
A limited response that demonstrates minimal knowledge and understanding of the topic through simple statements and uses little or no appropriate ITGS terminology.

[3–4 marks]
A response that demonstrates some knowledge and understanding of the topic and describes features of spreadsheets or databases in this scenario that would make them appropriate. Some relevant examples relating to the scenario are used within the response. There is some use of appropriate ITGS terminology in the response.

[5–6 marks]
A thorough response that demonstrates knowledge and understanding of the topic and makes comparisons between spreadsheets and databases in this scenario and why they are, or not, appropriate. The response demonstrates thorough knowledge and understanding of the topic. Relevant examples relating to the scenario are used throughout the response. There is appropriate ITGS terminology throughout the response.

(c) Oneto7, an examination board that serves 5000 schools, has been contacted by a new company, schoolscompare.com. This company, schoolscompare.com, wishes to buy the data about students' results from the Oneto7 examination board.

Schools, parents and others can pay schoolscompare.com for a more detailed analysis of the examination results. This analysis will be provided using data bought from Oneto7, as well as other data they have acquired.

Discuss the implications of the Oneto7 examination board selling the data it holds about the schools to schoolscompare.com. ***[8 marks]***

Answers may include:

- Oneto7 examination board would have to ask schools to authorize the sharing of their data
- Oneto7 examination board would have to wait for parents in the schools to authorize the sharing of their son's/daughter's data
- Oneto7 would have the possibility of comparing its results with those of other boards
- other boards would have access to Oneto7's results
- a more in-depth analysis may be provided to the schools and parents
- parents would be able to compare their children's results with others from the same and other schools / boards
- schools may be assessed by prospective parents from these results
- universities and other institutions may use this information to evaluate their prospective candidates
- policies of privacy and correct use of information would have to be put in place
- security issues to guarantee the reliability and integrity of the data must be evaluated
- Oneto7 must investigate that schoolscompare.com has adequate security measures
- agreement needed that Oneto7will not use the data for any purposes other than analysis (*eg* distributing tutoring information to schools that did not perform well).

Note: do not accept generic references to hacking or unauthorized access. References must be explicitly related to the scenario.

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 27.

2. Online training

(a) (i) Calculate the length of time it took to download the 720 MB video. ***[2 marks]***

- using 1024 KB as 1MB:
  - 720 MB is 720 x 1024 KB = 737 280 KB
  - bandwidth of 800 kb/sec = 100 KB/sec (KB is kilobyte, kb is kilobit)
  - 737 280 ÷ 100 = 7372.8 seconds = 123 minutes = 2 hours 3 minutes

- accept the approximate of 1000 KB as 1MB:
  - 720 x 1000 = 720 000 KB (KB is kilobyte, kb is kilobit)
  - bandwidth of 800 kb/sec = 100 KB/sec
  - 720 000 ÷ 100 = 7200 seconds or 120 minutes or 2 hours.

Note: accept 123 minutes = 2.048 hours = 2 hours and 3 minutes or approximately 2 hours.

*Award **[1 mark]** for the correct calculation of file size into KB (720 MB is 720 x 1024 = 737 280 KB or 720 x 1000 = 720 000 KB. Accept if some indication of units in the calculation. Award one mark for 737 280 or 720 000.)*

*Award **[1 mark]** for the correct calculation of file size into KB.*
*Award **[1 mark]** for the correct calculation into time.*

(ii) Outline the difference between lossless and lossy compression. ***[2 marks]***

Lossless data compression

Difference in the reconstruction of original data

- lossless data compression uses algorithms that allow the exact original data to be reconstructed from the compressed data
- lossy data compression does not allow the exact original data to be reconstructed from the compressed data as some data is removed during the compression.

Difference in the loss of data

- in lossless data compression no information is lost, it is only changed so that the file size is reduced.
- in lossy data compression some information is taken from the file that will change the final image or sound and will make the file smaller.

Difference in loss in quality

- in lossless data compression no information is lost and therefore no loss in quality
- in lossy data compression some information is taken from the file that will result in some loss in quality which normally goes unnoticed.

Difference in the types of file that are compressed

- in lossless data compression is used to compress text and data files
- in lossy data compression is used to compress audio, video and image files.

Note: each bullet point refers to a difference between lossy compression and lossless compression.

