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**Information technology in a global society**  
**Standard level**  
**Paper 1**

Friday 6 November 2020 (afternoon)

1 hour 30 minutes

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**Instructions to candidates**

- Do not open this examination paper until instructed to do so.
- Answer two questions. Each question is worth **[20 marks]**.
- The maximum mark for this examination paper is **[40 marks]**.

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

**1. E-voting**

A number of countries, such as India, have introduced e-voting systems. Citizens can vote by going to a specified location, such as a school, or they can vote from home using a computer. Each voter is provided with a unique identifier, such as IND55454, that they must enter into the system when they vote.

These e-voting systems usually consist of a user interface, such as the one in **Figure 1**, linked to a relational database (see **Figure 2**).

**Figure 1: An e-voting interface**

**State of Dhruva**  
Electronic voting machine  
State elections, April 2015

Voter ID: IND55454

	Candidate name	Button
<b>1</b>	Sandeep Pandey	<input type="checkbox"/>
<b>2</b>	Pratyush Sinha	<input type="checkbox"/>
<b>3</b>	Anshul Bhatt	<input checked="" type="checkbox"/>
<b>4</b>	Sarat Matturi	<input type="checkbox"/>
<b>5</b>	Srinivas Bongu	<input type="checkbox"/>
<b>6</b>	Lohit Kapoor	<input type="checkbox"/>

Vote for your preferred candidate by pressing the button next to your choice.  
The machine will be locked after your vote is captured.

(This question continues on the following page)

(Question 1 continued)

Figure 2: Some of the tables in the voting database

Voter	Votes	Candidate
VoterID	VoteID	CandidateID
First_name	CandidateID	Party
Surname	VoterID	First_name
Date_of_birth	Date	Surname
Gender	Time	More fields
More fields	More fields	

- (a) (i) State the primary key in the Voter table in **Figure 2**. [1]
  - (ii) Identify **one** foreign key in the Votes table in **Figure 2**. [1]
  - (iii) Identify the data type that would be used in the Gender field in **Figure 2**. [1]
  - (iv) State the relationship between the Candidate table and the Votes table. [1]
  - (v) Outline why a drop-down list would be used for the Party field in the Candidate table. [2]
- (b) A number of individuals and groups were consulted during the design of the e-voting system to enable designers to create an intuitive interface for it.
- Analyse questionnaires **and** interviews as methods of data collection to gather this information from these individuals and groups. [6]
- (c) Some states are planning to return to a paper-based voting system, where voters put a cross (X) in the column next to the party of their choice.
- Discuss whether these states should retain e-voting or return to a paper-based voting system. [8]

Turn over

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## 2. BYOD at Xingu Academy

Some students at Xingu Academy have been allowed to “bring your own device (BYOD)” into school so they can use assistive technologies, such as speech-to-text, to support their learning (see **Figure 3**). Mayu Jimenez, the Head of Learning and Teaching, has seen the benefits for these students. A number of other teachers believe there will be benefits if the school becomes a BYOD school. However, before a decision can be made, Alejandro Glandolla, the Head of IT, has been asked to investigate whether the school would be able to cope with the demands of the increased number of devices.

**Figure 3: Assistive technologies**



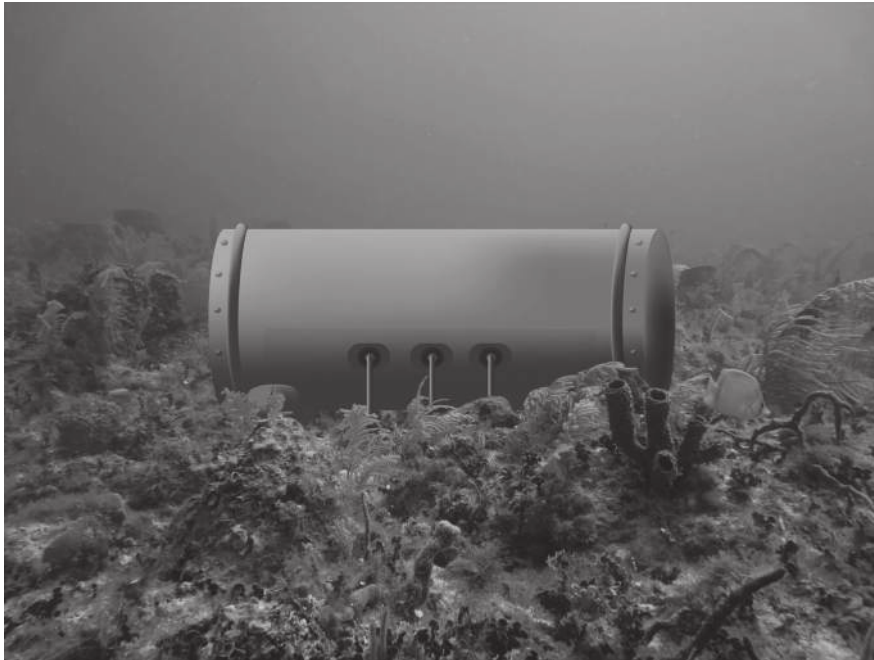
- (a) (i) Identify **two** pieces of information that would be used to identify a device on the IT network. [2]
- (ii) Identify the steps used by speech-to-text software. [4]
- (b) Digital citizenship is included in Xingu Academy’s IT acceptable-use policy.  
Explain why it is important that students at Xingu Academy are both competent users of digital technologies **and** good digital citizens. [6]
- (c) Discuss whether Xingu Academy should become a bring-your-own-device (BYOD) school. [8]

Turn over

### 3. Clouds under the sea

Microsoft has located one of its data centres on the seabed. Project Natick is now operating 100 feet below the surface of the North Sea (see **Figure 4**).

