Diploma Programme
Programme du diplôme
Programa del Diploma

Information technology in a global society
Standard level
Paper 1

Tuesday 17 November 2015 (afternoon)

1 hour 45 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer three questions. Each question is worth **[20 marks]**.
- The maximum mark for this examination paper is **[60 marks]**.

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

1. Streaming media in education

Teachers at One2seven school often need to make videos and share them with their students by streaming them from the cloud. In order to upload these videos to the cloud, teachers need to compress them.

Before uploading a video, it is necessary to convert it to a format that is acceptable to the specific requirements of the cloud hosting site, such as:
- file type
- maximum file size.

The conversion of the video can be done using video editing programs or video compression software, which have export settings that allow the type and size of the file to be changed.

(a) (i) State **two** video file types. [2]

(ii) Outline **one** difference between streaming and downloading videos. [2]

(iii) Identify **two** situations where streaming the video is not possible. [2]

(b) (i) Explain **one** advantage for the student when the video is compressed. [2]

(ii) Explain **one** disadvantage for the teacher of compressing a video before uploading to the cloud hosting site. [2]

(iii) Explain **one** reason why data compression is used when transferring a video file online. [2]

(c) The school is in the process of deciding where teachers will host these videos. There are two options:
- on an external site, such as YouTube
- on the school server.

Evaluate both options. [8]

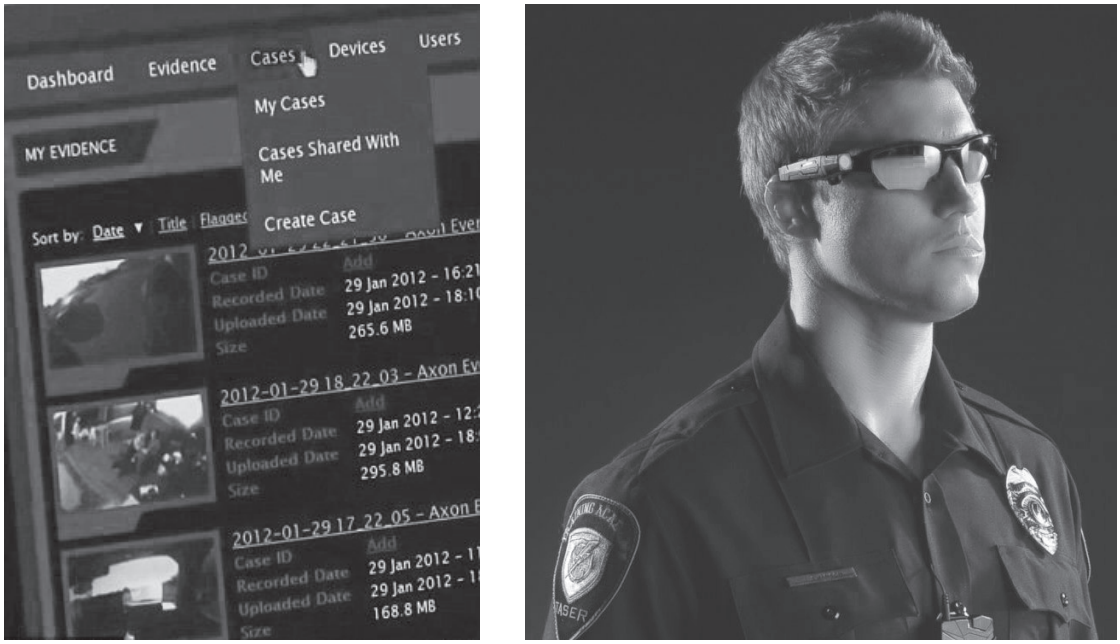
2. Headcams

One police department in the United States is making the headlines by clipping cameras on the side of all their officers' heads via glasses, helmets or hats. These "headcams" can record video of a crime scene or any interaction with the public, adding to the footage already produced by dashboard cameras in their cars.

The camera can be clipped onto a hat or sunglasses, with a control unit worn inside the uniform below the chest. Once switched on, the camera operates constantly for up to 12 hours, but it only begins recording when the officer presses a small button on the front of the control unit. The camera goes wherever the officer goes and records what the officer can see.

The camera contains 16 gigabytes (GB) of internal storage in the form of flash memory and has the capacity to provide about 28 hours of recordings. It even records the wearer's global positioning system (GPS) coordinates. As the camera captures the video, it is sent by Bluetooth to a mobile device and then streamed to the cloud. This web service stores and categorizes videos in a database so that they can be used in court to support police reports. The headcams are designed so that officers cannot edit the footage.

Figure 1: Headcam technology



[Source: Photos courtesy of TASER International, Inc., Scottsdale, AZ USA]

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(Question 2 continued)

(a) (i) Define "cloud computing". [2]

(ii) Identify **two** benefits of using a relational database instead of a flat-file database for storing the police data. [2]

(iii) Outline **one** disadvantage if the videos captured by the police were only stored in the cloud. [2]

(b) The data collected from the headcams is stored in its data centres. The police department is concerned about the environmental effects of these data centres.