*Award **[1 mark]** if there is a difference for either lossy or lossless compression with an implied reference to the other.*

*Award up to a maximum of **[2 marks]** for an outline of a difference between lossy and lossless compression that explicitly refers to both methods of compression.*

(iii) Outline the difference between downloading and streaming videos. ***[2 marks]***

Answers may include:

- streaming is when video content is sent in compressed form over the internet and displayed on the receiving device in real time. A downloaded video is played from a local storage device
- when streaming a video the user does not have to wait to download the video to play it / watch it. A downloaded video must be stored in order to view it
- streaming a video involves playing the video on one device while the media is displayed on another. The video is not moved or copied to the device that is playing it. Downloaded video is played directly from local media or storage device where it is stored
- a fast internet connection is needed to stream high definition videos from the internet without interruption (about.com). When downloading videos, a fast internet connection is not required
- when streaming video the user needs a player, which is a special program that uncompresses and sends video data to the display and audio data to the speakers. Downloaded videos are played with a media player that is installed as a part of most operating systems
- a streaming video is not saved on your device. Once you stop playing, the media is no longer available. A downloaded video is stored on local media or storage device (*ie* downloaded videos can be moved to different devices (by copying them, video is available whenever you want to play it, must wait until the download is complete before you can watch the media)

Note: each bullet point refers to a difference between streaming videos and downloading videos.

*Award **[1 mark]** if there is only reference to streaming video or downloading video with an implied difference to the other.*
*Award up to a maximum of **[2 marks]** for an outline of the difference between downloading and streaming videos.*

(b) Compare the use of online evaluation tasks versus face-to-face evaluation tasks to assess the skills the trainees may have learned with the training videos. ***[6 marks]***

Answers may include:

Face-to-face evaluation tasks specific to the scenario	**Online evaluation tasks specific to the scenario**
• examiner may ask the participant to repeat the particular procedure related to mining or to do something different that was not in the initial evaluation task • trainees can ask for a clarification of the tasks that is being evaluated • practical aspects are easier to assess face-to-face by seeing how the participants react and use the system (*eg* mining equipment) • participants need to fix a time for the evaluation to be held with the examiner • examiner can use judgment to assess participant and ask to repeat if he/she is nervous or if there was an equipment failure • evaluation may be subjective or biased • the evaluation can be closely monitored to ensure that no unacceptable assistance is provided.	• will have a limited set of questions which may not be customized in case the participant needs more emphasis on certain aspects • can be done by the participant at any time, from any place as long as the internet access available (*ie* poor access at times in the Andes) • evaluation module will need to be created and tested thoroughly, considering several options and assigning value to the actions of the participants • no hands-on tasks can be included in the evaluation • unbiased evaluation performed by the training system • online systems can give immediate feedback to some types of evaluation tasks (*eg* multiple-choice) • it may be possible to get unacceptable assistance during the evaluation (*ie* friends, books).

[1–2 marks]
A limited response that demonstrates minimal knowledge and understanding of the topic and identifies features of either online or face-to-face evaluation tasks. No examples from the scenario have been provided. The response uses little or no appropriate ITGS terminology.

[3–4 marks]
A response that demonstrates some knowledge and understanding of the topic and describes how specific online or face-to-face evaluation tasks would be appropriate. Some relevant examples from the scenario are used within the response. There is some use of appropriate ITGS terminology in the response.

[5–6 marks]
A thorough response that demonstrates knowledge and understanding of the topic and makes comparisons between specific online and face-to-face evaluation tasks and why they are appropriate. The response demonstrates thorough knowledge and understanding of the topic. Relevant examples from the scenario are used throughout the response. There is appropriate ITGS terminology throughout the response.

(c) Evaluate Fernando's decision to download the videos and use them to train his staff in the Andes. ***[8 marks]***

Answers may include:

Mining personnel

- can use the videos several times and go through the steps of the training that may have not been clear
- no need to travel to La Paz to watch the videos means that time will be saved because the videos can be watched at the mining site
- staff will not be able to receive recognition after having done the training
- will not be able to interact with the interactive parts of the video
- may not be using the most up-to-date version of the videos.

Fernando

- will have to take a manual record of those who completed the training and of their performance
- may lose credibility as he cannot guarantee that the training company will issue certificates for those who do the training
- may make several copies of the videos and share them with many employees who might need to go over the training
- needs to check if the training company allows the videos to be downloaded and used offline
- if training videos were not available onsite, the employees would need to be sent to La Paz from the mining site to be trained
- by downloading the videos, Fernando's company may avoid additional costs from the local ISP when trying to access the videos from the mining site in the Andes
- the downloaded videos offer the miners more training opportunities (*ie* view the videos as a group and group discussion of the various aspects of the video)
- due to poor internet access in the Andes, downloading the videos will ensure that the trainees will have uninterrupted access to the videos.

