

Information technology in a global society
Higher level
Paper 1

Monday 16 May 2016 (morning)

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.
- Each question is worth **[20 marks]**.
- The maximum mark for this examination paper is **[60 marks]**.

Section A

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

1. Public access to art museum databases

Museums around the world provide access to public databases containing information about the items in their collections. Some museums, like the British Museum in London, put the information on their websites. Others, like the Tate Modern (also in London) allow users to select and download part of the database and create reports using their own criteria. Most of the information can be accessed without restriction; however, some of the information is covered by Creative Commons licences.

People who download the data are sharing their results in innovative ways. One user made graphs of the number of artworks by individual artists, while another created a graph with the height and width of the paintings in the Tate Modern.

- (a) (i) Identify **two** different types of field that can be included in a database. [2]
- (ii) Describe **two** characteristics of Creative Commons licensing. [4]
- (b) Previously the information in the museum's database was only accessible to people working at the museum. Any changes will have implications for the museum's IT department.
- Analyse the implications for a museum's IT department of allowing public access to selected information in the museum's database. [6]
- (c) People who use the museum database are sharing the reports they create via blogs, social media and collaborative documents. For example, reports may show that the museum prefers artworks from artists of a specific gender, or show the differences in the frequency of loans of certain collections, or even the budget assigned for restoration and maintenance of certain museum pieces.
- Discuss the advantages and disadvantages for the museums' managers of providing public access to the museum database. [8]

2. Online learning on your own device

Mountains University, Australia, uses a virtual learning environment (VLE) to enable students to access its resources both within and outside of the classroom.

The university wants to use the VLE to provide distance learning programmes, so that students can participate in its courses from anywhere in the world. However many of these students have unreliable internet access and limited access to technology. As one way of addressing this issue, the university is considering whether to design courses that are suitable for m-learning.

- (a) (i) The distance learning programme requires that each student spends three hours a week on online activities.

Identify **three** online activities that the university course could use as part of the distance learning programme.

[3]

- (ii) Students have to prepare work that will be assessed by the professors at the university. Much of this work will be done in groups, and group members may be located in different countries.

Identify **three** different IT tools that could be used by students to complete their group work.

[3]

- (b) On the final degree certificate, Mountains University is required to state whether the course was either:
- an online course
 - a course completed by attending class at the university.

Analyse the impact of this statement for the student when using the degree certificate to apply for a job.

[6]

- (c) Some professors at Mountains University have been working with schools in the area as consultants on the use of online activities for education. Some of the local schools have a number of mobile equipment carts that may be pushed to the different classrooms when needed. However the number of devices available is not enough for the number of students in the school. Mountains University is recommending that, instead of purchasing more devices, schools should ask students to bring their own mobile devices or laptops to school as part of a Bring Your Own Device (BYOD) scheme.

Discuss the implications for a school of implementing a BYOD scheme.

