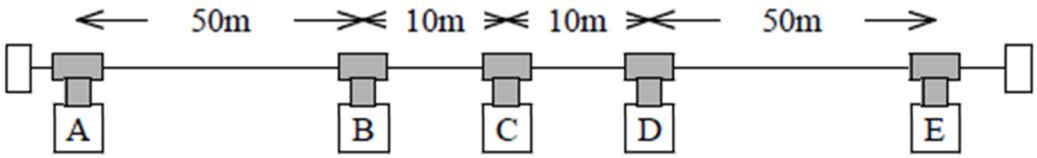
Data Link Layer – TD

Exercise 1: CRC

A bit stream 10011101 is transmitted using the standard CRC method described in the text. The generator polynomial is $x^3 + 1$.

1. Show the actual bit string transmitted.
2. Suppose that the third bit from the left is inverted during transmission.
    a. Show that this error is detected at the receiver's end.
    b. Give an example of bit errors in the bit string transmitted that will not be detected by the receiver.

Exercise 2: Ethernet 10Base 2



Given:
Signal propagation speed is $2*10^8$ m/s.

1. Is the cable length conform with the standard?
2. Suppose that A senses the carrier and finds the medium idle. It starts to transmit. What happens if E decides to transmit 1 µs later?
3. A and B detects a collision. It is the second collision for A and the third collision for B. What is the probability of a new collision?

Exercise 3: Ethernet 10BaseT

Given:
Signal propagation speed is $2*10^8$ m/s.

Suppose that 2 stations A and B are connected to a hub with Cat 3 twisted pair cables. The cable length is 75 m.
The hub traversing time is given as 10 bit duration.
1. Is the cable length conform with the standard?
2. Suppose that A senses the carrier and finds the medium idle. It starts to transmit. What happens if B decides to transmit 1.5 µs later?
3. Suppose that the minimum frame size is configurable, what is the minimal size a network designer can use?

Exercise 4

1. Remind the algorithm of CSMA/CD (Carrier Sense Multiple Access / Collision Detection) used in the Ethernet bus.
2. How to calculate the maximum length of a 10 Mbps Ethernet bus? The smallest size of an Ethernet frame is 64 bytes as defined by the IEEE standard
3. The new 100 Mbps Fast Ethernet networks are completely compatible with the IEEE standard. What is the maximum length of a Fast Ethernet segment? How can we increase this minimal network size?
4. Compare the functionalities of repeater, bridge and switch. Which devices allow increasing the size of an Ethernet network?