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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY
HIGHER LEVEL
PAPER 1

Friday 16 May 2014 (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. Analysis of external examination grades by an international school

Students from an international school sit end-of-course exams, which are set by the Oneto7 examination board. The Oneto7 examination board has a secure site from which schools may then download their exam results. The international school uses a spreadsheet to analyse the results.

The results are downloaded as CSV files and are then imported into a spreadsheet showing the data, as in Sheet 1. The CSV files contain data about individual candidates and the final grade awarded for each subject.

	A	B	C	D	E	F	G	H	I	J	K	L
1	**NUM**	**NAME**	**ART**	**MUSIC**	**SCIENCE**	**ECONOMICS**	**ENGLISH**	**SPANISH**	**FRENCH**	**GEOGRAPHY**	**HISTORY**	**MATHEMATICS**
2	257	JANET LEE			7	6	7	7			7	7
3	258	CARMEN SANCHEZ	2		4			5	5	5		3
4	259	ALEXANDRA JAMESON			6	5	5	5				5
5	260	CARLOS SANTANA			7	7	7	7			7	7
6	261	JOSEPH AUBRY	2	5	2			5	5		3	3
7	262	BARBARA DOLORES	2		3	3		5				4
8	263	ALEXIA HUMPHREY	3		3			6	5		3	3
9	264	PAUL GOYESCAS			6	6	6	6	6	6		6
10	265	ADRIAN CHAVEZ			7	7	7	7			7	7

Sheet 1: Examination grades imported from the CSV file provided by the examination board.

The school uses this information to carry out statistical analyses and to create graphs.

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

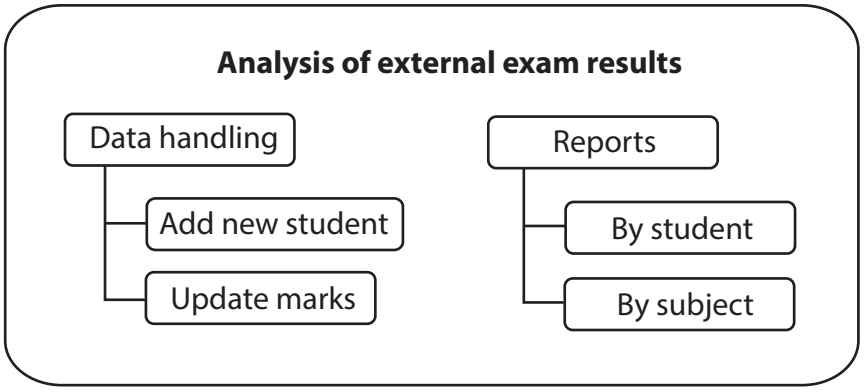
(ii) Identify **two** reasons why the Oneto7 examination board would provide files in CSV format. *[2]*

(iii) Identify **two** characteristics of a "secure site". *[2]*

(This question continues on the following page)

(Question 1 continued)

The previous headmaster used a database application designed by the IT department in the school that allowed him to list students with certain marks and create specific reports.



The present headmaster would like to analyse the results in more detail. This may include information such as:

- all the students who got 7 in their Spanish exam
- the average grade of the students
- charts to compare different subjects.

(b) Schools can use either spreadsheets or database software to analyse these exam results.

Analyse the use of these two software types for this purpose. *[6]*

(c) Oneto7, an examination board that serves 5000 schools, has been contacted by a new company, schoolscompare.com. This company, schoolscompare.com, wishes to buy the data about students' results from the Oneto7 examination board.

Schools, parents and others can pay schoolscompare.com for a more detailed analysis of the examination results. This analysis will be provided using data bought from Oneto7, as well as other data they have acquired.

Discuss the implications of the Oneto7 examination board selling the data it holds about the schools to schoolscompare.com. *[8]*

2. Online training

Fernando Garcia is a mining engineer based in La Paz, Bolivia. His company has a subscription to a training company that provides online streaming of interactive videos as a service for mining companies. As part of his job, he needs to use these videos to train his staff.

The training company has offered to provide certificates for the participants in the online training but they have to complete the online modules first. These modules have an evaluation area where trainees are required to answer questions related to the videos and participate in discussion forums.

However, most of the work of Fernando's company is carried out in the Andes mountains, a few hours from La Paz, where internet access can be poor at times.

A colleague informed Fernando that it is possible to download the videos from the training company website using lossy compression. He has downloaded these interactive training videos while in La Paz, so that he and his staff can use the videos when they are in the mountains.

