



MARKSCHEME

May 2012

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 *e.g.* “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. Implementation of a school database

(a) (i) State the name of the primary key field of the table *tblVisit*. [1 mark]

- Visit_Number.

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

(ii) State the relationship between the tables *tblNurse* and *tblVisit*. [1 mark]

- The Nurse_ID field in *tblNurse* and Nurse_ID field in *tblVisit*.

Accept Nurse_ID.

Award [1 mark] for the correct relationship stated.

(iii) State a field type that would be suitable for *Surname* in the table *tblStudent*. [1 mark]

Answers may include:

- string
- varchar
- text.

Do not accept number.

Award [1 mark] for a field type stated up to a maximum of [1 mark].

(iv) State a field type that would be suitable for *Salary* in the table *tblNurse*. [1 mark]

Answers may include:

- numeric / numeral / number
- floating point
- currency.

Award [1 mark] for a field type stated up to a maximum of [1 mark].

(v) State a field type that would be suitable for *Sent_Home?* in the table *tblVisit*. [1 mark]

Answers may include:

- logical
- Boolean
- yes/no.

Award [1 mark] for a field type stated up to a maximum of [1 mark].

- (vi) **State a field type that would be suitable for *Telephone_Number* in the table *tblNurse*.** [1 mark]

Answers may include:

- string
- character
- text
- varchar.

Award [1 mark] for a field type stated up to a maximum of [1 mark].

- (b) (i) **The database will allow teachers to export data to a spreadsheet.**

Explain *one* reason why teachers would export data from the database to a spreadsheet. [2 marks]

Answers may include:

- *Reason:* exported data in spreadsheet format may be shared with other users
Explanation: some users cannot work with a database but do work with a spreadsheet or do not have the database software
- *Reason:* exported data can be shared without having to share all data in the database *i.e.* data to be shared is selected
Explanation: exported file size smaller / avoid sharing unnecessary data
- *Reason:* exported data may need calculations
Explanation: these special functions and formulae are present in spreadsheet software and not in database software.

Do not accept answers that refer to “user friendly” or “easier to use”.

Award [1 mark] for one reason identified and [1 mark] for an appropriate explanation of that reason up to a maximum of [2 marks].

- (ii) **The new database will also require teachers to undertake training to be able to use it.**

A local company is offering to train users in the use of the new system. The two options proposed are:

- **online training**
- **face-to-face training.**

Contrast the two options. [4 marks]

Answers may include:

Examples of situations:

- time and place of the training
- IT requirements
- personal considerations
- cost considerations.

Contrasts may include:

Online training	Face to face training
<p><i>Time and place of training:</i></p> <ul style="list-style-type: none"> • online training can be scheduled for longer periods of time and 24/7 • training may be available to teachers regardless of where they are. 	<p><i>Time and place of training:</i></p> <ul style="list-style-type: none"> • training is scheduled in one place for a fixed period of time • teachers may have difficulties in participating in the f2f training due to other commitments.
<p><i>IT requirements:</i></p> <ul style="list-style-type: none"> • users need hardware, software and an Internet connection. 	<p><i>IT requirements:</i></p> <ul style="list-style-type: none"> • rooms need to be set up with the hardware and software resources for the training session. Internet access may not be necessary.
<p><i>Personal considerations:</i></p> <ul style="list-style-type: none"> • the participant may be distracted or feel isolated • the participant may have more time for reflection and posing questions • online simulation may crash and teachers may not have the resources or knowledge to solve the technical problem • lessons can be customized for the participant, <i>i.e.</i> move at the pace needed • stressful, impossible for a non-IT person. 	<p><i>Personal considerations:</i></p> <ul style="list-style-type: none"> • trainees may feel more comfortable to ask questions to an actual trainer • trainees may see what others are doing and receive help / advice or step-by-step guidance • the individual needs of the trainee can be more easily met • trainees may learn from each other as well as from the tutor • the presence of a tutor may provide a friendly atmosphere / be less threatening.
<p><i>Costs involved:</i></p> <ul style="list-style-type: none"> • no need for travel (tutors or learners) • need for personal equipment and software. 	<p><i>Costs involved:</i></p> <ul style="list-style-type: none"> • logistical and cost issues of trainees travelling to the training need to be addressed.

