Diploma Programme
Programme du diplôme
Programa del Diploma

Information technology in a global society
Higher level
Paper 1

Tuesday 6 November 2018 (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.
- Each question is worth **[20 marks]**.
- The maximum mark for this examination paper is **[60 marks]**.

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Section A

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

1.   *Google* **healthcare data**

Google is developing an app* to help hospital staff monitor patients with kidney disease. In order to develop this app, *Google* has signed an agreement with the UK's National Health Service (NHS) that will give *Google* access to data on 1.6 million patients held in the NHS database.

The database includes health-related data as well as personal data, some of which is sensitive.

Google plans to use data mining techniques to analyse the data and provide information that can be used to improve the app. Once the app has been developed, it will be provided to the NHS.

[Source: © 2016 New Scientist Ltd.
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(a)   (i)   Identify **two** items of health-related data that could be used to improve the treatment of patients.   [2]

(ii)   Identify **two** characteristics of *data mining*.   [2]

(iii) Identify **two** reasons why NHS records are stored in a database rather than a spreadsheet.   [2]

(b)   The agreement between *Google* and the NHS includes policies for the **collection**, **storage** and **sharing** of patient data.

Explain why it is important that the agreement between *Google* and the NHS includes policies for the **collection**, **storage** and **sharing** of patient data.   [6]

(c)   Evaluate the decision by the NHS to share patient data with *Google*.   [8]

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

Turn over

2. **Cell phone farmers**

Many farmers in Cameroon are not able to use the internet due to the very limited communication infrastructure in their country. In addition, accessing the internet is expensive for most farmers.

As many farmers have cell/mobile phones, they could make better use of technologies such as text messaging (texting or SMS*) to access information that would assist them in their farming.

Recent research has suggested that a lack of internet access is not the main factor limiting the development of farming in Cameroon. The main factor is farmers' lack of IT knowledge.

Some farmers in Cameroon are trialling a system called Agritexte that uses SMS to provide information on the market prices of produce such as cassava leaves and cocoa, see **Figure 1**.

[Source: © International Baccalaureate Organization 2018]

Figure 1: An example of a text message

[Source: © International Baccalaureate Organization 2018]

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*   SMS: Short Message Service

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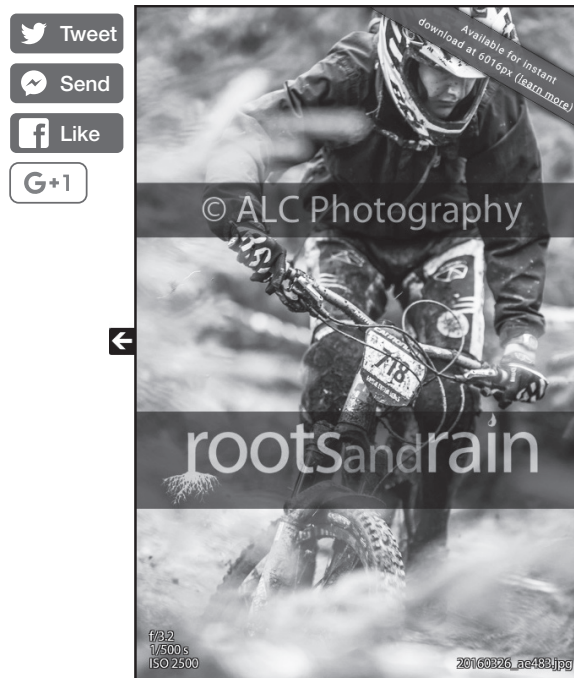
(Question 2 continued)

(a) (i) Identify **two** advantages of using text messaging to communicate. [2]

(ii) Identify **two** items that contribute to the cost of accessing the internet. [2]

(iii) Outline the difference between the internet and the World Wide Web. [2]

(b) Analyse the effectiveness of using face-to-face (F2F) training compared to distance learning to train farmers to use Agritexte. [6]

(c) The government of Cameroon is watching the results of the Agritexte initiative. It is considering two options:
   • Extend the functionality of Agritexte into a web-based information system.
   • Invest in education and training on the use of the existing Agritexte SMS system.

