Diploma Programme
Programme du diplôme
Programa del Diploma

Digital society
Higher level
Paper 1

10 May 2024

Zone A afternoon | **Zone B** afternoon | **Zone C** 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.
- The maximum mark for this examination paper is **[52 marks]**.

2224 – 5504

Section A

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

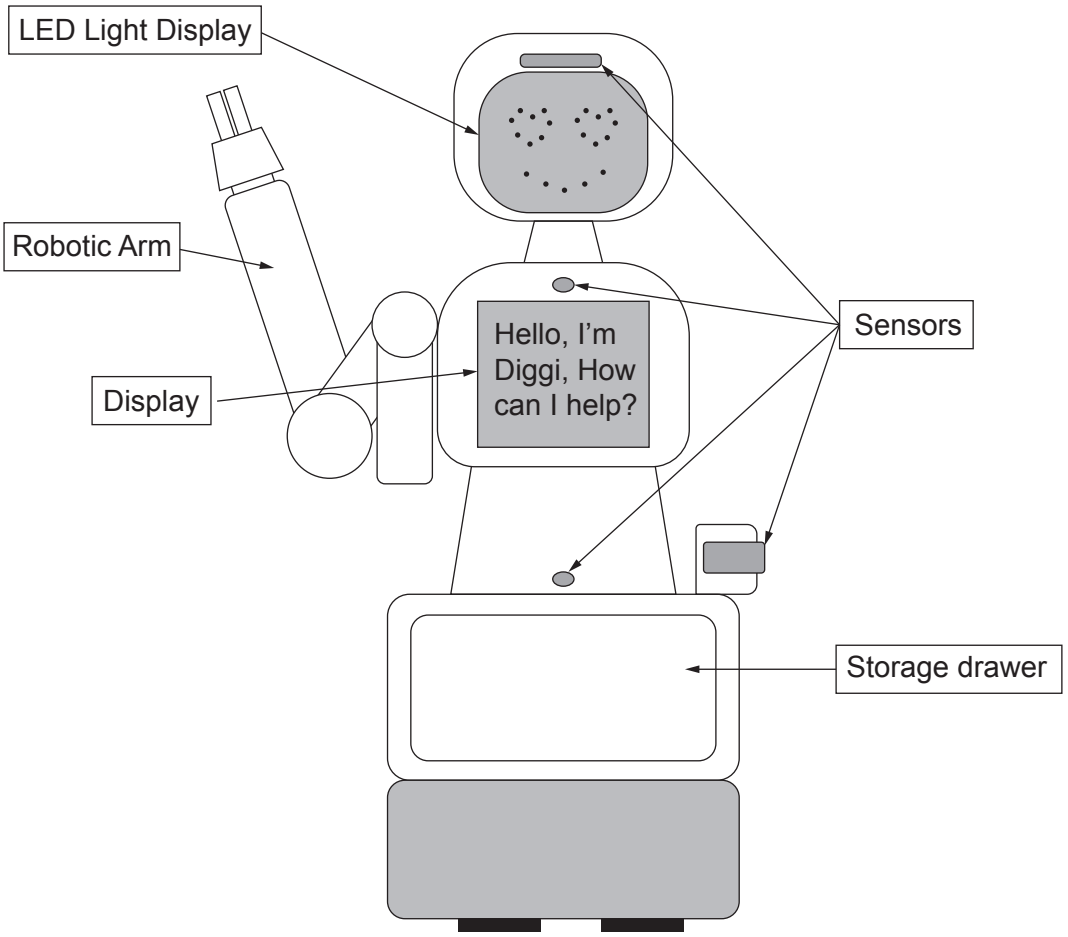
1. Diggi the health service robot

Some hospitals have started using a service robot called Diggi to assist the nurses and other staff with delivering tools and supplies to the places they are needed in hospitals.

Before Diggi can fully become part of the care team it must learn to navigate the hospital and respond to the nurses' needs. Using artificial intelligence (AI), Diggi maps out a hospital through sensors and other machine-learning technology so that it can ultimately navigate and work autonomously. Diggi can also learn to use its robotic arm to open doors and operate elevator panels (see **Figure 1**).

The more Diggi is used, the more Diggi learns and adapts to the specific hospital environment. Diggi was designed by Cave Robotics following an extensive consultation exercise with potential users.

