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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Higher Level

Paper 1

25 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. Health and dentistry

(a) (i) Describe *one* difference between a local area network (LAN) and a wide area network (WAN). ***[2 marks]***

Answers may include:

- LAN is within close proximity, (*ie* home, office, same building or group of buildings close together), whereas a WAN is not restricted to a geographical area
- WAN connects several LANs together
- they use different protocols. A LAN transmits to other devices within the network, whereas a WAN uses point to point transmissions between nodes
- LAN has a high transfer rate, WAN is much slower.

*Award **[1 mark]** for identifying one difference and an additional **[1 mark]** for a brief description up to a maximum of **[2 marks]**.*

(ii) The upgraded IT system is a LAN based on a client/server network. Outline the relationship between the client and the server in the upgraded IT system. ***[2 marks]***

Answers may include:

- the server hosts information and programs that are shared to the clients (computers used in the examination rooms by dental hygienist/dentist)
- the client (computer used by the dental hygienist/dentist) makes a request to the server
- the server fulfills the request.

*Award **[1 mark]** for any aspect of the relationship between the client and the server that is identified. Award an additional **[1 mark]** if the relationship between the two is outlined.*

(iii) The developers of the upgraded IT system own the intellectual property rights for the system. Define the term *intellectual property*. ***[2 marks]***

Answers may include:

- intellectual property refers to any property that is created using original thought
- the creator owns the rights to the artifacts that they created, this includes artistic works and ideas
- intellectual property is protected by copyrights, trademarks and patents
- unlike tangible property, rights are not extinguished when the property is destroyed
- developers of the IT system own the ideas used in the system (design, how it works and what it does). No other developer can create a system with these same ideas.

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

(b) Analyse the impacts of implementing the upgraded IT system for the dentist. ***[6 marks]***

Answers may include:

- access to data – transfer data from paper records to electronic will make access easier to data
- access to data – dentist and his staff have faster access to a patient's electronic chart than it is to locate a patient's paper chart
- queries – dentist will be able to do online search queries for patient information
- simulations – dentist can use the new IT system to show before and after simulations so patients can see what their teeth will look like once a procedure is completed, or what it will look like if they don't have a procedure done
- cost – dentist will need to provide training for all office staff, which can be costly and time is needed to implement this new system
- backup – if system malfunctions (power outage, server crash, virus), dentist requires a backup plan will need to be in place to access patient records
- updates – once the system has been installed, the dentist may want to keep up with updates and this might have a cost / involve a risk of having to adapt to great changes / assume mistakes of the newer and not tried versions.

Award marks for impacts for the dentist.

[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 should dentists use simulation software to determine future treatment for their patients? ***[8 marks]***

Answers may include:

- dentists can show patients what will happen if they don't take care of their teeth
- dentists can show how a certain procedure could correct their current problem with their teeth
- simulations cannot account for all unexpected complications
- simulations can persuade patients into taking care of the situation now, rather than later
- if dentists enter incorrect data into the simulation, then the output will not be reliable and the patient can be given incorrect information.

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 25.

2. ***Live-brary***

(a) The information about the e-books, borrowers and circulation is stored in a relational database, similar to the one shown below.

(i) State the key field in the table *tblBorrower*. ***[1 mark]***

- Borrower_ID

*Award **[1 mark]** for the correct key field stated.*

(ii) State the data type for *Telephone*. ***[1 mark]***

Accept any of the following answers:
- text (if not used in calculations)
- varchar datatype (variable-length data type)
- alphanumeric.

*Award **[1 mark]** for data type stated to a maximum of **[1 mark]**.*

(iii) *Loan_Length* uses a drop-down list with 7, 14 and 21 days. Outline why the drop-down list is used for this field. ***[2 marks]***

Answers may include:
- consistency – user cannot input different numbers or formats/prevents users from making mistakes
- preset values – limits users choices to those provided
- simplifies process – values are already provided/select options is faster than typing
- input does not need validation check.

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

(iv) Identify *two* features of the database query shown below. ***[2 marks]***

Answers may include:
- is a derived query / has a calculated field
- shows three fields of the five / two fields are hidden
- only selects records where IsJunior value = 0 / does not select records where IsJunior value = –1
- uses data held in the *tblBorrower* table
- only includes borrowers who are under 18 years old the day the query is run
- uses the DateAdd and Date functions.

