Diploma Programme
Programme du diplôme
Programa del Diploma

Information technology in a global society
Standard level
Paper 1

Tuesday 19 May 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]**.

9 pages

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

1.   **BodyGuardian**

The BodyGuardian is a lightweight, wearable and wireless body sensor. This technology allows patients to remain active and independent while their health is being monitored with a simple sensor that is in contact with their skin.

Figure 1: The BodyGuardian device

The BodyGuardian system consists of the BodyGuardian device and a smartphone with the BodyGuardian app* installed. The smartphone connects to the cloud-based service mHealth using a 3G cell/mobile phone network.

Doctors are able to access their patient's data via mHealth using a mobile device. They can also set different limits for each patient, allowing for personalized alerts.

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*   app: application software, typically a small, specialized program downloaded onto
     mobile devices; apps can also run on the internet, on a computer, on a cell/mobile
     phone or other electronic device.

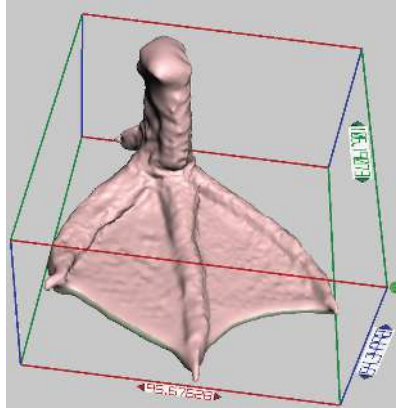**(This question continues on the following page)**

(Question 1 continued)

(a) (i)   Identify **two** health indicators that could be measured by the BodyGuardian   [2]
          device.

     (ii) Identify **four** steps taken by the software to decide if a health indicator
           measurement needs to be sent to a doctor for a decision.   [4]

(b) The managers of mHealth are investigating the nature of passwords used by doctors to
     access patient information. The two options being investigated are:
     • the doctor creates a password that does not need to be changed
     • the mHealth system requires doctors to create a strong password that must be
       changed every 40 days.

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

(c) As part of the development of the BodyGuardian device, it is being tested in clinical
     trials by doctors and patients.

     Discuss the implications for doctors and patients of trialling the BodyGuardian device
     before it is sold publicly.   [8]

2.   3D printing

Buttercup is a duck who hatched with a deformed left foot that had to be amputated. His owner took pictures of another duck's foot from different angles and was able to use 3D printer technology to produce a new plastic foot for him.

Figure 2: Computer-generated image of a duck's foot

[Source: Courtesy of the Feathered Angels Waterfowl Sanctuary]

Figure 3: Charlie's new plastic foot

[Source: Courtesy of the Feathered Angels Waterfowl Sanctuary]

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(Question 2 continued)

Figure 4: A 3D printer

Removed for copyright reasons
Please go to: http://en.wikipedia.org/wiki/3D_printing#/media/File:MakerBot_Replicator_2.jpg

A 3D printer, like the one shown in **Figure 4** creates an object by adding plastic layer by layer until it is complete.

Inspired by Buttercup's story, Alejandro Toys has created a company that uses a computer with a 3D printer and software to produce plastic toys for children.

Alejandro Toys has found out that some software will allow them to input 2D images into the 3D printer software so that they can be converted into a 3D object. They are considering either to use open source software or to purchase proprietary software.

(a) (i) Identify **two** ways that a 2D image file can be input into the 3D printer software. [2]

(ii) Identify **four** of the steps required to produce Buttercup's replacement foot. [4]

(b) Analyse Alejandro Toys's decision to either use open source software or to purchase proprietary software to produce the company's 3D toys. [6]

(c) It is now possible to use a 3D printer to print a large range of products in addition to toys. These include guns, bicycles and human prosthetic limbs. However some governments are concerned about the software for 3D printers being freely available on the internet.

To what extent should governments regulate the access to software for 3D printers? [8]

Turn over

3. **Small town book shop moves to computer-based records**

El Hoyo is a small village in the south of Argentina. The local book shop has recently received a number of academic books from a large university in Buenos Aires. The university also sent a computer which has all of the books listed in a spreadsheet.

The table in **Figure 5** shows a small part of the list of books. The complete table has 400 different entries (last entry is in row 401).

Daniela, the shop manager, has been waiting for a computer for a long time. She knows that, with this computer, her staff will provide a faster service when they are searching for specific books.

