2023-DSE
ICT
PAPER 2B

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HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2023

Candidate Number

INFORMATION AND COMMUNICATION TECHNOLOGY
PAPER 2B
Data Communications and Networking
Question-Answer Book

11:15 am – 12:45 pm (1 hour 30 minutes)
This paper must be answered in English

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5 and 7.

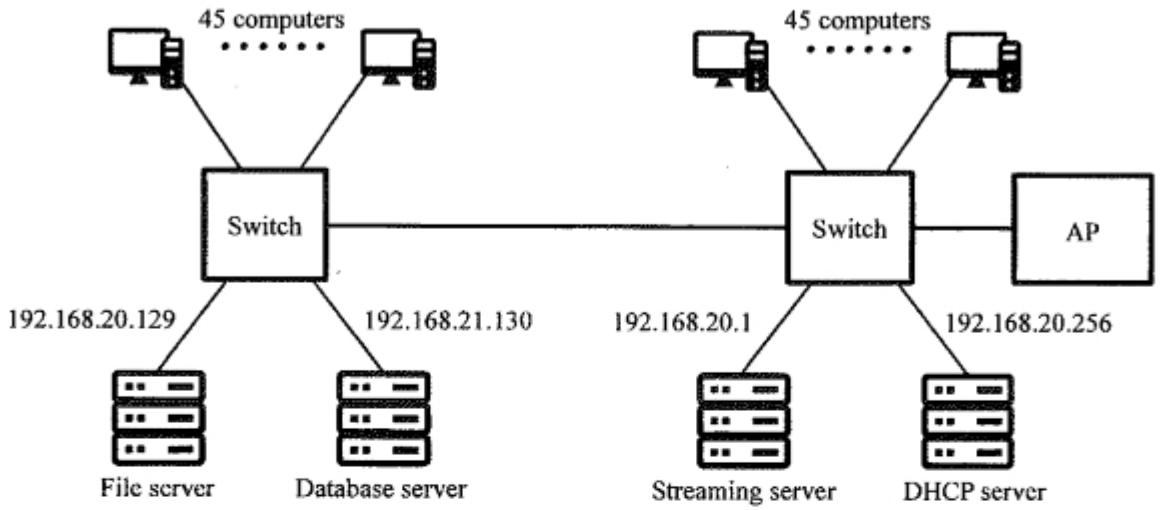
(2) Answer **THREE** out of four questions. Write your answers in the spaces provided in this Question-Answer book. Do not write in the margins. Answers written in the margins will not be marked.

(3) Supplementary answer sheets will be supplied on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this book.

(4) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

Answer THREE questions only.

1. Peter is a school technician. He builds a class C network that contains 90 computers, 2 switches, 4 servers, and an Access Point (AP), as shown below:



(a) Identify the problems in the setting of the IP addresses of the servers below.

Database server: _____

_____

DHCP server: _____

_____

(2 marks)

(b) The file access on the file server becomes very slow when video streaming is in operation. Why?

_____

_____

_____

_____

(2 marks)

Answers written in the margins will not be marked.

