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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY
HIGHER LEVEL
PAPER 1

Wednesday 7 November 2012 (afternoon)

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Section A: answer two questions.
- Section B: answer one question.
- Section C: answer one question.
- Each question is worth *[20 marks]*.
- The maximum mark for this examination paper is *[80 marks]*.

SECTION A

*Answer **two** questions. Each question is worth [20 marks].*

1. Health and dentistry

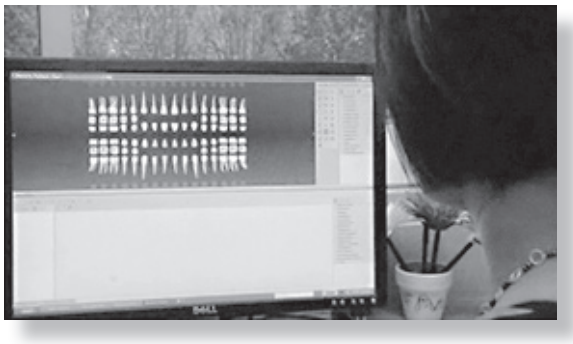
Many dentists have upgraded their IT systems by using a local area network (LAN). This makes it possible for the dental technician to take an X-ray of a patient's teeth and for the dentist to review the patient's X-rays on a monitor in another room.

[Source: http://www.bluehousedental.com.au/images/Xray/Digital_Dental_Xray.jpg]

The upgraded IT system includes simulation software which allows dentists to view the predicted changes in the condition of a patient's teeth over a period of time, showing the result with or without treatment.

With these upgraded systems, dentists are now using electronic, instead of paper, charts for each patient. These charts can be updated by the dental technician on one computer while the dentist views them on another.

The patient can also view their charts on a monitor. This is useful when the dentist would like to discuss a treatment with the patient.



[Source: http://www.cisco.com/web/solutions/smb/heroes/uk/index.html#/skyeDental, 18 July 2012]

(This question continues on the following page)

(Question 1 continued)

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

(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]*

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

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

(c) To what extent should dentists use simulation software to determine future treatment for their patients? *[8]*

2. ***Live-brary***

A local library has acquired a lending service called *Live-brary* that uses *Adobe* Digital Editions software which allows borrowers to access free digital content which can be both read online and downloaded to read offline. To borrow e-books from the library, borrowers need to install special software to download e-books on to their e-reader, smartphone, tablet or laptop.

Borrowers create an account to register the software. Activation allows the borrower to either read the e-book online through streaming or read offline from the downloaded copy that is "borrowed" for a period of 7, 14, or 21 days. If a borrower keeps an e-book for more than the number of days allowed, then they must pay a fine for each day over the limit.

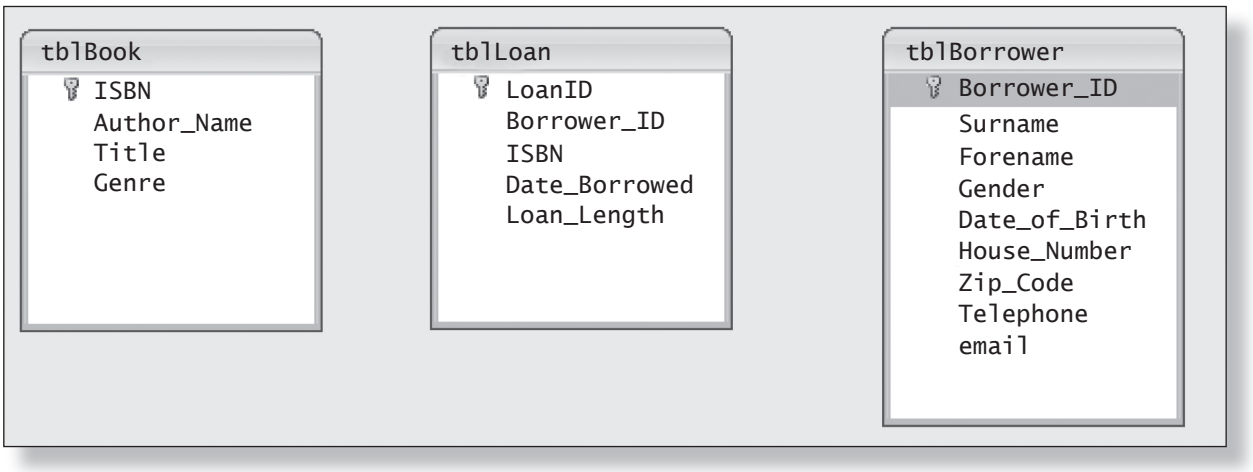
Borrowers will need a device to access the library's website to download the book. The books are available in both EPUB and PDF format. Both formats include digital rights management (DRM).

