Diploma Programme
Programme du diplôme
Programa del Diploma

Information technology in a global society
Standard level
Paper 1

Tuesday 7 November 2017 (afternoon)

1 hour 30 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer two questions. Each question is worth **[20 marks]**.
- The maximum mark for this examination paper is **[40 marks]**.

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

1. **Voice biometrics technology in banking**

    Telephone passwords and security questions could soon become obsolete as financial institutions such as *CBR Bank* implement technology that can authenticate a customer's identity based on the characteristics of their voice. *CBR Bank* is now introducing voiceprint biometrics technology that can identify customers when they telephone the bank.

    As part of the registration process, the customer has to say the phrase, "my voice is my password" three times. This provides a "voiceprint" that will be used to verify the customer's identity in future telephone calls to the bank.

    [Source: adapted from www.cbc.ca]

    (a) (i)   Identify **two** forms of biometric identification other than voice.   [2]

         (ii) Identify the steps used by the voiceprint biometric technology to authenticate a customer calling *CBR Bank*.   [4]

    (b) *CBR Bank* holds a large amount of information on its customers. Some customers are concerned about the security, privacy **and** anonymity of their data.

         For **each** of the concerns above, explain **one** policy that *CBR Bank* could use to address the concerns of its customers.   [6]

    (c) The chief executive officer (CEO) of *CBR Bank*, Alice McEwan, said in a recent interview, "*CBR Bank* will be replacing all passwords, PINs and personal verification questions for our online banking and mobile banking with voice biometric recognition."

         Discuss whether the changes proposed by Alice are beneficial for **both** *CBR Bank*'s customers and *CBR Bank*'s IT support.   [8]

Turn over

**2.	Goal-line technology in soccer (football)**

In 2010, at the soccer World Cup tournament in South Africa, England were denied a goal in a match against Germany, even though the ball had clearly crossed the goal-line. This led football officials to introduce goal-line technology in the 2014 World Cup in Brazil. The referees wore watches that vibrated and displayed the word "GOAL" every time the ball crossed the goal-line.

Goal-line technology includes 14 cameras that track the ball around the pitch and uses a network of high-speed video cameras to track the ball in flight. The cameras create high resolution images.

The software calculates the ball's location in each frame by identifying the pixels that correspond to the ball. The software can track the ball and predict its flight path, even if the view of several cameras is blocked. An encrypted message is sent to the referee's watch in less than one second to let the referee know whether the ball has crossed the goal-line.

[Source: © International Baccalaureate Organization 2017]

Figure 1: Illustration of goal-line technology in action

[Source: www.goalcontrol.de]

All of the information collected by the goal-line technology is stored in a database.

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(Question 2 continued)

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

(ii) Using the following assumptions:
1 pixel is made of 24 bits
1 kilobyte (KB) = 1000 bytes
1 megabyte (MB) = 1000 KB

Calculate in megabytes (MB) the storage requirements for an image size of 2000 pixels by 4000 pixels. [2]

(iii) The system records the ball's flight path into a database.

Identify **two** fields that would be found in the goal-line technology database. [2]

(b) The goal-line technology is capable of collecting vast quantities of data. To make this manageable three policies are needed: for the collection, storage **and** sharing of data.

Explain how **each** of these **three** policies could be implemented so that the quantity of data is manageable. [6]

(c) Many sports have introduced technology to assist officials with their decision-making at critical moments. These include whether to award a goal in soccer (football), whether a shot in tennis is in, or whether a sprinter has made a false start.

To what extent do the advantages of introducing technology in sport outweigh the disadvantages? [8]

Turn over

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3. **Social media and political tension**

National governments sometimes block websites at a time of political tension. One example was in 2011, when a government prevented its citizens access to *Twitter*, *Facebook* and YouTube. Images on these websites were considered inappropriate, with the potential to cause hatred, violence and political unrest in that country. The national government gave direct orders to the internet service providers (ISPs) to block access to these sites for four hours. The aim was to give enough time for site officials to remove the offending images from their websites.

Despite these attempts by the government, some citizens were still able to access these images using proxy servers.

Many people, such as academics, believe that this approach is not appropriate and governments should focus on the education of their citizens so that they are able to make informed decisions about how to react to potentially offensive information on websites and social media.

[Source: © International Baccalaureate Organization 2017]

(a) (i) In addition to providing access to the Internet, identify **two** functions of an internet service provider (ISP). [2]

(ii) Identify **two** characteristics of a proxy server. [2]

(iii) Identify **two** ways that the government could have determined the identity of the persons responsible for posting the offending images on the social media. [2]

(b) Many schools block access to social networking websites such as *Twitter*, *Facebook* and YouTube. However, other schools are investigating two different options:

• monitoring the network to view what websites the students are viewing, or
• giving different ages of students different levels of access to social media sites.

Analyse these **two** options. [6]

(c) Many citizens have raised concerns about the surveillance of their web browsing history or censorship of selected websites by their national government.

To what extent is it appropriate for national governments to use surveillance and censorship to control citizens' access to websites? [8]

Turn over

4.   Sports watches used in physical education (PE) lessons

Sports watches are now used with high school students (aged 11–18) in their physical education lessons at Collège Earlet in Quebec. Students will wear the device around their wrist during sports and fitness activities. In some lessons, teachers can use their tablet to see the students' vital signs* provided by the sports watches and even project the information for all students to see (see **Figure 2**).

Before the lesson, teachers set heart rate targets, measured in beats per minute (bpm), for each student.

During the lesson, students should aim to stay within their recommended heart rate limits. After the lesson, the software will email the students a summary of their heart rate data as well as a number of other vital signs recorded by the sports watch, with a copy sent to their teachers and parents.

Figure 2: Sports watch showing the heart rate of a student

[Source: adapted from www.lakecityeducationfoundation.org, image from www.dcrainmaker.com]

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*   vital signs: signs of life used to monitor medical problems (for example heart rate)

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(Question 4 continued)

(a) (i) Apart from heart rate, identify **two** possible vital signs that could be recorded by the sports watch. [2]

(ii) At the start of each lesson the student is asked to set their maximum heart rate on the watch to 220 bpm − their age; so in the case of a 15-year-old it would be 220 bpm − 15 = 205 bpm.

Identify the steps used by the software in the sports watch to encourage students not to exceed their maximum heart rate. [4]

(b) (i) Explain **one** advantage for the student of using these monitoring devices. [2]

(ii) Explain **one** advantage for the teacher if their students are using these monitoring devices. [2]

(iii) Explain why the reliability of the sports watches may be a concern for the teachers. [2]

(c) The principal at Collège Earlet has been discussing arrangements for sharing data from the students' watches with a third party, *Fitness World*.

Discuss whether the principal at Collège Earlet should agree to share data that has been collected by the students' watches with *Fitness World*. [8]