[1–2 marks]

The candidate identifies one or more situations that have differences in online and face-to-face training but they have been described in isolation.

[3–4 marks]

The candidate explicitly describes one or more situations that have differences in online and face-to-face training in relation to each other. Appropriate terminology is used throughout.

- (c) **The following screen shows the options this database will have in its online version.**

When the system was purchased it was possible to include a Virtual Private Network (VPN), giving remote access to teachers to this database, which is stored on the school’s server.

Discuss the impact for the school of the decision to allow teachers remote access to the school server.

[8 marks]

Answers may include:

Positive impacts for the school – “school includes teachers, administrators and students”

- school may bring deadlines forward because teachers will be able to work after school from home
- school will provide a better service for students if teachers can access students’ records from home to do follow-ups, upload homework, update the calendar *etc.*

Negative impacts for the school – “school includes teachers, administrators and students”

- some teachers may have difficulty meeting deadlines because their connection from home may not be as good as needed to work with the software
- teacher dissatisfaction – there may be more expectation on teachers to work in the evenings on school-related tasks
- teachers may request extra compensation because they are expected to work from home
- teachers may not feel comfortable with the use of IT and may need training
- school will now have the responsibility to have the system running after school hours and provide some support / provision for failure; IT support available after school, robust servers, hacker protection
- school will have to provide teachers with the hardware such as laptops and, additional software to use the VPN from outside of school
- some teachers may not log out of the network when away from school which may present security issues.

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. Telemedicine

- (a) (i) **Define the term *real-time communication*.** **[2 marks]**

Answers may include:

- communication in which information is received at (or nearly at) the time it is sent
- is synonymous with “live communication”
- uses a direct path between the source and the destination
- data goes from source to destination without being stored anywhere
- often used for communication between people in different locations.

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

- (ii) **After an accident an image of an x-ray of a badly broken leg was taken in bitmap format. To ensure the resolution was clear/high enough for a doctor to see the extent of the injuries, the image size was 12 MB (Megabyte). The connection the doctor will be using has a speed of 240 kb/s (kilobit per second).**

Calculate how long it will take to download an image of each x-ray. (Show your working.) **[2 marks]**

The following calculation must be shown:

- Conversion to kilobit:
 $12 \text{ MB is } 12 \times 1024 \text{ KB} = 12\,288 \text{ KB (Kilobyte)}$,
 $12\,288 \times 8 = 98\,304 \text{ kb (kilobit)}$
- Calculation of transfer time:
 $98\,304 / 240 = 409.6 \text{ seconds (6.83 min / 6 min 49.6 seconds)}$.

Or

Considering the conversion by 1000 instead of 1024:

- $12 \text{ MB} = 12\,000\,000 \text{ bytes} = 96\,000\,000 \text{ bits (approx)}$
- $\text{download speed} = 240 \text{ kb/s} = 240\,000 \text{ bits per second}$
- $\text{length of time for download} = 96\,000\,000 / 240\,000 = 9600 / 24$
 $= 400 \text{ seconds (approx)}$
 $= 6.67 \text{ min/6 min 40 seconds (approx)}$.

Award [1 mark] for the conversion to the same units (e.g. 12 MB to kb, or kb/s to MB/s).

Award an additional [1 mark] for the calculation of the transfer time.

Accept correct calculations if units are not stated.

- (iii) **In some cases the technology available in the remote locations will not allow for large images to be sent to the hospital.**

Identify *two* methods to resolve this problem.

[2 marks]

Answers may include:

- compress the image (and save into a different picture format *e.g.* JPG)
- take a picture again in a different format that has a lower resolution (sacrifice resolution for transfer time)
- break down the file into smaller files using appropriate software and send individual files separately
- resize the image
- convert the image to a different format (that requires less space *e.g.* jpeg files smaller than png files).