[Source: http://www.pocket-lint.com/news/26619/how-to-loan-an-ebook, 27 August 2009 and http://news.cnet.com/8301-17938_105-20028767-1.html, 29 September 2011]

(This question continues on the following page)

(Question 2 continued)

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

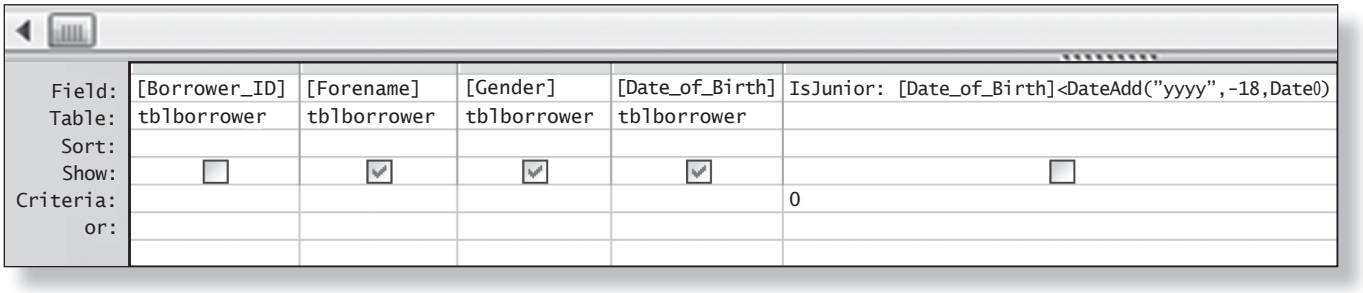


(i) State the key field in the table *tblBorrower*. *[1]*

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

(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]*

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



Field:	[Borrower_ID]	[Forename]	[Gender]	[Date_of_Birth]	IsJunior: [Date_of_Birth]<DateAdd("yyyy",-18,Date0)
Table:	tblborrower	tblborrower	tblborrower	tblborrower	
Sort:					
Show:	☐	☑	☑	☑	☐
Criteria:					0
or:					

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

(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]*

3. Voice over internet protocol (VOIP)

Some countries ban services such as *Skype*, which use VOIP technology.

Skype and other operators offering VOIP services bypass telephone networks in favour of offering free calls via the internet. These countries have laws that state all calls must pass through their national telecom companies.

Skype has more than 500 million users worldwide and many cell/mobile phone providers now offer *Skype* services.

Skype has been growing in popularity among individuals and businesses to make cheap or free international phone calls. Some governments are concerned that their national telecom companies will be losing income and will be unable to track conversations.

As a result, some countries are calling for severe measures to be taken against citizens using illegal VOIP services.

[Source: http://news.bbc.co.uk/2/hi/technology/8585998.stm, 24 March 2010 and http://www.theglobeandmail.com/news/technology/china-poised-for-skype-crackdown/article1854189/, 31 December 2010]

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

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

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

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

(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]*

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SECTION B

*Answer **one** question. Each question is worth [20 marks].*

4. Online marking

An examining organization has been advised that it needs to find an IT system to replace its current paper-based system. In the paper-based system the papers are sent to various examiners around the world who mark the papers with red ink. When the examiner has finished, they send the marked papers to the examining organization.

The proposed solution is to send the candidates' handwritten exam papers to a scanning centre in Singapore. Once the papers are scanned, they are made available to the examiners online. The new system will have the following requirements specification:

Specification Number	IT System Requirement
1	Able to handle the increasing number of students taking the exam each year
2	Will speed up the marking and processing of the exam papers
3	Will be cheaper than the cost of posting exam papers around the world
4	Examiners can view the completed exam papers on their computers
5	Able to provide remote access for the examining organization to monitor the marking of each examiner
6	Will be acceptable to all stakeholders

The examiners have to install special client software on their PCs to access these online scans of completed exam papers and carry out the marking. They also need to have a reliable broadband connection because this system does not allow them to download and store the scanned exam papers to be marked offline.

The examining organization has commissioned analysts from a software development company to investigate possible solutions.

(This question continues on the following page)

(Question 4 continued)

