COMPUTER AND INFORMATION TECHNOLOGY
PAPER 2 (MODULE C)
DATA COMMUNICATIONS & NETWORKING

Question-Answer Book

11.15 am – 12.15 pm (1 hour)
This paper must be answered in English

(SAMPLE PAPER)

Instructions:

1. Write your Candidate Number, Centre Number and Seat Number in the spaces provided.

2. Answer all questions.

3. Write your answers in the spaces provided in this question-answer book.

4. Supplementary answer sheets will be supplied upon request. Write your Candidate Number on each sheet and fasten them with string inside this book.
1. Thomson is the EDP manager of a company. The headquarters are located in HK with a branch office in the USA. Currently, both offices have networks with 10M Ethernet connections. One 128 kbps leased line is hired from a telecommunication company to connect the two offices. Below is a logical diagram of the current connection.

(a) (i) Which network(s) is/are the LAN?  
\[\text{Network P and Network Q}\]  
(1 mark)

(ii) Which network(s) is/are the WAN?  
\[\text{Network R}\]  
(1 mark)

(b) Name the devices X and Y.  
\[X \text{ is a router and } Y \text{ is a switch/hub.}\]  
(2 marks)

(c) Which types of physical topology are used in Network P (HK) and Network Q (USA) respectively? Describe briefly the arrangement of the workstations and file server in the topologies employed.  
\[\text{Network P uses bus topology while Network Q uses star topology.}\]

\[\text{Bus topology has all workstations and file server connected to a control cable (called a trunk or bus).}\]

\[\text{Star topology has all workstations connected directly to a file server through a hub but not to each other.}\]
Due to expansion in business and the extensive use of IT in the office, the company is now planning to upgrade the IT facilities.

(d) To improve the quality of the communication service between the two offices, the company plans to upgrade the bandwidth of data communication between the two offices. Thomson proposes two methods:

Method A: Upgrade the leased line to 1.5 Mbps.
Method B: Establish a 1.5 Mbps broadband connection to a local ISP using ADSL modem.

(i) What is the meaning of Mbps? (1 mark)

_It is a data transmission rate expressed in Mega bits per second / 10^8 bits per second._

(ii) What is the minimum time required to transfer a 10 MBytes file? Express your answer in seconds and show your steps. (2 marks)

\[
(10 \times 1024 \times 1024 \times 8) / (1.5 \times 1000 \times 1000) = 55.92 \text{ seconds}
\]

(iii) What is the advantage of Method A? (2 marks)

_A leased line has guaranteed bandwidth._

(iv) What is the advantage of Method B? (2 marks)

_The running cost is cheaper._
2. Jackson's computer at home is connected to the Internet through an ADSL modem. When he checks the network configuration of his computer, the following is found.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHCP Enabled</td>
<td>Yes</td>
</tr>
<tr>
<td>Autoconfiguration Enabled</td>
<td>Yes</td>
</tr>
<tr>
<td>IP Address</td>
<td>210.3.119.143</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>255.255.255.192</td>
</tr>
<tr>
<td>Default Gateway</td>
<td>210.3.119.129</td>
</tr>
<tr>
<td>DHCP Server</td>
<td>210.0.144.6</td>
</tr>
<tr>
<td>DNS Servers</td>
<td>210.0.144.66, 210.0.144.26</td>
</tr>
</tbody>
</table>

(a) (i) What is the meaning of ADSL? 

*It stands for asymmetric digital subscriber line, a technology that allows higher data rate to be sent over existing copper telephone lines.*

(ii) From time to time, the last number ‘143’ of the IP address varies. Explain why. 

*The IP address is assigned by the ISP's DHCP server. It will be renewed from time to time.*

(iii) How many bits are used to represent the Default Gateway address? 

32

(iv) What is the function of the DNS server? 

*To translate the requested domain name (web address) to its IP address.*

(b) When Jackson browses the Internet, he visits the following web address: ‘http://edu.chansir.net.hk’

(i) What is the meaning of ‘http’? 

*Hyper text transfer protocol OR a protocol in transmitting web page*

(ii) Which part indicates the region where the domain name is registered? 

*"hk"*

(iii) Which part indicates the nature of the domain name? 

