



# **MARKSCHEME**

**November 1999**

## **INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY**

**Standard Level**

**Paper 2**

**SECTION A**

1. (a) *(Award [2 marks] for one reason described up to a maximum [2 marks]. Award [1 mark] if it is only stated.)*
- Random Access Memory (RAM) was expensive
  - using two digits for the year required less RAM than using four digits
  - less RAM could be installed in earlier models of computers
  - hard disk space was expensive
  - storing two digits for the year required less hard disk space
  - need for using more than two digits for dates in some applications was unforeseen
  - assumed that programs that were written would not still be in use by the year 2000

*Reward other acceptable answers.*

- (b) (i) *(Award [1 mark] for any of the answers below. No marks should be awarded for an incomplete calculation.)*
- \$ 2 000 000
  - two million dollars
- (ii) *(Award [1 mark] for showing some correct work for the calculation to justify the final answer; award [1 mark] for the final correct answer. Award [1 mark] for answers with appropriate calculation which show how much it would have cost if they had started exactly one year later and not how much more it would have cost.)*

First Solution

- \$ 3.75 (cost of altering one line of code in second half of 1999) – \$ 2.00 = \$ 1.75
- \$ 1.75 × 1 000 000 lines of code = \$ 1 750 000

Second Solution

- \$ 3.75 (cost of altering one line of code in second half of 1999) × 1 000 000 lines of code = \$ 3 750 000
- \$ 3 750 000 – \$ 2 000 000 = \$ 1 750 000

Alternative Solutions

*Reward appropriate calculations and answers for approximating the cost of one line of code in the second half of 1999 being between \$ 3.70 and \$ 3.80 inclusive (\$ 1 700 000 and \$ 1 800 000 inclusive).*

- (c) *Award up to [3 marks] for a full description of how the cost changes. Award [1 mark] if it is only stated.)*
- cost to alter one million lines of code continuously increases from the 1st half of 1998 to the 1st half of 2000
  - cost to alter one million lines of code increases from \$ 1.75 to \$ 4.25
  - cost to alter one million lines of code more than doubles from the 1st half of 1998 to the 2nd half of 1999
  - cost to alter one million lines of code more than doubles from the 1st half of 1998 to the 1st half of 2000
  - difference in cost continuously increases for each interval from the 1st half of 1998 to the 2nd half of 1999
  - the amount of cost increases for the interval from the 2nd half of 1999 to the 1st half of 2000 is less than for the previous two intervals

*continued...*

Question 1 (c) continued.

(Some candidates may have summarised the information from the graph into a table. Award [1 mark] maximum for a table with specific values. Values listed under the cost vary by \$ 0.05 above or below the values indicated below.)

Time intervals/half years	Cost to alter one million lines of code /US\$
1st half of 1998	\$ 1.75 (any value \$ 1.70 to \$ 1.80 inclusive)
2nd half of 1998	\$ 2.00
1st half of 1999	\$ 2.75 (any value \$ 2.70 to \$ 2.80 inclusive)
2nd half of 1999	\$ 3.75 (any value \$ 3.70 to \$ 3.80 inclusive)
1st half of 2000	\$ 4.25 (any value \$ 4.20 to \$ 4.30 inclusive)

or

Time intervals/half years	Cost to alter one million lines of code/US \$	Difference in cost
1st half of 1998	\$ 1.75	
2nd half of 1998	\$ 2.00	\$ 0.25
1st half of 1999	\$ 2.75	\$ 0.75
2nd half of 1999	\$ 3.75	\$ 1.00
1st half of 2000	\$ 4.25	\$ 0.50

Reward other acceptable answers.

(d) (Award [1 mark] for each action up to a maximum of [2 marks].)

- analysing what lines of code within the company must be altered
- analysing whether the alterations can be performed by company employees or external experts
- testing of the solution by company employees to insure correctness of the solution
- monitoring the solution by company employees during the year 2000 for correctness
- training employees in using the solution
- training employees in using new software and/or hardware in instances where the solution required this change
- producing company documentation for the alterations which have been made
- publishing information for customers concerning changes (entering data, reading financial statements)
- publishing new forms to replace outdated company forms for collecting data

Reward other acceptable answers. Award marks only for answers that are closely related to coding.

continued...