Figure 5: Part of the spreadsheet of books

	A	B	C	D	E	F	G
1	Book title	Number of books	Author	ISBN	Cost in pesos ($)	Subject area	Subtotal pesos ($)
2	Flatland: A Romance of Many Dimensions	4	Abbott	978-0486272634	$200	Mathematics	$800
3	Exploring Anatomy and Physiology	2	Amerman	978-1617310560	$148	Natural sciences	$296
4	Wellness	8	Anspaugh	0-078022509	$202	Physical education	$1616
5	Research Strategies: Finding Your Way	3	Badke	978-1491722336	$169	English	$507
6	Parent–Child Relations	8	Bigner	978-0135002193	$213	Psychology	$1704
7	Ordinary Men: Reserve Police Battalion	4	Browning	978-0060995065	$187	History	$748
8	The Earth and its Peoples, Vol II	3	Bulliet	978-0495902881	$188	History	$564
9	Lab Book CH251	8	CER	978-0495642152	$150	Natural sciences	$1200
10	The Story and its Writer	1	Charters	0-312596243	$184	English	$184
11	Environmental Science: A Global Concern	12	Cunning	978-0073383255	$152	Natural sciences	$1824
12	Feasting, Fasting	2	Desai	978-0618065820	$177	English	$354
13	Reconstructing Gender	1	Disch	978-0073380063	$182	English	$182

[Source: © International Baccalaureate Organization 2015]

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(Question 3 continued)

(a) (i) Daniela needs to see the books in alphabetical order, with the "Subject area" sorted from A to Z and then the "Number of books" sorted from largest to smallest.

State the author that would appear in the first row of the sorted spreadsheet using only the books shown in **Figure 5**. [1]

(ii) State the formula that would be required to add up the cost of all the books in the book store. [1]

(iii) Daniela now thinks that she should have installed a database for the information about the books. Outline **two** advantages that a database would have over a spreadsheet for the El Hoyo book shop. [4]

(b) Explain **three** impacts that the new computer system may have for the staff at the book shop. [6]

(c) El Hoyo receives a large number of tourists during the summer when the fruit festival takes place, but suffers from periods of poor internet connectivity. Daniela has now created a separate area in the book shop that has several computers with free broadband internet access so that tourists can use them to check their emails and find information about the local area.

Evaluate the impacts of this initiative for Daniela as shop manager. [8]

Turn over

4. **Digital citizenship**

After several problematic situations with the use of technology by students and staff, a school decided to adopt "We are Digital Citizens" as its mission statement for the year. This goes beyond limiting access to some resources such as social networking sites and video streaming sites, and instead focuses on using technology inside and outside of school in a responsible way.

The network administrator has also been told to allow the downloading or streaming of videos from the internet. However he has explained to the principal that allowing this would cause issues related to bandwidth, storage and appropriateness of content for high school students.

A working party has been set up, consisting of the network administrator, teachers from different departments and some students. This working party will meet to plan a programme of activities for the next year that will be used to help teachers and students understand what digital citizenship is, and how to promote the responsible use of technology by everybody in the school.

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

(ii) Define the term "bandwidth". [2]

(iii) The science teacher wants to show to the class a video about polar bears and how they survive living near the north pole.

The size of this video is 3.2 gigabytes (GB) and it is available for download. The teacher will download it in advance to be able to show it to the class without the need for an internet connection.

The school has a bandwidth of 50 megabits per second (Mbps). Calculate how long it will take the teacher to download the video.

Use 1 GB = 1000 megabyte (MB). [2]

(b) At the request of the principal, the network administrator has allowed teachers to download videos. Students are still not allowed to download videos at any time using the school internet.

Analyse the impact this will have on the teachers and the students. [6]

(c) One area that the working party will focus on is the responsible use of the available bandwidth. Some teachers have found that the internet is too slow to allow a class to investigate a topic when students in different classes are using social networking sites.

To what extent can the implementation of the digital citizenship policies ensure the responsible use of technology in the school with respect to sharing the available bandwidth? [8]

5.   Professional photography for family events

Mrs Claudia Vega would like to become a professional photographer. She would like to focus her work on taking photographs at family events and is looking for a good camera to buy.

She would like to offer three different products:
- the printing of a selection of the photographs
- a three-minute video posted online
- a two-hour video, on a DVD, consisting of a sequence of photographs and videos covering the special moments throughout the event.

She knows she has to have images of a high resolution to be able to offer customers good quality photographs as well as photograph enlargements.

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

        (ii)   Identify **two** problems that will occur if Claudia uses photographs with a low resolution.   [2]

        (iii)   Claudia stores photographs and videos on the hard disk of her computer. Identify **two** additional locations where these files could be stored.   [2]

(b)   Claudia holds large amounts of personal information, photographs and videos from her customers. Explain **three** actions Claudia could take to protect the security of the information that she holds.   [6]

(c)   Claudia needs to allow potential customers to see her work. She would like to be able to show these potential customers her best pictures and a list of former clients that they may contact. Some friends have suggested that she should create a website and other friends have suggested that she should open an account on a social networking site to post her work.

        Discuss these **two** alternatives as a way of showing her work to potential clients.   [8]