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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY
HIGHER LEVEL
PAPER 1

Friday 4 May 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.   **Implementation of a school database**

Golden Sylvie School needs to be able to manage information such as students' personal details, health details, grades, parents' contact details and financial statements. To solve this management problem the school has purchased a relational database application.

One purpose of this database is to keep a record of students' visits to the school nurse. This part of the relational database is illustrated below.
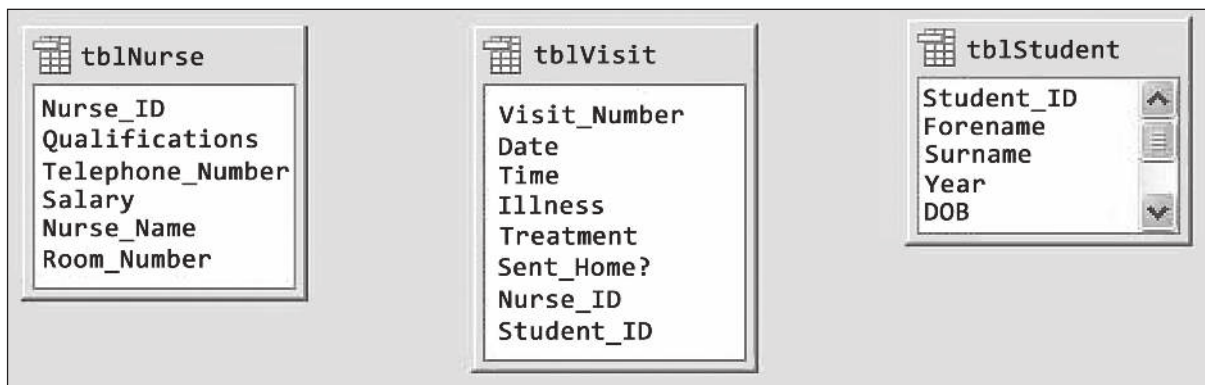
(a)   (i)   State the name of the primary key field of the table *tblVisit*.   *[1]*

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

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

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

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

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

(This question continues on the following page)

(Question 1 continued)

(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]*

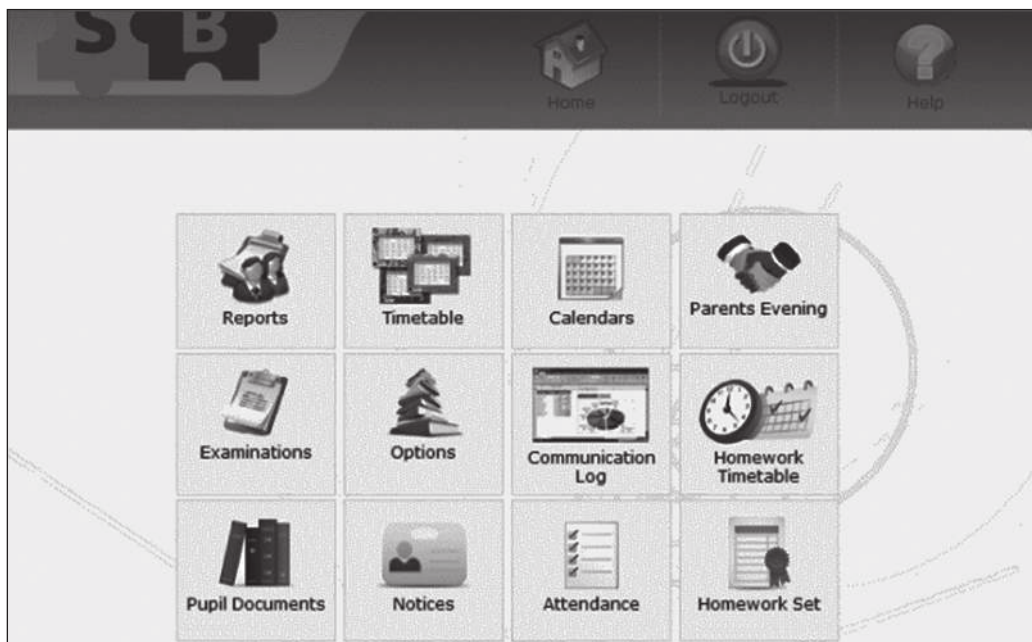(ii) The new database will also require teachers to undertake training to be able to use it.