Training company

- may lose track of its videos if several copies are made and given out to many people
- downloading the videos may violate copyright policy (*ie* download policy may only allow the use of one copy of the training videos, employees may share the videos with other miners who are not in the company)
- will not be able to keep an updated record of the personnel who have received the training.

Note: do not accept references to video quality due to compression.

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 27.

3. Energy efficient data centres

(a) (i) Define the term *terabyte*. ***[1 mark]***

Answers may include:
- 2^{40} bytes
- 1 099 511 627 776 bytes
- 1024 gigabytes
- 1 trillion bytes
- 10^{12} bytes
- 1000 GB.

Note: units must be included in the response.
*Award **[1 mark]** for any of the above.*

(ii) Identify *three* features/characteristics of data centres that make them consume large amounts of energy. ***[3 marks]***

Answers may include:
- large amount of hardware (computers/servers/routers/switches) need energy to function
- processing requiring large amounts of energy (*ie* large volume of CPU activity, inefficient processors)
- redundant or backup power supplies
- air conditioning is needed to cool equipment
- need for the data centre to work 24/7 (*ie* run all of the equipment)
- fire control systems
- cabling with high energy consumption (*ie* some types of cabling require more energy than optic fibre cable, energy consumption can vary between types of optic fibre cable).

*Award **[1 mark]** for each of the above up to a maximum of **[3 marks]**.*

(iii) Identify *two* ways that data redundancy may occur in data centres. ***[2 marks]***

Answers may include:
- local backups (kept for security in case of device failure)
- data centres are backed up in different locations (to allow a different data centre to pick up in case the previous one fails)
- data centres (that store information from social networks) may have files saved by several users repeatedly.

*Award **[1 mark]** for each of the above up to a maximum of **[2 marks]**.*

(b) Some governments have decided that data centres will be charged for their environmental impact. This may be done by monitoring the volume of data stored and the energy consumed to maintain the data centre.

Analyse this decision. ***[6 marks]***

Answers may include:

- monitoring by government may be an invasion of privacy and may cause clients to find a data centre in a country where these regulations do not exist
- some data centres will put more emphasis on the purchase of energy efficient equipment even if these are more expensive
- some data centres will opt to downsize their facilities causing slower access or lack of backup services causing discontent among clients
- data centres may investigate ways to reduce redundant data stored on their servers
- data centres may increase the amount that they charge their clients for data storage
- large data centres with high incomes may support economically projects for more efficient energy generators (*eg Facebook* funding the changes from coal to solar panels of the energy-producing companies)
- in order to implement this decision the government will have to monitor the data centres. This has implications for cost, personnel and infrastructure.

Note: accept responses that address the impacts of the decision as well as those that relate to the decision itself.

[1–2 marks]
A limited response that demonstrates minimal knowledge and understanding of the topic and uses little or no appropriate ITGS terminology.

[3–4 marks]
A partial analysis, either lacking detail or balance, that demonstrates some knowledge and understanding of the topic. Some relevant examples related to the scenario are used within the response. There is some use of appropriate ITGS terminology in the response.

[5–6 marks]
A balanced and detailed analysis of the issue which demonstrates thorough knowledge and understanding of the topic. Relevant examples related to the scenario are used throughout the response. There is appropriate ITGS terminology throughout the response.

(c) ORM, a large company, is expanding and the managers are concerned that their IT systems will need an expensive upgrade to be able to manage the increasing amount of data held by the company. The company is considering moving all of its data to an external data centre and relying on their services to store and provide access to this data.

Discuss whether ORM should move all of its data to a data centre. ***[8 marks]***

Answers may include:

- costs – they will have to compare the cost of upgrading their local servers and IT facilities with the cost of paying for the services of the external data centre provider
- complexity of the change – they will have to take into account the complexity of the change from their local in-house providers of IT services to the move of data to the external data centre (time required, changeover period, reliability of the files when moved to a different location – may be too large and time to upload will make them unavailable)
- personnel – many of the ORM IT personnel may not be needed and will be made redundant – social implications
- policies – they will have to carefully review the policies at the external data centre to understand their responsibilities in the keeping of backups, privacy of the information and availability of the services
- confidential information – ORM will need to determine whether data that involves confidential company information should be stored on data centre servers. Data can be accessed by personnel at the data centre.