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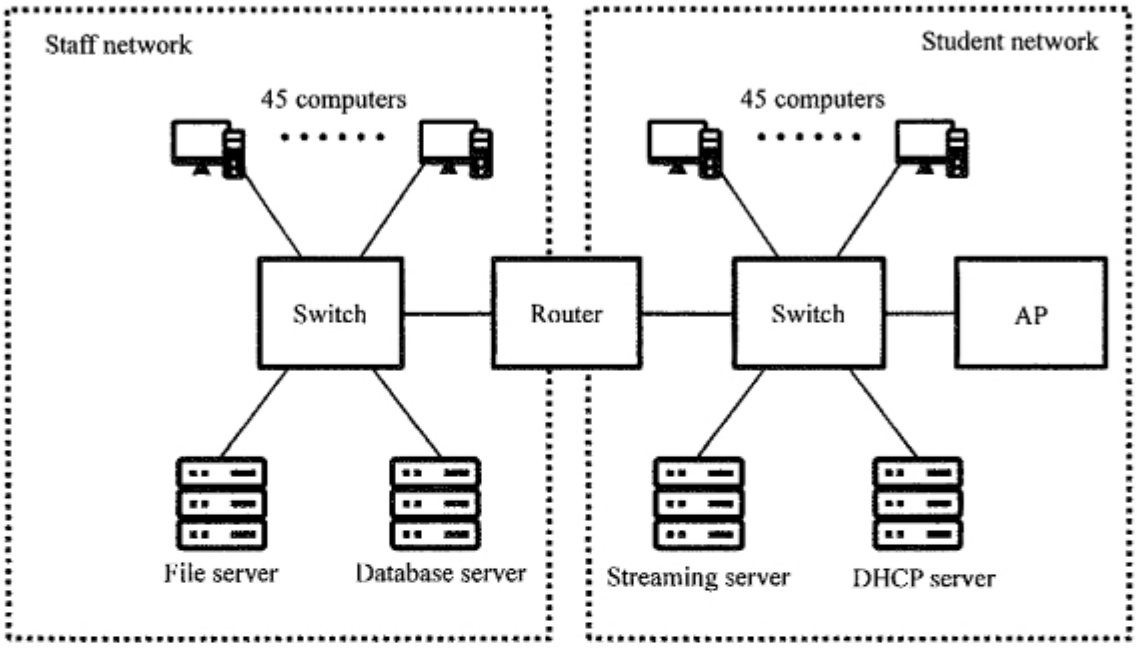
(c) Peter redesigns the network into two class C subnets, as shown below:



(i) How does a router determine the path down which to send data packets?

_____

_____

_____

(1 mark)

(ii) Complete the network setting below.

Usage	IP address range		Subnet mask
	From	To	
Student network	192.168.20.1	192.168.20.126	
Staff network		192.168.20.254	

(3 marks)

Answers written in the margins will not be marked.

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(iii) State the broadcast address of the staff network.

_____

(1 mark)

(iv) How many mobile devices can connect to the AP?

_____

_____

(1 mark)

(d) Based on the network in (c), all mobile devices in the student network can obtain an IP address via the DHCP server.

(i) Other than the IP address, give **two** pieces of information that are obtained from the DHCP server.

_____

_____

(2 marks)

(ii) The computers in the staff network cannot obtain IP addresses from the DHCP server. Why?

_____

_____

(1 mark)

(iii) Peter assigns fixed IP addresses to the servers. Explain why dynamic IP addresses are not suitable for the servers.

_____

_____

_____

_____

(2 marks)

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2. Mary is the network administrator of a wetland park.

(a) A network engineer and a network administrator have different duties. What are their duties?

(2 marks)

(b) Researchers in the wetland park collect data based on samples from different regions in the park. The data is sent to the database server via a mobile phone network.

(i) Give **two** advantages of using a mobile phone network for the data transfer.

(2 marks)

(ii) Give a benefit of using satellite technology instead of the mobile phone network.

(1 mark)