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]*

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

[Used with permission.]

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 held on the school's server.

Discuss the impact for the school of the decision to allow teachers remote access to the school server.   *[8]*

2.   Telemedicine

Many countries are increasing their use of telemedicine as a method of providing healthcare in remote locations. To transfer the data from a remote location to a hospital, two methods may be used: *real-time* or *store and forward*. *Store and forward* is a technique common in messaging services. Data is sent from one device to a receiving device, but first it passes through an exchange server, such as an email server. It may take 24 to 48 hours for the message to be received.

[Source: http://historiadelatelemedicinaschirlysuarez.blogspot.com/2010/09/importancia-de-la-telemedicina.html, 17 June 2011]

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

(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 the image of the x-ray. *(Show your working.)*   *[2]*

(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]*

(This question continues on the following page)

(Question 2 continued)

(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]*

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

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

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

3.   Improving Lima's transport system

Lima has been promoting a new transport system which has been designed to make it easier to travel from one side of the city to the other. However, the transport system has not worked as well as expected and citizens of Lima have used social networking websites such as *Facebook* and *YouTube* to report problems, such as extreme delays between buses, or a road accident.
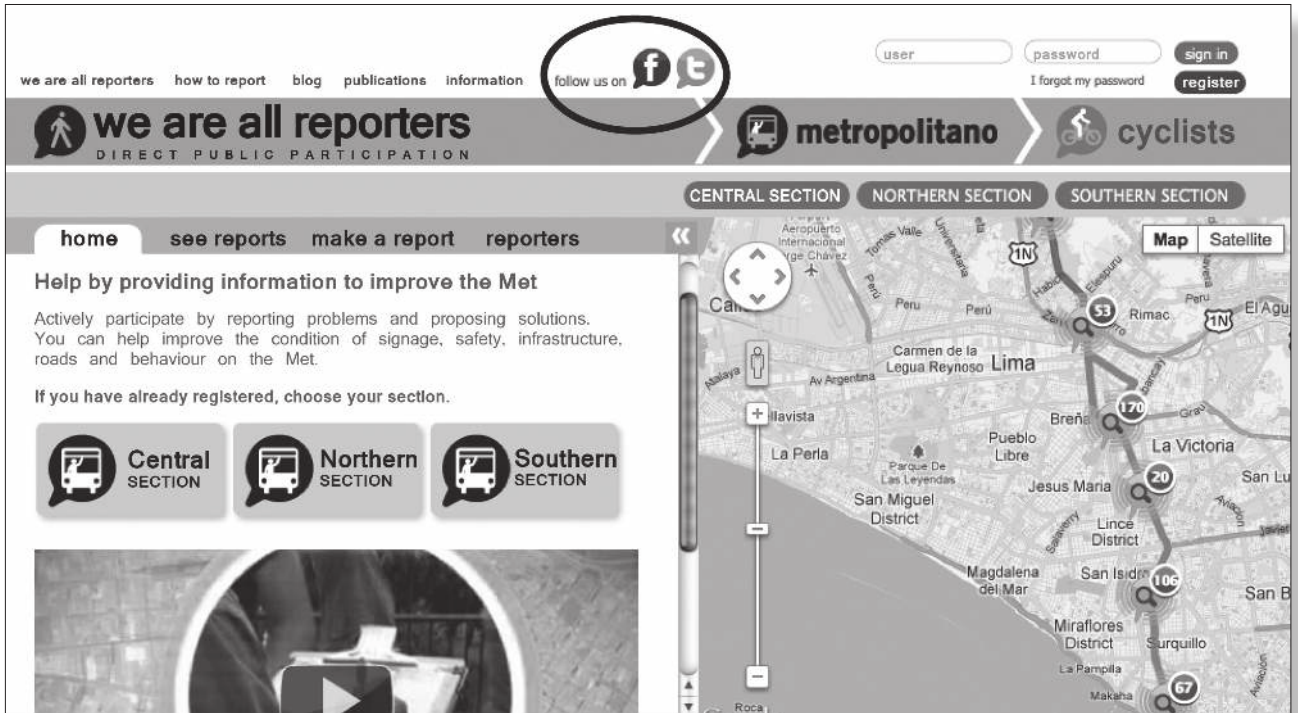
[Used with permission.]