Do not accept uploading the image to a service such as Flickr so that the hospital can download them.

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

- (b) (i) **Explain *one* situation in telemedicine that is better suited to *real-time* data transfer and *one* situation in telemedicine that is better suited to *store and forward* data transfer.** [4 marks]

Answers may include:

Situation in telemedicine better suited to *real-time* data transfer:

- doctors guiding an operation in a remote location (robotic operation) – he will need to have the information such as blood pressure or oxygen levels in blood in real-time during the operation
- an ambulance at an accident – paramedics may need real-time data such as heart rate of the patient(s).

Award [1 mark] for situations similar to those stated above. Award an additional [1 mark] for a reason why specific data needs to be transferred in real time.

N.B. In this situation “store and forward” is used to refer to “delayed data transfer” where it is saved on a device or server until it can be sent.

Situation in telemedicine better suited to *store and forward* data transfer:

- doctors in remote locations may not have a permanent internet connection – X-ray files, or similar, will be stored at the server and transferred when the internet connection is available
- situations that might not need immediate response or do not need to have all the participants available simultaneously – data can be digitized, sent and transferred only when recipient accepts it for clinical consultation rather than for a hospital visit.

Award [1 mark] for situations similar to those stated above. Award an additional [1 mark] for a reason why the specific data needs store and forward data transfer.

Award a maximum of [4 marks] for this question.

- (ii) **Many mobile devices use *store and forward* to manage data transfer.**

Explain *one* reason for using *store and forward* by such devices. [2 marks]

Answers may include:

- messages will be stored until the recipient is available to receive the message – the recipient’s cell phone may be turned off or without service and the message will be kept in the server until the mobile phone appears as available. Otherwise the message would be lost
- exchange server stores messages and prioritizes their delivery
- mobile devices use different networks so routing messages through an exchange server allows it to be sent to the destination.

Award [1 mark] for the point stated up to a maximum of [2 marks].

- (c) **In many countries doctors are using videoconferencing to treat patients remotely. Evaluate this medical practice.** [8 marks]

Answers may include:

Advantages

- patients do not have to travel
- doctors do not have to travel
- patients in remote locations have access to experts from around the world
- doctors/nurses/health care workers in remote locations benefit from assisting/listening to an expert who will be doing the treatment
- video conferences can be recorded for later review
- more patients may be treated by the same doctor as there is no need for the doctor to have to travel between patients.

Disadvantages

- equipment for videoconferencing is needed
- time may be a problem if doctors are in a different time zone
- doctors do not get to “see” and touch the patient, must trust doctor in remote location
- connection may fail and ruin the communication
- results from tests and exams will have to be sent (*e.g.* emailed/transferred) in advance
- some patients may not be familiar with video conferencing, and be less willing to describe their symptoms to the doctor.

Do not accept costs involved in video conferencing systems.

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.

3. Improving Lima’s transport system

- (a) (i) Describe what is meant by *social networking*. [2 marks]**

Answers may include:

- online services that allow users to contact and make connections with other individuals
- social networking establishes interconnected online communities
- social networks are made of people who gather together online to share in a common purpose
- assumes all users have equal access to one another in an online community
- share and collaborate using social media (*i.e.* videos, images, text)
- specific examples such as *Facebook, Twitter*.

Do not accept communicating with others – too vague.

Award [1 mark] for an aspect of social networking identified and award [1 mark] for the description of that aspect. Award a maximum of [2 marks] for the answer.

- (ii) Different types of files can be uploaded to highlight the traffic problems described above.**

Describe *two* appropriate types of files which could be uploaded *and* how they highlight the problem. [4 marks]

Answers may include:

- image files (accept file formats such as .jpg .gif) showing buses in large traffic jams / showing an accident
- audio files (accept file formats such as .mp3 .wmv) providing opinions about the service of trains / buses being delayed
- video files (accept file formats such as .mp4 .mov) – users may film situations like full buses, accidents on the route, large queues
- text / document files (accept file formats such as .txt .doc) describing a particular transport problem.