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

Turn over

3. **Sports photographs**

Action Link Click Photography (*ALC Photography*) is a company that specializes in taking photographs of participants in large sporting events, such as cycling and running events. *ALC* recently photographed the participants in a cycle event, see **Figure 2**.

Figure 2: An example of a low-resolution image from the *ALC* website

[Source: Image provided with permission from ALC Photography]

ALC's photographers were positioned at five different points on the course, including the start and finish lines. Each photographer was equipped with a digital camera that takes high-resolution images. The photographer's job is to photograph as many participants as possible.

After the event, the photographs are compressed using lossless compression and transferred from the cameras' memory cards to the *ALC* database. The photographs have tags added by the software, which recognizes the race participant by the number pinned to their bike.

The images for each participant have their resolution reduced and are watermarked before they are added to *ALC*'s website. The participants are then able to purchase high-resolution copies of the photographs that do not have watermarks.

It is also possible for anybody who views the image to purchase and download a high-resolution copy.

[Source: © International Baccalaureate Organization 2018]

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(Question 3 continued)

(a)   (i)   Identify **two** image file formats that *ALC* could use for its photographs. [2]

      (ii)   Define the term *resolution*. [2]

      (iii)   Outline the differences between lossless and lossy compression. [2]

(b)   Explain why each image has its resolution reduced and is watermarked before it is uploaded to the *ALC*'s website. [6]

(c)   Some people feel uncomfortable about having their photographs taken and posted on a public website.

      To what extent is it acceptable for *ALC Photography* to take photographs of participants, post them online and sell them? [8]
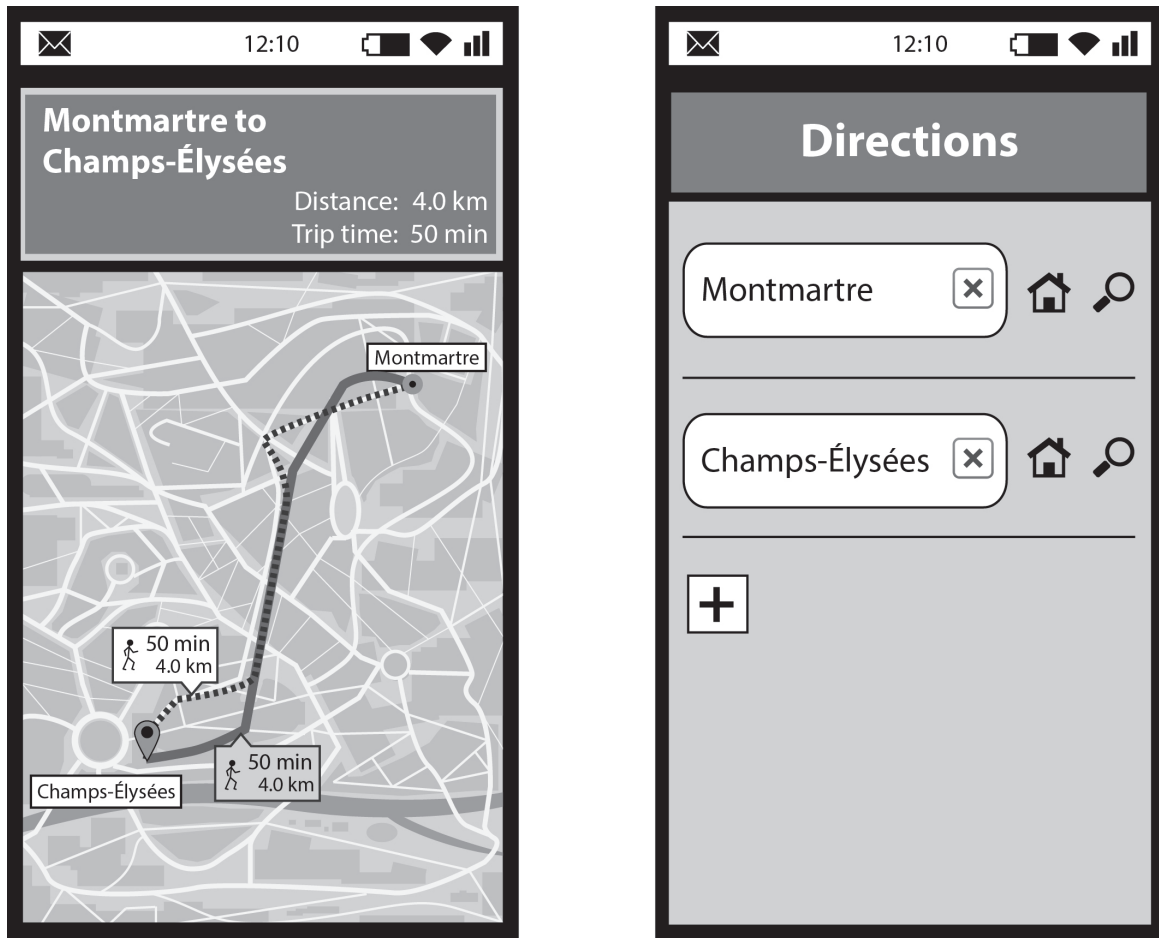
Turn over