Figure 1: Diggi the health service robot



(This question continues on the following page)

(Question 1 continued)

(a) (i) Identify **two** output devices that might be included on a service robot. [2]

(ii) Identify **two** types of sensors on a service robot which could be used to navigate through a hospital's corridors. [2]

(iii) Identify **two** ways in which the developers of Diggi might make the robot seem more human. [2]

(b) Diggi's design was based on data gathered by primary and secondary research.

Explain **three** methods of primary data collection that would provide information that could enable Diggi to complete its tasks. [6]

(c) Evaluate the opportunities **and** dilemmas associated with the use of service robots, such as Diggi, in the healthcare sector. [8]

2. "Art is dead"

Jazz musician, Janine de Klerk, is releasing some new work and needs an album cover. Instead of hiring a professional artist to create the album cover, she uses PIX-ia, an online artificial intelligence (AI) art generation program, to create the image.

Janine inputs keywords that are processed by PIX-ia's algorithms to create a unique image. For example, the keywords "jazz club, smoke, piano" may create an image like the one shown in **Figure 2**.

Figure 2: An example of an image created by PIX-ia

PIX-ia uses unsupervised learning based on an art dataset of over 100 000 copyright-free images. It has been developed by the open-source software development community.

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

(ii) Identify **two** types of artificial intelligence (AI). [2]

(iii) Identify **two** image formats that may be used by PIX-ia. [2]

(b) (i) Explain **one** advantage of using the open-source software development community to develop PIX-ia. [2]

(ii) Suggest **two** ways in which PIX-ia could obtain copyright-free images. [4]

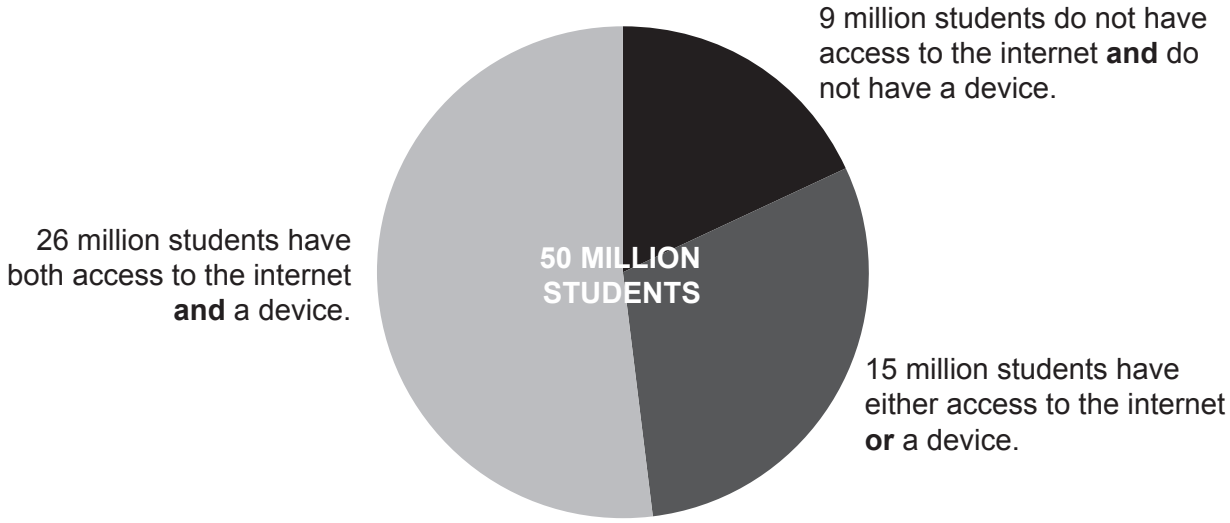
(c) Discuss the opportunities **and** dilemmas of using artificial intelligence (AI) to create new artworks. [8]

3. Connecting the unconnected

In many countries, there are significant differences between communities in their access to the internet. This has become a problem for students who rely on the internet to do their homework. This digital divide has been named “the homework gap”.

Figure 3 shows the scale of the homework gap in a more economically developed country.

Figure 3: The homework gap in a more economically developed country



To improve their access to the internet and reduce the homework gap, some communities are creating their own communications networks. These networks include infrastructure to connect people to the internet in community areas (such as bus stops, libraries and community centres), in businesses, and in their homes.

