N11/3/ITGSX/SP2/ENG/TZ0/XX/M

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

MARKSCHEME

November 2011

INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Standard Level

Paper 2

20 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 the case of a "describe" question, which 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. In the case of an "explain" question, which asks for a specified number of explanations *e.g.* "explain two reasons", mark the **first two** correct answers. This could include two full explanations, one explanation, one partial explanation, *etc*.

"ITGS terminology refers to both the IT technical terminology and to the terminology related to social and ethical impacts."

SECTION A

Area of impact: Business and employment

1. (a) Define the term *pattern recognition*. ***[2 marks]***

Answers may include:
- the identification of objects and images by their characteristics (*e.g.* shape, form, outline, colour, movement, *etc.*)
- automatic matching against stored data
- uses artificial intelligence
- classifies data (patterns) based on prior knowledge.

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

(b) In addition to fingerprints, describe *two* other methods of biometric recognition. ***[4 marks]***

Answers may include:
- facial recognition – facial characteristics captured by a camera/numerical data associated with facial features/"faceprint" is compared to a database of "faceprints"
- retinal scanning – using a low intensity light source to capture the pattern of blood vessels in the retina
- iris scanning – captures the unique random patterns of the iris using a camera
- voice recognition – compares voice patterns
- hand geometry – measures the physical characteristics of the user's hand and fingers.

The description may include the biometric recognition method used or the details of the comparison of the data collected with the data stored in a database.
N.B. Do not accept "gait recognition".

*Award **[1 mark]** for each method identified up to a maximum of **[2 marks]**. Award an additional **[1 mark]** for the description of each method up to a maximum of **[2 marks]**.*

(c) Explain why biometrics is increasingly used to authenticate employees entering a building. ***[4 marks]***

Answers may include:

- extremely difficult to falsify – biometrics are unique to each individual person and therefore are a reliable method of identifying an individual
- they don't need to have an ID card – it is part of the person (finger, eyes, face, voice, *etc.*), so there is nothing that has to be brought with them to gain access, can't lose it like you can an ID card
- can't be stolen – it isn't a portable object hence no one can steal it, it is part of the person's anatomy
- can't be easily manipulated – can't alter oneself easily to impersonate an employee and gain access to a building.

[1 mark]
A limited response that indicates very little understanding of the topic.

[2–3 marks]
A reasonable description of why biometrics is increasingly used to authenticate employees entering a building, although the answer may lack appropriate reasoning at the lower end of the band.

[4 marks]
A clear, detailed and balanced explanation of why biometrics is increasingly used to authenticate employees entering a building.

(d) Discuss the advantages and disadvantages of using the way a person walks (video gait pattern recognition) to verify the person's identity. ***[10 marks]***

Answers may include:

Advantages

- unobtrusive – the gait of a person walking can be extracted without the user knowing they are being analysed and without any cooperation from the user in the information gathering stage, unlike fingerprinting or retina scans.
- distance recognition – the gait of an individual can be captured at a distance, unlike other biometrics such as fingerprint recognition
- reduced detail – gait recognition does not require captured images to be of a very high quality, unlike other biometrics such as face recognition, which can be easily affected by low resolution images
- difficult to conceal – the gait of an individual is difficult to disguise, by trying to do so the individual will probably appear more suspicious. With other biometric techniques, such as face recognition, the individual's face can easily be altered or hidden
- video footage is readily available – cameras are inexpensive to install
- difficult to imitate – many parameters involved (*i.e.* step length, step width, step speed, joint movement, height).

Disadvantages

- stimulants/depressants – drugs and alcohol will affect the way in which a person walks. Reliability of data collected is in question as the video may have been taken when they were under the influence
- physical changes – pregnancy, accident/disease affecting the leg, or severe weight gain/loss can all affect the movement characteristic of an individual
- privacy of the individual being videotaped may be compromised as they are unaware they are being recorded
- psychological – a person's mood can also affect an individual's gait signature which may vary from the time the data was collected
- clothing – the same person wearing different clothing may cause an automatic signature extraction method to create a widely varying signature for an individual
- camera positioning – person must walk perpendicular to camera.

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information.

SECTION B

Area of impact: Education

2. (a) Define the term *spam*. ***[2 marks]***

Answers may include:
- unsolicited e-mail
- e-mail sent in bulk to lists of recipients
- e-mail that is often irrelevant and contains inappropriate material.

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

*Award **[1 mark]** for any one of the points below if a student has not already reached the maximum marks. (A student may not gain **[2 marks]** by only mentioning the points below as alone these do not define spam).*

- e-mail that is often irrelevant and contains inappropriate material/often advertising products
- generally comes from an unknown source
- is automatically generated
- may contain a virus.

