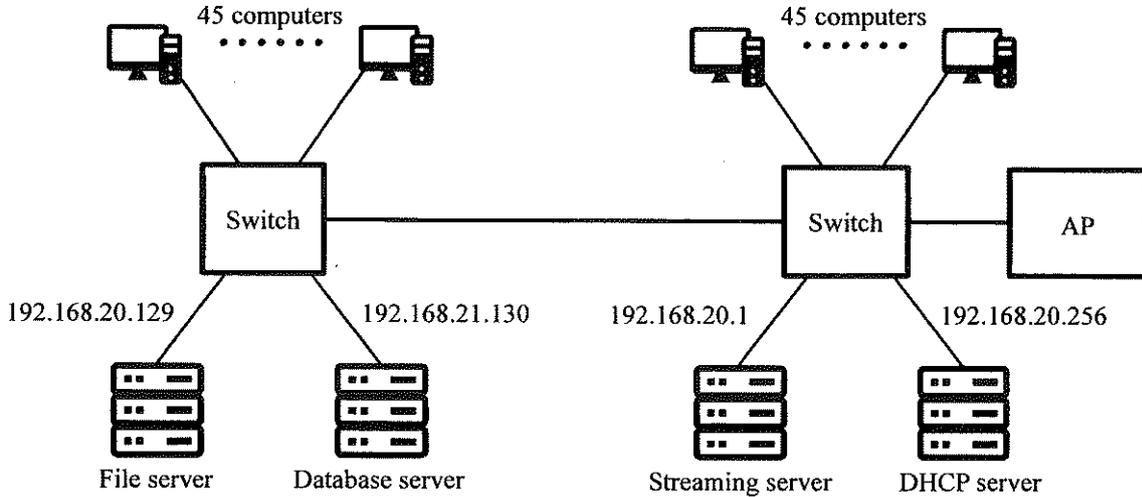




Answer **THREE** questions only.

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)

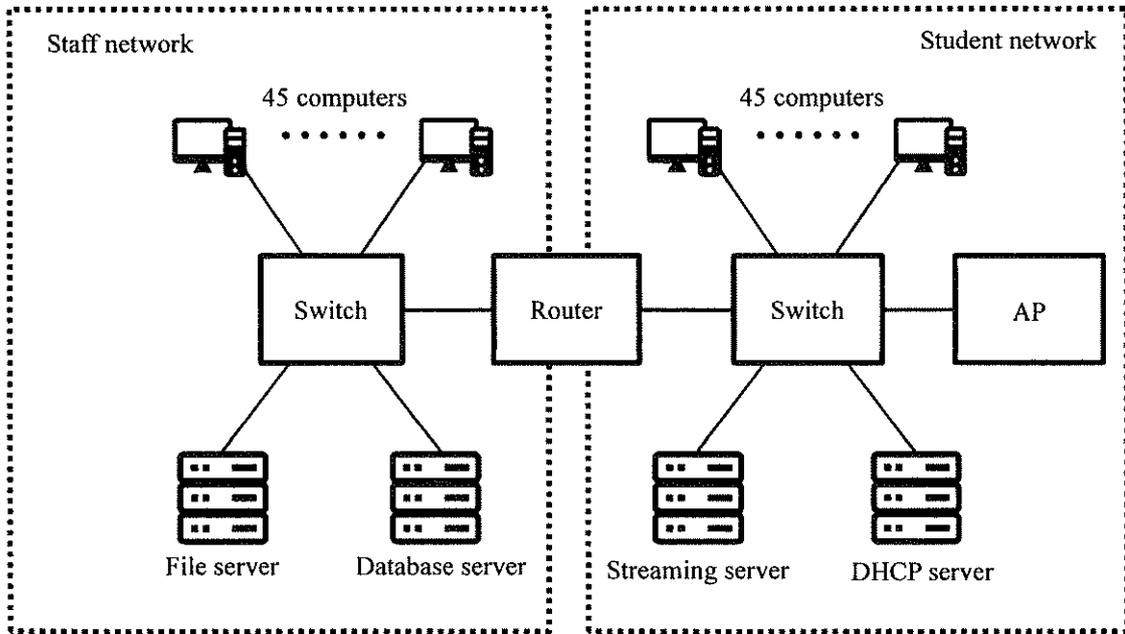
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(c) Peter redesigns the network into two class C subnets, as shown below:



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

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(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)

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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?