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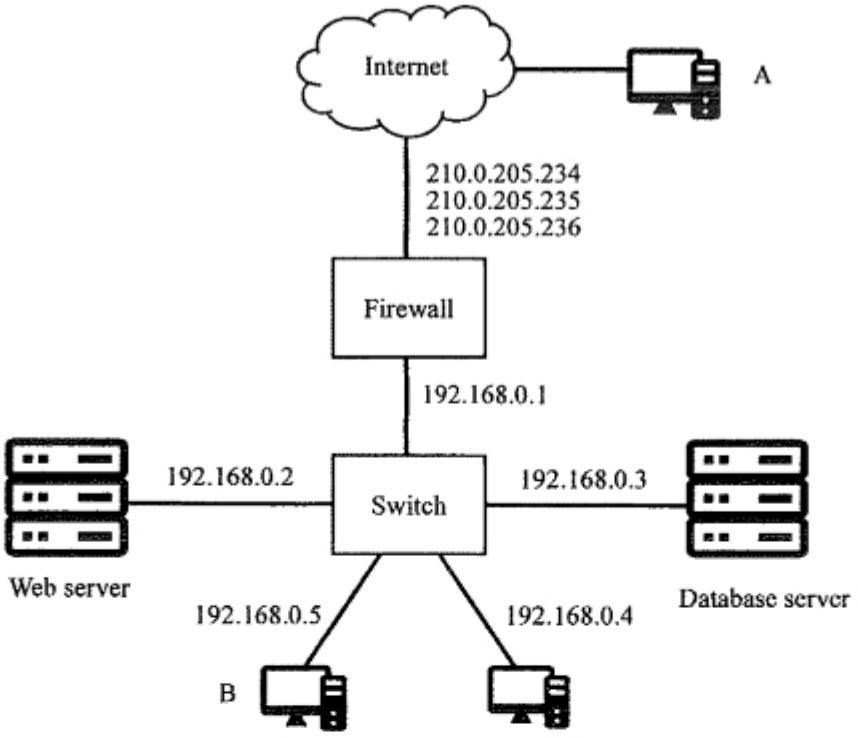
Answers written in the margins will not be marked.

The network in the park is shown below:



Mary uses public IP addresses, as shown in the table below:

Public IP address	Device
210.0.205.234	Web server
210.0.205.235	Database server
210.0.205.236	Other computers

Below is the firewall setting:

Rule number	Source	Destination	Application	Allow/Block
1	Internet	210.0.205.234	Web	Allow
2	Internet	210.0.205.235	Database	Block
3	210.0.205.236	Internet	Any	Allow
4	Internet	210.0.205.236	Any	Block

(c) (i) Can computer A access the database server? Explain briefly.

_____

_____

_____

_____

(2 marks)

Answers written in the margins will not be marked.

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(ii) Can the web server access the database server? Explain briefly.

(2 marks)

(iii) Can computer B access the Internet? Explain briefly.

(2 marks)

(d) Mary considers using a domain name or an IP address to access the web server through a browser. Give an advantage and a disadvantage of using a domain name for this.

(2 marks)

(e) Give **two** authentication methods to protect the network against unauthorised access, other than username and password.

(2 marks)

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3. In a museum, each exhibit is tagged with an RFID label. Each tourist takes a WiFi-enabled guiding device equipped with an RFID reader. When a tourist gets close to an exhibit, the guiding device detects the label and starts an audio introduction.

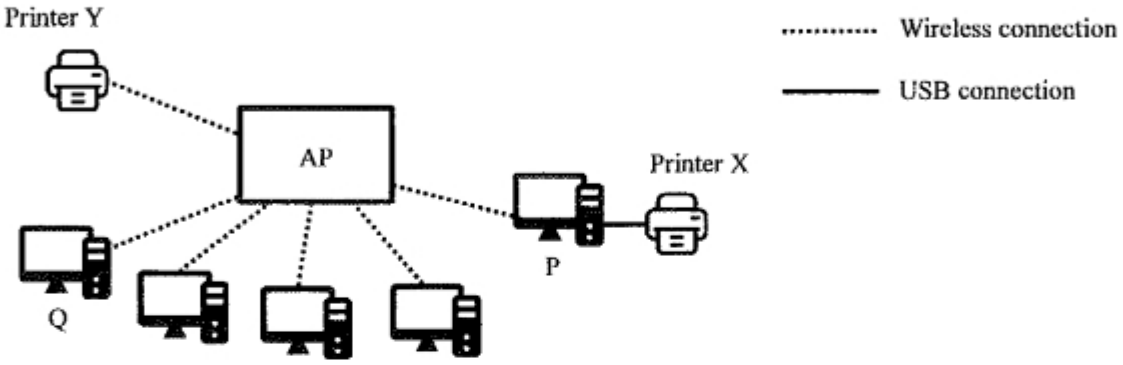
(a) Give an advantage of using RFID technology in the application.