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

(b) Explain *two* advantages that digital rights management (DRM), associated with the e-books, provides to the *Live-brary*. ***[6 marks]***

Answers may include:

- e-book is encrypted – may need an electronic key to unlock it
- cannot copy and paste the e-book into another program
- e-books do not have to be returned
- cannot keep the e-book
- stops borrowers from sharing the e-book with others when it has been downloaded.

For each explanation:
*Award **[1 mark]** for an advantage identified.*
*For that advantage award up to **[2 marks]** for an explanation.*
*Award a maximum of **[3 marks]** for explanation of each advantage.*

(c) *Live-brary* allows borrowers to access free digital content which can be read online and be downloaded to read offline. Evaluate *both* these options. ***[8 marks]***

Answers may include:

Streaming

- must be online to read the book, constant internet access
- if connection is slow, may have difficulty reading, turning pages
- if connection is lost, unable to read book
- can get access to up-to-date books.
- if the text has links (*ie* to websites, additional content material), these may be followed while reading the online version
- if users are making comments to passages in the book these will be updated online and the online reader will be able to access them at any time
- large books may be read online without having to worry about the amount of storage space they might take.

Downloading

- only need to have internet access long enough to download book
- can read the book in areas without internet access once downloaded
- cannot get more books unless internet connection is established
- may require a large amount of storage space on the device used to read the e-book offline
- the device's battery will last longer if the device is not connected to the internet while reading the downloaded book (*ie* provides user with more hours of use without recharging, important consideration when travelling)
- books can be read on planes, trains or other places where there is no WiFi connection.

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 25.

3. Voice over internet protocol (VOIP)

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

Answers may include:
- a telephone connection over the internet
- audio data is sent digitally over the internet
- a system for converting analogue signals to digital so that telephone calls can be made over the internet.

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

(ii) Define the term *protocol.* ***[2 marks]***

Answers may include:
- set of rules/standards/instructions
- protocols determine specific tasks (*ie* error checking, method of data compression, when the receiving device has received all of the data, when the sending device has completed the transmission of data)
- governs the transmission of data
- protocols specify interactions between devices
- specific example of protocol (*ie* FTP).

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

(iii) State *two* stages where a *Skype* call can be blocked from reaching the intended recipient. ***[2 marks]***

Answers may include:
- user level
- server level
- firewall
- ISP level.

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

(b) Analyse the decision of some countries to ban services such as *Skype*. ***[6 marks]***

Answers may include:

Advantages for the government:

- economic – countries will lose money if business is taken away from national telecom companies
- increased government control over calls and records that happen within their country through national telecom companies
- security – data can be more easily intercepted
- reduce the demands caused by Skype on Internet service (*ie* bandwidth).

Disadvantages for the government:

- restriction of users' communication promotes illegal providers of *Skype* to emerge.

Advantages for the user:

- better national telecom services may emerge because all citizens must use these services.

Disadvantages for the user:

- users could have no alternative to paying excessive fees charged by national telecom companies
- anyone attempting to by-pass the law will face consequences such as imprisonment or fines
- users may need to travel to neighbouring countries that do not have such restrictions to use *Skype*
- encryption of telephone communication is no longer possible (whereas *Skype* is encrypted so governments do not have easy access to the data).

[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) In most countries the use of VOIP is legal. Discuss the decision of a business in these countries to use VOIP services instead of a conventional phone system. ***[8 marks]***

Answers may include:

- low cost – can make long distance calls for free, anywhere in the world via VOIP
- portable and convenient – can make calls anywhere there is an internet connection by signing into your VOIP account
- added features – caller ID, call forwarding, call waiting, voicemail at no charge unlike conventional phone systems
- sharing resources – can send picture and documents while you are talking on the phone since it uses data lines
- virtual phone number – you can choose a phone number with an area code different from where you reside
- group conversations – on a traditional phone line, only two persons can speak at a time. With VOIP, you can setup a conference with a whole team communicating in real time
- power – internet based phones need power, so they will not work during a power outage unlike conventional phones
- emergency calls – emergency services cannot trace the location of a call (dangerous if you can't talk in an emergency) if it is on a data line such as VOIP
- sound quality – voice data sent across the internet can experience dropped data packets which would cause short periods of silence
- video quality – delay in the video resulting from technical limitations (*ie* low bandwidth either by the sender or receiver, incorrect settings)
- reliability – the distance and speed of the connection affects the reliability of the sound arriving
- bandwidth – too much traffic on a network can cause a drop in audio data when using VOIP
- security – VOIP may not be as secure as a regular telephone service; phone calls may be intercepted as they are transmitted over the internet.

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 25.