Accept references to traffic and transport problems, but not passengers.

Do not accept a problem being stated only as a “traffic problem”, a specific problem needs to be cited.

Award [1 mark] for each type of file identified and award [1 mark] for the description of how they highlight the problem. Award a maximum of [4 marks] for the answer.

Award [1 mark] if a candidate identifies two correct files types relating to the same scenario.

- (b) **Some managers of local businesses have realized that social networking may provide new business opportunities and have created company webpages on Facebook.**

Explain why companies will use social networking websites to develop new business opportunities.

[6 marks]

Answers may include:

- social networking websites can provide updated information frequently, for example, a new business opportunity such as informing users of new products or the opening of a new office
- social networking websites can keep users interested with latest changes/opportunities, for example, a new business opportunity making the business known to more people
- many new potential customers are already using these networks to communicate with friends, for example, a new business opportunity providing users and potential users of a better or more interesting way of promoting products
- social networking sites are free
- social networking sites may have services not offered by websites such as join interest groups “like a product”
- social networking sites are used to target specific customers based on age, interest, gender *etc.*
- a presence on social networking sites may encourage customers to go to an official business website.

[1–2 marks]

A limited response that demonstrates minimal knowledge and understanding of the topic. There may only be a reference to why companies use social networking websites and uses little or no appropriate ITGS terminology.

[3–4 marks]

A partial explanation that demonstrates some knowledge and understanding of the topic. There may be a reference to why companies use social networking websites. Some relevant examples are used within the response. There is some use of appropriate ITGS terminology in the response.

[5–6 marks]

A detailed explanation of the issue which demonstrates thorough knowledge and understanding of the topic and explains why companies use social networking websites to develop business opportunities. Relevant examples and appropriate ITGS terminology are used throughout the response.

- (c) **Although the *Facebook* page reporting system is not managed by the Lima authorities, they are using it to solve the transport problems that happen in the city of Lima.**

The Lima authorities are considering implementing an official website for reporting transport problems.

To what extent is a social networking website preferable to an official website for reporting transport problems?

[8 marks]

Answers may include:

- official website needs to be maintained and made sure to be working properly – additional costs involved
- no website hosting service is needed to store the website if a social networking service such as *Facebook* is used
- people may feel more at ease using a social networking website such as *Facebook* because they use it frequently
- one comment may trigger others and information may be greater on a social networking website
- the social networking website is probably used and known by citizens who use it for several purposes – an official website would have few uses and may not be known by users
- social networking websites such as *Facebook* already has applications for portable devices that are checked by users when they are away from home or their office
- comments may not always be true on a social networking website
- people may regard information on an official website as being more reliable or legitimate than on a social networking website
- social networking websites may not be available to all users
- some users may not feel comfortable using social networking websites.

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. University IT support

(a) The information services department employs:

- **information system managers**
- **programmers**
- **IT support staff.**

(i) Identify *two* specific tasks that the information system managers must perform. [2 marks]

Answers may include:

- hardware inventories
- provisioning
- server availability monitoring
- software inventory / installation
- anti-virus / anti-malware management
- user activities monitoring
- capacity monitoring
- security management
- storage management
- network capacity and utilization monitoring
- manage the provision of IT support.

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

(ii) Identify *two* specific tasks that the programmers must perform. [2 marks]

Answers may include:

- write / create / edit / customize / design software
- test software
- debug software
- maintain software
- upgrade software.

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

(iii) Identify *two* specific tasks that the IT support staff must perform. [2 marks]

Answers may include:

- monitor computer systems
- maintain computer systems
- maintain networks of an organization
- install / configure computer systems
- diagnose hardware / software faults
- solve technical and applications problems.
- provide guidance on how to use applications
- classify / prioritize incidents
- provide guidance on how to use IT systems (access the network, use equipment: printers, scanners, projectors, whiteboards, ...)
- keep a log of incidents.

