Please stick the barcode label here.

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 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.
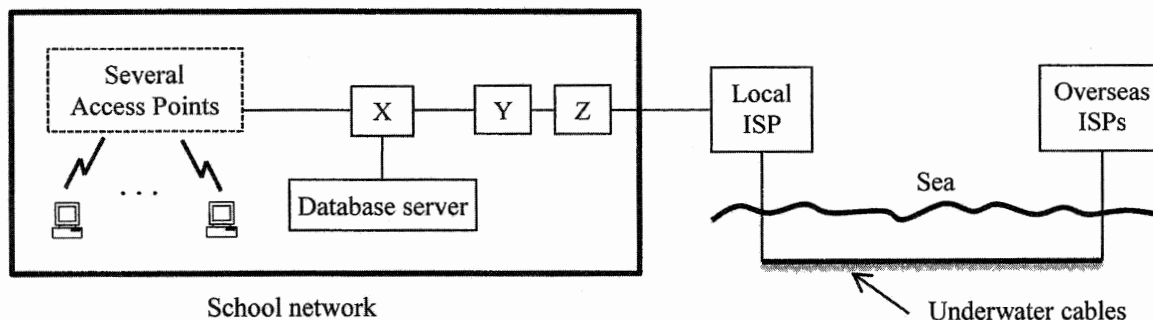
A200E02B

Answer all questions.

1. Mr Li is the IT manager of a school. He manages a wireless network of desktop computers and tablet computers. To access web pages in other countries, the network is connected to overseas Internet Service Providers (ISPs) through a local ISP via underwater cables, as shown in the diagram below:

School network

(a) What is the transmission medium of the underwater cables? Explain your answer briefly.

_____

_____

(2 marks)

(b) X, Y and Z are different network devices. Y is used to forward data packets between the school network and the Internet. Z is used for network security.

   (i) What network devices are X, Y and Z?

   X _____

   Y _____

   Z _____

   (ii) Give a major function of Z.

_____

_____

(4 marks)

(c) Suggest **two** different network controls that can ensure that each student can only connect one mobile device to the school network.

_____

_____

_____

_____

(2 marks)

(d) Students can seamlessly connect to any access point in the school campus. What access point settings should Mr Li configure? Give **two** examples.

_____

_____

_____

_____

(2 marks)

(e) Mr Li plans to install an Uninterruptible Power Supply (UPS) on the network.

   (i) Give **two** major functions of the UPS.

_____

_____

_____

_____

   (ii) To which component on the network should the UPS be connected?

_____

   (iii) Suppose that an emergency happens and the UPS is activated and used. What should Mr Li do with the component in (e)(ii) next?

_____

_____

(4 marks)

2. A coffee shop subscribes to a broadband connection with:

- a fixed IP address
- download speed: 300 Mbps
- upload speed: 50 Mbps

The coffee shop has an 802.11n router with wireless connections (54 Mbps) and wired connections (100 Mbps). A staff computer, a public computer, an IP camera and customers' mobile devices are connected to the router, as shown below:
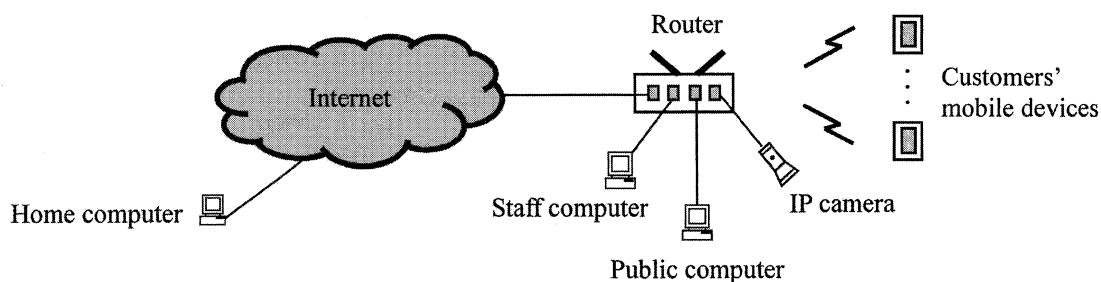
(a) Assume that there is no overhead during network transmission. Estimate the minimum time taken for each of the following activities.

(i) Upload 500 MB image files from a customer's mobile device to a server through the Internet.

_____

_____

_____

_____

(ii) Download a 1 GB video file from the Internet through BT software in the staff computer.

