C1   Networking and Internet Basics

Short Question 1

Tiffanys has a dozen different devices such as desktop computers, mobile devices and servers. She wants to create a network so all these devices can be connected.

(a)   State a benefit of implementing the network using a client-server network.   (1 mark)

(b)   State a benefit of implementing the network using a peer-to-peer network. (1 mark)

(c)   Tiffany has decided to implement a client-server network. She is now planning to share some photos of the company from last year. Describe how she can use a server to enable devices to access the photos.
          (1 mark)

Short Question 1 (Answer)

(a)   More secure as better user management / Server-specific services such as file server print server are available   (1 mark)

(b)   Lower setup cost /Higher flexibility to add or remove devices   (1 mark)

(c)   Set up a file server to store all the photos and share the folder to the devices connected to the LAN.   (1 mark)

Short Question 2

Collaborative learning involves students working together on different learning activities or tasks in a small group. Common examples of collaborative learning include creating a presentation or a video as a group.

(a)   Suggest how file sharing using a server can be used to facilitate collaborative learning.   (1 mark)

(b)   Suggest how video conferencing can be used to facilitate collaborative learning.   (1 mark)

(c)   Students of an Art School need to use paid photo editing software. The network manager has two options:

    (1) Purchase a network licence that allows the network manager to install the software on all computers in the network.

    (2) Purchase multiple single-device licences. Each licence allows the network manager to install the software on one computer only.

    Aside from the cost, give two reasons why option (1) is better than (2).   (2 marks)

Short Question 2 (Answer)

(a)   Upload their work for collaboration /View the files of other group members /or any acceptable answer.   (1 mark)

(b)   Discuss group project through video conference /Virtual presentation /or any acceptable answer.   (1 mark)

(c)   Easier installation across multiple devices using centralised deployment /Easier to manage software updates
Easier to migrate software installation from old to new devices   (2 marks)

Short Question 3

Mary has a desktop computer which she wants to connect to the home's wireless network. Her brother said she needs to purchase a network device to make it possible.

(a)   What is the name of this device?   (1 mark)

(b)   Mary visits a computer shop to buy the device specified in (a). The staff tells her that there are two variants of this device:

        (1) Installed inside the motherboard of a computer using a peripheral component interconnect (PCI) slot

        (2) Installed externally using the USB port

        Aside from ease of setup, explain a benefit of each of the above methods.   (2 marks)

(c)   After purchasing the device, she noticed the print on the box was smeared, as shown below.

                        "XXXXX Address: 10:2B:54:43:3A:B7"

        What should "XXXXX" be?   (1 mark)

(d)   Her friend Bruce makes the following comment on the address shown in (c).

                        "Whenever you connect to a new network, the router will replace this address and assign you a new one. So this particular address is useless."

        Explain why Bruce is wrong, and state who assigns this address.   (2 marks)

Short Question 3 (Answer)

(a)   Wireless Network Interface Card (NIC)   (1 mark)

(b)   (1) It is harder for the NIC to be removed accidentally from bumps

        (2) The antenna can be extended using aUSB cable for better reception /The NIC can be easily moved to another computer   (2 marks)

(c)   Media Access Control (MAC) (1 mark)

(d)   The MAC address is assigned by the manufacturer of the NIC, it does not change when connected to a new network. (2 marks)

Short Question 4

(a)   The network manager chose to use Shielded Twisted Pair (STP) cable over Unshielded Twisted Pair (UTP) cable even though it is much more expensive. Give a reason for this decision.   (1 mark)

(b)   The laboratory needs to connect to the campus network to access research files. The laboratory is located on a hillside about 1km from the campus. Is STP cable suitable for this connection? Explain briefly.   (1 mark)

(c)   A consultant suggested using fibre optic cable for the connection between the laboratory and the campus. Give an advantage and a disadvantage of using fibre optic cable. (2 marks)

Short Question 4 (Answer)

(a)   STP cable is less affected by electromagnetic interference (EMI) by other instruments in the laboratory.   (1 mark)

(b)   No. As STP cable can only be used within a short distance (100m).   (1 mark)

(c)   Advantage: Fastest transmission speed /Longer transmission distance /Not affected by EMI (1 mark)
        Disadvantage: Higher setup cost   (1 mark)

Short Question 5

Nowadays,it is common for users to have multiple mobile devices and peripherals such as wireless earphones and smart watches.

(a)   Give an advantage of connecting a wireless earphone to a smartphone using Bluetooth over Wi-Fi. (1 mark)

(b)   Ryan asked the following question.

> "Wi-Fi has a much higher data transfer rate and coverage area than Bluetooth, so why isn'tWi-Fi used to connect all peripheral devices?"

Explain why it is impractical to connect all peripheral devices to a host device (e.g. a phone) using Wi-Fi.   (1 mark)

(c)   Ryan is considering subscribing to a 5G mobile data plan. A staff member tries to demonstrate the much higher throughput of 5G by running an Internet test on a 5G phone in the shop. The staff member made sure that 5G is enabled on the phone, but the Internet speed test still shows only LTE (4G) speeds. Give a possible explanation for this.   (1 mark)

Short Question 5 (Answer)

(a)   Lower power consumption (1 mark)

(b)   Bluetooth supports multipoint connections but Wi-Fi supports single connection only (1 mark)

(c)   There is no 5G signal coverage in that area. (1 mark)

Long Question 1

Your cousin asks you to help set up his home network. There are three devices to connect to the network:

- A desktop computer which only has LAN port
- A laptop and a smartphone that only has wireless connection

He also needs to access the Internet from his home network.

(a)   The Internet Service Provider provided a modem to your cousin. What Is the function of a modem?   (1 mark)

(b)   He currently has an ADSL broadband connection to the Internet.