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

(b) When a user reports an incident, the IT support staff have to create a log of the incident and then make decisions about the course of action to be taken.

The information services department needs to classify incidents as major or minor. Explain *three* criteria that the information services department could use to reach this decision. [6 marks]

Answers may include:

- does it affect the core business of the university? + reason why the work of the IS Dept affects the core business of the university, may relate to the part of the business affected
- does it affect more than n users? + reason why the number of users makes the incident a priority
- how senior is the complainant? + reason why the seniority of the complainant may make the issue a priority
- does it affect the image/reputation of the university? + reason why the image / reputation of the university may be affected
- is it intermittent? + reason why an intermittent problem may be more serious than one that happens, but does not seem to resolve itself
- the time required to complete the repair + reason why the particular incident needs a speedy resolution (or not)
- day of the week – how does this help classify an incident as major or minor? – + reason as it may determine the number of users, type of activity interrupted *etc.*

Award [1 mark] for each criterion identified and [1 mark] for the explanation of that criterion. Award a maximum of [6 marks] for the answer.

- (c) **The computer science department wants to run its computers using a different network operating system to that used by the rest of the university.**

To what extent should it be the responsibility of the information services department to provide support for this?

[8 marks]

Answers may include:

- the operating system might be needed as a teaching resource – it might be an essential service for them
- the operating system might create a system conflict – it might create problems for other users (investigation of possible problems)
- the operation system might bring security issues to the rest of the university – it might create problems for the university
- the CS Dept might need hardware (computers, cables, hubs, ...) that belong to the university – information services may have to provide the equipment
- the support might have a cost (equipment, staff, software) that the IS Department does not have
- the support might require training – the IS Department might not know how to do this and cannot use their resources to learn / train others
- the support might take time – the IS Department might be dealing with too many incidents in other key areas and cannot deal with a different one that involves only one dept
- the CS dept might want to do this as a private investigation project – information services would want to keep this network isolated from the others to avoid problems /conflicts / security issues.

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

Please see generic markband information sheet on page 27.

5. Daffodil Hotels

- (a) (i) Identify *two* overall responsibilities of a project manager. [2 marks]**

Answers may include:

- ensure project is delivered on time / or stages are delivered on time
- make sure the project meets the specifications to specification
- makes sure the project is within constraints (*e.g.* financial)
- liaise with the client / suppliers.

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

- (ii) Identify *four* features that might be part of a software requirements specification. [4 marks]**

Answers may include:

- a complete description of the behaviour of the system to be developed – what should the system do
- the interactions the users will have with the software – for example, how does the software interact with people, HCI interface issues, the systems hardware, other hardware, other software
- functional requirements – the performance of the system
- non-functional (or supplementary) requirements such as security, portability
- constraints on the design or implementation such as performance engineering requirements, quality standards, design constraints, policies, resources, standards.

Award [1 mark] for each feature identified. Award a maximum of [4 marks] for the answer.

(b) During discussions with the developers, prototypes are frequently used.

Explain how the use of prototypes can assist in the development of a software product that is acceptable to the client.

[6 marks]

Answers may include:

- quick way to show business managers what is possible
- facilitates communication between developer and client
- developer uses different concepts / language to the business managers
- changes can quickly be demonstrated using prototyping software
- prototypes can often be developed into the real product, saving effort
- prototypes assist iteration with client
- issues linked to functionality can be resolved as the product is developed
- costs reduced, as alterations made during development are cheaper than when the product is launched.

[1–2 marks]

A limited response that indicates very little understanding of the topic or the reason is not clear. There may only be a reference to why prototypes are used. There is little or no ITGS terminology.

[3–4 marks]

A reasonable explanation that demonstrates some knowledge of why prototypes can assist in the development of a software product. There may be some relevant examples given with some use of ITGS terminology.