**Figure 4: An artist’s representation of a data centre on the sea bed**



Microsoft has chosen to develop data centres on the seabed because concerns have been raised about the impact of data centres built on land. These seabed data centres can be constructed and placed on the sea bed in 90 days. This is compared to the two years that are required for land-based data centres.

The demand for data storage is doubling every two years, so it is likely that an increasing number of data centres will need to be constructed under the sea as cloud computing continues to grow. Google patented their design for an underwater data centre in 2009 but, although functioning prototypes have been trialled, none have been used commercially.

- (a) (i) Identify **two** characteristics of cloud computing. [2]
- (ii) Servers used in cloud computing hold considerable amounts of data.  
Identify **two** forms of backup that could be used for the data on these servers. [2]
- (iii) A user is downloading a ZIP (zipped file) from cloud storage.  
The ZIP file is 0.6 GB in size and the download rate is 8 mb/s.  
Calculate the total time it will take to download the ZIP file.  
Note: 1 GB = 1000 MB. [2]

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

**(Question 3 continued)**

- (b) (i) Compression software can be used to speed up the upload and download of files.

The ZIP file recently downloaded from the cloud-based server contained a number of images and videos.

Explain why lossy compression techniques would be used for the images that have been downloaded from cloud storage. [2]

- (ii) Explain why lossless compression techniques would be used for the videos that have been downloaded from cloud storage. [2]

- (iii) Cloud storage providers are responsible for protecting the privacy and anonymity of the individuals whose data is held on their servers.

Distinguish between privacy and anonymity. [2]

- (c) Evaluate Microsoft’s decision to build data centres on the seabed. [8]

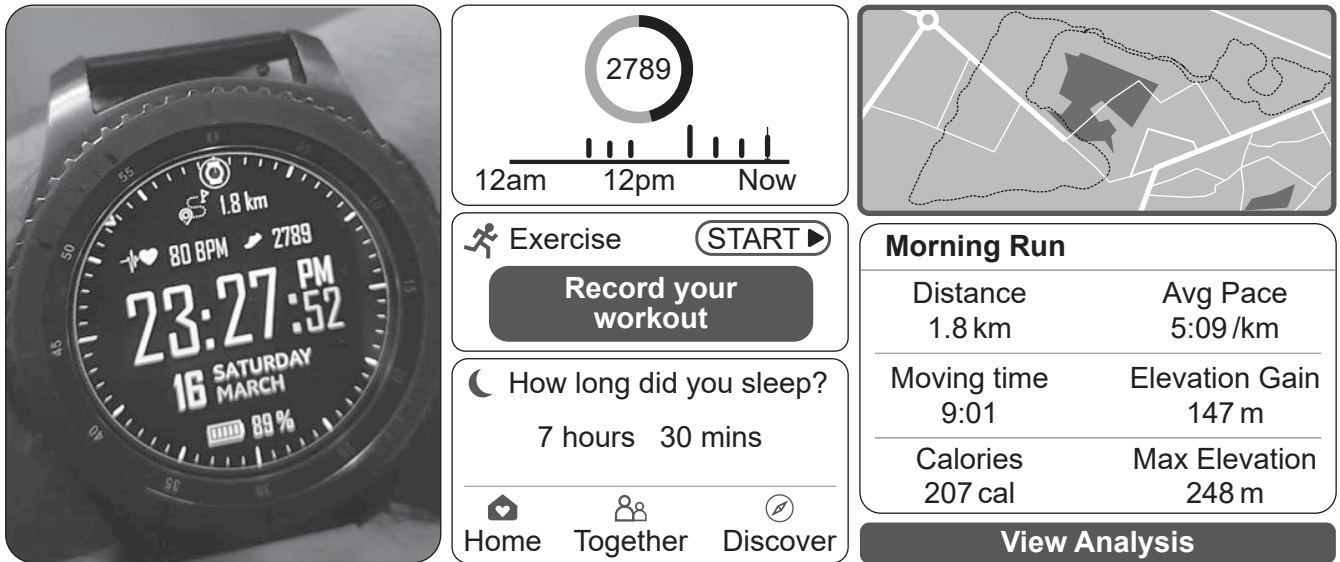
**Turn over**



#### 4. The role of portable digital devices in health

Jaime is an athlete and uses his sports watch to monitor his training sessions. He also uses it to keep a record of his health and well-being. The sports watch can monitor Jaime's vital signs. It is also global positioning systems (GPS) enabled, so it can track his location (see Figure 5).

Figure 5: Data collected by a sports watch



The information that is recorded by Jaime's sports watch is synchronized with a mobile application (app) installed on his cell/mobile phone.

- (a) (i) Identify **two** vital signs that can be recorded by Jaime's sport watch. [2]
- (ii) Describe the steps that the GPS receiver in Jaime's sport watch uses to show the routes of his training runs. [4]
- (b) Jaime has decided to share his personal health information with researchers at the University of Sierra Nevada (USN).  
  
Analyse Jaime's decision to share his personal health information with the University of Sierra Nevada (USN). [6]
- (c) The development of mobile health apps has changed the way citizens manage their own health and wellbeing.  
  
Discuss whether citizens such as Jaime should rely only on the advice of a health app to manage their own health and wellbeing. [8]

**References:**

**Figure 1.** © International Baccalaureate Organization 2020.

**Figure 3.** © International Baccalaureate Organization 2020.

**Figure 4.** Adapted under sea photo by NOAA on Unsplash.

**Figure 5.** © International Baccalaureate Organization 2020.