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Information technology in a global society Standard level Paper 1

3 November 2023

Zone A afternoon | Zone B afternoon | Zone C afternoon

1 hour 30 minutes

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. Smart lamp posts

The city of Hong Kong, in China, has installed smart lamp posts (see **Figure 1**). The lamp posts include LED lighting, sensors that monitor the environment, and cameras that take images of the surrounding area. The data collected is transmitted to a data centre that is part of a cloud computing network. This is part of a strategy to use digital technologies to improve the physical quality of life.



Figure 1: A smart lamp post

[Source: © Hong Kong Special Administrative Region (HKSAR) Government. GovHK (www.gov.hk).]

(a)	(i)	Identify two sensors the smart lamp posts could use.	[2]
	(ii)	Outline one reason why encryption is used to transmit the data from the smart lamp posts to the data centre.	[2]
	(iii)	Outline one reason the Hong Kong authorities are using cloud computing to store the data collected by the lamp posts.	[2]
(b)	Explain three technical requirements that will need to be met to enable the smart lamp post system to function effectively.		[6]
(C)	To what extent will the introduction of smart lamp posts lead to an improvement in the environmental conditions within a city?		[8]

2. No more snow days

Around the world, extreme weather can prevent schools from opening. Examples of extreme weather include snow in Canada, rain in Oman, and typhoons in Japan.

In 2020 and 2021, many schools implemented a distance learning programme so they did not need to add days to the school year to make up for lost learning. Schools were given funding to upgrade their information technology (IT) infrastructures so students and staff would be able to study and work from home.

Some schools have used this funding to introduce a virtual private network (VPN), and others have used it to increase their cloud computing capability.

Students and staff are required to agree to an acceptable use policy before they are allowed to access a school's network.

With the movement towards online learning, teachers have also been asked to teach synchronously and asynchronously.

(a)	(i)	Identify two types of software required for distance learning.	[2]

- (ii) Identify **two** reasons why a school would introduce an acceptable use policy. [2]
- (iii) Outline **one** advantage for users if a school introduces a virtual private network (VPN).
- (b) Two strategies for distance learning are synchronous teaching and asynchronous teaching.

Analyse these strategies.

(c) Many schools are considering moving to a one-to-one mobile device programme where each student has access to one device.

Two options for implementing a one-to-one mobile device programme are:

- · schools owning devices that are issued to students
- students owning their own devices and using them in the school (also called a bring-your-own-device (BYOD) policy).

Evaluate these options.

[8]

[2]

[6]

3. Digital documentation

Governments currently use paper documents, such as a passport or driving license, to authenticate a citizen's identity.

Some governments, however, are allowing citizens to create a digital ID that they can use as proof of identity. This digital ID can be securely stored in a digital wallet app* on smartphones and other digital devices (see **Figure 2**).

Figure 2: Using a digital ID



Some governments are also considering extending their digital services and moving them completely online. These services could include digital medical records, digital tax information, digital driving licenses, and digital car registration documentation.

(This question continues on the following page)

[2]

[8]

(Question 3 continued)

Citizen IdentID

Given_Name Surname DoB

More fields

One proposal is to store this data in a relational database. **Figure 3** shows part of the relational database.

	Licenses
	License_ID
	IdentID
	Driving_Lic_ID
	More fields

Figure 3: Part of the relational database

Driving_License
Driving_Lic_ID
Date_Issued
Date_Expires
Issue_Centre
More fields

* app: small specialized program run on mobile devices, the internet, a computer or other electronic device

- (a) (i) State the primary key in the Citizen table in **Figure 3**. [1]
 - (ii) State the relationship between the Licenses and Driving License tables in **Figure 3**. [1]
 - (iii) Outline **one** advantage of using a relational database instead of a flat file database to store the data collected by the government.
 - (iv) Describe the difference between identification and authentication. [2]
- (b) The development of digital services will require policies for the collection, storage and sharing of data.

Explain how a government and the developers of its digital systems can ensure that the privacy of citizens is not compromised when data is collected, stored **and** shared. [6]

(c) Discuss the advantages **and** disadvantages for the citizens of a country if the government moves its services online.

4. Workforce monitoring

Amy Davies is a programmer working for *SaskWater*. Recently, she has been working from home.

During the first few weeks of remote working, Amy noticed that new software had been installed on her laptop. The software was monitoring her daily tasks and the time she was spending on them.

One of the applications checks that Amy is moving her mouse or carrying out an action. If she fails to do this for more than 15 minutes, an alert is sent to her supervisor informing her that Amy is not working (see **Figure 4**).



Figure 4: Alert sent to Amy's supervisor

(This question continues on the following page)

(Question 4 continued)

At the end of each month, managers at *SaskWater* are sent a report that shows the number of times each employee has generated an alert. This information is stored in a spreadsheet (see **Figure 5**).

	А	В	С	D	Е
1	EmployeeID	FirstName	Surname	Manager	AlertsSent
2	Emp0087	Amy	Davies	Lucy	4
3	Emp0098	Jacques	Rossignol	Lucy	1
4	Emp1254	Jose	Cortes	Pierre	0
5	Emp3456	Liu	Zhao	Pierre	4
6	Emp8754	Edward	Prince	Lucy	12
_					

Amy has discussed this with some of her colleagues. She is concerned that all employees may have this software installed on their laptops. She has described this software to her colleagues as spyware.

(a) The URL for *SaskWater* is: <u>https://www.saskwater.com/index</u>

	(i)	State the protocol.	[1]
	(ii)	State the domain name.	[1]
	(iii)	State the formula used to calculate the total number of alerts sent.	[1]
	(iv)	State the EmployeeID that would appear in the second row of the spreadsheet if the alerts were sorted in descending order.	[1]
	(v)	Identify two other ways in which SaskWater could monitor its staff.	[2]
(b)	(i)	Distinguish between the way monitoring software and spyware gather information.	[2]
	(ii)	Explain two reasons why a spreadsheet was chosen to store and manage the information about alerts.	[4]
(C)	To w emp	hat extent is it acceptable for employers to use monitoring software on their loyees' work laptops?	[8]

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References:

Figure 1 © Hong Kong Special Administrative Region (HKSAR) Government. GovHK (www.gov.hk).

Figure 2 Fedpol. https://commons.wikimedia.org/wiki/File:NIDK-front.jpg. Licensed under CC 3.0 CH https://creativecommons.org/licenses/by/3.0/ch/deed.en. Image adapted.

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