[5–6 marks]

A detailed explanation that demonstrates knowledge of why prototypes can assist in the development of a software product. Relevant examples are given and ITGS terminology is used throughout the response.

- (c) The project manager used the waterfall method of systems development in order to draw up the project plan shown in the Gantt chart below.

The changeover did not go according to plan. When the software was ready to be installed, many serious problems occurred, leading to a failure to deliver the required specification.

With reference to the Gantt chart and other examples you have studied, to what extent is the project plan adequate as the basis for this software changeover?

[8 marks]

Answers may include:

Adequate

- jobs are divided up clearly
- time plan given
- dependencies shown
- milestones shown
- logical progression
- can determine when a task is complete.

Inadequate

- example testing left out
- example hardware procurement / other examples left out
- resources/personnel not shown
- no provision for problems
- no provision for data migration
- no provision for changed requirements
- no provision for parallel tasks, *e.g.* training users could be done before/at the same time as installation at developer's premises
- agile development and/or combination of waterfall and agile
- no evidence of contingency planning
- no slack time in the diagram
- no time allotted for discussions with client.

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 C

6. Fuzzy logic

(a) Some washing machines can examine the washing and can add or reduce time to the washing cycle, based on factors such as the hardness of the water in the washing. This gives more precise control over the washing conditions, thereby saving time, water and energy.

(i) Identify *two* data items, in addition to the hardness of the water, that must be measured in order to make a suitable decision about washing time. *[2 marks]*

Answers may include:

- water temperature
- water volume
- size / weight of washing
- dirtiness of washing
- amount of detergent added
- nature of detergent (solid or liquid)
- previous washing experience (machine “self-learns”)
- type of fabric.

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

(ii) Identify *four* steps that the washing machine software must take in order to adjust the length of the washing cycle correctly. *[4 marks]*

- receive input from (any) sensor.

Award [1 mark] for first input identified. Do not award marks for any subsequent inputs.

Answers may include any three of the following steps:

- compare value with stored table / data
- calculate difference
- calculate difference required in washing cycle duration
- alter washing cycle duration accordingly.

Award [1 mark] for each step described up to a maximum of [3 marks].

(b) A bank is considering introducing new IT systems to support the processing of customers' accounts. Two cases where these systems would be applied are:

- processing customers' monthly bank statements
- detecting fraudulent bank transactions.

Contrast the suitability of using fuzzy logic in these *two* cases.

[6 marks]

Answers may include:

Bank statements – fuzzy logic not suitable

- account data is not subjective
- an account is either overdrawn or it is not
- no validity in assigning account data to a set on the basis of a rough assessment.

Fraudulent transactions – fuzzy logic is suitable

- many variables to be considered
- a matter of judgment whether a transaction is suspect
- suitable situation for the system to learn the characteristics of a customer
- example such as “is a withdrawal in another country out of character for this customer?”

Mark in 3 stages:

- Award [1 mark] if the candidate states whether the use of fuzzy logic is not suitable for processing a bank statement. Award an additional [1 mark] for a description of the unsuitability of this case.
- Award [1 mark] if the candidate states whether the use of fuzzy logic is suitable for detecting fraudulent bank transactions. Award an additional [1 mark] for a description of the suitability of this case.
- Award up to [2 marks] if the candidate gives an account of the differences between the suitability/unsuitability of using fuzzy logic in the two cases referring to both of them throughout. There is appropriate ITGS terminology in the response.

The maximum mark for this question is [6 marks].

- (c) **Computer systems are being developed based on fuzzy logic to predict market trends for investors.**

To what extent is it sensible for an investor to trust such systems instead of his own judgment?

[8 marks]

Answers may include:

Advantages

- system can be supplied with a large data set
- no likelihood of it forgetting data
- judgments will be based on evidence from past events
- system can learn from its mistakes
- unbiased decisions.