Explain **three** environmental concerns that may result from data centres. [6]

(c) Discuss whether the benefits to the police department of using video headcams are more important than the citizens' concerns about the misuse of the video recordings. [8]

3. Next Generation Cane

The Next Generation Cane is a walking stick created by Fujitsu. It includes technologies such as Wi-Fi, global positioning system (GPS) and Bluetooth. It has a handle that has a bright dot matrix screen that displays a big green arrow to point the user in the right direction.

Joe loves the idea that he can keep an eye on his aging grandmother, Carol. The device acts as a mutually-controlled GPS system. If Carol wishes to go to the supermarket, Joe would first use the cane's navigation software on a personal computer (PC) to show the route, using an interface similar to Google Maps. The cane then displays large arrows on the handle to guide Carol in the right direction as she walks. The light emitting diode (LED) dots that make up the screen are large, making it easily visible for someone with poor eyesight. On the top are indicators for the Wi-Fi and battery status. Her position is relayed back to the computer so that Joe can see her progress on a map, and to check that she does not go the wrong way.

The Next Generation Cane constantly relays its current location back to the PC while the user is walking. There are various sensors built in too, such as temperature and humidity sensors, so Joe can monitor how hot it is and change the route, perhaps directing Carol to some shade.

Figure 2: Next Generation Cane

[Source: www.engadget.com and www.designboom.com]

(a) (i) State **two** items of data that Joe must enter into the navigation software on the PC to guide Carol to the supermarket. [2]

(ii) After Joe has input the data, identify the steps used by the GPS system to guide Carol to the supermarket. [4]

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(Question 3 continued)

(b) The product development life cycle (PDLC) was used to ensure that the original design for the Next Generation Cane met the needs of the end user. Three of the PDLC stages are:

- investigation of existing system
- feasibility study
- requirements specifications.

Explain how each of these three stages of the PDLC were used to contribute to the successful development of the Next Generation Cane. [6]

(c) Fujitsu is planning to make future improvements to the cane, such as adding a camera and audio commands.

To what extent will these further improvements to the functionality of the Next Generation Cane also lead to increasing benefits for Carol and her family? [8]

4. Bitcoin

Bitcoin is a digital internet currency. Bitcoin uses peer-to-peer (P2P) technology to operate, with no central authority or banks managing transactions. Bitcoin is open-source: nobody owns or controls Bitcoin, and everyone can take part. People are able to exchange money securely without the need for a third party, such as a bank or a company like PayPal. Bitcoin allows a person to be sure the money they receive is genuine, even if they do not trust the sender.

Once the Bitcoin client software is downloaded and running, it connects over the internet to the decentralized network of all Bitcoin users. It automatically generates a pair of unique, mathematically linked keys, which are needed to exchange Bitcoins with any other client. One key is private and kept hidden on the initial computer. The other is public and a version of it is called a Bitcoin address. This address is given to the other person so they can send the Bitcoins.

A Bitcoin address looks something like this: 15VjRaDX9zpbA8LVnbrCAFzrVzN7ixHNsC.

There is a food delivery website that arranges home delivery for restaurants in the Netherlands. The website accepts payment in Bitcoins. The company says customers pay via the site using debit cards, credit cards, PayPal or an online system run by Dutch banks. Paying with Bitcoins could save customers money because the food delivery company adds surcharges of up to one euro for other forms of online payment.

(a) (i) Define the term “open source software”. [2]

(ii) Describe **one** advantage to the retailer of using Bitcoins as a form of payment. [2]

(iii) Describe **one** disadvantage to the retailer of using Bitcoins as a form of payment. [2]

(b) (i) Distinguish between privacy and anonymity. [4]

(ii) Explain **one** reason why Bitcoin makes use of private key and public key encryption. [2]

(c) To what extent is it acceptable to use a P2P network rather than centralized servers supported by a system administrator to manage data such as Bitcoin transactions? [8]

5. LOKI bracelet

The LOKI is more than a wearable bracelet. It is a new biometric device that can replace all of your passwords. It uses your electrocardiogram (ECG); this is a measure of the electrical activity generated by your heart. An ECG is not your heart rate but is completely unique to each individual, like your fingerprints. However, unlike fingerprints, you do not leave your ECG data on drinking glasses, windows, mobile devices or wherever else that you go.

The LOKI uses a biometric sensor to read your ECG and authenticate your identity through your unique heartbeat pattern. The LOKI connects to other devices, such as a computer, using Bluetooth. While using a device such as a computer, the LOKI is constantly checking that the person wearing it is authorized to use the device.

The LOKI also contains sensors that tell a device, such as your cell/mobile phone, how far away you are from it, and lock it if you are not holding it. However, once you are holding the cellphone the LOKI can unlock it without a password. Some LOKI users are considering using it to control all the devices in their smart homes, such as their lighting, heating and other electrical devices.

Figure 3: LOKI user authentication

[Source: www.dailymail.co.uk]

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

(ii) Identify the steps that are used by the LOKI to authenticate the user. [4]

(b) A home owner is considering changing his passwords in his smart home from text to biometric input, such as an ECG. Analyse this decision. [6]

(c) Discuss whether the LOKI should be used as the sole control for smart devices in your smart home. [8]