SECTION B

4. Online marking

(a) (i) Identify *three* stakeholders that should be consulted in the initial investigation. ***[3 marks]***

Answers may include:
- examiners
- examining organization
- examining organization managers
- scanning centre managers
- project managers (any)
- members of the development team/programmers *etc*
- managers in schools
- teachers in schools.

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

(ii) Identify *three* methods that the analysts could use in order to collect information about the current system. ***[3 marks]***

Answers may include:
- questionnaires
- interviews
- focus groups
- examination of paperwork
- observation of current processes.

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

(b) As part of their investigation, the analysts carry out a feasibility study. Explain what must be included in a feasibility study in this case to ensure that the final product meets the client's requirements. ***[6 marks]***

Answers may include:

- examine the hardware required by the examiners – may require purchases
- examine software required by the examiners – may require purchases
- examine the hardware required by the organization – may require purchases
- examine software required by the organization – may require purchases
- look at requirements specification – is it achievable?
- look at costs – is it achievable within constraints?
- look at benefits – do they outweigh the costs?
- look at time frame – how soon is it needed?
- look at training/skills issues – will the users need training? What will that cost? Will they be willing to be trained?
- examine whether technically feasible – is it possible to produce the required functionality and performance?
- a risk analysis – what drawbacks might there be?
- health and safety issues
- what if it fails in use?
- look at alternatives – there may be better ways – may be solutions already in existence
- may recommend not undertaking project – not all projects are worth it in the end.

Marks	Level descriptor
0	No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.
1–2	Minimal knowledge and understanding of ITGS issues and concepts related to the use of feasibility studies. Minimal use of appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.
3–4	A description or partial examination with limited knowledge and/or understanding of the role of feasibility studies in system development. Some use of appropriate terminology relating to feasibility studies. Some reference is made to the scenario in the stimulus material.
5–6	A thorough examination with a detailed knowledge and understanding of the role of feasibility studies in systems development. An examination that uses appropriate ITGS terminology such as how feasibility studies may influence the design of a product. Explicit and relevant references are made to the scenario in the stimulus material.

(c) All IT projects, such as that proposed by the examining organization, should be based on a requirements specification to meet a client's needs.

To what extent does the requirements specification determine the success of IT projects? ***[8 marks]***

The extent to which the requirements specification meets the following conditions determines the success of the IT project. The requirements specification in the scenario, or other examples can be used.

- complete and specific checklist to guide the complete process from planning through to implementation
- requirements specification based on the information collected from stakeholder(s)
- basis for the contract between the stakeholder(s) and developer(s)
- requirements specification takes into account requirements from all stakeholders
- where the interest of stakeholders conflict in the formulation of requirements specification, requirements are prioritized to ensure success
- requirements specifications can be achieved with the given resources, budget and time
- each requirements specification must be measurable/testable to show that the requirement is satisfied.

Please see generic markband information sheet on page 25.

5. Software development

(a) Use the data flow diagram to answer the following questions.

(i) State *two* places where data will be stored in the planned system. ***[2 marks]***

Answers may include:
- customer database
- offers.

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

(ii) State *two* processes that are planned in this project. ***[2 marks]***

Answers may include:
- check application form
- input customer details
- produce personalized mailing.

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

(iii) State *one* entity that is planned in this project. ***[1 mark]***

Answers may include:
- customer

*Award **[1 mark]** for the correct entity stated.*

(iv) State the person responsible for checking that the customer forms are correctly filled in. ***[1 mark]***

Answers may include:
- data entry clerk

*Award **[1 mark]** for the correct person stated.*

(b) Explain why *Rodriguez Developers* use modelling techniques before undertaking a project. ***[6 marks]***

Answers may include:

- models help to clarify what needs to be done
- models help to communicate plans to managers
- models help in developing ideas with managers
- models help in showing the client some features of the system before the project is developed
- when constructing a model, ideas are broken down into pieces and some possible errors may be discovered and fixed
- models help to reduce the complexity of a large system so makes it easier to develop
- models help to estimate costs
- models help to reduce costs
- models encourage the re-use of components, saving time and costs
- models can form part of the documentation
- models help to pass on requirements to the programmers who produce the system
- models encourage consistency
- models help to make sure that all requirements are dealt with.

Marks	Level descriptor
0	No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.
1–2	Minimal knowledge and understanding of ITGS issues and concepts related to the use of modelling. Minimal use of appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.
3–4	A description or partial examination with limited knowledge and/or understanding of the role of modelling in system development. Some use of appropriate terminology relating to modelling. Some reference is made to the scenario in the stimulus material.
5–6	A thorough examination with a detailed knowledge and understanding of the role of modelling in systems development. An examination that uses appropriate ITGS terminology such as how modelling can lead to a better product. Explicit and relevant references are made to the scenario in the stimulus material.