(b) Many schools no longer print and post newsletters.

Describe *two* ways schools can distribute newsletters electronically to parents and the school community. ***[4 marks]***

Answers may include:
- via a listserv – subscribers join the listserv which automatically sends e-mails to all names on a mailing list
- via a web site/intranet – the newsletter file (in PDF format) is uploaded to the school's web site and parents can log in and download it
- via a web site – the newsletter is copied and pasted onto the web page
- via e-mail – parents' names are on a distribution list and the school secretary sends the newsletter by e-mail/parents subscribe or choose to opt in/sent as an attachment which can be downloaded and saved to parents' computer/sent as a pdf so it cannot be edited/can be accessed by laptop or PC or smart phone
- via a school portal/intranet using push technology
- via a blog – parents can subscribe to receive updates *e.g.* via RSS.

*Award **[1 mark]** for identifying each way up to a maximum of **[2 marks]**. Award an additional **[1 mark]** for the description of each way up to a maximum of **[2 marks]**.*

(c) Many parents receive the SMS alerts on their smart phones. The latest smart phones come with up to 32 GB of storage.

Explain the reasons why many people want this amount of storage on their smart phones. ***[4 marks]***

Answers may include:

- users can download and store "apps" – apps add functionality but require storage space
- the smart phone stores an operating system – if this is updated, the operating system requires additional memory
- storage for podcasts – these may be long and hence require large amounts of storage space
- movies and TV shows can be downloaded and stored – multimedia files are large
- storage of digital photos taken with the inbuilt camera – high resolution photos are large
- storage of music files – takes up a large space
- users often wish to store files so they can be shared with friends
- smart phones can be used as eReaders – therefore storage space is needed to store eBooks
- smart phones need storage space to store documents that can be edited with Docs to Go applications, or sent by email and need to be stored to work on them, read or share.

[1 mark]
A limited response that indicates very little understanding of the topic.

[2–3 marks]
A reasonable description of the reasons why smart phones need this amount of storage space, although the answer may lack appropriate reasoning at the lower end of the band.

[4 marks]
A clear, detailed and balanced explanation of the reasons why smart phones need this amount of storage space.

(d) Discuss the advantages and disadvantages of introducing *Simplified Alerts* for schools *and* parents. ***[10 marks]***

Answers may include:

Advantages for schools

- a cheap way of contacting a large group of people
- fast/convenient – one message can be sent to all relevant school staff and parents
- easy to reach parents in cases of emergency
- easy to use – little staff training is required
- convenient as standard messages can be prewritten and stored
- allows the school to keep records of past messages.

Disadvantages for schools

- the school does not know if the message is received – who is responsible in an emergency if parents don't check their cell (mobile) phones or e-mail?
- if the system fails an alternative method must be put in place
- the system relies on up-to-date parental information / notification of alternative contact details if parents are away
- training costs
- cost of purchase and maintenance of the system
- if parents enter incorrect details/data entry error then messages will not be received
- there will be a time lag at the start whilst parents sign up and enter details.

Advantages for parents

- parents can be alerted to sports cancellations – saves time travelling to a cancelled practice
- it is a fast way of making contact in an emergency
- many parents have cell (mobile) phones/e-mail – no additional services are needed
- parents can be alerted anywhere they have their cell (mobile) phones
- more reliable than a note sent home after school – *e.g.* to inform of changed location of sport practice.

Disadvantages for parents

- if the system fails messages may not arrive/may arrive too late
- parents who do not have cell (mobile) phones or e-mails cannot participate – alternative methods would need to be used in this case as parents may feel excluded
- parents may not check e-mails regularly and therefore they will not receive the information or will receive it too late
- size limit on SMS messages means they will be cryptic and may not be fully understood
- overuse of the system could become annoying
- the school must ensure that personal details (name, email address, mobile phone number) are secure
- if parents are not in the country messages may have a high cost to send (some phone carriers may even charge parents when receiving them)

- alerts may arrive at inconvenient times and interrupt parents activities at work (*e.g.*: during an office meeting) and parents may switch it off or opt out if these become too frequent.

Award up to a maximum of ***[7 marks]*** *for only discussing implications to* ***either*** *schools* ***or*** *parents.*

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information.

Area of impact: Health

3. (a) With reference to the relational database diagram above, describe the nature of the relationship between the table DRUGS and the table INTERACTIONS. ***[2 marks]***

Answers may include:
- one to many
- one drug can have many different interactions
- one record in the DRUGS table may have many corresponding records in the INTERACTIONS table
- The field Drug_Name links the two tables.