Disadvantages

- there are more variables than can be adequately programmed
- the human element may be important
- *e.g.* knowledge of the personalities / behaviour of board members of companies may be good indicators of future performance
- new unexpected information may not be reacted to by a computer system
- gut feeling may sometimes be more successful than analysis
- possibility of bias from developer
- past performance may not be a guide to future returns.

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. Expert car repairs

- (a) (i) Sensors are used to provide data to show that the emission control system is not working properly.**

Identify *two* sensors that could provide this data.

[2 marks]

Answers may include:

- oxygen
- gas such as CO₂, NO₂ / specific pollutant sensor
- temperature
- water / moisture
- light
- pressure
- electrical
- air flow (indicates a parameter may be outside of tolerance).

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

- (ii) Many cars have a traction control system to prevent the wheels from spinning if the accelerator is pressed too hard. This is controlled by the engine control unit (ECU).**

Identify *four* different ways in which the software in the ECU could carry this out.

[4 marks]

Answers may include any four of the following ways:

- sensors are used to capture information such as accelerator pressure, wheel rotation, variations in wheel rotation
- information is sent to ECU
- preset range of acceptable values for parameter(s) identified such as those above are stored in memory in ECU
- if the parameter(s) is outside of the acceptable value then
- the traction control system is engaged / the ECU could
- action is taken such as “cutting the link” between the accelerator and the wheels and the wheels or reducing fuel intake.

Award [1 mark] for one way identified within each group up to a maximum of [4 marks].

Do not accept the second case from any group.

- (b) When the mechanic carries out the first diagnostic test on a car, a series of *diagnostic trouble codes* (DTC) are produced (see Figure 1 below).

Explain why a mechanic would need to use an expert system in order to proceed with repairing a car.

[6 marks]

Answers may include:

The expert system:

- holds more information than a human can (provides access to knowledge compiled from the experience of many experts the issue is more quality than quantity)
- provides a code that may indicate a component in the car where there is a fault (the code is the link to the expert system inference engine (decision making))
- can ask questions that will help it find probable causes of the problem and then
- suggest the most likely cause of the problem
- can, if the solution provided does not solve the problem the expert system ask further questions to try to diagnose the fault
- may provide a more rapid method of diagnosing / finding the fault or act as a way of confirming (or not) the diagnosis of the mechanic
- will reduce time spent in the repair of the car
- reduce the labour costs to the car owner
- increase the income of the mechanic / garage owner.

[1–2 marks]

A limited response that indicates very little understanding of the topic or the reason is not clear. Uses little or no appropriate ITGS terminology.

[3–4 marks]

A partial explanation of the reasons why a mechanic would need to use an expert system. Some examples are used within the response.

[5–6 marks]

A clear and detailed explanation of why a mechanic would use an expert system. Relevant examples are used throughout the response. There is appropriate ITGS terminology throughout the response.

- (c) **Discuss the impacts on motorists and car repair shops of the use of diagnostic expert systems to investigate problems in cars.** *[8 marks]*

Answers may include:

Positive impacts

- training of the staff – upskilling – staff will become more knowledgeable
- the system will allow the garage to work more effectively / efficiently
- expert systems will detect finer problems than a human mechanic can
- shows proof the car owner what needed to be repaired, reducing the chances of being overcharged by the garage
- might identify other problems or factors that need to be fixed as well?

Negative impacts

- reliability of the machines must be acceptable
- cost of machines may outweigh financial advantages gained
- limitation of the knowledge base – not all situations will be diagnosed
- updating the knowledge base – this requires IT skills and possible additional expense
- every model is different – this may limit the usefulness of the system
- accuracy and currency of the knowledge base
- de-skilling of staff – mechanics might eventually be incapable of carrying out traditional repairs.

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.

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

<i>Marks</i>	<i>Level descriptor</i>
<p>No marks</p>	<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>
<p>Basic 1–2 marks</p>	<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>
<p>Adequate 3–4 marks</p>	<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>
<p>Competent 5–6 marks</p>	<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>
<p>Proficient 7–8 marks</p>	<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>