HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2012

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 and 5.

(2) **ANSWER ALL 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.

A200E02B

Provided by dse.life

Answer all questions.

1.   Mr Chan organises a student activity at an outdoor playground.

   (a) Mr Chan considers setting up a wired network using a router. The back of the router is shown below.
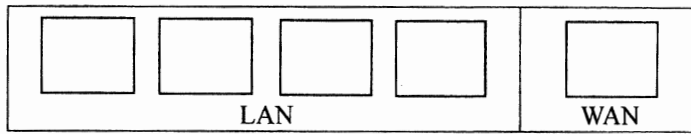
   (i) How many computers can connect to this network at the same time? _____

   (ii) If the rightmost 'WAN' port is unused, what will happen to the network?

   _____
   (2 marks)

   As the wired network only supports a small number of connections, Mr Chan decides to set up a Wi-Fi network and a virtual private network (VPN) for his students.

   (b) Mr Chan wants to enhance the network security.

   (i) Which method, WEP or WPA2, should he use? Explain briefly.

   _____

   _____

   (ii) What security measure should he use in the VPN?

   _____
   (3 marks)

   (c) Mr Chan sets up a DHCP server and a proxy server in the Wi-Fi network.

   (i) Give **two** advantages of using DHCP to assign IP addresses to the students' notebook computers.

   _____

   _____

   _____

   _____

   (ii) The Wi-Fi network connects to the Internet using a 3G mobile network. Describe how the proxy server improves the efficiency of web browsing.

   _____

   _____

   _____
   (4 marks)

Provided by dse.life

(d) The students find that CSMA/CA instead of CSMA/CD is used in the wireless network.

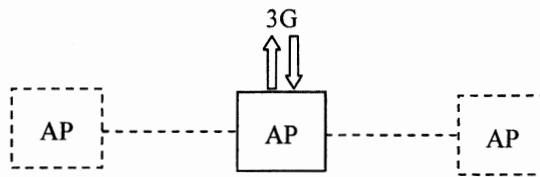(i) CSMA/CD is not suitable for the wireless network. What is the main reason for this?

_____

_____

(ii) Describe how CSMA/CA handles collisions.

_____

_____

_____

(2 marks)

(e) Mr Chan enhances the accessibility of the Wi-Fi network by adding two Access Points (APs) using non-overlapping channels. Students can connect their notebooks to all the APs without changing the existing configuration.

(i) How can Mr Chan configure the service set identifiers (SSIDs) of the APs?

_____

_____

(ii) He uses three non-overlapping channels 1, 6 and 11 for the three APs so that a notebook computer can identify and connect to the AP having the strongest signal. Next, he wants to install one more AP using channel 1. What is the potential problem with this installation? How can he prevent this problem from happening?
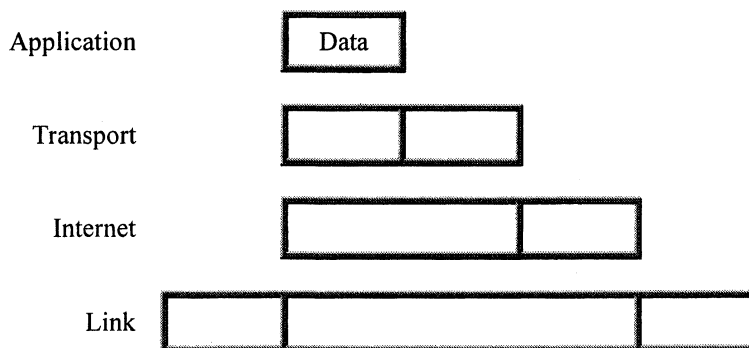
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(3 marks)

2. Mr Li is the IT network administrator in a company with offices in different locations. He is going to set up a network of 200 computers with the TCP/IP suite.

(a) A TCP/IP reference model has four layers, as shown below.

Application   Data

Transport

Internet

Link

(i) Briefly describe why data encapsulation is necessary in the model.

_____

_____

_____

_____

(ii) Mr Li will develop a file sharing program for staff. When he selects a protocol, which layer is he working on?