*Question 1 continued.*

- (e) *(Award [1 mark] for an explanation for banks/stockmarket to close up to a maximum of [2 marks]. Award [1 mark] for an explanation of transport/postal services to be disrupted up to [2 marks] max. Total is [4 marks].)*

Banks and stockmarket must close

- banks and stockmarkets use date fields for financial calculations (calculating interest, calculating dividends, track deposits, loan payments, transfer funds, direct deposits)
- banks and stockmarkets use security systems which depend on time calculations (automatic teller machines, security vaults, communication networks)
- banks and stockmarket will lose considerable money if the calculations using dates are not performed properly

*Reward other acceptable answers. Answers must include a clear reference to date fields.*

Transport and postal services will be disrupted

- transport and postal services use dates as an indication of time (time schedules, post dates)
- transport and postal services do not use dates in financial calculations

*Reward other acceptable answers. Answers must include a clear reference to date fields.*

- (f) *(Award [1 mark] for any of the below up to a maximum of [2 marks].)*

- birth date
- entry date of a patient
- discharge date of a patient
- dates of medical examinations
- date of surgery visit
- date of medications
- date of treatments

*Reward other acceptable answers. Answers must include a clear reference to date fields.*

- (g) *(Award up to [2 marks] for each ethical consideration with supportive statements. Award [1 mark] if the consideration is only stated. Award the final [1 mark] if there is a weighing-up of the arguments/reasons or some mention of hierarchy of importance of arguments. Total is [4 marks].)*

- Which service area affects the most people? Should this be the highest priority?
- Should the health and safety of the people (Hospitals) have priority over other considerations such as services affecting the entire population or the varying cost of altering the code in the different services?
- Which costs should be the responsibility of the government and which costs should be the responsibility of institutions and services?
- Should the government supplement the cost in certain instances?
- Should some cost be passed on to customers?
- Who will assume the responsibility of which services should be prioritised?

*Question 1 (g) continued.*

- What are the consequences of prioritising?
- Are there qualified persons available to make the necessary alternations in the various lines of code used by the various services?
- Who is responsible if the code which has been altered in a service area results in a problem for individual(s), organisation(s), or the government?
- Who is to blame?
- Who is responsible for correcting the problem?
- Who will assume the responsibility if something goes wrong in the case that some code was not altered and a year 2000 problem occurred?

*Reward other acceptable answers.*

## SECTION B

For each essay up to [2 marks] are available for quality of construction.

2. (a) *(Award [1 mark] for each item identifying highly confidential personal data, up to a maximum of [2 marks]. Do not reward answers which are not 'highly confidential'.)*
- medical records (HIV positive, cancer patients, terminally ill)
  - legal records (criminal records containing arrests, convictions, sentences, paroles)
  - military records (service record, discharge status)
  - financial records (bank account, credit rating, credit card accounts, loans)
  - employment records (salary, terms of employment)
  - membership of subversive organisations
  - purchases (sensitive purchases made using a credit card)

*Reward other acceptable answers.*

- (b) *(Award up to [2 marks] for a full explanation of each situation up to a maximum of [4 marks]. Award only [1 mark] for stating a situation without an explanation.)*
- company employee views customer records for his own interest
  - unauthorised access (by hacker, company employee, organisational member)
  - receiving unsolicited e-mail or junk mail from a customer database collected for another purpose
  - distribution of personal data to other institutions/organisations without the person's knowledge
  - outdated or invalid data stored in databases which result in problems for the person (confused identity, financial problems, criminal action or other inconvenience to an individual)
  - data matching between data collected in one database and matched with data in another database (*i.e.* data regarding social security benefits matched with medical insurance claims)
  - collection and use of data without the knowledge of the individual (from government agencies to tracking the library usage habits of foreign nationals through the library circulation system, credit card purchases)

*Reward other acceptable answers.*

- (c) *(Award up to [3 marks] for a complete discussion for each concern up to a maximum of [9 marks]. Award [1 mark] if the concern is only stated. Award up to another [3 marks] for outlining some hierarchy of importance/ 'weighing-up' of arguments. Total is [12 marks].)*
- Will the individual have the possibility to view the data whenever he/she needs to?
  - Will the individual have the opportunity to make corrections and additions?
  - Which person(s) in the organisation/company has (have) access to the data?
  - What is the purpose of the database?
  - Does the institution/organisation/government only collect data that is necessary for its operation?
  - Which person(s) monitor(s) the access of data by organisational/company personnel?