(i) What is the difference between an ADSL and an SDSL broadband connection? (1 mark)

(ii) He is considering updating to a Fibre-to-the-Home (FTTH) broadband connection. Give an advantage of this. (1 mark)

(iii) Explain why the modem must be changed if he wants to switch to an FTTH broadband connection. (1 mark)

(c)   He purchased a new device called a"Wireless Dual Band Router".

(i) This router combines the function of three network devices into one. State these three devices.   (1 mark)

(i) What does "Dual Band" in the router name mean?   (1 mark)

(iii) Although most devices nowadays operate on the 802.11ax (Wi-Fi 6) standard, this router still supports old standards (802.11a/b/g/n/ac). Give a reason for this.   (1 mark)

(d)   After setting up, he connects his laptop to the Wi-Fi network. He finds that the Wi-Fi connection standard is 802.11ac.

(i) Suggest a possible reason why the connection standard is not 802.11ax (Wi-Fi 6). (1 mark)

(ii) He has ensured that the router's settings are correct. Suggest an upgrade to his laptop that can solve the problem above.   (1 mark)

(e)   Your cousin also has a network printer with a LAN port and wireless connection. State an advantage of connecting the printer to the network using

(i) wired connection   (2 marks)

(ii) wireless connection   (2 marks)

Long Question 1 (Answer)

(a) To convert between the analog signals from the Internet and the digital signals from computers, and vice versa. (1 mark)

(b) (i) The download speed is much faster than the upload speed in ADSL. /The download and upload bandwidth are the same in SDSL. (1 mark)

(ii) Higher bandwidth (data transmission rate) (1 mark)

(iii) Because ADSL connection uses electrical signal in telephone line while FT'TH connection uses optical/light signal in optical fibre. (1 mark)

(c) (i) Router, Switch and Wireless access point. (1 mark)

(ii) It supports wireless connections/Wi-Fi over two radio frequencies / bands (2.4GHz and 5GHz). (1 mark)

(iii) This ensures older devices without 802.11ax can still connect to this router. (1 mark)

(d) (i) The router is set to 802.11ac only mode /The Network Interface Card (NIC) of the laptop does not support 802.11ax (1 mark)

(ii) Install a new NIC which supports 802.11ax. (1 mark)

(e) (i) Advantage: more stable connection /higher transmission speed /less affected by radio signal interference (1 mark)

Disadvantage: the printer cannot be moved easily /setup takes more time and effort (1 mark)

(ii) Advantage: the printer can be put in places that are hard to connect with wires/easier to move the printer/easier setup (1 mark)

Disadvantage: les stable connection /lower transmission speed /may be affected by radio signal interference (1 mark)

Long Question 2

Most hospitals in Hong Kong have implemented computer networks for easier management and better patient care.

(a)   Hospitals usually restrict the use of wireless devices (such as smartphones) in the wards and near sensitive medical equipment. Give a possible reason for this. (1 mark)

(b)   Some workstations in the hospitals are connected to the hospital network using twisted pair cables. What is the purpose of 'twisting' the copper wires in the cable? (1 mark)

(c)   A network manager proposed 2 ways of storing the patients' files within the hospital network.

        Option 1: All patients' files are stored in his/her attending doctor's computer. Other staff members who need to access any patient's file can request it from the computer of the patient's attending doctor.

        Option 2: All patients' files are stored in a file server on the network. Staff members can access the file server from their computer.

        (i) Identify a problem that may arise from using option 1. (1 mark)

        (ii) Give two disadvantages of using option 2 compared to option 1. (2 marks)

(d)   Most hospitals use leased lines to connect networks instead of broadband connections that are commonly used in homes.

        (i) Suggest a common method of broadband connections used in households. (1 mark)

        (ii) Give an advantage of leased line compared to broadband connection. (1 mark)

        (iii) Explain why it is very rare for an individual household to use a leased line connection despite the advantage stated in (i). (1 mark)

(e)   Some hospitals are now using wearable health trackers to collect patients health indicators such as heart rate and blood oxygen level so that when the patients are outside the hospital, data can still be sent back to the hospital for recording purposes. Give an advantage and a disadvantage of each connection method below when used in a wearable health tracker.

        (i) Bluetooth connection to smartphone app. (1 mark)

        (ii) Cellular connection to the hospital's server through the Internet. (1 mark)

(f)   A student thinks that since the data collected by a health tracker are mostly numeric or text based, only 3G cellular connection is needed.

        (i) Explain why 3G cellular connection is not suitable for wearable devices if many cellular users are in the same area. (1 mark)

        (ii) Aside from a higher data transfer rate, suggest an advantage of using a 5G connection instead of 4G connection in a wearable health tracker. (1 mark)

Long Question 2 (Answer)

(a)   To avoid interference with medical equipment (1 mark)

(b)   To reduce electromagnetic interference (EMI) /To reduce crosstalk between wires (noise from nearby wires) (1 mark)

(c)   (i) Troublesome to find the patient's attending doctor/ Changes made by another staff may not be stored in copy in another staff's computer (1 mark)

        (ii) Higher setup cost /More vulnerable to system outage as all files are stored in one location (2 marks)

(d)   (i) ADSL/Fibre-to-the-cabinet /Fibre-to-the-home (1 mark)

        (ii) Fixed bandwidth /More secure /More stable (1 mark)

        (iii) It's much more expensive (1 mark)

(e)   (i) Longer battery life/No additional Internet subscription needed (1 mark)

        (ii) Able to upload data anytime and anywhere /still has connections to server even when the phone is not around the tracker /higher data transfer rate (1 mark)

(f)   (i) 3G cellular tower only supports a much lower device density. (1 mark)

        (ii) Lower latency /Lower power consumption /Better reliability /Supports higher device density (1 mark)