*"net"*
(c) Jackson wants to establish a web server at home. Since the IP of his computer varies from time to time, he registers a static Domain Name with a ‘Domain Name Service Provider’ through the Internet. In order to access his web server using this Domain Name, he has to run a program in his Server. What is the function of the program and the role of the Service Provider? (3 marks)

- The program is used to report its updated IP address to the Service Provider regularly.
- The Service Provider will act as the Domain Name server of the registered domain name.
- It translates the registered domain name to the IP address reported by Jackson’s server.

(d) Jackson also wants to have remote control over his web server. His friends suggest using ‘telnet’, but, Jackson argues that ‘telnet’ is not secure. Give a reason to support Jackson’s argument. (2 marks)

- The user name and password are both sent in plain text if ‘telnet’ is used.
- The damage is great when the ‘telnet’ service is attacked by hackers.
A secondary school has installed a local area network containing a number of terminals, a file server and a printer server. All student information is stored in the file server. All teachers have their own terminals.

(a) Describe two advantages and one disadvantage for a teacher of using the terminal in his daily work.

**Advantage : A teacher can access the students' information easily using the terminal.**

**Advantage : A teacher can share his teaching notes with his colleagues.**

**Disadvantage : If there is a failure in the network, teachers' work will be affected.**

(b) The personal computers in a computer room are also connected to the local area network. Students have access to the personal computers in the computer room.

(i) How can this arrangement facilitate teaching and learning? Give three examples.

**Communication between teachers and students can be improved.**

**Submission of students' work and distribution of teachers' notes can be enhanced.**

**A discussion forum can be held in the network.**

(ii) Comment on this arrangement in terms of security. How should the issue of security be addressed?

**If the PCs are easily accessed by all students, security is a problem.**

**Virus may be easily spread and the information in the file server may be corrupted under attack.**

**Security should be addressed. Firewall and anti-virus programs should be installed.**
c) The school is planning to have its network connected to the LANs of the other schools to form a WAN using a telephone line.

(i) Describe the differences between LAN and WAN. (2 marks)

*LAN is a network connection within a small area like a building.*

*WAN is a network connection over a much wider area, e.g. over countries.*

(ii) Apart from the telephone line, what extra hardware is needed for the connection with other schools? Explain briefly the function of this hardware. (2 marks)

*Modem*

*The function of the modem is to convert digital signals to analogue signals or vice versa.*

(iii) Describe two advantages of connecting the LANs of several schools together. (2 marks)

*Information may be shared among schools.*

*Teaching and learning can take place across schools.*
4. A trading company has 20 employees and an office area of about 5000 square feet. It is located on a single floor of a commercial building in the Central Business District. There are currently 15 personal computers running Windows NT 4.0 in the office. The personal computers are used to run spreadsheet and word processing software. Data files are shared among staff members. It is recommended that the personal computers be networked together using Ethernet.

(a) Describe briefly why the trading company has to set up the computer network. What kind of network is this? (3 marks)

To improve the company’s efficiency.

To share information among the staff.

This is a local area network.

(b)Recommend a type of communication medium for the above personal computer network. (1 mark)

It is recommended to use Unshielded Twisted Pair (UTP) or coaxial cable.

(c) State two advantages of the communication medium recommended in (b). (2 marks)

Lower cost for other supporting devices, like NIC cards and hubs.

Popular and easily available.

(d) What kind of network topology will be most appropriate for the communication medium recommended in (b)? (1 mark)

Using STAR for UTP or BUS for coaxial cable.

(e) In order to share the data files, the files have to be stored in a central location. What do we call this central location? What other function can this central location perform? (2 marks)

The central location is known as a File Server.

The File Server stores application programs and has large amount of secondary storage.

(f) In addition to cabling, describe two other essential hardware items that are needed for the network. What are their functions? (4 marks)

Network interface cards are required for all client PCs.

The function of NIC is to provide a connection to the network.

A hub is needed to connect all the UTP cables from the PCs together.

It is a common connection point to connect all segments of a LAN.
3) Apart from the hardware, name a software required for the management of the network. Give one of its functions. (2 marks)

*Windows NT 4.0 Server OS or Novell Netware is required for the management of the network.*

*This software has the functions of managing the network resources and sharing of files.*