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

(b) It is important that the database is accurate.

Describe *two* design features that a database designer could use to prevent data input errors. ***[4 marks]***

Answers may include:
- setting field types – *e.g.* a field set to "numeric" only allows numbers to be entered / a field set to "date format" only allows dates to be entered
- using input masks – the number of characters and their type can be specified
- creating drop down lists – this limits the input to a set list
- adding validation rules – this allows a range check on the data
- creating user input forms – limits data input to information specified by the database designer.

*Award **[1 mark]** for identifying each feature up to a maximum of **[2 marks]**. Award an additional **[1 mark]** for the description of each feature up to a maximum of **[2 marks]**.*

N.B. *Do not accept access levels/passwords*

(c) This prescription database now comes in many electronic formats. Two possible formats are a CD-ROM version and an online version accessible through a web site.

Compare the effectiveness of these two formats in providing a doctor with the necessary information. ***[4 marks]***

Answers may include:

- the CD may only be updated a couple of times a year – the online version can be updated as new drugs/conditions appear
- the information on the CD is limited – the online version can provide hyperlinks to further medical information/contacts
- multimedia files, *e.g.* for training, are readily accessible on a CD – access to multimedia will depend on bandwidth in the online version
- the CD runs on a local computer with no internet requirements – the online version requires internet connection
- if the internet connection is lost then the database is not accessible throughout the doctor's consultation with the patient – if a single computer breaks down another computer can be used to access the CD
- the online version could be slower than the CD if there is a slow internet connection – this might increase the time of the consultation
- CD content cannot be changed – the online version is susceptible to hacking
- CDs have limited storage (more than one CD may be needed) – more can be stored using an online version
- CDs can become damaged or lost – the online version is less susceptible to damage/lost data (provided it is secured/backed up).
- technical issues could arise when installing a CD
- online versions available on mobile devices and netbooks, CD-ROM is not accessible on these devices

[1–2 marks]

A limited description that shows some understanding of the effectiveness of a CD-ROM version and an online version. The two ways are described in isolation.

[3–4 marks]

A direct ***comparison*** *of the effectiveness of a CD-ROM version and an online version in providing the* ***doctor*** *with the necessary information.*

(d) Discuss how the use of the prescription database shown above can help a doctor to improve medical care. ***[10 marks]***

Answers may include:

- a database contains comprehensive information – a textbook can be more limited due to size/updates and/or the doctor's own knowledge is limited
- search techniques/complex queries allow fast access to information – whereas doctors may take time consulting textbooks / doctors may have more time for other patients
- provided data is entered correctly, information will be accurate – textbooks become out of date quickly and may not include details of the latest drugs – and/or a doctor's memory may not be reliable
- information can be easily updated – a text book becomes out of date quickly and needs to be reprinted – and/or a busy doctor may not have time to keep up to date with the latest medical journals
- complex queries/reports can be generated and provide a more detailed explanation of drug effects – whereas manual searching is limited
- by alerting doctors to interactions with other drugs/conditions, serious side effects can be avoided – side effects could be flagged in a database – and/or doctors can't remember all interactions/side effects
- a database can include a user-friendly interface – books are sometimes difficult to navigate
- electronic formats enable printing of prescriptions and these could possibly be copied to a patient's electronic file
- results displayed on a screen will be easier to read (may be enlarged) – small print in textbooks can be difficult to read and may result in incorrect doses.

CONCERNS

- doctors cannot use the system and training may be required
- doctors cannot apply their findings to a particular patient
- the database is not up-to-date – new drugs/interactions are not included
- the design of the database is faulty/queries are not accurate.

In part (d) 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.

Area of impact: Arts, entertainment and leisure

4. (a) Identify the data type for:

(i) player's name ***[1 mark]***

- text.

*Award **[1 mark]** for the correct answer.*

(ii) player's account balance. ***[1 mark]***

- currency/number.

*Award **[1 mark]** for the correct answer.*

(b) Identify the steps involved in updating the database when a player purchases a street from the bank or other players. ***[4 marks]***

Answers may include:
- get player ID
- get location
- get price
- deduct purchase price from player account
- add purchase price to the seller account
- flag property as purchased
- record owner of property.

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

(c) Explain the possible reasons for the increased interest in playing internet-based versions of popular board games such as *Monopoly*. ***[4 marks]***

Answers may include:
- interaction with others online – can play with others around the world play with different opponents in different sessions online, can play when no one is physically present
- more realistic – uses online maps that represent real places
- constantly updated – changes represent new cities and streets in the world
- not defined to local area – can play with others around the world
- educational – tour new areas, learn about different places that exist.