*continued...*

*Question 2 (c) continued.*

- Can the data be distributed to other institutions/organisations/governments without the individual's consent?
- Will the personal data in the database be matched with personal data in other databases (data matching)?
- What effort is made within the data-collecting organisation to protect the data from unauthorised access?
- What policies have been made by the data-collecting organisation to maintain accurate and updated records?
- How long will the data be kept that has been collected?
- Who owns the data?

*Reward other acceptable answers.*

3. (a) *(Award [1 mark] for each input device indicated below up to a maximum of [2 marks]. Candidates may state the name of a specific input device because specific names have been used in the question . Award [1 mark] max. for each type of device. Do not accept the answer 'game controller'. All input devices are game controllers.)*
- joystick
  - joypad (game pad)
  - gun (used to aim at objects on the screen)
  - steering wheel (as used in racing games)
  - pedals (as used in racing games)
  - virtual reality gloves

*Reward other acceptable answers.*

- (b) *(Award [2 marks] for a complete explanation of each reason up to a maximum of [4 marks]. Award [1 mark] for only stating an answer.)*
- emulate the playing of the game with a human opponent
  - challenge the player with expert game playing strategies
  - provide a more interesting and stimulating game for the human opponent
  - to provide more variety in the game each time it is played
  - allow the game 'to learn' game plays of the human opponent
  - provide remedial learning in educational games (mathematics, language learning)

*Reward other acceptable answers.*

*continued...*

*Question 3 continued.*

- (c) *(Award up to [3 marks] for a complete discussion of each of three effects up to a maximum of [9 marks]. Award [1 mark] if the effect is only stated. Award up to [3 marks] for 'weighing-up' of arguments. Total is [12 marks].)*
- computer users have obtained better application software due to advancements in game graphics and sound
  - disabled persons have benefited from advancements in game control devices
  - children have more motivating learning software through educational games
  - individuals have improved their skills/abilities through playing electronic games (hand-eye co-ordination, reflex response, spatial awareness, thinking skills )
  - electronic game developers have profited financially from the development of games
  - computer companies involved in the home market have to make certain that their products support electronic games (personal computers, peripheral devices)
  - individuals have become motivated to learn programming, and create 'shareware'
  - many individuals earn their living from the game industry (programming, marketing, sales)
  - individuals are able to play web games with players from all over the world
  - individuals are able to play games against the computer which could only be played against a human opponent in the past
  - many individuals play electronic games as a new leisure activity
  - negative health effects due to long hours of play (ergonomic problems, warnings of inducing epilepsy)
  - isolation and reduced social contact with peers
  - development of a false sense of reality from brutal games
  - increased software piracy by companies copying games from commercial CD-ROMs

*Reward other acceptable answers.*

4. (a) *(Award [1 mark] for each item up to a maximum of [2 marks].)*
- appropriate computer hardware (computer, printer); telecommunication capability (modem, modem card; ISDN line)
  - communications software (data transfer, accessing company files, e-mail)
  - telephone
  - company software which would allow for e-mail, data transfer, and file access with the employee
  - hardware and software support manuals (use of company systems, troubleshooting home systems)
  - written company policies for employees who are telecommuting (payment, benefits, support, supervision, access to company computer services)
  - support program for new telecommuting employees;

*Reward other acceptable answers.*

- (b) *(Award [2 marks] for each skill or attitude fully explained up to a maximum of [4 marks]. Award [1 mark] if a skill or attitude is only stated.)*
- self-discipline to complete the assigned tasks on time
  - self-monitor work habits to monitor working hours (monitor 'overworking' or laxness)
  - self-monitor work habits and/or work area to insure good ergonomic work conditions
  - ability to be organised (organised approach to tasks, establish work schedule)
  - skill in using communications software as needed (data transfer file access capabilities, e-mail)
  - ability to troubleshoot problems with home hardware and software
  - be able to work independent from immediate supervision or managerial support
  - demonstrate responsibility for personal health and financial benefits (social security, medical benefits, taxes)
  - persevere in maintaining communication with company personnel as needed in order to maintain professional and social contact