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

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

(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]*

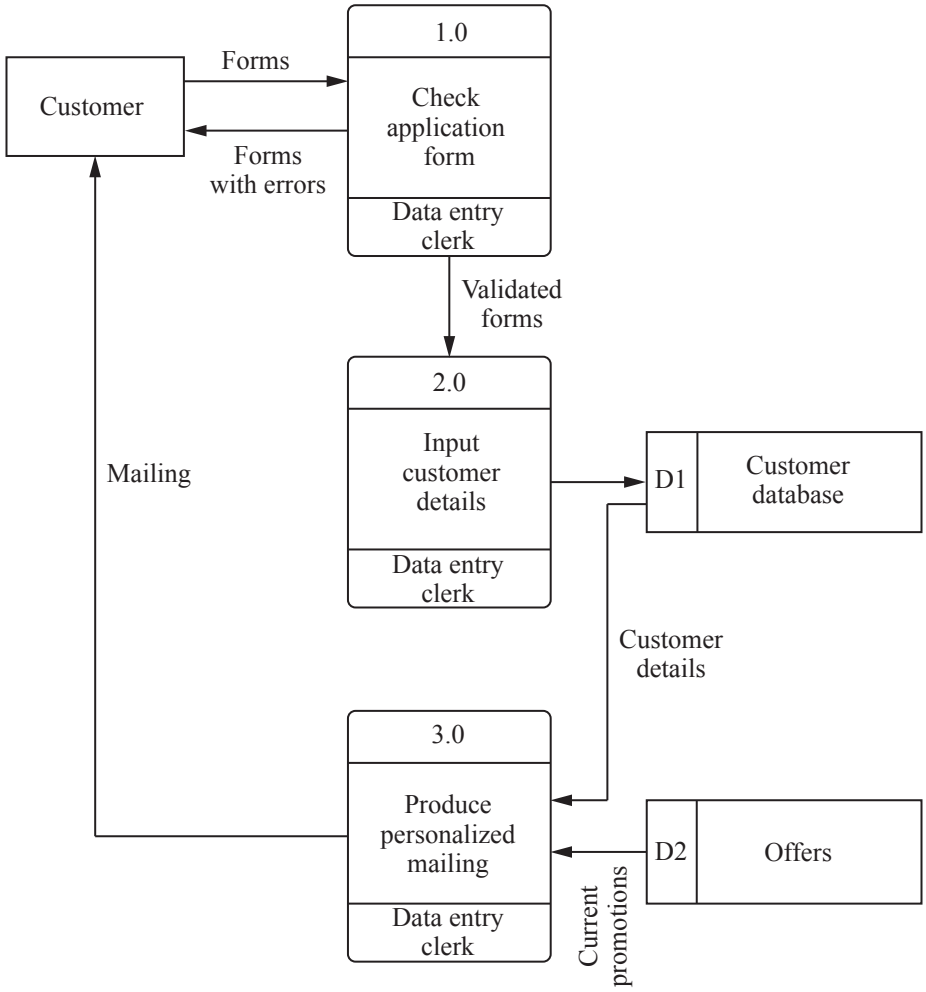
(c) All IT projects, such as that proposed by the examining organization, should be based on a requirements specification to meet a client's needs.

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

5. Software development

La Vianda is a small supermarket whose manager is looking to develop a loyalty card system that allows it to send promotional offers to members. To become a member, a customer fills in a form to provide their personal details and information about the kind of products they buy.

The manager of the store has hired *Rodriguez Developers* to produce software to support this initiative. The developers are intending to use agile methodology in order to produce the necessary software and data structures. This is an iterative process that involves the supermarket manager as well as the developers. The developers use a variety of modelling techniques in order to discuss plans with the manager. The modelling process involves making diagrams such as the data flow diagram below.



(This question continues on the following page)

(Question 5 continued)

(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]*

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

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

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

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

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

SECTION C

*Answer **one** question. Each question is worth [20 marks].*

6. Artificial intelligence (AI) / pattern matching

Images can be analysed by computer software in order to identify the subject. Most image analysis is done by looking for "features of interest". Such features can be edges, corners or blobs (**b**inary **l**arge **ob**jects).

An edge can be detected by examining the intensity of colour of a row of pixels and determining where there is a sudden change.

A blob is an area where all the pixels have some feature such as colour or shade that is distinct from the background.

Each image has a set of characteristics, as illustrated by the dots in the picture below, that create a unique "signature". This allows the image to be compared with others.

(This question continues on the following page)

(Question 6 continued)

Google has produced a phone app called *Google Goggles* which can examine an image and from this information produce a list of likely locations.

Image removed for copyright reasons
Availabe at:http://appadvice.com/appnn/2010/06/google-goggles-coming-iphone/

Google Goggles can recognize faces of well-known people, many products, places and buildings. It is not very good at recognizing animals or cars.

Most cell/mobile phones have a range of features such as GPS and a digital compass. They can also detect their location with some accuracy by determining the identity of the nearest cell/mobile phone base station.