(c) To what extent is the use of agile development methodology suitable for *La Vianda's* requirements in this case? ***[8 marks]***

Answers may include:

Advantages:

- a flexible approach – can make changes as they develop it
- can respond to challenges that occur during development
- can incorporate new ideas as the product develops
- leads to the early production of working software modules
- project plans are never perfect – agile encourages a "good enough" approach
- can respond to cost issues
- can try out ideas before committing to them
- encourages iteration with business managers
- can fix bugs as you go
- helps communicate with *La Vianda* managers
- direct involvement with programmers – encourages pragmatic approach
- encourages change of role in team – common ownership
- faster development
- face to face communication removes guesswork.

Disadvantages:

- lack of initial plan might lead to inadequate resources being set up
- no definite stages so may be time/cost overrun
- may lead to requirements being left out
- lack of emphasis on design
- lack of emphasis on documentation
- requires clarity from *La Vianda* managers
- needs experienced developers
- requires developers to be physically present.

Conclusions:

- this scenario might be part of a bigger system
- small supermarket
- agile will allow new ideas to be incorporated as they develop it.

Please see generic markband information sheet on page 25.

SECTION C

6. Artificial intelligence (AI) / pattern matching

(a) (i) State *three* practical uses of edge detection in image processing. ***[3 marks]***

Answers may include:
- fingerprint analysis
- face or any other biometric application
- cleaning up blurred photographs
- OCR
- classifying images
- reading bar codes.

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

(ii) Identify the steps that *Google Goggles* may use to establish the location of the image in the photograph. ***[3 marks]***

Answers may include:
- a picture is taken then *Google* sends the user's image to *Google's* data centres
- using computer vision algorithms, *Google* then create signatures of objects in the image
- comparison of signatures are done against all other known items in image recognition databases
- a search is carried out for matching results
- based on available meta data and ranking signals, *Goggle* returns one or more search results.

*Any three steps, award **[1 mark]** each up to a maximum of **[3 marks]**.*

(b) Explain why the image recognition system is better at recognizing locations than it is at recognizing people. ***[6 marks]***

Answers may include:

- system depends on data already available on the internet
- likely to be lots of data about well known locations
- a database with the features of known locations can be kept
- location more likely to be recognized because of distinct edges, *eg* building outlines
- locations will maintain their main characteristics
- faces have several different ways depending on the hair, age, facial expression
- a database with everyone's features is not kept, even though some countries may keep digital photographs
- features of locations are public, features of faces may be kept secure by institutions who have them
- locations, buildings, may have distinct edges, faces change angles, may join other faces
- locations do not move, people do.

Marks	Level descriptor
0	No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.
1–2	Minimal knowledge and understanding of ITGS issues and concepts related to the use of pattern matching. Minimal use of appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.
3–4	A description or partial examination with limited knowledge and/or understanding of the role of pattern matching. Some use of appropriate terminology relating to pattern matching. Some reference is made to the scenario in the stimulus material.
5–6	A thorough examination with a detailed knowledge and understanding of pattern matching. An examination that uses appropriate ITGS terminology such as how pattern matching can have limitations. Explicit and relevant references are made to the scenario in the stimulus material.

(c) To what extent can artificial intelligence software combine image processing with cell/mobile phone features to help a tourist get the most out of visiting a city? ***[8 marks]***

Answers may include:

- location can be detected by GPS – knows about nearby attractions
- location can be detected by mobile phone masts/tower – knows about nearby attractions
- direction can be detected by compass – can give directions based on where user is heading
- interests can be gleaned/stored – so can produce suggestions of likely interest to user
- interests can be gleaned from *Facebook etc* – see above
- surroundings identified from photo processing – further indication of location
- location/interests can be deduced from images – can suggest other activities related to place in image
- knows about dining preferences from various sources – restaurants/attractions identified from searches
- foreign text can be translated from image – useful for decoding notices/menus *etc*
- map can be displayed – with locations found from any of the above methods.

Please see generic markband information sheet on page 25.

7. Artificial intelligence (AI) / expert systems

(a) (i) Define the term *expert system*. ***[2 marks]***

Answers may include:
- software
- that uses knowledge
- emulates a human expert
- to solve a problem.