_____

_____

_____

_____

(4 marks)

(b) A customer tries to use his mobile device to download some image files through the wireless connection, but the download speed is much slower than 54 Mbps. Give **three** possible reasons.

_____

_____

_____

_____

_____

_____

_____

(3 marks)

The IP address of the IP camera is 192.168.0.8. John, a staff member of the coffee shop, wants to connect to the IP camera through the staff computer and the home computer.

(c) (i) Which computer(s) can John use to connect to the IP camera through the following IP addresses?

(1) 192.168.0.8

_____

(2) The fixed IP address of the broadband connection

_____

(ii) John is worried about eavesdropping on the IP camera although password protection is in place. Give a security measure that can minimise this threat.
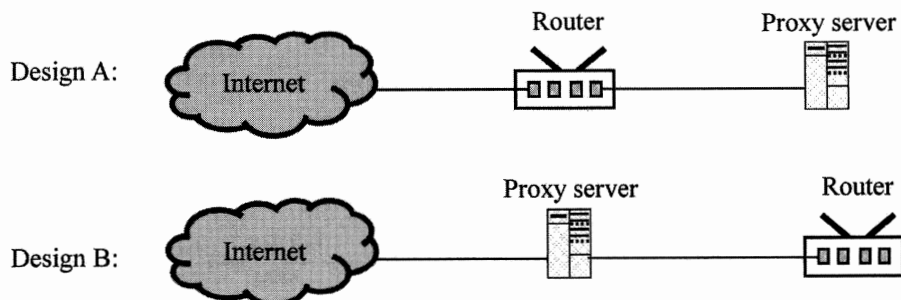
_____

_____

(3 marks)

Provided by dse.life

(d) The coffee shop expands the existing computer network with a proxy server. There are two designs, as follows:

Design A:

Router   Proxy server

Internet

Design B:

Proxy server   Router

Internet

(i) In general, which design is more commonly used? Justify your answer.

_____

_____

_____

_____

(ii) Explain how a proxy server can improve customers' Internet browsing experience.

_____

_____

_____

_____

(iii) Give another function of a proxy server, other than the function in (d)(ii).

_____

_____

_____

(5 marks)

3. Peter develops a private network for users to send text messages and files through, and to dial phone calls.

    (a) Peter considers using the following designs for the private network. Briefly describe each design and its characteristics.

        (i)   Duplex communication mode

        _____

        _____

        _____

        _____

        (ii) Synchronous transmission

        _____

        _____

        _____

        _____

        (iii) Circuit switching

        _____

        _____

        _____

        _____

                                                                (6 marks)

Provided by dse.life

Peter decides to use packet switching in the network. When sending a file, a number of packets will be sent and each packet consists of a header and a payload which is the actual data to be sent.

(b) (i) Give **three** pieces of information that are stored in the header.

_____

_____

_____

_____

_____

_____

(ii) Packets are sent to a receiver through different routes. What will be done at the receiver to process the packets?

_____

_____

_____

_____

(5 marks)

(c) Peter plans to test the file transfer function. The testing environment is:

File size:	2 MB
Bandwidth:	1 Mbps
Packet size:	1 KB
Header size of a packet:	40 bytes

Each packet consists of a header and a payload. Assume that there is no data lost and no other overhead on the network during the transmission.

(i) Find the size of a payload.

_____

_____

(ii) Estimate the number of packets to be sent.

_____

_____

_____

_____

(iii) Estimate the time for transferring the file.

_____

_____

_____

_____

(5 marks)

4. Ms Chan plans to build a Local Area Network (LAN) with four zones in a school campus. She collects some network specifications from the school, as shown below:

- IP address: 192.168.0.x $(0 \leq x \leq 255)$
- Each zone is a subnet.
- There is a router that supports four subnets.
- There is a domain controller.

(a) (i) What is the main characteristic of a LAN compared with a Wide Area Network (WAN)?

_____

_____

(ii) Why is a router needed for the LAN?

_____

_____

(2 marks)

(b) Give **two** common network services provided by the domain controller.

_____

_____

_____

(2 marks)

(c) Ms Chan evenly distributes the number of network connecting devices in the subnets.

(i) What is the maximum number of network connecting devices in each subnet? Show your calculation.