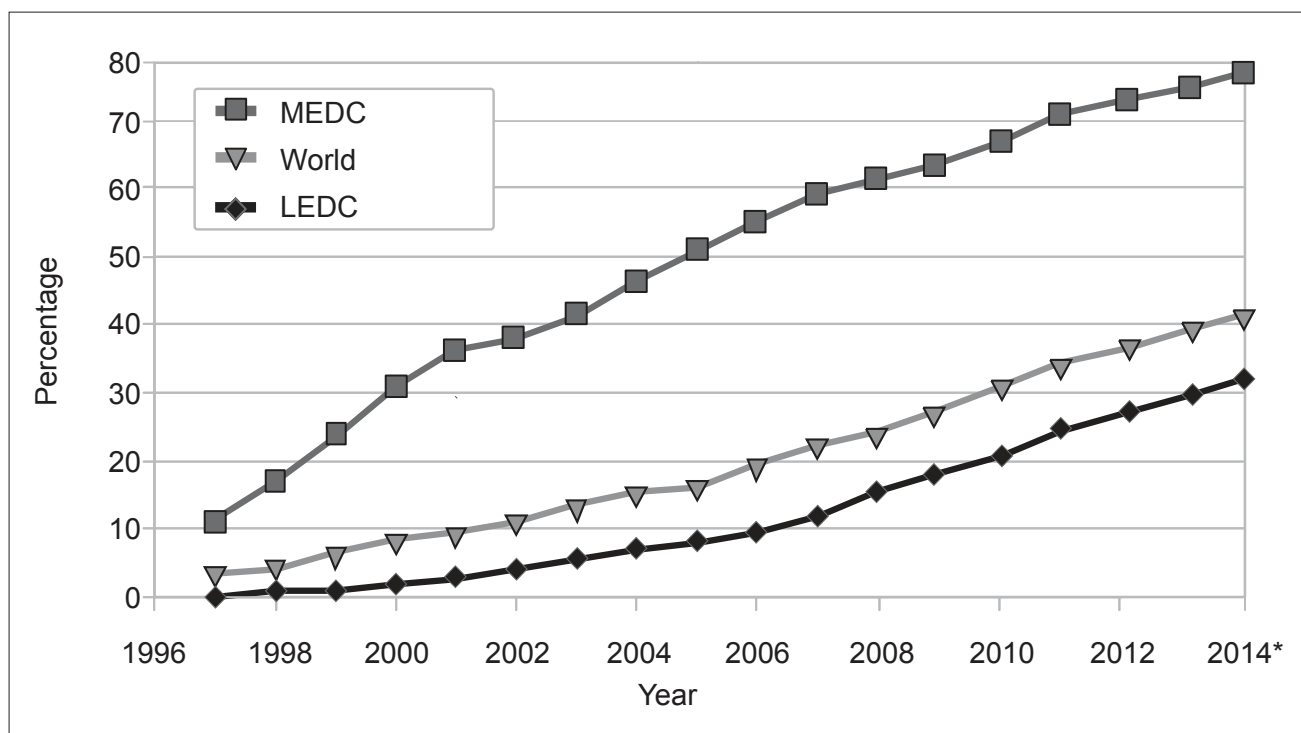
[8]

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3. Our interconnected world

Access to the internet and World Wide Web (WWW) has now become essential for many people. **Figure 1** shows the percentage of internet users in more economically developed countries (MEDCs) and in less economically developed countries (LEDCs).

Figure 1: Percentage of internet users in MEDCs and LEDCs (*estimated)



[Source: https://en.wikipedia.org/wiki/File:Internet_users_per_100_inhabitants_ITU.svg, by Jeff Ogden.]

Figure 2 shows the affordability of a broadband connection by giving the cost of a broadband subscription as a percentage of average annual income. Broadband affordability is necessary for users to be able to utilize the possibilities the World Wide Web offers.

People can connect to the internet in different ways, such as those listed below:

- At home or work through a router provided by an internet service provider (ISP), either by physically using an ethernet connection or by connecting with Wi-Fi.
- By using a “hotspot”.

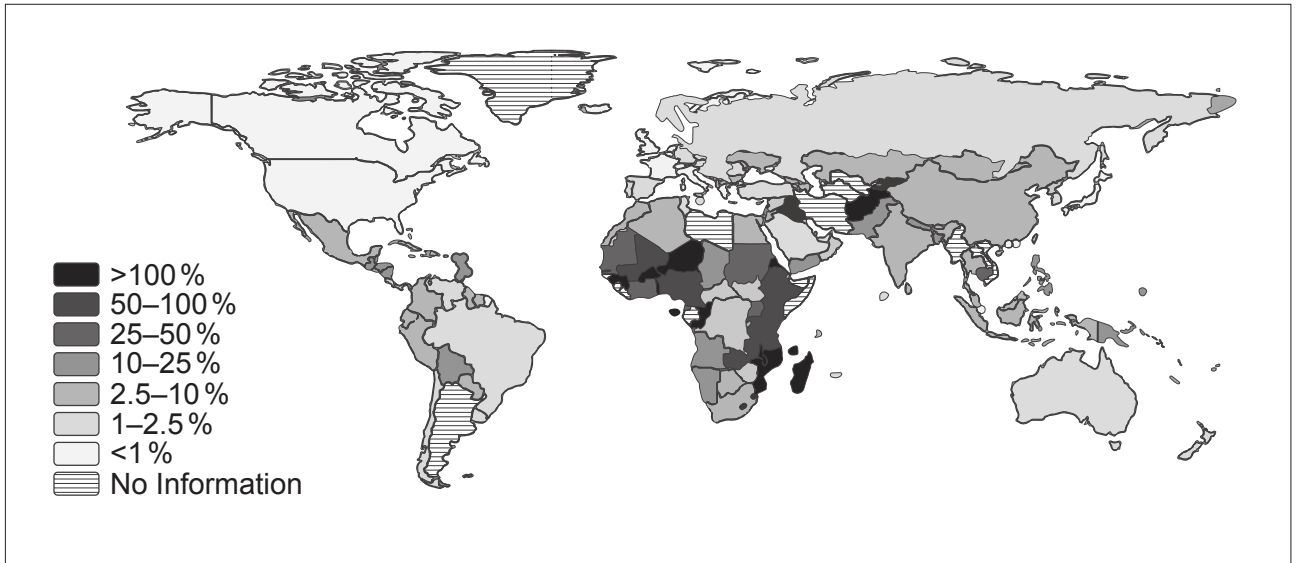
Hotspots are wireless access points that provide internet access to mobile devices, but can be used by desktop computers if they are close enough to the hotspot. They are typically available in public locations. Free hotspots can be found in cafes, shops and hotels, as well as on the street in many cities.