Note: the external data centre does not belong to ORM.
Note: do not consider any references to hacking into the data centre servers.

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 27.

SECTION B

4. Project management at Larssons

(a) (i) State *three* items that will be included in the project initiation document. ***[3 marks]***

Answers may include:

- project definition
- background (why is project needed, events that caused the need)
- project objectives and desired outcomes (expected results)
- project scope and exclusions / boundaries for the project (what is included and what is not)
- constraints and assumptions (what will it not do)
- users, suppliers, sponsors
- interfaces (internal or external and interactions to other projects)
- project approach (how will the solution will be delivered including skills required to achieve aims)
- business case / justification for the business (estimated costs, risks, benefits)
- project management team structure (definition of the different levels of the members of the team)
- role descriptions (roles of members of the team)
- quality management strategy (how will quality expectations be met, identifying responsible team members)
- configuration management strategy (approach to identify, track and protect project assets)
- risk management strategy (techniques to identify, assess and control the risks – include people responsible for this)
- communications management strategy (informing stakeholders of project status methods and frequency of communication)
- project plan (defining costs and timescales, define products, activities and resources required, update the plan throughout the lifecycle)
- project controls (tools to help in decision making – tolerances and monitoring of these).

*Accept either the item (*eg *"background") or a reasonable definition of the item (*eg *"why is project needed")*

Award ***[1 mark]*** *for each item up to a maximum of* ***[3 marks]****.*

(ii) Identify *three* responsibilities of the Information Systems Manager. ***[3 marks]***

Answers may include:

- determines the IS strategy for the company
- establishes an information technology strategy
- decides on platforms
- line manages other IT staff
- has budgetary responsibility for IT
- evaluates user needs and system functionality and ensures that ICT facilities meet these needs
- schedules upgrades and security backups of hardware and software systems
- researches and installs new systems
- ensures the smooth running of all ICT systems
- ensures that software licensing laws are adhered to
- provides secure access to the network for remote users
- ensures the security of data from internal and external attack
- manages crisis situations, which may involve complex technical hardware or software problems
- mentors and trains new ICT support staff
- keeps up to date with the latest technologies.

*Award **[1 mark]** for each responsibility up to a maximum of **[3 marks]**.*

(b) Explain *three* problems that may arise if a project does not make use of a properly designed project methodology such as PRINCE2. ***[6 marks]***

Answers may include:

- scope creep – the project may drift into unplanned territory without a guiding plan
- failure to deliver project results on time / on budget – items may get forgotten or not allocated sufficient resources
- project team loses focus – individuals may go their own separate ways without a definitive plan
- stakeholders lose ownership – the development team may lose sight of what the client really wants
- critical path to complete project sub optimal – may lose sight of dependencies and waste time
- failure to properly estimate project resources, time and costs – items may be neglected or added
- project progress / risks / changes not communicated – this can lead to disillusionment on the part of the clients
- project assumptions not explored properly – unexpected snags can turn up at a late stage.

*Award **[1 mark]** for each problem identified up to a maximum of **[3 marks]**.*
*Award **[1 mark]** for each expansion on the problem up to a maximum of **[3 marks]**.*

(c) Project managers need a range of skills, including technical IT skills, to ensure a project is completed on time and within budget.

To what extent is a project manager's technical knowledge critical to the success of the projects they manage? ***[8 marks]***

Answers may include:

- programming skills are needed in order to understand programmers' issues
- understanding of project management methodologies so that the work is kept on time, of a sufficient quality and to budget
- needs to have knowledge of all areas of the project to ensure it goes as planned
- technical knowledge allows the manager to evaluate the results
- having a range of skills, such as the ones below, is more critical than having technical knowledge:
  - be highly organized and a good multi-tasker because the project manager has to manage multiple tasks simultaneously
  - be a good leader; build consensus, inspire the team, build relationships with key stakeholders
  - be an effective communicator; needs to be clearly understood by all stakeholders
  - problem solver; can address the problem with minimal disruption
  - able to delegate tasks
  - able to set up and manage budgets.

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

Please see generic markband information sheet on page 27.

5. Updating Top Dog's information system

(a) (i) Identify *three* reasons why the Top Dog owners have decided that it is time to replace their old information system. ***[3 marks]***

Answers may include:
- maintenance costs too high
- lack of maintenance provided
- more economical alternatives
- needs of the business have changed
- legislation has forced changes
- adopts a new hardware strategy / platform
- better performance / interface wanted
- old information system is not compatible with new developments in technology
- old supplier ceases operating.