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

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

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

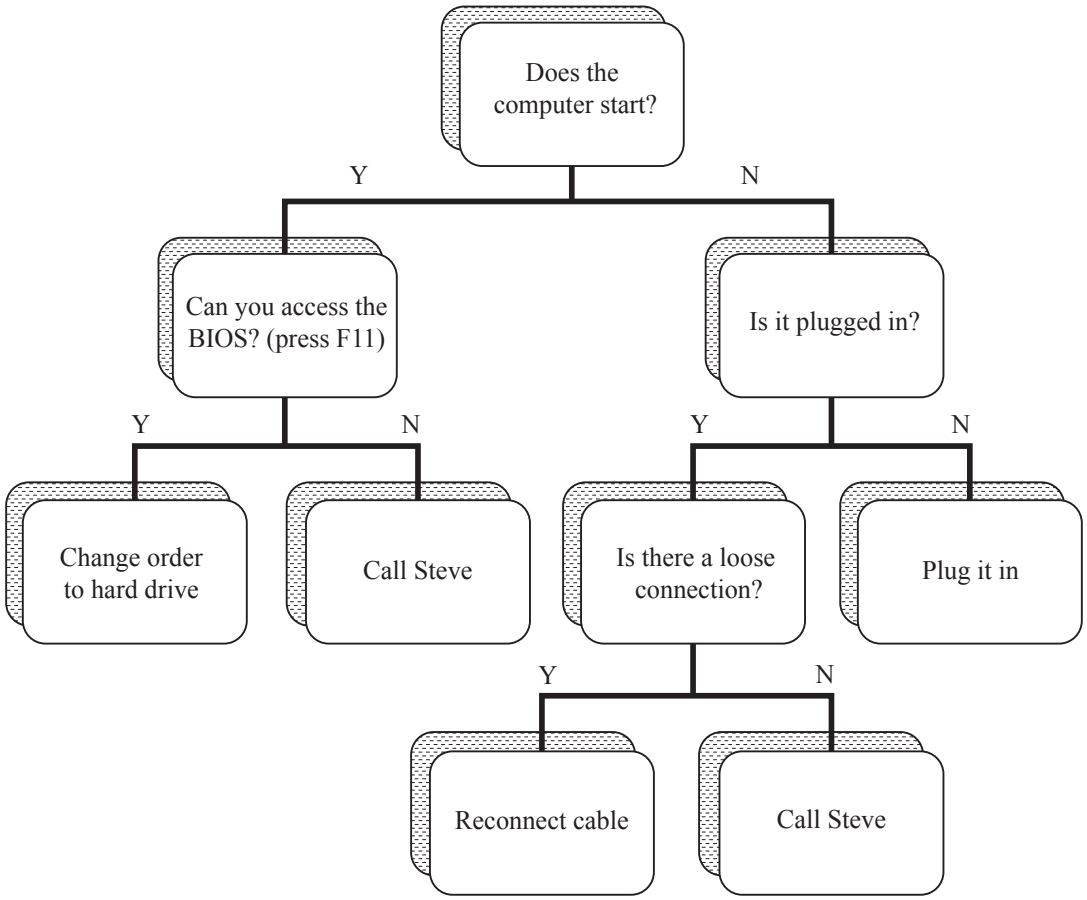
(c) To what extent can artificial intelligence software combine image processing with cell/mobile phone features to help a tourist get the most out of visiting a city? *[8]*

7. Artificial intelligence (AI) / expert systems

Steve Jackson is a computer shop owner in Pittsburgh. Many people phone his shop saying their computer will not start. Steve realizes that most of the problems could be solved by the owner rather than needing him to make a visit to carry out the repair.

Expert systems can be used in a number of ways to try to resolve problems; they can be created using an expert system shell.

Steve has created a simple chart to help his customers, which is based on a decision tree. He hopes to develop it into an expert system that can be used to resolve simple computer problems.



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

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

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

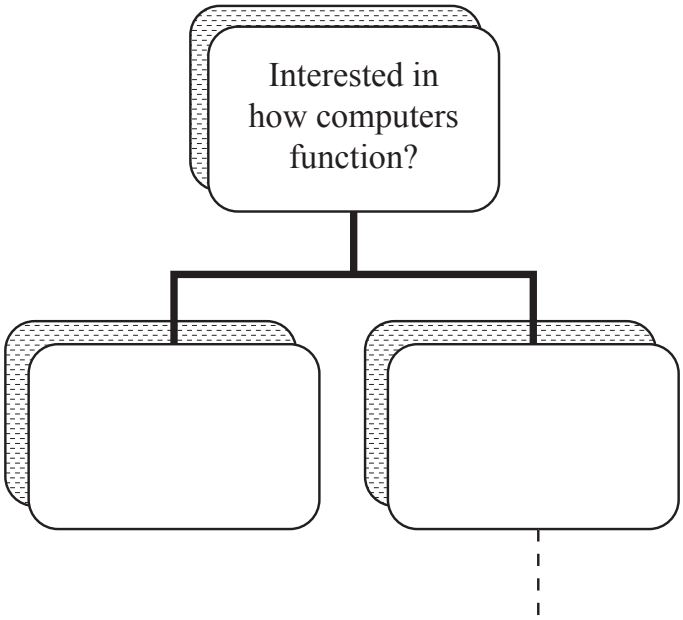
(This question continues on the following page)

(Question 7 continued)

(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]*



(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]*