This growth in the number of hotspots offers a great advantage to all citizens who need an internet connection, but also brings great risks.

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(Question 3 continued)

Figure 2: Broadband affordability



[Source: www.geography.oii.ox.ac.uk]

- (a) (i) Outline the difference between the internet and the World Wide Web. [2]
- (ii) Identify **two** characteristics of a router. [2]
- (iii) Identify **two** pieces of information that the following URL provides about the site it connects to: <https://www.khanacademy.org/math> [2]
- (b) A group of university students has rented a house near a free hotspot that can be used from inside the house. Some of the students want to sign a contract with a local ISP so that they can have their own Wi-Fi in the house, while others want to continue using the free hotspot.

Analyse the advantages and disadvantages of home internet connections and hotspots. [6]
- (c) Tim Berners-Lee, creator of the World Wide Web, believes that the ability to access and use the World Wide Web is necessary for the benefit of everyone in our global society.

To what extent do you agree with this statement? [8]

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Section B

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

4. A computer has graded my essay!

The IB teachers at Colegio del Lago Amplio (CLA) are facing a difficult problem. Teachers in most departments have five classes, with 25 to 30 students in each class. They expect their students to do a significant amount of writing, including practice essays and exam questions. However the teachers do not have time to mark and write comments on this practice work.

The teachers have asked the school to purchase essay evaluating software. In addition to fuzzy logic, the software uses both a machine learning algorithm and a natural language processing algorithm. It is trained by marking sample essays that have already been marked by teachers. The software can mark essays written in English or Spanish.

Essay evaluating software can also provide feedback to students on each draft of their essay so they can improve their work. The teachers can ask the students to use the software to evaluate drafts of their essays so that the students can revise them before handing in their final copy. The software gives feedback based on the guidelines the teachers have provided. It can comment on spelling, grammar, word choice, writing style and vocabulary used.

- (a) (i) Identify **two** characteristics of machine learning. [2]
- (ii) Define “natural language”. [2]
- (iii) Define “algorithm”. [2]
- (b) (i) Machine learning software often relies on neural networks. Explain why neural networks are particularly useful for machine learning. [4]
- (ii) Distinguish between fuzzy logic and inference rules. [2]
- (c) The teachers at Colegio del Lago Amplio (CLA) are considering whether to use the essay evaluating software to give students feedback on each draft of their essays, as well as grading them.
- Discuss the advantages and disadvantages of using essay evaluating software to give students feedback on how to improve their essays. [8]

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5. Better Than Ever Health Clinics (BTEHC)

Better Than Ever Health Clinics (BTEHC) has expanded from one clinic to three clinics in different locations within Singapore. As part of the expansion, the managers have purchased a new information system that will be tested and installed by Larsson Systems. All three clinics will have access to the new information system through the internet.

The information system includes information about patients and staff, an accounting system, an appointment booking system and a system for ordering supplies. The people who will need access to various parts of the system include therapists, office staff and maintenance staff.

Harpreet Singh has been hired as information systems manager (IS manager) for all three clinics. Before the new system is installed, Mr Singh has to determine who can access what information and how that access should be controlled. He will inform Larsson Systems about these access arrangements, and work with Larsson Systems to ensure information flows securely across the network.

