Number:	3. Assignment
Issued:	20.11.08
Tutorial:	27.11.08 & 28.11.08
Lecturer:	Prof. Dr. Güneş, Dipl.-Inf. Blywis
Contact:	{guenes, blywis}@inf.fu-berlin.de

General information about the exercises
Accompanying the lecture, we will give out some assignments. You shall do the exercises on your own but you do not have to submit your solutions. The solutions will be presented in the tutorial sessions. We expect each student to have solved the exercises and might ask anyone to present these.

Exercise 1, Cyclic Redundancy Checksum:

Determine whether the following bit sequences have been transmitted error-free. Use the generator polynomial

$$x^4 + x + 1$$

If you encounter an error, assume the checksum is wrong and (re-)calculate the value.

	Data + CRC
1.	0111 0110 0010
2.	0101 0010 1001
3.	1111 0110 1100

Exercise 2, Transmission with HDLC:

The *High Level Data Link Protocol* (HDLC) is a protocol of the Data Link Layer (DLL). One of its purposes is to protect the data communication of two adjacent hosts (A and B). Transmission errors are detected by checksums.

1. Consider the bit sequence 110111110101. This sequence is to be transmitted including its CRC checksum. Compute the checksum by using the following generator polynomial instead of CCITT CRC-16:
$$G(x) = x^4 + x + 1$$
2. Create/sketch the HDLC frame that is used to transfer the data from host A to B. Assume that the sequence number counters have been initialized with the value of zero. The frame shall be used to signal host B that the first two frames were received successfully. The address of host B is 11111111_2. The P/F bit shall be ignored and set to 0. Instead of the normal 16 bit HDLC checksum, the 4 bit checksum computed in part 1 shall be used.
3. The frame created in part 2 is now passed to the physical layer. Draw/sketch the data part of the HDLC frame using:
   (a) the Manchester Code
   (b) the Differential NRZ Code

Exercise 3, Sliding Window Mechanism:

HDLC uses the sliding window mechanism for flow control. Each frame contains a sequence number $N(S)$ as well as an acknowledgement number $N(R)$. The acknowledgement number acknowledges all frames up to $R-1$. Thus, frame R is expected to be received as next. To avoid an overflow of the counter, the value is calulated modulo M.

1. How many frames is a sender allowed to send without getting an acknowledgement?
2. Consider an example with $M = 8$ and window size $W = 7$. The frames with $N(S) = 5, 6, 7, 0, 1$ have been sent. No acknowledgement has been received yet. List the remaining sequence numbers that may be used by the sender?
3. How does the situation in part 2 change if a frame with the following acknowledgement number is received:
   (a) $N(R) = 2$
   (b) $N(R) = 6$
   (c) $N(R) = 5$

   List the acknowledged sequence numbers and the window of remaining sequence numbers.

Exercise 4, Transmission Capacity:

Consider a host-to-network technology with a sliding window mechanism and a window size of $W = 7$. The frames are up to 1,500 bytes long and the round trip time is given with 50 ms. Calculate the maximum data rate that can be achieved with these parameters when sending frames from host A to B.

Exercise 5, Sliding Window - Retransmission Strategies:

List and discuss the advantages and disadvantages of the three retransmission strategies introduced in the lecture.

Exercise 6, Multiplexing and Multiple Access:

Elaborate the notion of multiplexing and multiple access. Name and explain the different "types"; give examples. How are these terms correlated with the duplex, half-duplex, or simplex properties of particular transmission technologies?

Exercise unrelated to Telematics. Solve the following brainteaser if you like.

Exercise 7, Free the Prisoners:

143 persons are imprisoned in a jail. The prison warden offers the prisoners a chance to be freed if they solve the following task. Each day a random prisoner will be taken out of the cell into an interrogation room. This room contains only a chair, table, and a table lamp. The prisoner can switch the lamp on and off and no guard will tamper with it; it is the only means of communication. Any prisoner can state at any time that all of them have been taken to the interrogation room at least once. If he is right, all of them will be set free; if he is wrong, they remain imprisoned forever. After the announcement of the task the prisoners are given time to communicate with each other. They have to come up with a communication protocol to solve the task. Afterwards, they are taken into their cells (cellular confinement) and will never again be able to talk to each other.
Can you specify a protocol/algorithm to free the prisoners? Hint: We do not care how long it will take to get the prisoners freed.