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(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.

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(2 marks)

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

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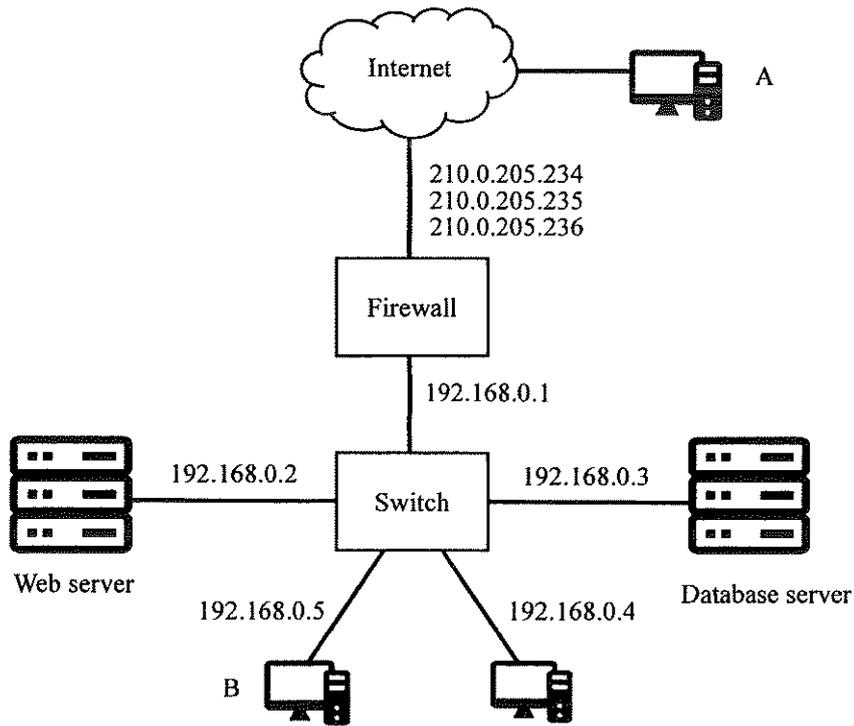
(1 mark)

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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.

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(2 marks)

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

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(2 marks)

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

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(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.

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(2 marks)

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

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(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.

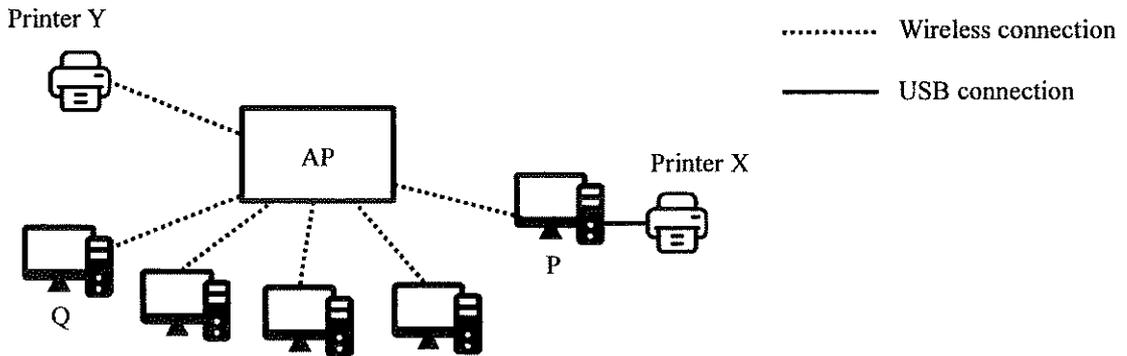
(a) Give an advantage of using RFID technology in the application.

