

Answer all questions.

1. An oil company has a communication network connecting its offices in major cities around the world with oil wells on land and in the ocean.

(a) The network mainly uses fibre optics as the transmission medium.

(i) Give two benefits of using fibre optics in the network.

(2 marks)

(ii) Suggest another appropriate transmission medium for establishing a communication link between offices and oil wells in the ocean. Give a reason for your suggestion.

(2 marks)

(b) (i) The communication network supports both simplex and duplex communication modes. What are the differences between these two modes?

(2 marks)

(ii) Give an application of each communication mode used in the oil company.

Simplex communication mode: _____

Duplex communication mode: _____

(2 marks)

Answers written in the margins will not be marked.

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The following example shows data transmitted over the communication network.

Data packet:

Data	Parity bit
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	Data packet received
X	10110001
Y	10110010
Z	10110101

(c) Assume that the even parity check is used for error detection.

(i) Which data packet received, X, Y or Z, has an error? _____ (1 mark)

(ii) Occasionally some errors cannot be detected. Why not? Explain your answer with an example.

(2 marks)

(iii) Suggest an error detection method to solve the problem in (c)(ii).

(1 mark)

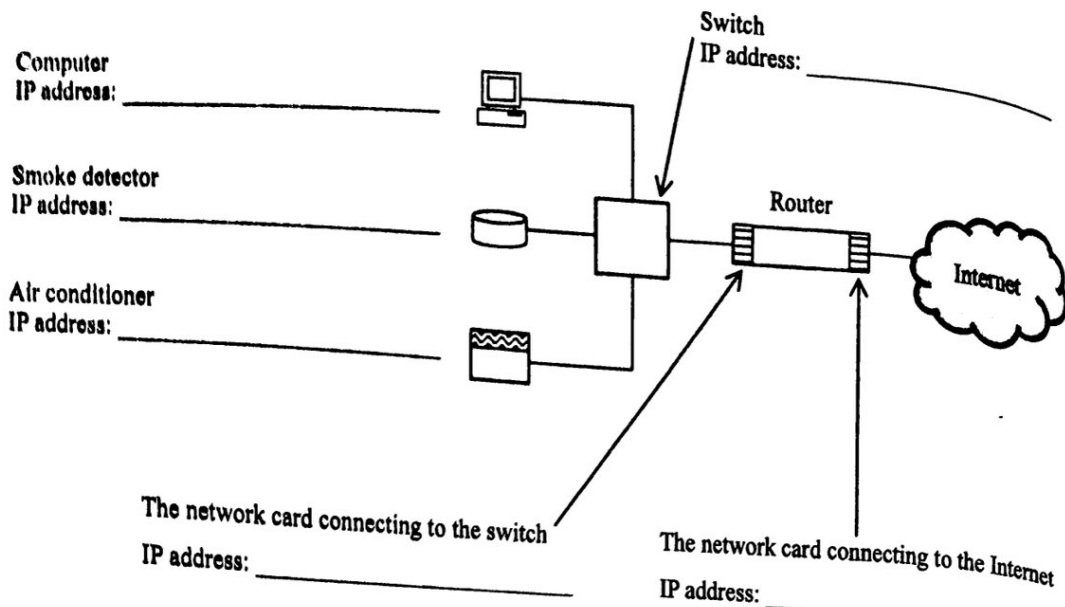
(d) Assume that the CSMA/CA protocol is used to coordinate wireless data transmission in the network. Briefly describe how collisions are avoided during data transmission.

(2 marks)

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2. Mr Li builds a smart home for a customer, as shown below:



(a) Use the following IP addresses to complete the diagram above.

210.0.205.213, 192.168.1.1, 192.168.1.2, 192.168.1.3, 192.168.1.4, 192.168.1.5

(2 marks)

(b) Mr Li considers using wireless connections in the network.

(i) Give an advantage of using Bluetooth over Wi-Fi.

(1 mark)

(ii) Give an advantage of using Wi-Fi over Bluetooth.

(1 mark)

(iii) Give two advantages of using Bluetooth over infrared.