_____
                                                    (3 marks)

(b) Mr Li plans to provide the following services and considers using the protocols TCP, UDP and FTP. Write the most commonly-used protocol for each service.

(i) World Wide Web   _____

(ii) Voice over IP (VoIP)   _____

(iii) Email   _____

(iv) DHCP   _____

                                                    (4 marks)

(c) Data transfer over the network is prone to error.

(i) Give one major source of error during data communication.

_____

(ii) Mr Li can adopt checksum, parity check or CRC for error detection. Which one gives the best error detection? Justify your answer.

_____

_____

_____

(3 marks)

(d) Some staff members will use video conferencing. Mr Li uses IPv6 instead of IPv4.

(i) What is the maximum number of IP addresses available in IPv6? _____

(ii) How does IPv6 handle packets to support better quality service?

_____

_____

(iii) Suggest and describe a design feature of IPv6 that can contribute to better video conferencing.

_____

_____

(5 marks)

3.	A city is going to implement digital television broadcasting.

(a) A simple communication model has four components: Transmission Medium, Agent, Data and Signal. Match the following parts of a digital television broadcasting system with the components of the communication model.

1.	Encoded video
2.	TV station
3.	Cable
4.	TV programmes

(i)	Transmission medium:	_____

(ii)	Agent:	_____

(iii) Data:	_____

(iv) Signal:	_____

(2 marks)

(b) Suppose that multiplexing is used. Describe how TV programmes are transmitted through a multiplexer, a transmission medium and a demultiplexer.

_____

_____

_____

_____

(3 marks)

(c) Digital television broadcasting supports the duplex communication mode. How does duplex communication benefit TV viewers? Give an example to illustrate the benefit.

_____

_____

_____

(2 marks)

(d) Mr Wong is going to install several TVs in a commercial building to receive the TV programmes. He can use either coaxial cables or Cat-5e Unshielded Twisted Pair (UTP) wires.

   (i)   Compare these two kinds of cable in terms of capacity and transfer distance.

   _____

   _____

   _____

   (ii) Mr Wong decides to use Cat-5e UTP wires. However, he cannot view TV programmes because the signal sent from the TV sockets to the TVs is too weak. How can he solve this problem without changing the transmission medium or relocating the TV sockets and TVs? Explain briefly.
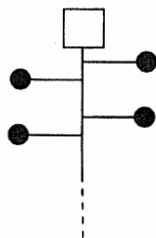
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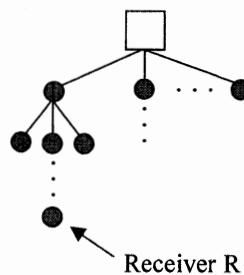   (4 marks)

(e) A TV station proposes a change to the way to broadcast programmes. Peer receivers will help with the broadcasting as well as the TV station. The network topologies are shown below.

   (i)   Explain a positive impact of the proposed design on the broadcasting operations of the TV station.

   _____

   _____

   _____

   (ii) Give **two** potential problems with the proposed design, which has Receiver R at the bottom end of the network.