Do not accept "the system (hardware/software) is outdated"
Award ***[1 mark]*** *for each reason up to a maximum of* ***[3 marks]***.

(ii) Identify *three* tasks that might need to be performed during the implementation of the new information system. ***[3 marks]***

Answers may include:
- order new equipment
- install new equipment
- test new equipment
- train users
- install system on target computers
- transfer data from old system
- enter new data
- a changeover
- run in parallel to ensure working properly
- backing up data.

Award ***[1 mark]*** *for each task up to a maximum of* ***[3 marks]***.

(b) The project manager is considering either direct changeover or phased changeover for the implementation of the new information system for Top Dog Veterinary Practice. Analyse these options. ***[6 marks]***

Answers may include:

Direct changeover

- may take less time, new system is up and running immediately
- may be less confusing for staff as they have only one system to understand
- may lead to duplication of work if comparisons are made between the system
- will remove the issues of compatibility between the two systems that may occur with a phased changeover
- training is required before the implementation
- high risk of data loss.

Phased changeover

- may provide time for staff to learn the new system (training) and may allow for original system to be used in parallel
- may give time to appraise the new system as it is implemented – that 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. May not be possible with direct changeover
- allows closer monitoring of new system as each phase of the implementation can be thoroughly evaluated before the next stage. However, this may extend the time (and cost) required for the changeover
- low risk of data loss.

[1–2 marks]

A limited response that indicates very little understanding of the topic.

[3–4 marks]

A reasonable description of the differences between direct and phased changeover methods. The answer may be unbalanced and lack appropriate reasoning at the lower end of the band.

[5–6 marks]

A clear and detailed explanation of the differences between direct and phased changeover methods.

(c) Many companies now outsource their IT provision. This may involve handing over responsibility for the running and maintenance of the information system to a cloud computing provider.

To what extent would it be advantageous for Top Dog Veterinary Practice to outsource its information system to a cloud computing provider? ***[8 marks]***

Answers may include:

- definition of cloud computing
  - virtualization of resources
  - services offered remotely
  - transparent to user
  - cloud computing is sold on demand
  - the service is managed by the provider
  - user can determine the amount of service they take
  - users can log on to the network from any computer in the world
  - issues related to outsourcing.

Pros

- access to a huge range of applications without having to download or install anything
- applications can be accessed from any computer, anywhere in the world
- users can avoid expenditure on hardware and software; only using what they need
- companies can share resources in one place
- consumption is billed as a utility with minimal upfront costs
- scalability via on-demand resources
- reduced need for onsite resources
- reduced need for skilled personnel
- the cloud computing provider becomes responsible for backing up the company's data.

Cons

- users do not physically possess storage of their own data, which leaves the responsibility and control of data storage with the provider
- users could become dependent upon the cloud computing provider
- with data held externally, business continuity and disaster recovery are in the hands of the provider
- data migration issues when changing cloud provider
- what happens if your cloud provider goes out of business?
- needs an active Internet connection
- confidentiality issues.

Do not accept "hacking" as this can happen regardless the information system is outsourced or not.

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

Please see generic markband information sheet on page 27.

SECTION C

6. Expert systems in health care

(a) (i) Identify *two* characteristics of an expert system. ***[2 marks]***

Answers may include:
- computer system that emulates a human expert
- used to solve complex problems
- uses reasoning
- has inference engine
- knowledge base
- interface.

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

(ii) Identify *two* reasons why a doctor would use an expert system in order to help diagnose a patient's condition. ***[2 marks]***

Answers may include:
- to have access to the latest information about the condition
- to have the benefit of the knowledge from top experts in the field
- to confirm their diagnosis with that of the expert system
- to make sure that interactions / complications are properly taken into account
- avoid mistakes in diagnosis
- have greater time to spend on less common conditions as the expert system diagnoses the common conditions more quickly.

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

(iii) Outline the relationship between the knowledge base and the knowledge engineer. ***[2 marks]***

Answers may include:
- the knowledge engineer translates knowledge into computer usable form in the knowledge base
- knowledge engineer has the experience / background to determine what should be included in the knowledge base
- knowledge engineer can test the knowledge base to see if it performs adequately
- knowledge engineer does not need to maintain contact with the knowledge base after it is implemented – otherwise no point in having the autonomous system.