(2 marks)

Answers written in the margins will not be marked.

(c) Briefly explain how the following network design can be applied to a smart home.

(i) Virtual Private Network (VPN)

(2 marks)

(ii) Personal Area Network (PAN)

(2 marks)

The Internet of Things (IoT) is the network of devices and items embedded with network connectivity. Mr Li estimates that there will be over 2^{34} IoT objects worldwide by 2020.

(d) (i) Briefly explain why IPv6 instead of IPv4 should be used for IoT by estimating the numbers of network addresses supported.

(2 marks)

(ii) Describe another advantage of using IPv6 over IPv4, other than the numbers of network addresses in (d)(i).

(2 marks)

Answers written in the margins will not be marked.

3. Mr Chan plans to build an online system that 100 concurrent users can use to upload photos for printing and storage.

(a) The system has a router, a switch, a firewall and some cables represented by the following symbols:

R

Router

S

Switch

F

Firewall

— Cable

Draft a network diagram for the system below.



Web server

Mr Chan's computer

LAN for internal users

(3 marks)

- (b) Mr Chan hires a network engineer and a network administrator for this project.

(i) Give a major duty for each post.

Network engineer:

Network administrator:

(2 marks)

(ii) Suggest two kinds of network testing that the network engineer should perform before launching the system.

(2 marks)

Answers written in the margins will not be marked.

(iii) Mr Chan worries that the response of the web server might be very slow. He wants to install a proxy server. Do you agree? Explain briefly.

(2 marks)

(c) Mr Chan estimates that there are about 2.5 TB photo files in total in the system.

(i) Suggest a backup solution for Mr Chan using Redundant Array of Independent Disks (RAID). Write the suggested RAID type and describe your answer briefly.

(2 marks)

(ii) Explain why RAID is not sufficient for disaster recovery and suggest an additional measure for this.

(2 marks)

Answers written in the margins will not be marked.

(d) Ransomware is a kind of network attack that encrypts users' data files and demands a ransom to decrypt and restore the data files.

(i) Do you think Ransomware applies a public and private key encryption system during an attack? Describe how the keys are used in a public and private key encryption system to support your answer.

(2 marks)

(ii) Mr Chan worries that the system might be affected by ransomware. Suggest two common security measures which can be used to handle the threat, other than anti-virus software.

(2 marks)

Ms Ng plans to provide Internet service for ABC Primary School and ABC Secondary School.

(a) Ms Ng has many network components represented by the following symbols:

R

Router

S

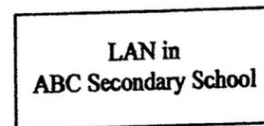
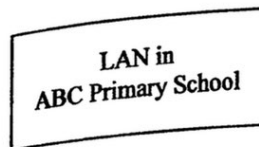
Switch

————

Cable

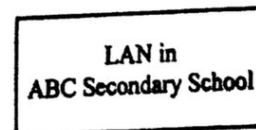
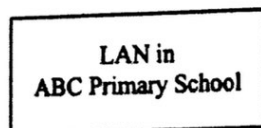
Complete the network diagrams in the following cases. Do not include more components than necessary in the diagrams.

(i) A single network with Internet access



(2 marks)

(ii) Two separate networks with Internet access



(2 marks)