   _____

   _____

   _____
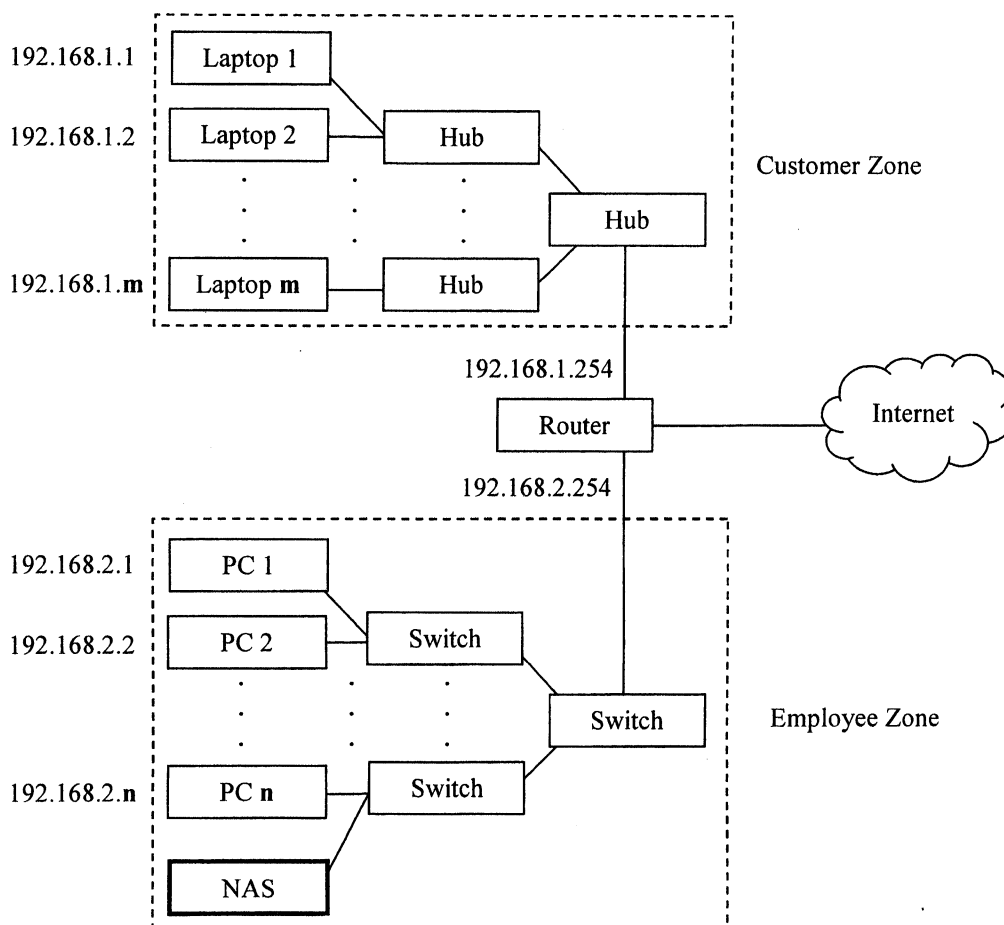
   _____

                                                                    (4 marks)

4. Billy is a network engineer and Christine is a network administrator. They design the following network in IPv4 for a computer retail store.

(a) The network is divided into a Customer Zone and an Employee Zone. Computers in each zone can only communicate with other computers in that zone, plus the Internet.   **m** and **n** are positive integers less than 250.

   (i) Billy tells Christine that the network in the Employee Zone is a Class C network. Justify Billy's classification.

   _____

   _____

   _____

   (ii) Suggest an IP address and a subnet mask for the Network-attached Storage (NAS) device in the Employee Zone.

   IP address: _____

   Subnet mask: _____

   (4 marks)

Provided by dse.life

(b) Christine asks Billy to add a firewall in the Employee Zone to enhance network security. State how a firewall device detects and processes the following potential security risks.

(i) Denial of Service (DoS) attack

_____

_____

(ii) Unauthorized access

_____

_____

(iii) Trojan horse program

_____

_____

(3 marks)

(c) Christine asks Billy to use the NAS (network-attached storage) device for file sharing in the Employee Zone. State how the following features, supported by the NAS, can help protect data stored in the NAS.

(i) An access control list

_____

_____

(ii) Redundant Array of Independent Disks (RAID) level 5

_____

_____

(iii) A connection with an Uninterruptible Power Supply (UPS)

_____

_____

(3 marks)

(d) Christine notices that Laptop 1 in the Customer Zone cannot access the Internet.

(i) Suggest **three** possible technical actions she can take to troubleshoot this network issue.

_____

_____

_____

_____

_____

_____

(ii) She plans to replace the hubs with switches. How can this plan improve network throughput?

_____

_____

(4 marks)

(e) Other than designing a network based on user requirements, state **two** major duties that Billy needs to perform as a network engineer.

_____

_____

(2 marks)

END OF PAPER