Section B

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

4.   **Route finding in Paris**

The Paris Transport Council has decided to develop the *Système de Voyage dans Paris* (SVP), an integrated journey planning system that will enable its users to find routes to their destination using different types of transport, see **Figure 3**.

Figure 3: An example of a route suggested by SVP

After some research, it was revealed that many factors influence people's journey decisions. For example, travel time would be a key factor for someone going to work, as they would want the fastest route. However travel time would be a less significant factor for a tourist who may prefer a more scenic route. As a consequence, SVP project managers have put principles of fuzzy logic at the core of their system.

Initially Joelle de Stark, the project manager decided to use an agile development methodology for SVP. However, as she got closer to the release of SVP, she also included the phases of alpha and beta testing as part of user acceptance testing (UAT).

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(Question 4 continued)

(a) (i)   In addition to travel time, identify **four** other factors that could be used in the development of the SVP. [4]

(ii) Identify **two** development personnel that would be included in Joelle de Stark's team. [2]

(b) (i)   Distinguish between alpha testing and beta testing. [2]

(ii) Explain why the project manager decided to use an agile development methodology for the SVP. [4]

(c) Discuss the project manager's decision to use fuzzy logic in the development of the SVP. [8]

5.   Meet Dennis, the restaurant robot

Figure 4: Dennis, the restaurant robot

Figure 5: The user interface on Dennis

SingBot Robotics has developed a humanoid robot called Dennis. A large restaurant chain, *Gustavo's*, has recently purchased a number of Dennis robots to use as waiters for one of its restaurants in Singapore.

Customers can give Dennis their orders in two ways:
• They can talk directly to him, in which case Dennis uses pattern recognition to distinguish menu items ordered, see **Figure 4**.
• They can enter their choice directly on a touch screen, see **Figure 5**.

When the order is ready, Dennis collects it from the kitchen and brings it to the table. Customers can pay by swiping their credit card above Dennis's card reader.

The marketing manager at *Gustavo's* says that the robots improve the convenience and efficiency of the ordering process. She adds that "in their feedback, customers tell us that Dennis makes their experience more memorable".

The managers at *Gustavo's* are considering the introduction of Dennis robot waiters in all their restaurants. They need to decide between using a Gantt chart or a Pert chart as project management tools.

[Source: Images provided with permission from Mastercard]

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(Question 5 continued)

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

(ii) Identify **two** methods that the marketing manager at *Gustavo's* could use
to collect feedback from customers about Dennis.   [2]

(iii) Identify **two** sensors that Dennis needs in order to operate successfully in the
restaurant.   [2]

(b) (i)   Customers speak to Dennis to give him their orders. Dennis uses pattern
recognition to understand what has been said to him.