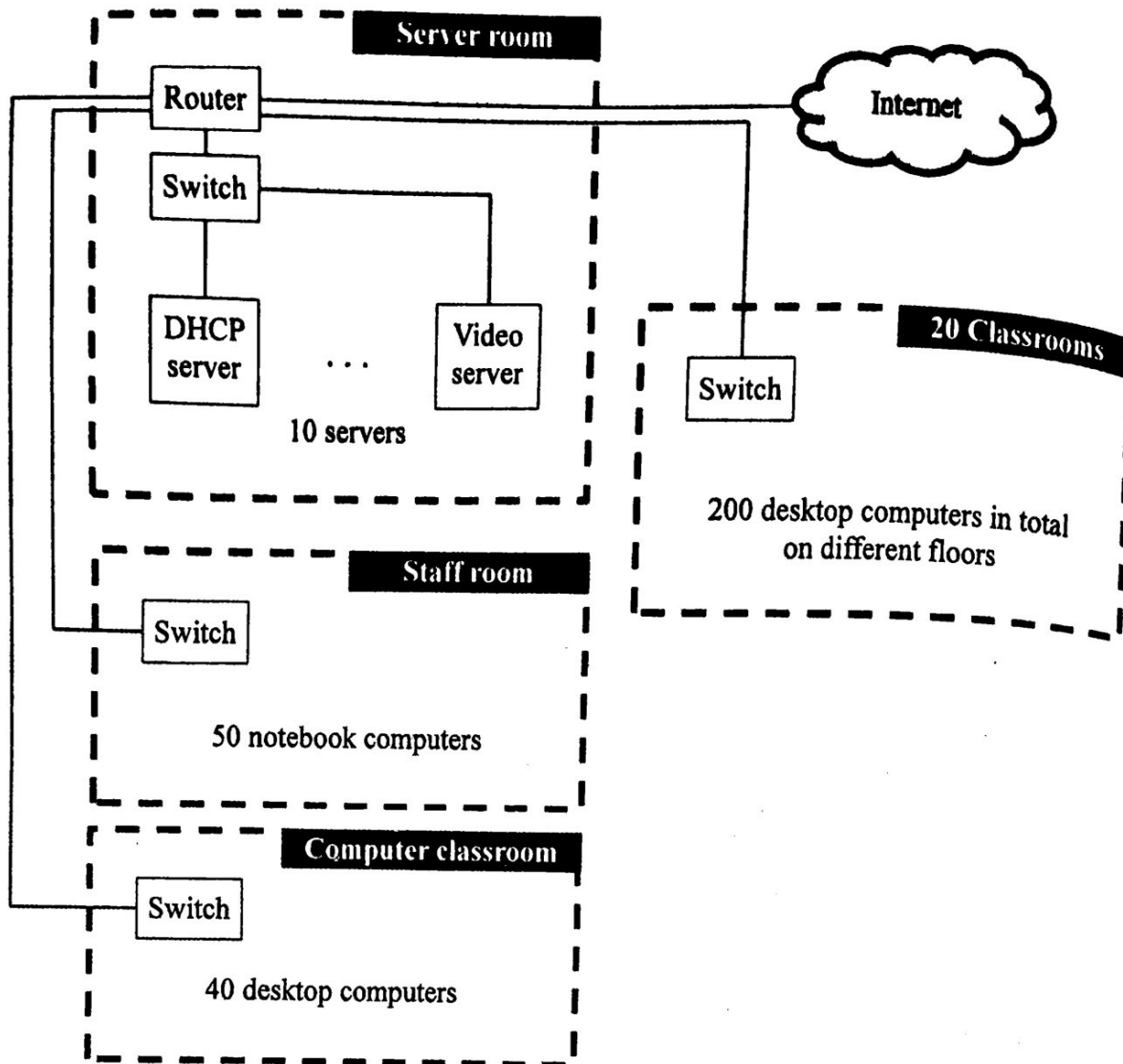
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Ms Ng plans to divide the LAN in ABC Secondary School into 4 subnets, as shown below:

IP address: 172.16.x.y ($0 < x < 255$, $0 < y < 255$)



(b) (i) Give two benefits of using subnets in the LAN.

(2 marks)

Answers written in the margins will not be marked.

- (ii) Suggest the IP ranges and subnet masks for the server room and staff room.

Server room

IP address range: _____

Subnet mask: _____

Staff room

IP address range: _____

Subnet mask: _____

- (c) Give an advantage and a disadvantage of using DHCP in the LAN. (4 marks)

(2 marks)

- (d) Ms Ng finds that sometimes the videos on the video server cannot be viewed smoothly on the desktop computers in the computer classroom.

- (i) Why does this network issue happen?

(1 mark)

- (ii) Suggest a solution for the network issue without replacing or adding hardware. Explain your answer briefly.

(2 marks)

END OF PAPER

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