_____

_____

(1 mark)

Below shows the network in the museum with an Access Point (AP).



(b) A folder is created in computer Q for the following:

Staff use a staff account to read and write digital exhibits in the folder. Tourists use a guest account to read the digital exhibits.

State the folder access rights that should be set in computer Q for the staff account and guest account respectively.

_____

_____

_____

_____

(2 marks)

Answers written in the margins will not be marked.

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(c) There are two different connections of printer sharing in the network. Give **two** benefits of using the connection between printer Y and the AP.

_____

_____

_____

_____

(2 marks)

(d) Below shows the configuration of the AP:

SSID : MUS
Channel (2.4 GHz / 5 GHz) : 5 GHz
Maximum number of connections : 50
Protocol (WEP / WPA / WPA2) : _____
MAC filter : None

(i) Which protocol should be used? Why?

_____

_____

(1 mark)

Answers written in the margins will not be marked.

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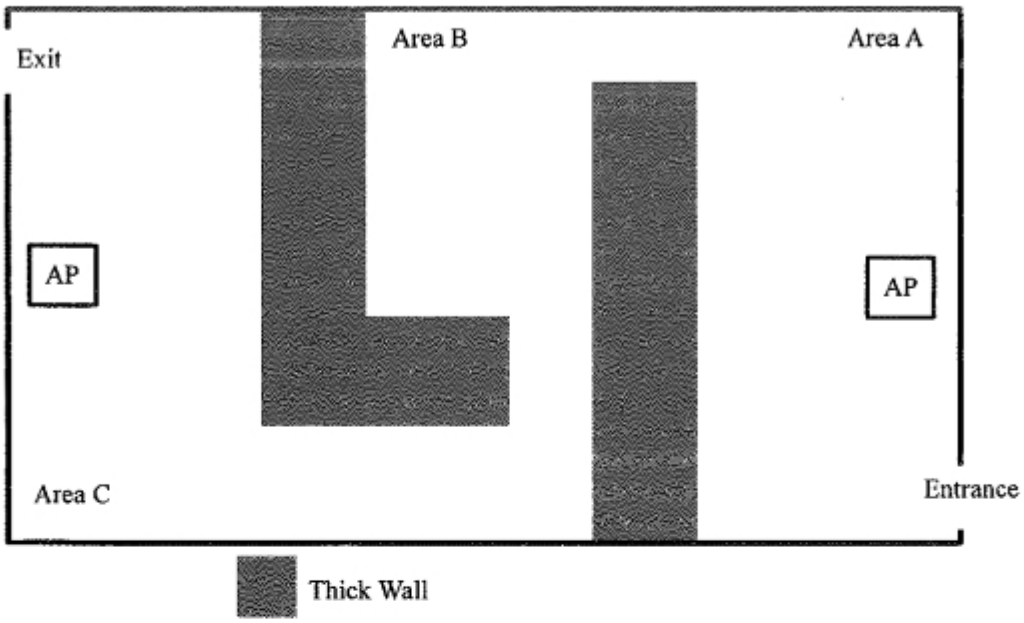
The floor plan of the museum



(ii) Tourists complain that guiding devices cannot receive network signals in some places. Two additional APs should be installed to solve the problem. Draw the **two** APs on the floor plan above.

(2 marks)

(iii) The guiding devices receive weak network signals due to the thick walls in the museum. State a change in the configuration of the APs to improve the signal reception.

_____

_____

(1 mark)

(iv) The museum finds that some guiding devices cannot connect to the network and the network speed is very slow during peak hours. It installs more APs to solve this problem. State **two** advantages of this approach.

