Data Communications and Networking
Assignment 1, Semester 2 of 2024-2025

A. Answer All Questions (10 points for each question)

1. What is the OSI model?
   (1) Explain different layers in the OSI model.
   (2) Compare the differences between the OSI and TCP/IP models.

2. What are the advantages of using fiber-optic cabling rather than copper cabling?

3. A company's computer network is the backbone of its business as it connects all its computers and related devices, allowing staff to work more efficiently across the organization. Suppose a commercial company has about 1000 staff. As a computer officer in the company, you are required to design a computer network for that company. Note that network design involves evaluating and understanding how all the elements of the network link together and how they can be made to run as efficiently as possible. Please answer the following questions.
   (1) Which network topology will you adopt?
   (2) What components will be used in the network?
   (3) Give five important factors when designing a computer network (please give your explanations).
   (4) Use a figure to illustrate the overall design.

4. Explain the concept of signal attenuation and how it affects data transmission.

5. There are three typical network cables: Fiber-optic, Twisted-pair (STP and UTP), and Coaxial. Which type of network cable contains multiple copper wires and uses extra shielding to prevent interference? Explain your answer.

6. The CRC method is used to transmit a bit stream of 1101 1111 with the generator polynomial $x^3 + x^2 + 1$. Show the actual bit string transmitted. Suppose the third bit from the left is inverted during the transmission. Show that this error is detected at the receiver's end.

7. Sketch the Manchester encoding for the bit-stream: 1101 1010.

8. Calculate the Hamming Code for the bit-stream: 1111 1110 0110.

9. Both methods, "**Error correction**" and "**error detection and retransmission**," can tackle error bits in data communication. State two reasons why some applications use error correction instead of error detection and retransmission.

10. What is the primary function of the Physical Layer in the OSI model?

11. How does the Physical Layer handle data encoding, and why is it important?

12. The Internet of Things (IoT) is doing great in many fields and services. Numerous IoT applications can ease our commercial operations. Suppose you are a project leader in a software house, and your team is required to write a proposal about IoT innovation. Please suggest what kind of application you would propose and why.

B. Submission

1. Due date of Assignment 1: 11th April 2025 (Friday, 4:00 pm).
2. Students are required to upload their assignments to iSpace before the deadline.