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

(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]*

(This question continues on the following page)

(Question 3 continued)

(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]*

(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]*

SECTION B

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

4.   **University IT support**

The University of Passmore has five faculties which between them contain over fifty departments. All of them make extensive use of computer facilities and require effective IT support. This is provided by an information services department. Its role is to provide:
- 24 hour access to IT data centres
- full access to library services
- support for student access to the broadband network through the student halls of residence, and for wireless networks across all the campuses
- support for university staff access to networked systems and services
- web-based information resources (e-journals and e-books) and services for learning, teaching and research
- management and development of a virtual learning environment for the university
- central IT support for management information systems governing financial, personnel and student records functions.

In addition to this, many departments also want their own specific facilities. For example, the computer science department needs access to compilers, and the performing arts department needs a wide range of video and music editing capability.

As with any organization, interruptions to IT services can be hugely inconvenient and also costly.

The information services department ensures that essential services are maintained and incidents that may lead to an interruption of services are dealt with at all times.

When a user reports an incident, the IT support staff have to log the incident and then make decisions about the course of action to be taken.
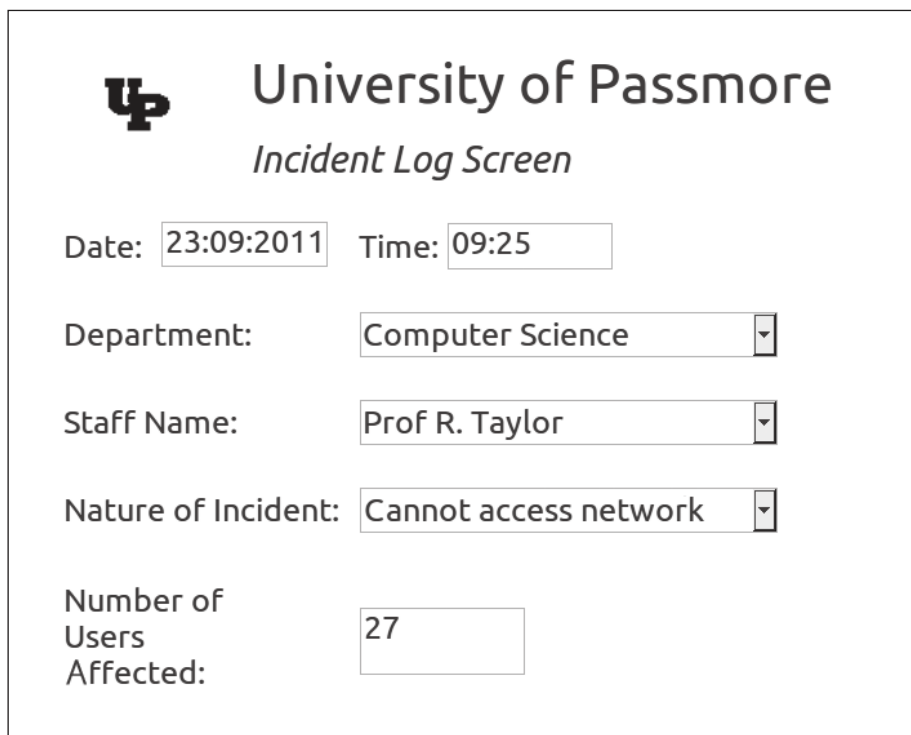
Procedures have been developed so that incidents are responded to in the most timely and cost effective way possible.

(Question 4 continued)

(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]*

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

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

(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]*

(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]*

5. **Daffodil Hotels**

Daffodil Hotels is a chain of five hotels that currently uses an old text-based computer system to store and process bookings. Its management has decided that it needs to change to a more up-to-date and user-friendly system that also has online booking and other useful services.