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(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.

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(2 marks)

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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.

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(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?

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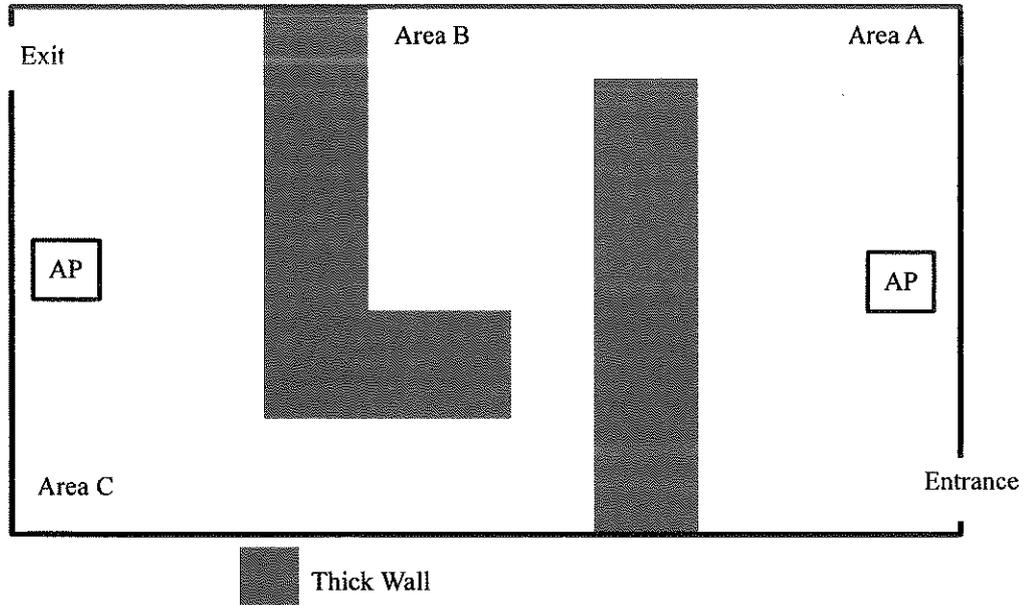
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(1 mark)

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The floor plan of the museum



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- (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.

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(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.

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(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.

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(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.

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(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
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Step 1:  
= 1001 + 1100  
= 1 0101

Step 2:  
= 0001 + 0101  
= \_\_\_\_\_

Step 3:  
The checksum is \_\_\_\_\_

(2 marks)

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

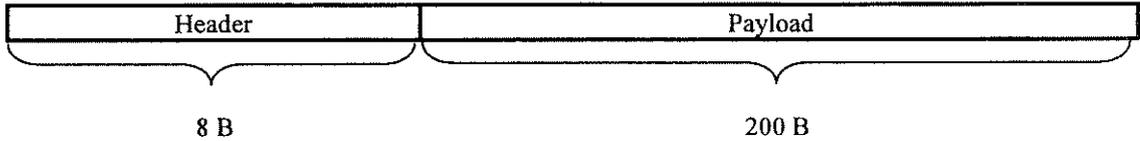
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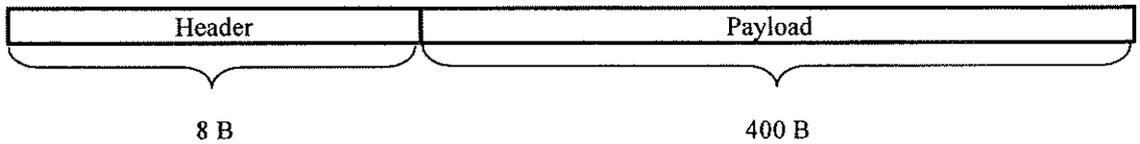
(1 mark)

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.

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(2 marks)

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

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(2 marks)

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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.

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(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.

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(2 marks)

**END OF PAPER**

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