[1 mark]
A limited response that indicates very little understanding of the topic.

[2–3 marks]
A reasonable description of the possible reasons, or the increased interest in playing internet-based versions of popular board games such as Monopoly, although the answer may lack appropriate reasoning at the lower end of the band.

[4 marks]
A clear, detailed and balanced explanation of the possible reasons or the increased interest in playing internet-based versions of popular board games such as Monopoly.

(d) Discuss the agreements that need to be in place between *Google* and *Hasbro* to retain the integrity of the *Google Maps* database and to ensure the accuracy of the game data. ***[10 marks]***

Answers may be accepted for either of the following scenarios.

Scenario 1: Assuming the Monopoly *database is* ***not*** *updated during the duration of the game.*

Answers may include:
- *Hasbro* must have an understanding of the formats used by *Google* – standard formats – reason
- *Google* must be prepared to give certain details of data structure – reason
- *Google* has the right to view and use data collected in the *Hasbro* database, impact may be that popular streets are identified – reason
- *Google* must not have access to personal details of players of *Hasbro* – reason
- *Google* logo must be displayed on all pages of the map – reason
- *Hasbro* must not change the design of the page without agreement with *Google* – reason
- *Google Maps* database has to be read only – so the data can be imported but not changed – reason.

Scenario 2: Assuming the Monopoly *database* ***is*** *updated frequently during the game to reflect current real life changes in streets,* ***the additional responses are also acceptable****.*

Answers may include:
- *Google* has to let *Hasbro* know of updates and the frequency of these updates – reason
- *Google* has to carry out updates at a reasonable price – reason
- *Hasbro* must have a contingency method implemented to deal with deleted/ changed streets so that players' rights are not overwritten – reason.

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information.

Area of impact: Science and the environment

5. (a) Describe *one* way in which a robot can distinguish between another robot and a different object. ***[2 marks]***

- camera – robot matches stored images
- signal emitted – recognizes signal emitted from a fellow robot.

*Award **[1 mark]** for identifying the way up to a maximum of **[1 mark]**. Award an additional **[1 mark]** for the description of the way up to a maximum of **[1 mark]**. Mark the first correct way identified.*

(b) Identify the step-by-step process that robots follow in order to remain within a certain distance of each other. ***[4 marks]***

Answers may include:
- detect other robots using a sensor (ultrasound, infrared, laser rangefinders, sonar, radar)
  http://robofaqs.com/questions/314/what-types-of-distance-sensors-are-there.html
- measure initial distance from robot "x"
- compare with a pre-determined value
- if too far, move closer to robot
- if too near, move further away from robot
- repeat process for every direction (front, back, left, right).

*Award **[1 mark]** for identifying each correct step up to a maximum of **[4 marks]**.*

(c) Explain *two* real-life situations on a road that would make the model ineffective. ***[4 marks]***

Answers may include:
- roadworks – construction on the route may cause problems
- bridge – the distance below the bridge could be a factor
- accidents – unpredictable circumstances will need to be accounted for
- roundabout – could make the proximity of other robots appear closer than they are
- traffic lights – this would need to be incorporated into the model
- queuing traffic – these vehicles are stopped temporarily, which is different to immobile objects such as a parked car. Are they programmed to deal differently with different scenarios?
- human or animal crossing the road – there are no conditions stated what the robot should do if an obstacle crosses the road

[1 mark]
A limited response that indicates very little understanding of the topic.

[2–3 marks]
A reasonable description of the situations, although the answer may lack appropriate reasoning at the lower end of the band.

[4 marks]
A clear, detailed and balanced explanation of the situations.

(d) Discuss the issues that arise when putting total responsibility for driving in the hands of robots. ***[10 marks]***

Answers may include:

- human decision-making versus robot's – is a robot more or less reliable than a human in various driving situations?
- robot malfunction – what would happen if the robot malfunctions (override option, backup system, *etc.*)
- robot expertise – they can learn from previous mistakes
- data collection (speed, braking, steering, *etc.*) – privacy issues for its users. Who has access to this information?
- responsibility – who is responsible if system fails?
- system failure – if the system fails an alternative method must be put in place
- robots could be instructed to drive at a maximum speed within the law and abide by other traffic laws
- environmental factors – robots could be programmed to drive for maximum efficiency (time, fuel emissions, *etc.*)
- how would a robot cope with dangerous weather conditions or obstacles (strong winds, fog, or ice on the road, *etc.*)?

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information.