Explain why Dennis uses pattern recognition rather than pattern matching to
understand what customers are saying to him.   [3]

(ii) Explain why the managers at *Gustavo's* would choose a Gantt chart as a
project management tool for the introduction of Dennis robot waiters in all their
restaurants.   [3]

(c) Discuss whether the managers at *Gustavo's* should introduce Dennis robot waiters in
all their restaurants.   [8]

Turn over

6. **Use of expert systems in university admissions departments**

Many universities have more applicants than places available. Eli McClure is the admissions officer for engineering at Curitiba University. It is his job to decide which students should be offered places on the engineering program. Many programs receive as many as 15 applications for every place and it is not possible to interview each student. Many of these applications are from students who are not suitable for the engineering program, as some do not have a mathematics qualification while others are predicted to achieve a low grade.

At the moment, Eli's staff look through each application and decide which applicants will be offered an interview. Eli is concerned that some suitable applicants may be incorrectly rejected because staff cannot read all of the applications as carefully as they would like. He wants to improve the application process, and is considering the introduction of an online questionnaire linked to a forward chaining expert system. Prospective students can take the questionnaire and answer a number of yes/no questions to find out whether they are likely to be offered a place at Curitiba University before they apply. This should then reduce the number of applications Eli's team has to process and lead to the most appropriate applicants being selected for an interview.

Eli is going to use a prototype of the expert system. It is anticipated that in the next five years this expert system will be used by all departments at Curitiba University.

[Source: © International Baccalaureate Organization 2018]

(a) (i) Identify **two** reasons why a prototype of the expert system was developed prior to its release. [2]

(ii) Identify **two** constraints that the developers of the expert system might face. [2]

(iii) Outline the difference between forward chaining and backward chaining. [2]
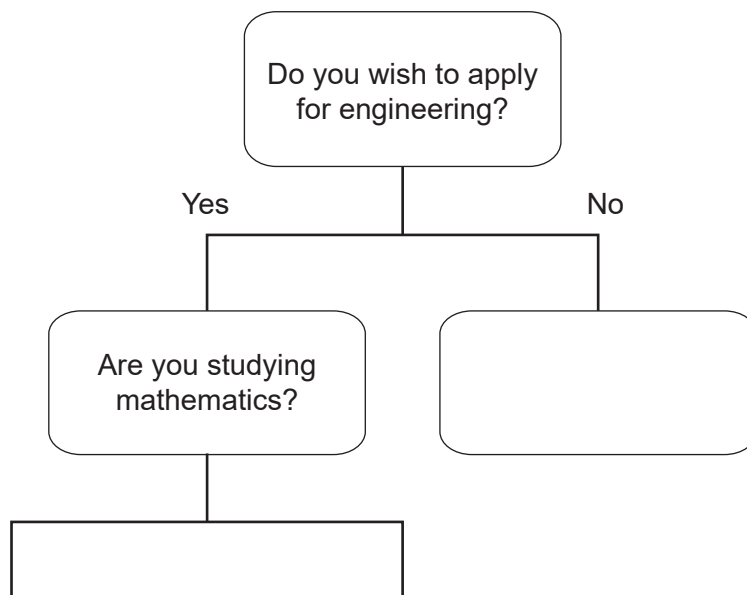
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(Question 6 continued)

(b) (i) Explain why Curitiba University would use a phased changeover method for the introduction of the expert system. [3]

(ii) The diagram below shows the beginning of a decision tree that is part of an expert system to advise prospective students on their suitability for studying engineering at Curitiba University.

Read the rules below, then copy and complete the decision tree. [3]

- Applicants will be suitable to progress to the interview if they are taking mathematics AND are predicted to achieve a grade 4 or above.

- If an applicant meets both these requirements, they will receive the following message: "You should continue with your application".

- If an applicant does not meet both these requirements, they will receive the following message: "Unfortunately you do not meet the requirements".

(c) As part of the admission process, some universities are considering the introduction of an online questionnaire and video submission, where the prospective student explains why they are applying for the program. It is hoped that the online questionnaire and video in combination with the face-to-face interview will give the admissions department the information required to decide whether or not to accept a student.

To what extent will the introduction of an online questionnaire and video submission assist the admissions department when deciding whether to accept a student? [8]