*Reward other acceptable answers.*

- (c) *(Award up to [3 marks] for a complete discussion of each social impact up to a maximum of [9 marks]. Award [1 mark] if the impact is only stated. Award up to another [3 marks] for outlining some hierarchy of importance/ 'weighing-up' of arguments. Total is [12 marks].)*

- institutions, organisations, and governments have access to worldwide workers working globally (range of expertise, cheaper labour, range of cultural experiences and languages)
- distribution of the working day for an employee will be over the entire day
- increase in types of work done through telecommuting
- change in the nature of offices (decentralisation of offices, creation of satellite offices; fewer and smaller central offices)
- workers requiring middle range hardware and software will telecommute, workers requiring more power systems will work in offices
- employees telecommuting will tend to be paid by the specific task rather than salary

*continued...*

*Question 4 continued.*

- role of company managers and supervisors will change (lack of direct contact with employees); increased flexibility for employees to merge work schedules with personal schedules and other responsibilities
- communication between company employees will be more formal through telecommunications and telephone conversations
- decrease in the casual informal conversations and social contact between telecommuting employees
- decrease in the amount of time and expenses for employees going to the office (transportation, clothes)
- decrease in transportation problems in major cities (rush-hour traffic, packed public transport)
- increased possibility for individuals to be engaged in two or more full-time jobs
- increased emphasis on individuals to have good information technology skills
- greater opportunity for families to be together for a greater part of the day (working parents with their children at home, decreased amount of time travelling to and from work)

*Reward other acceptable answers.*

5. (a) *(Award [1 mark] for each advantage up to a maximum of [2 marks]. Award [1 mark] one disadvantage.)*

Advantages

- can be manipulated by application software (volume, pitch, special effects, adding and deleting sounds, rearranging sound sequences)
- portable, quick and easy to copy
- file transfer is possible between computers or over networks
- used to create products (presentations, multimedia, web pages)
- can randomly access sounds stored in digital form
- easier to compose and edit music stored in digital form

*Reward other acceptable answers.*

Disadvantages

- can consume large amounts of hard disk space
- can consume large amounts of Random Access Memory (RAM)
- increased plagiarism and infringement of copyright
- caused changes in occupations where traditional sound and broadcasting technologies were used (radio broadcasting)
- can be used for fraud (re-digitised voices for blackmail)

*Reward other acceptable answers.*

*continued...*

*Question 5 continued.*

- (b) *(Award [1 mark] for each method up to a maximum of [3 marks].)*
- diskette to transfer to data (zip diskette, jaz disk, removable cartridge)
  - infra-red transfer of data between computers
  - connect the two computers by an interface cable and use software specifically designed for data transfer (personal digital assistants (PDA), scientific calculators, laptop computers)
  - connect the two computers by an interface cable, select one computer as the host computer and the other as the client, and transfer the files using a file sharing program
  - copy the files from the first computer to a file server on a network, and then copy the files from the server to the second computer
  - copy files from a remote computer over the Internet using ftp software to local computer
  - use LAN communications software, attach the file to a communications file and send the file from the first computer to the second computer
  - attach the file to an email message and send the email message, access the email with attachment from the second computer

*Reward other acceptable answers.*

- (c) *(Award [3 marks] for a complete discussion of a consequence up to a maximum of [9 marks]. Award [1 mark] if the consequence is only stated. Award up to another [3 marks] for outlining some hierarchy of importance/ 'weighing-up' of arguments. Total is [12 marks].)*

*(Discussion may focus on the legal and illegal aspects of copying intellectual property from printed materials.)*

- information may not be copied accurately causing problems for the original author
- the quality of the information may not be the same as in the printed materials
- legal problems may arise with using copyrighted materials in other documents
- copyright infringement (laws) may not be consistent from country to country
- individuals producing the intellectual materials are not fairly compensated when illegal copies of their work are made
- individuals producing the intellectual materials are not fairly recognised for their creativity and intellectual work
- individuals lose financial compensation
- businesses and/or institutions lose money when copies of the works are made without payments; money is lost in tax revenues when copyrighted materials are used without proper purchases; copying copyrighted materials will discourage the production of new materials

*Reward other acceptable answers.*