(a) (i) Identify **two** items of hardware that are needed for a student to connect to the internet at home. [2]

(ii) Identify **two** services provided by an internet service provider (ISP) **other than** access to the World Wide Web. [2]

(iii) Identify **two** ways in which students could use the internet to collaborate online. [2]

(b) (i) Distinguish between the internet and the World Wide Web. [2]

(ii) Suggest **two** reasons why some communities have limited access to the internet. [4]

(c) Discuss whether it is acceptable for schools to require students to access the internet when completing their homework outside of school. [8]

Section B

Answer **one** question from this section. Each question is worth [12 marks].

4. Responsibly managing e-waste

A global challenge is the environmental impact caused by the disposal of computer hardware and mobile devices. In 2019, the quantity of electronic waste (e-waste) was 53.6 million metric tons, and it is expected to rise to 74.7 million tonnes by 2030.

One intervention to address this is a service where computer hardware and mobile devices are taken to a central location and either donated to local schools or shipped to another country to be recycled.

It is claimed that this service will reduce the amount and impact of e-waste.

To what extent do you agree with this claim? [12]

5. Utilizing artificial intelligence in employment application screening

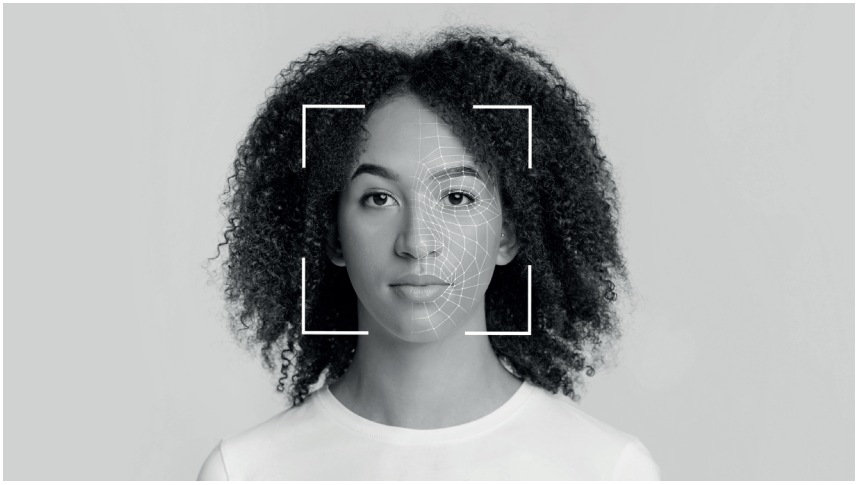
The digitalization of the job application process has led to employers receiving large numbers of applications for each job. Recent estimates suggest that each job receives approximately 250 applications. A global challenge is the amount of time it takes employers to determine which applicants are suitable for the job.

One intervention is the use of artificial intelligence (AI) to help employers rank job applicants. The AI is based on an algorithm that calculates candidates' suitability for the jobs being advertised on the employer's website.

Applicants are asked to upload documents and a video to the employer's website. The algorithmic ranking is calculated by analysing the documents provided by applicants and their speech and facial expressions in the video.

The AI analyses 350 elements of speech, such as the applicant's tone of voice, sentence length, and the speed they talk. It also analyses thousands of facial expressions, such as brow furrowing, brow raising, the amount eyes widen or close, lip tightening, chin raising and smiling (see **Figure 4**).

Figure 4: Facial keypoints used by the AI software



It is claimed that the use of AI will accurately rank job applicants.

To what extent do you agree with this claim? [12]

Disclaimer:

Content used in IB assessments is taken from authentic, third-party sources. The views expressed within them belong to their individual authors and/or publishers and do not necessarily reflect the views of the IB.

References:

Figure 3 Common Sense Media, 2020. *Closing The K-12 Digital Divide In The Age Of Distance Learning.* [pdf online]. Available at: www.commonsensemedia.org/sites/default/files/research/report/common_sense_media_report_infographicfinal.pdf [Accessed 24 April 2023]. Source adapted.

Figure 4 Prostock-Studio, n.d. *Biometric facial recognition of calm young American female, isolate on gray background – stock photo*. [image online] Available at: www.gettyimages.co.uk/detail/photo/biometric-facial-recognition-of-calm-young-african-royalty-free-image/1352856539 [Accessed 24 April 2023]. Source adapted.