_____

_____

_____

_____

(2 marks)

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(e) The museum stores ticket sales records in a computer. It considers the following two backup methods.

Method 1:

Month	Backup content
First month	All data
Second month	Data changed in the second month
Third month	Data changed in the third month
Fourth month	Data changed in the fourth month

Method 2:

Month	Backup content
First month	All data
Second month	Data changed in the second month
Third month	Data changed in the second and third months
Fourth month	Data changed in the second, third and fourth months

(i) Which months among the two methods have the same backup content?

_____

(1 mark)

(ii) Give an advantage of Method 1 over Method 2.

_____

_____

(1 mark)

(iii) Suppose that Method 1 is used. The backup for the third month completes, but the backup file for the second month is corrupted. Explain why the data cannot be fully recovered.

_____

_____

_____

_____

(2 marks)

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4. John develops an application for a smartphone. It connects to a smart watch to collect health data in real time.

(a) Give **two** advantages of using Bluetooth to connect the smart watch to the smartphone.

_____

_____

_____

_____

(2 marks)

(b) John considers two methods of error detection for data packets: parity checking and checksum.

(i) Write the check digit of data 1001100 for even parity check. _____

(1 mark)

(ii) Give a disadvantage of using parity checking.

_____

_____

(1 mark)

(iii) The method for calculating a checksum is

Step 1: Separate the data into groups of four bits as 4-bit numbers and sum up the numbers.
Step 2: If the sum has more than 4 bits, repeat step 1 until the sum has not more than 4 bits.
Step 3: The checksum is the one's complement of the sum.

Complete the calculation of the checksum of the data below.

1001 1100	Checksum

Step 1:
= 1001 + 1100
= 1 0101

Step 2:
= 0001 + 0101

= _____

Step 3:
The checksum is _____

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

(iv) Give an advantage of using checksum over parity checking.

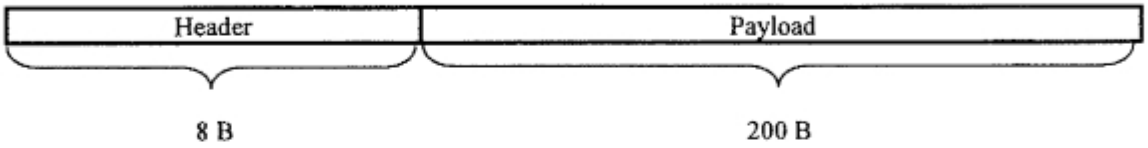
_____

_____

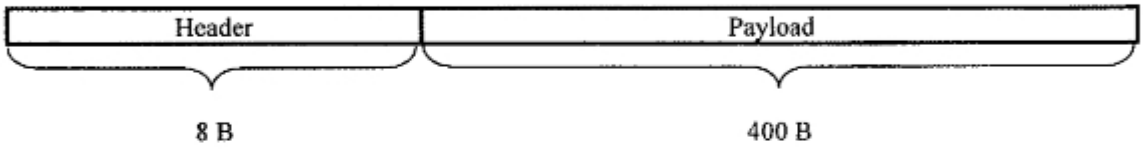
(1 mark)

The smart watch can download music from the smartphone via a wireless connection. John considers the following two types of data packet for data transmission:

Data packet A



Data packet B



(c) (i) Describe **two** components of a header.

_____

_____

_____

_____

(2 marks)

(ii) Which type of data packet gives a higher throughput in terms of data transmission? Explain briefly.

_____

_____

_____

_____

(2 marks)

Answers written in the margins will not be marked.

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(d) Assume that Data packet A is used to transfer a 4 MB music file.

(i) Find the total amount of transmitted data. Show your calculation.

(2 marks)

(ii) Assume that there is no network delay and the data transfer rate is 3 Mbps. Find the time required to transfer the file. Show your calculation.

(2 marks)

END OF PAPER

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