

Information technology in a global society
Higher level
Paper 1

Tuesday 17 November 2015 (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]**.

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Section A

Answer **two** 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

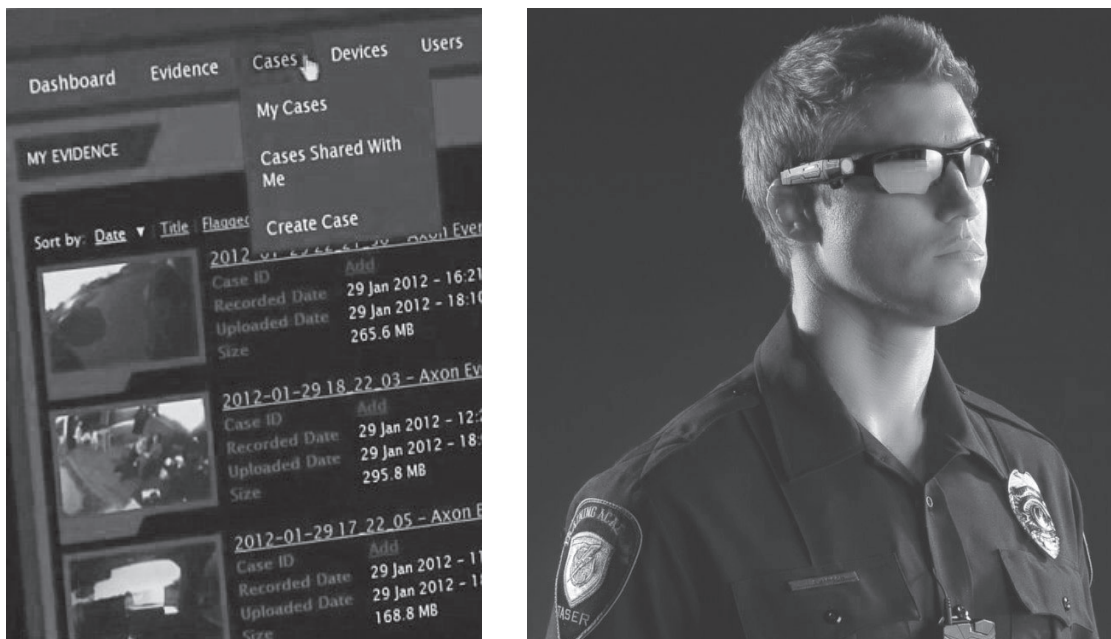
More than 3500 law-enforcement agencies in the United States is making the headlines by clipping cameras on the side of all their officers' heads via glasses, helmets or hats. These "headcams" can record video of a crime scene or any interaction with the public, adding to the footage already produced by dashboard cameras in their cars.

The camera can be clipped onto a hat, collar, helmet, or sunglasses, with a control unit worn inside the uniform below the chest. Once switched on, the camera operates constantly for up to 13 hours in a pre-event buffer mode, which only saves the previous 30 seconds of video. To record an event the officer presses a small button on the front of the control unit, which saves the 30-second pre-event buffered video and then begins recording both audio and video until the event is over and the button is held down for 5 seconds. The camera goes wherever the officer goes and records what the officer can see.

The camera contains 8 gigabytes (GB) of internal storage in the form of flash memory and has the capacity to provide about 4 to 13 hours of recordings. depending on the settings. It can even record the wearer's global positioning system (GPS) coordinates when using a mobile app. As the camera captures the video, it can be viewed via Bluetooth™ streaming to a mobile device for playback purposes and to allow the officer to create a report which creates metatags. At the end of the officer's shift, the device is placed in a charger that is connected to the Internet. The encrypted recordings and metatags are then streamed to the Cloud. This web service stores and categorizes videos in a database that meets and/or exceeds CJIS standards so that they can be used in court to support police reports. The headcams do not have a delete button and are designed so that officers cannot edit the footage.

Note: Additional information has been added by Steve Tuttle VP of Taser, which goes beyond the stimulus material in the question to ensure the authenticity of the information published.

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

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- (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]

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Section B

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

4. Introducing a new IT system

For a number of years a publishing organization, Lizerts, has used a paper-based system to produce annual reports. These annual reports consist of a number of articles written by different authors who live in different regions of the world, with different time zones, that are posted to the Lizerts head office. The authors of the articles only come to the offices of Lizerts for a three day meeting once a year.

In 2015, however, the organization decided to use a direct changeover method to implement a new web-based system. It was also decided that the authors would no longer come to the head office, as all discussions could take place in an online forum. Unfortunately there were problems with the changeover, and many of the paper authors complained about problems such as:

- lack of web browser compatibility
- a non-intuitive user interface
- lack of testing of the system
- lack of user-friendly documentation
- lack of appropriate training to use the new system.

To try to understand why there were so many problems with the new web-based system, a business analyst was employed by Lizerts. He reported that not all of the primary stakeholders had been consulted during the analysis phase of the project. For example, authors and staff in the Lizerts head office who deal directly with the authors were not consulted.

