## Computer Networks Prof. Dr. Mesut Güneş SoSe 2017



# 5. Problem Sheet

Out Due Discussion 17. 05. 17 23. 05. 17 26. 05. 17 - 30. 05. 17

MSc. Marian Buschsieweke MSc. Kai Kientopf marian.buschsieweke@ovgu.de kai.kientopf@ovgu.de

Please solve the problems in groups with two people and submit your solutions before the lecture. The discussion of the problem sheet is in the exercise course after the submission.

#### Problem 5.1: Multiplexing and Multiple Access

2+2 = 4 points

- Discuss the terms multiplexing and multiple access and give examples.
- How do these terms relate to the duplex, half-duplex, or simplex properties of particular network technologies?

## Problem 5.2: Hamming-Code

1+2+2 = 5 points

Two entities have agreed to use the following encoding to transmit characters:

Code Word
10000
01000
11000
00100
01011

- 1. How many check bits are required to correct all 1-bit errors in messages with a length of m bits?
- 2. A Hamming Code with 4 check bits shall be used in the following. Create the code words which represent the word HAMMING.
- 3. Consider the following code words have been received:

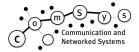
Decode this sequence, mark the blocks that contain an error, and correct the errors if possible.

### Problem 5.3: Generator Polynomial

 $4 \times 1 = 4$  points

The bit sequence 10100001 has to be transmitted. Use  $x^3 + 1$  for the generator polynomial of a CRC.

- 1. Calculate the check sum.
- 2. Name the bit sequence for the transmission.
- 3. How can the receiver check the correctness of the bit sequence? Show the calculation.
- 4. Assumed there is a bit error on the third bit. Show how the receiver recognizes the error.



# Computer Networks Prof. Dr. Mesut Güneş SoSe 2017



## Problem 5.4: Cyclic Redundancy Checksum

3 points

Determine if the following bit sequences have been transmitted error-free. Use the generator polynomial G to apply a CRC check.

$$G(x) = x^4 + x + 1$$

If you find an error in a bit sequence, assume that the checksum bits contain the error. Recalculate the checksum.

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

## Problem 5.5: CRC in Header or Trailer

1 point

Most data link layer protocols store the CRC value in the trailer rather than the header. Discuss why this is a common approach.

#### Problem 5.6: LLC vs. MAC

3 points

Discuss the difference tasks of the LLC and MAC.

 $a\ total\ of\ 20\ points$