_____

_____

_____

(ii) What is the subnet mask?
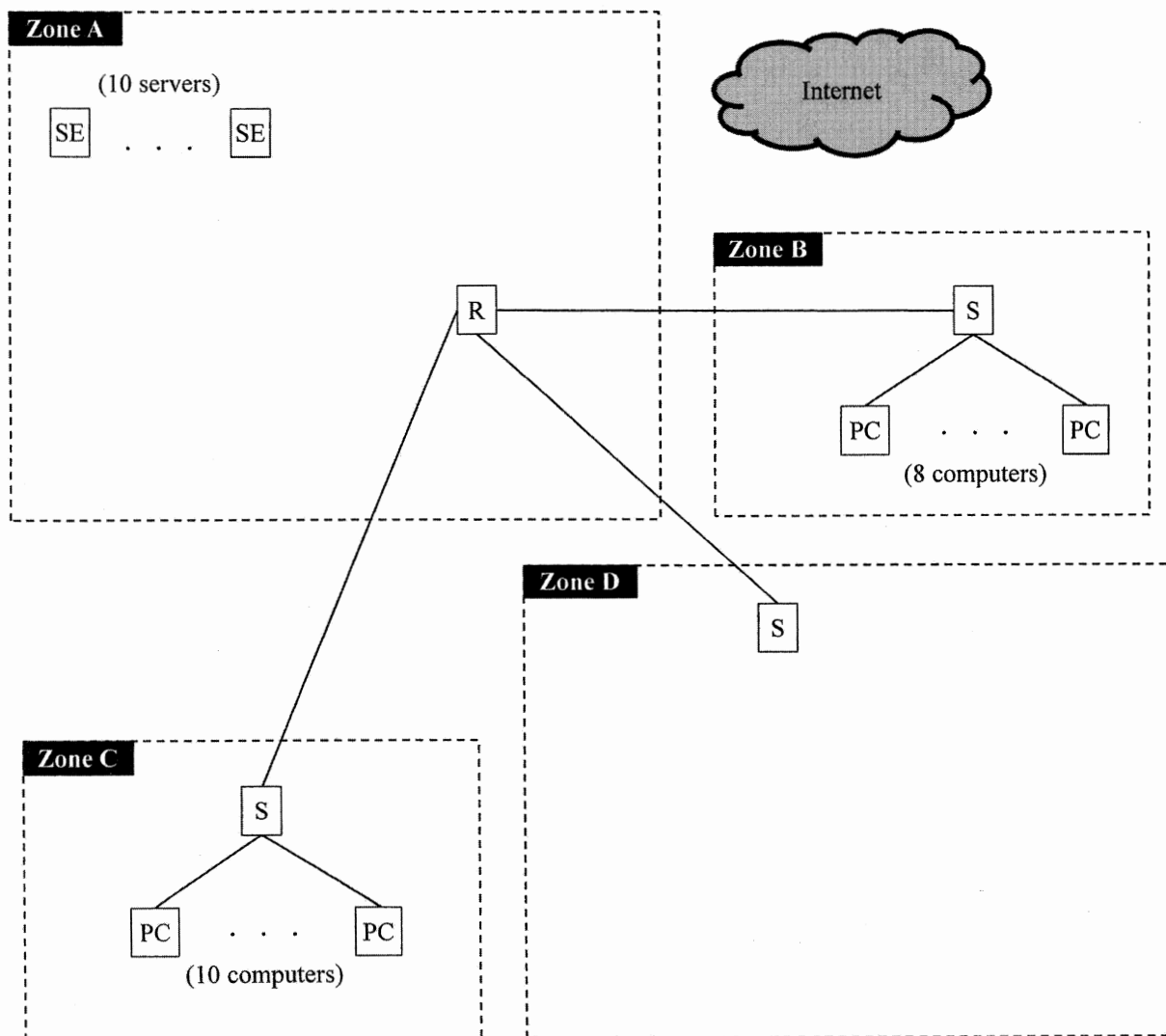
_____

(3 marks)

Provided by dse.life

In Ms Chan's plan, there will be a domain controller, a firewall, a router and five 16-port switches in the network and some devices in the zones, as shown below:

Zone	Name	Device
A	Server room	10 servers
B	General office	8 computers
C	Teacher room	10 computers
D	Science lab	20 computers

(d) Complete the following network design of the school campus by drawing the necessary network connecting devices and cable connections. Use the following symbols to represent the relevant network components.

SE	Server	DC	Domain controller	F	Firewall	R	Router
S	Switch	PC	Computer		Cable		

(8 marks)

END OF PAPER