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

(ii) Identify *two* features of an expert system shell. ***[2 marks]***

Answers may include:
- a development environment
- used for building and maintaining knowledge-based applications
- provides a step-by-step methodology
- provides a user-friendly interface such as a graphical interface.

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

(iii) State *two* rules for chaining when solving a problem. ***[2 marks]***

Answers may include:
- define the first target towards solving the problem
- gather information to determine the outcome for that target
- monitor the outcome
- when a target in the chain is completed, define/continue to the next target in the chain
- when all of the targets in the chain are completed the problem is solved.

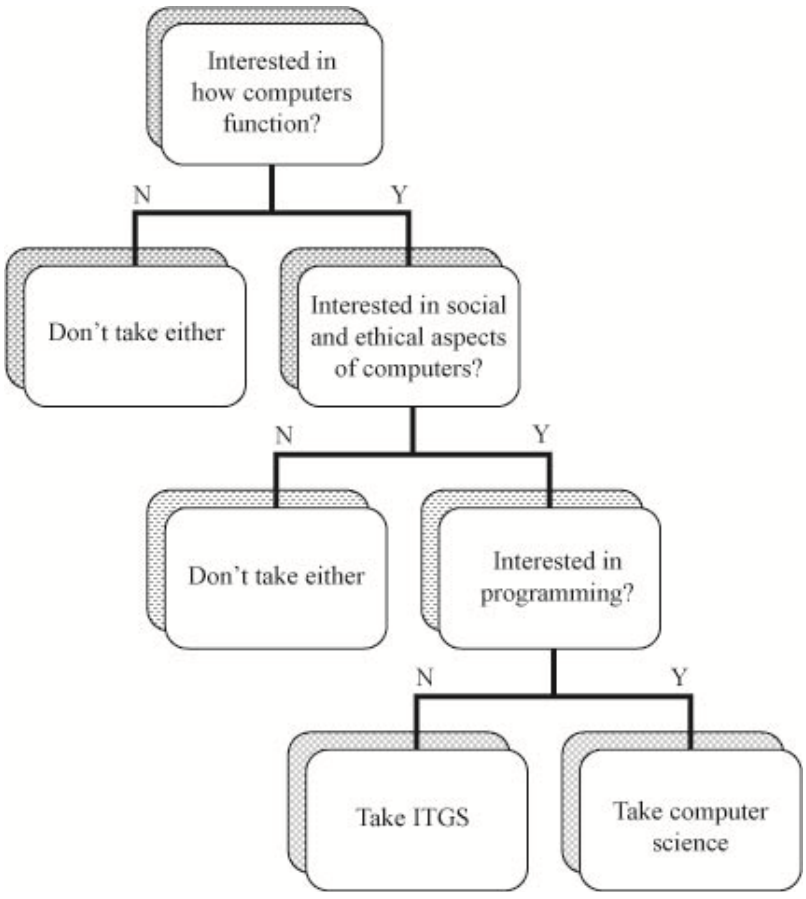
*Award **[1 mark]** for each rule stated up to a maximum of **[2 marks]**.*

(b) A school has decided to interview students who need advice in choosing their diploma subjects. It has purchased an expert system to assist with this. Students may take either ITGS or computer science, but not both.

- **Both ITGS and computer science require students to have an interest in how computers function.**
- **Both ITGS and computer science require students to have an interest in social and ethical issues related to computing.**
- **Computer science is recommended to those students who enjoy programming.**

Copy and complete **the information below to construct a decision tree that could be used as part of an expert system in order to automate this subject advice.** ***[6 marks]***

Answers should include:



- Y/N at each decision node
- leads to correct conclusions (bottom line)
- allows for "don't take either" options
- as above – second time
- no false leads
- exactly 4 levels
- exactly 4 terminators.

Any six points, award ***[1 mark]*** *each up to a maximum of* ***[6 marks]****.*

(c) Many schools are using expert systems to help students in making decisions about which subjects to take as part of their diploma.

To what extent is it appropriate to use an expert system as the only method of giving advice to a student in their choice of diploma subject? ***[8 marks]***

Answers may include:

Suitable:

- it is a suitable domain because a human expert could solve this too
- it is solved repetitively
- removes the need for a human expert
- a quick first stage in the process.

Unsuitable:

- very limited in response
- only takes into account a limited number of variables
- subject choice may be affected by the personality of the student
- subject choice may be affected by the (perceived) quality of the teacher
- may be better if a human can read some of the more subtle signals.

Please see generic markband information sheet on page 25.

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.*