Daffodil Hotels approached a software development company that has already produced systems for other hotel chains. Some modifications would be necessary in order to suit the particular requirements of Daffodil Hotels.

The management of Daffodil Hotels has designated its current IT manager to act as project manager for the commissioning and installation of the new system. The project manager has a meeting with the suppliers in order to draw up a software requirements specification.

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

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

(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]*

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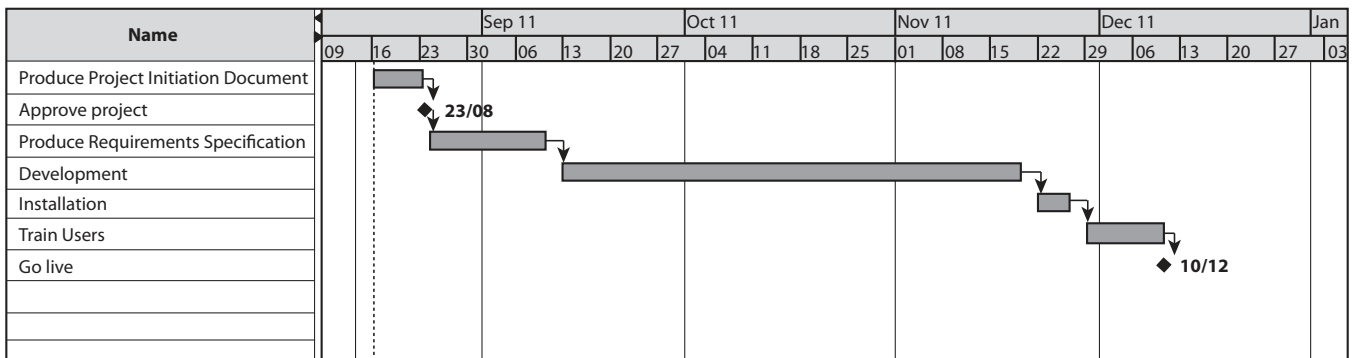
The changeover did not go according to plan. When the software was ready to be installed, many serious problems occurred, leading to a failure to deliver the required specification.

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]*

SECTION C

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

6. **Fuzzy logic**

    Computers work with binary logic. They are good at making decisions based on whether a condition is true or false. Real life is not like that. A glass can be empty or full. It can also be 0.3 (30 %) full or we might say that it is partly full.

    With fuzzy logic we can produce computer systems that work better than those based on pure binary logic. In fuzzy systems, values are indicated by a number (called a truth value) in the range from 0 to 1, where 0 represents absolute falseness and 1 represents absolute truth. A piece of washing might be completely clean (0) or completely dirty (1). However, in some cases it might be slightly dirty (0.4).

    (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]*

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

    (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.
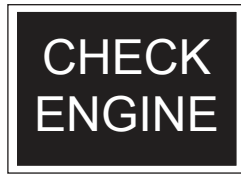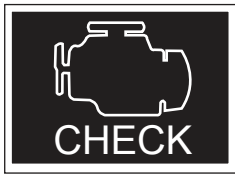
    Contrast the suitability of using fuzzy logic in these **two** cases.   *[6]*

    (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]*

7.   Expert car repairs

Many cars display a "check engine" light on the dashboard.

[Photo from: http://en.wikipedia.org/wiki/File:Vw_engine_check.jpg]

This means that the vehicle's engine control unit (ECU) has determined that either a component has failed or the emission control system is not working properly.

When the light comes on, one or more *diagnostic trouble codes* (DTC), *e.g.* P0071 and P0076, are stored in the engine control module.

Figure 1

P0071	Ambient Air Temperature Sensor Range/Performance
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)

[Source: http://www.aa1car.com/trouble-codes/codes_99.htm, 15 September 2010]

In order to solve one of these problems, a car mechanic retrieves the DTCs and the appropriate troubleshooting information from the expert system is followed in order to determine the problem.

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(Question 7 continued)

    (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]*

        (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]*

    (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).

        Explain why a mechanic would need to use an expert system in order to proceed with repairing a car. *[6]*

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