Area of impact: Politics and government

6. (a) Identify *two* devices that can be used as portable storage media. ***[2 marks]***

Answers may include:
- CD-ROM
- DVD
- memory stick/memory key/thumb drive/flash drive/flash disk/USB drive/ jump drive
- PDA (accept particular models that have storage capabilities such as *iPod*)
- cell (mobile) phones.

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

(b) Describe *two* ways to ensure that data cannot be retrieved when computer components are disposed of. ***[4 marks]***

Answers may include:
- overwriting media for sanitization – replacing previously stored data on a drive or disk with a random pattern of meaningless information which effectively renders the data unrecoverable
- using commercial software designed to permanently erase the data from computer components
- destruction of media – the process of physically damaging a medium so that it is not usable by any device that may normally be used to read electronic information.

*Award **[1 mark]** for identifying each way up to a maximum of **[2 marks]**. Award an additional **[1 mark]** for the description of each way up to a maximum of an additional **[2 marks]**.*

(c) Compare *two* different methods used to dispose of computer hardware that is no longer required by an organization. ***[4 marks]***

Answers may include:

- recycle/sell – giving it to another person or organization who may need it, hardware remains in use and not in the garbage/landfills. This could have security issues if data is not properly removed from hardware
- re-use – environmentally friendly, take parts and use them for other purposes
- landfill – cheaper, minimal costs to dispose at a landfill
- trade-in – trade older hardware for newer hardware, saves money.

[1–2 marks]

The candidate conveys some understanding of the similarities between the two different methods used to dispose of computer hardware, but the two ways would have been described in isolation.

[3–4 marks]

The candidate provides an explicit and direct comparison of the two different methods with the use of appropriate terminology.

(d) A government has introduced two policies to prevent unauthorized access to sensitive data:

- **employees must have secure passwords that they do not share with anyone**
- **no sensitive data can be downloaded from the main server to any other devices.**

To what extent will these two policies prevent unauthorized access to sensitive data? ***[10 marks]***

Answers may include:

- employees are accountable for their actions from their accounts, but it will be very difficult to prevent people from sharing passwords if they wish to do so
- secure passwords will be difficult to crack
- if data can only be accessed on the server, it is harder to carelessly lose sensitive data
- data isn't allowed to be transferred to other devices that can be lost or stolen
- data transfer cannot be intercepted since transferring of data is prohibited
- these policies are limited if data can be copied from a screen display and recorded electronically or by hand (could have legal implications)
- policies – will not prevent human failing such as leaving a client computer logged on while they are absent for a period of time
- how can/will this policy be enforced to prevent unauthorized access (policies and procedures)?

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information.

Markband for all extended response questions.

Opinion discuss, evaluate, justify, recommend and to what extent	***0***	*No knowledge or understanding of IT issues and concepts or use of ITGS terminology.*
	1–2 marks	*A brief and generalized response with very little knowledge and understanding of IT issues and concepts with very little use of ITGS terminology.*
	3–5 marks	*A response that may include opinions, conclusions and/or judgments that are no more than unsubstantiated statements.* *The response will largely take the form of a description with a limited use of ITGS terminology and some knowledge and/or understanding of IT issues and/or concepts.* *If no reference is made to the information in the stimulus material, award up to* ***[3 marks]****.* *At the top end of this band the description is sustained.* *At the lower end of the band a tendency towards fragmentary, common sense points with very little use of ITGS terminology.*
	6–8 marks	*A response that demonstrates opinions, conclusions and/or judgments that have limited support.* *The response is a competent analysis that uses ITGS terminology appropriately. If there is no reference to ITGS terminology the candidate cannot access this markband.* *There is evidence that the response is linked to the information in the stimulus material.* *At the top end of the band the response is balanced, the response is explicitly linked to the information in the stimulus material and there may be an attempt to evaluate it in the form of largely unsubstantiated comments. There is also evidence of clear and coherent connections between the IT issues.* *At the lower end of the band the response may lack depth, be unbalanced or tend to be descriptive. There may be also implicit links to the information in the stimulus.*
	9–10 marks	*A detailed and balanced (at least one argument in favour and one against) response that demonstrates opinions, conclusions and/or judgments that are well supported and a clear understanding of the way IT facts and ideas are related.* *Thorough knowledge and understanding of IT issues and concepts.* *Appropriate use of ITGS terminology and application to specific situations throughout the response.* ***If there is no reference to ITGS terminology candidates cannot access this markband.*** *The response is explicitly linked to the information in the stimulus material.* *At the lower end of the band opinions, conclusions and/or judgment may be tentative.*

"ITGS terminology refers to both the IT technical terminology and to the terminology related to social and ethical impacts."