- (a) (i) Mr Singh, as IS manager, is responsible for incident management.
- Identify **two** steps that could be taken to manage an incident in this system. [2]
- (ii) Mr Singh's major responsibility will be the maintenance of the information system.
- State **two** elements of the maintenance phase of the system development life cycle (SDLC). [2]
- (iii) Describe **one** business task that can be performed using one specific type of business software. [2]
- (b) The software developer has provided Mr Singh with information from the modelling systems they used during development. This included an entity relationship diagram (ERD) and a data flow diagram.
- (i) Distinguish between an ERD and a data flow diagram. [2]
- (ii) Mr Singh will be in charge when it is time to phase out the current information system. Explain **two** reasons why this information system will need to be phased out. [4]
- (c) The BTEHC staff need quick and easy access to the customers' data, but the clinic's customers want their data to be secure and private.
- To what extent is it possible to create specific policies that can address the potential conflict between the security and privacy of customer data, and the ease with which the clinic's staff can access this data? [8]

6. Upgrading Weston Bank’s information system

Weston Bank requires a new information system. The team developing the new system has fallen behind schedule, so the bank has requested the appointment of a new project manager. Isabel De Souza has been given the job.

Isabel has two major problems to address. First, she needs to agree a schedule with the developers that meets the agreed completion date and is within budget. Second, the bank wants to keep a legacy system running alongside the new information system.

- (a) (i) Identify **two** items that would be included in a feasibility study. [2]
- (ii) Identify **two** kinds of failure that could arise if employees of Weston Bank are not adequately trained to use the new information system. [2]
- (iii) Identify **two** actions that must be taken when the old system is phased out. [2]
- (b) Analyse the decision by the managers of Weston Bank to keep a legacy system running alongside the new information system. [6]
- (c) Isabel De Souza believes that the individual skills and personalities of the team members and how they communicate with stakeholders are far more important than the project development/management method used (such as waterfall, agile, PRINCE2).

Her plan is to analyse the team members’ skills and personalities. She will use this analysis to make changes to the team to make it as effective as possible.

Discuss the impact of her plan to focus on the skills and personalities of the team members, rather than on a specific project development/management method. [8]

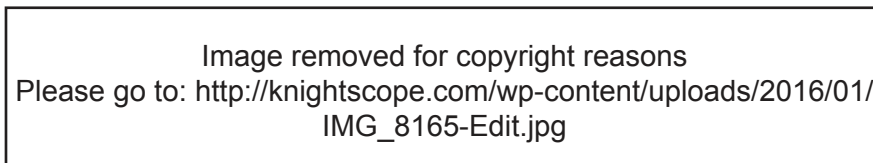
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7. Robotic watchmen

Security is a serious concern for businesses, schools and public buildings. It is debatable whether human security guards are always the best option. For example, in March 2014 a teenager crawled through a hole at the World Trade Center site in New York, USA (“Ground Zero”), slipped past a sleeping security guard, and took the elevator (lift) to the top of a new building that was being constructed on the site.

A company, Secure Mall Inc in the United States, has a solution to poor security: robotic watchmen. The watchman is a mobile robot equipped with features such as voice recognition, face recognition and multiple sensors. It can collect and store data such as video and licence plate numbers. The robots are also able to communicate wirelessly with human security staff. The robots can emit a very loud alarm if unable to move for more than a few minutes. If someone needs assistance, they can press a button on the top of the robot’s head to call for help.

Figure 3: A robotic watchman



- (a) (i) Identify **two** input devices the robotic watchman would need to be able to identify security problems. [2]
- (ii) Define “voice recognition”. [2]
- (iii) Define “robot”. [2]

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(Question 7 continued)

- (b) (i) Robots are likely to have difficulty deciding what changes or activities in a particular environment are normal and what might be a security threat.

Explain **one** reason why this is the case. [2]

- (ii) Secure Mall Inc is considering using androids rather than robotic watchmen to patrol a shopping mall. However, at the current time they are unable to function well enough to carry out this task.

Explain **two** challenges that need to be overcome in order to create an android that can do this job effectively. [4]

- (c) A shopping mall manager has to decide how to organize security for the mall at night. They can use either:
- human security guards and dogs in the mall
 - robotic watchmen who will communicate wirelessly with a small team of security staff.

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