The first video Fernando downloaded had a file size of 720 MB and he used a service with a bandwidth of 800 kb/sec (kilobits per second).

(a) (i) Calculate the length of time it took to download the 720 MB video. *[2]*

(ii) Outline the difference between lossless and lossy compression. *[2]*

(iii) Outline the difference between downloading and streaming videos. *[2]*

(b) Compare the use of online evaluation tasks versus face-to-face evaluation tasks to assess the skills the trainees may have learned with the training videos. *[6]*

(c) Evaluate Fernando's decision to download the videos and use them to train his staff in the Andes. *[8]*

3. Energy efficient data centres

The Green Grid is an association of IT professionals seeking to raise the energy efficiency of data centres.

Even though companies like *Amazon*, *Google*, *Facebook* and *Apple* are becoming more energy efficient, they are still using large amounts of energy. Consumers are not aware that constant uploading and downloading of large files stores large amounts of information on many data centres. Consumers also expect instant access to these files; this requires the servers and data centres to be permanently active.

It is estimated that the total of the world's data storage is in the region of 300 exabytes (300 million terabytes). It is believed much of this data is redundant.

(a) (i) Define the term *terabyte*. *[1]*

(ii) Identify **three** features/characteristics of data centres that make them consume large amounts of energy. *[3]*

(iii) Identify **two** ways that data redundancy may occur in data centres. *[2]*

(b) Some governments have decided that data centres will be charged for their environmental impact. This may be done by monitoring the volume of data stored and the energy consumed to maintain the data centre.

Analyse this decision. *[6]*

(c) ORM, a large company, is expanding and the managers are concerned that their IT systems will need an expensive upgrade to be able to manage the increasing amount of data held by the company. The company is considering moving all of its data to an external data centre and relying on their services to store and provide access to this data.

Discuss whether ORM should move all of its data to a data centre. *[8]*

SECTION B

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

4. Project management at Larssons

Larssons is a company that produces chips for embedded systems. Larssons has factories in China and Korea with research, development, and sales offices in the UK and US. The management of Larssons has decided that the company needs to commission an information system that can keep track of research and development operations across the world and be accessible from all their locations. They have decided to recruit developers in Vietnam and India to write the code.

The consultants recommend that a formal methodology such as PRINCE2 should be used in order to organize the stages of the project development.

A project manager is appointed who is a certified PRINCE2 practitioner. He starts by producing a project initiation document.

To ensure that the project is completed on time and within budget, the project manager must liaise with all the appropriate stakeholders such as the:

- Information Systems Manager at Larssons
- factory managers
- hardware and software suppliers
- end-users
- programmers/developers.

(a) (i) State **three** items that will be included in the project initiation document. *[3]*

(ii) Identify **three** responsibilities of the Information Systems Manager. *[3]*

(b) Explain **three** problems that may arise if a project does not make use of a properly designed project methodology such as PRINCE2. *[6]*

(c) Project managers need a range of skills, including technical IT skills, to ensure a project is completed on time and within budget.

To what extent is a project manager's technical knowledge critical to the success of the projects they manage? *[8]*

5. Updating Top Dog's information system

The owners of Top Dog Veterinary Practice, a chain of 20 clinics, have been using an information system for many years to manage data about customers, animals, accounts and salaries. They have decided that it is time to replace it with a new one.

(a) (i) Identify **three** reasons why the Top Dog owners have decided that it is time to replace their old information system. *[3]*

(ii) Identify **three** tasks that might need to be performed during the implementation of the new information system. *[3]*

(b) The project manager is considering either direct changeover or phased changeover for the implementation of the new information system for Top Dog Veterinary Practice. Analyse these options. *[6]*

(c) Many companies now outsource their IT provision. This may involve handing over responsibility for the running and maintenance of the information system to a cloud computing provider.

To what extent would it be advantageous for Top Dog Veterinary Practice to outsource its information system to a cloud computing provider? *[8]*

SECTION C

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

6. Expert systems in health care

Doctors, such as Dr James, working in busy city hospitals sometimes use expert systems in order to help make an initial assessment of their patient's condition. When Dr James begins talking with a patient, she inputs the patient's details into the expert system. These include:

- age
- body mass index (BMI)
- blood pressure.