*Award **[1 mark]** for each appropriate comment that outlines the relationship between the knowledge base and the knowledge engineer up to a maximum of **[2 marks]**.*

(b) (i) Explain the purpose of an expert system shell. ***[2 marks]***

Answers may include:

- a means for creating an expert system
- has features for adding rules
- allows if/then conditions to be created
- provides interface between the expert system and its creator
- provides algorithms for making inferences from the rules.

*Award **[1 mark]** for each appropriate comment that explains the purpose of the expert system shell up to a maximum of **[2 marks]**.*

(ii) Construct the inference rules that were put into the expert system by the knowledge engineer. ***[4 marks]***

- if age >=18 **and** age <=65 then check weight, (else no)
- if weight >=50 kg then check blood pressure, (else no)
- if blood pressure <180/100 then check hemoglobin, (else no)
- if male **and** hemoglobin >=135 g/l then yes
- else if female **and** hemoglobin >=125 g/l then yes, (else no).

*Award **[1 mark]** for each interface rule up to a maximum of **[4 marks]**.*

(c) To what extent should Dr James trust the results produced by an expert system in making her final decision about a course of treatment for a patient? ***[8 marks]***

Answers may include:

A doctor should trust the findings

- all known factors were taken into account when making decisions about the treatment because they are programmed into the expert system
- they are making use of the knowledge of many experts in determining the treatment
- a treatment may involve a complex situation that might be difficult for humans to comprehend unaided by an expert system.

A doctor should not trust the findings

- from past experience in using the system, the expert "knowledge" seems to be not reliable in providing an accurate diagnosis and treatment
- the patient has multiple illnesses and the expert system cannot make sensible recommendations for treatment
- risks of new treatments not known so they could not be added to knowledge base
- may encounter unprecedented situations and there is no data to draw on.

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

Please see generic markband information sheet on page 27.

7. Robots in war

(a) (i) Define the term *artificial intelligence*. ***[2 marks]***

Answers may include:

- human-like intelligence
- study (and design) of intelligent agents
- the science and engineering of making intelligent machines
- an agent having qualities that we associate with intelligence *eg* learning ability / adaptability
- the ability of machines to have thoughts and make decisions like humans.

*Award **[1 mark]** for a basic comment about AI with **[1 mark]** for each additional comment up to a maximum of **[2 marks]**.*

(ii) Identify the steps that could be taken by the drone to identify a target. ***[4 marks]***

Answers may include:

- relay image to human operator
- detect cell phone transmissions – if recognized as enemy then attack
- pattern recognition algorithms – match against known images / determine if non-natural, *ie* man-made
- the drone uses sensors to scan and identify the scene
- the drone retrieves information from an expert system to identify which target matches the established criteria
- heat detection – unexpected body heat could identify a human target
- detect man-made light source.

*Any four steps, award **[1 mark]** each up to a maximum of **[4 marks]**.*

(b) Analyse the decision to train soldiers using battlefield computer games. ***[6 marks]***

Answers may include:

- it is more cost-effective than training soldiers in a battlefield environment
- it is safer than training soldiers in a battlefield environment
- may give commanding officers an insight into how they may react in real life
- good tool to examine the best strategy to use when approaching a situation
- games should include normal and unusual situations
- through the games soldiers should be able to visualize the worst-case scenarios
- games should emphasize importance of reacting to warnings
- because it is a game, soldiers may not take it as seriously, may not think it is important
- soldiers might get fatigued by visual / aural signals
- lack of danger may reduce realism.

[1–2 marks]
A limited response that demonstrates minimal knowledge and understanding of the topic and uses little or no appropriate ITGS terminology.

[3–4 marks]
A partial analysis, either lacking detail or balance, that demonstrates some knowledge and understanding of the topic. Some relevant examples are used within the response. There is some use of appropriate ITGS terminology in the response.

[5–6 marks]
A balanced and detailed analysis of the issue which demonstrates thorough knowledge and understanding of the topic. Relevant examples are used throughout the response. There is appropriate ITGS terminology throughout the response.

(c) To what extent is it acceptable in war that robots should be able to make their own decisions? ***[8 marks]***

Answers may include:

Benefits

- standard response to standard danger
- prevents panic responses
- prevents ill-judged responses
- less chance of not noticing a danger
- leaves operator free to make judgments.

Drawbacks

- response might be inappropriate / computer systems can make errors
- might be a new situation never anticipated
- might fail to take into account unexpected variables
- makes the operator less alert as the system is trusted
- unclear who is taking responsibility for lethal action.

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

Please see generic markband information sheet on page 27.

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.*