- (a) (i) Identify **two** advantages of using the direct changeover method. [2]
- (ii) Identify **two** advantages of using the phased changeover method. [2]
- (iii) Lizerts carried out an economic feasibility study. Describe **one** other feasibility study that should have been carried out at this time. [2]
- (b) Lizerts is considering two possible options for training users of the new system. Both will include video demonstrations of the new system, but Lizerts must decide whether to use either completely asynchronous discussion forums or synchronous discussions using voice over internet protocol (VoIP).
- Analyse these **two** options. [6]
- (c) Two primary stakeholders of the new system are:
- senior managers of Lizerts
 - authors of the articles who will use the new system.
- To what extent does the success of the project depend on the data collected from these two primary stakeholders during the analysis stage? [8]

5. New technology park in East Africa

The government of an East African country has decided to develop a technology park in the Valley Region, 1000 km from the capital city. This will help to develop the Valley Region and create more skilled jobs there. This will in turn make the country less dependent on the capital city.

They are preparing a plan to develop the Valley Region Technology Park and expect to complete the project in two years. The primary aim of the project is to make use of the recently completed national fibre optic network, which connects the capital city and the technology park, to create more skilled jobs.

In the technology park there would be a number of new technology-based companies. The government would subsidize these companies within the Valley Region Technology Park by providing them with an IT service department that could deal with all of their IT-related issues through a help desk.

- (a) (i) Identify **two** ways how the use of either Gantt charts or PERT charts can assist in the development of the technology park project. [2]
- (ii) Identify **two** possible ways how the project manager can ensure the success of a project such as the development of the new technology park. [2]
- (iii) Outline the role of the analyst in a project such as the development of the new technology park. [2]
- (b) The project manager for the technology park project has not decided whether to use an agile or waterfall project management methodology.
- (i) Explain **one** difference between agile and waterfall project management methodologies. [2]

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(Question 5 continued)

An incident reporting form will be completed by employees of companies in the technology park and sent to the help desk. The incidents reported can be viewed in a format such as the one below in **Figure 3**.

Figure 3: Incident reporting form

Category	Sub-category	Title	Status	Request user	Assigned to	Priority	Request time
Servers	File server	Server does not respond	Open	Richard Stefan	Craig Russell	High	28/03/2015 14:44
Servers	Internet server	Lost internet connection	Open	Barbara Star	Craig Russell	High	28/03/2015 14:23
User	PC	Cannot turn on PC	Open	Tammy Orams	Ken Patrick	Medium	27/03/2015 15:36
Software	PC	Error message	Open	Sandra Hancox	Ken Patrick	Medium	27/03/2015 10:15
Software	Other	Cannot access email	Open	Michael Brooks	Ken Patrick	Medium	27/03/2015 08:23
User	Screen	Cannot set up correct focus	Open	Sharon Milner	Craig Russell	Low	26/03/2015 16:30
User	Printer	Paper jam	Open	Lara Dudley	Craig Russell	Low	26/03/2015 14:44

[Source: © International Baccalaureate Organization 2016]

- (ii) Explain **two** criteria that could be used to determine whether an incident is classified as a high priority. [4]
- (c) Concerns have been expressed about the ability of the help desk at the technology park to manage all incidents. The managers of the technology park are considering two options:
- increasing the training for staff at the technology park
 - moving the help desk to the head office in the capital city.

Evaluate the **two** options. [8]

Section C

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

6. Robotic cars

Many companies are in the process of developing self-driving (autonomous) cars. Currently most of these cars are being tested on special test tracks, but Google is already testing cars on public roads, and several states in the United States have passed laws making self-driving cars legal on their roads. In Europe, cities in Belgium, France, Italy and the United Kingdom are planning to operate transport systems for driverless cars, and Germany, the Netherlands and Spain have allowed the testing of robotic cars in traffic.

Figure 4: Control panel of a self-driving car



[Source: Image courtesy of the Department of Engineering Science, University of Oxford]

These self-driving cars are controlled by a central computer, using specialist software that uses data from the sensors. It is hoped that the software controlling the driverless cars will be able to detect obstacles and read road signs, as well as react to traffic signals and the behaviour of other drivers. The software will also determine the driving style of the car. For example, it can be programmed to wait a second for the traffic signal to turn green before it starts moving.

- (a) (i) Identify **three** sensors that could be used by self-driving cars. [3]
- (ii) Identify **three** characteristics that a self-driving car would need to have in order to be considered a robot. [3]

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(Question 6 continued)

- (b) Self-driving cars may encounter a number of potential problems when driving in real traffic on public roads, rather than on a special test track.

Explain **three** potential problems that might occur when self-driving cars are used on public roads.

[6]

- (c) Several companies expect to put self-driving cars on the market within the next three to 10 years. Many people have concerns about using self-driving cars.

To what extent are self-driving cars advantageous?

[8]

7. Computer games

Angus Neilson has started EduGame, a company that produces video games for education. His games will use artificial intelligence, including fuzzy logic, to enhance the students' experience. Like most video games, Angus's games will include non-player characters (NPCs). NPCs are not controlled by the player of the game. Instead, they are usually controlled by artificial intelligence, and often fuzzy logic as well.

Angus hopes his games will enhance student learning and motivation as well as increasing their interest in the subjects they are studying.

- (a) (i) Identify **three** characteristics of artificial intelligence systems. [3]
 - (ii) Identify **three** reasons why new games cannot be played on old computers. [3]
 - (b) (i) Explain why fuzzy logic can be used to create more realistic computer-generated NPCs in games. [4]
 - (ii) Explain why a character in a game may or may not pass a Turing test. [2]
 - (c) To what extent can educational video games enhance student learning and motivation? [8]
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