(a) (i) Identify **two** characteristics of an expert system. *[2]*

(ii) Identify **two** reasons why a doctor would use an expert system in order to help diagnose a patient's condition. *[2]*

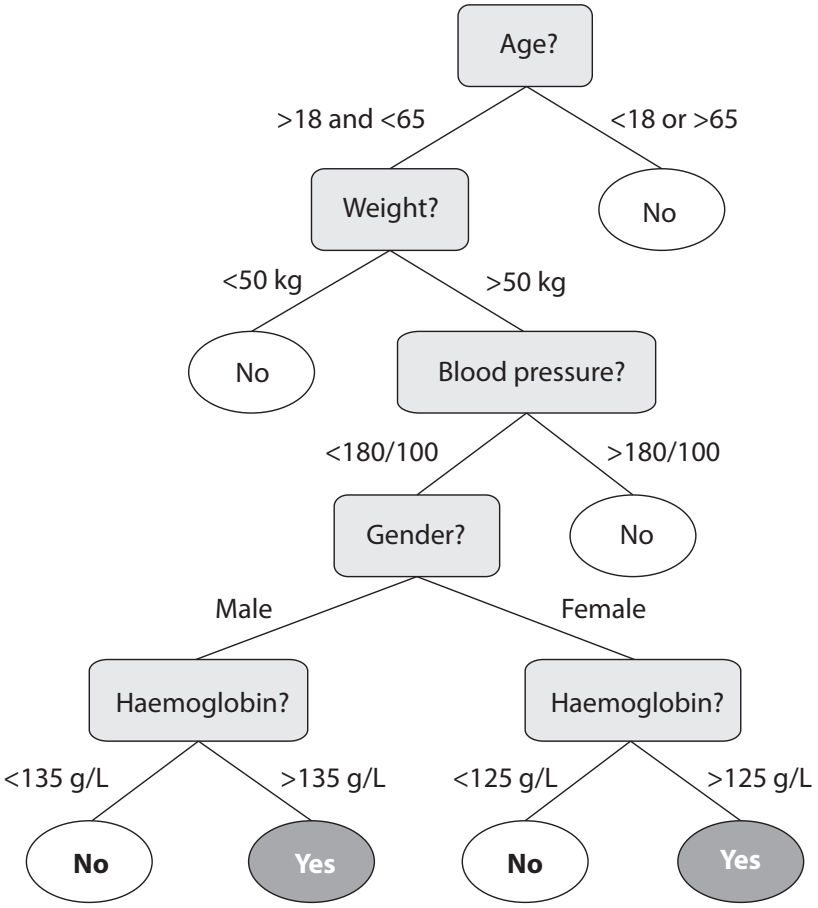
(iii) Outline the relationship between the knowledge base and the knowledge engineer. *[2]*

(This question continues on the following page)

(Question 6 continued)

(b) (i) Explain the purpose of an expert system shell. *[2]*

The chart below shows a decision tree used by the expert system to determine the suitability of a person to be a blood donor.



[Source: *Data Mining and Knowledge Discovery*, Vol. 2 Issue 3 (May/June 2012). "Evolutionary design of decision trees for medical application: advanced review". Peter Kokol, Sandi Pohorec, Gregor Štiglic, Vili Podgorelec. Published Online: Apr 26 2012. DOI: 10.1002/widm.1056]

(ii) Construct the inference rules that were put into the expert system by the knowledge engineer. *[4]*

(c) To what extent should Dr James trust the results produced by an expert system in making her final decision about a course of treatment for a patient? *[8]*

7. Robots in war

Unmanned aerial vehicles, often known as drones, are pilotless aircraft that are operated from a remote location. Drones equipped with bombs and missiles have been used hundreds of times to target specific military objectives. More pilots are being trained to operate drones than conventional fighter aircraft.

Drones navigate by using GPS, but they can also make use of various ground-based signals such as from radio, cell (mobile) phones or Wi-Fi. High resolution images of terrain can be relayed to the operator.

[Source: http://upload.wikimedia.org/wikipedia/commons/f/f5/MQ-9_Reaper_CBP.jpg, last accessed 21 May 2014.]

Artificial intelligence is used in battlefield computer games to produce the illusion of intelligence in the behaviour of game characters. This allows the game player to adapt their behaviour to that of the game's characters. Soldiers are now trained using battlefield computer games.

In the air, on land and at sea, the use of military robots such as drones is increasing rapidly. As robots become more autonomous and able to make decisions, identifying a human to be held accountable for an incident such as killing innocent civilians will become very difficult. Should it be the robot's programmer, designer, manufacturer, the drone operator or his superiors who is accountable?

(a) (i) Define the term *artificial intelligence*. *[2]*

(ii) Identify the steps that could be taken by the drone to identify a target. *[4]*

(b) Analyse the decision to train soldiers using battlefield computer games. *[6]*

(c) To what extent is it acceptable in war that robots should be able to make their own decisions? *[8]*