7. Problem Sheet

Out	Due	Discussion
31. 05. 17	06. 06. 17	09. 06. 17 - 13. 06. 17

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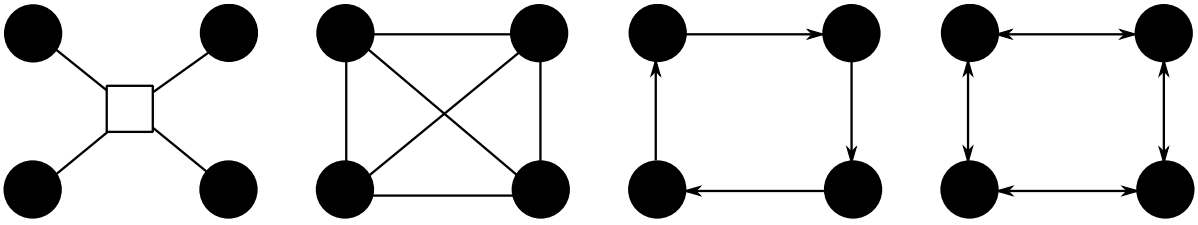
Please solve the problems in groups with two people and submit your solutions before the lecture. The discussion of the problem sheet is in the exercise course after the submission.

Because Monday 05.06.17 is a legal holiday the members of the affected group should distribute on the other exercise courses.

Problem 7.1: Network Topologies

$\frac{1}{2} + \frac{1}{2} + 1 + 1$ = *3 points*

Consider the following four network topologies, each with n nodes: Specify formulas to calculate the minimum, maximum, and average number of hops between any two nodes for any number n.



(a) Star (b) Full Mesh (c) Unidirectional Ring (d) Bidirectional Ring

Problem 7.2: Transmission with HDLC

1+4 = *5 points*

The *High Level Data Link Protocol* (HDLC) is a protocol of the data link layer (DLL). One of its tasks besides flow control is to enable the detection of errors by check-summing.

a) 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:

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

b) Sketch the HDLC frame that is created to transfer the bit sequence from a) from host A to B. Assume that the sequence number counters have been initialized with the value zero. The frame shall also be used to signal host B that the first two frames from B to A were received successfully. The address of host B is 11111111_2. Ignore the P/F bit and set it to 0. Use the checksum calculated in a).

Problem 7.3: HDLC vs. PPP

3 points

Compare the HDLC and PPP protocols. Specify appropriate metrics for the comparison.

Problem 7.4: Verification: Finite State Machine Models *1+1+1 = 3 points*

a) Which property do FSM states have, that are considered as a deadlock state?
b) Is it possible that "protocol 3" (see chapter 4 slides 51) enters a deadlock state? Use the FSM model of this protocol (chapter 4 slide 103) to proof your answer.
c) Is it possible that "protocol 3" enters a livelock, in which no further data is transmitted? Prove that no livelock exists, or give a counter example of a livelock.

Problem 7.5: Finite State Machine to Petri Net *3 points*

How can you transform a finite state machine into a petri net? Explain your idea.

Problem 7.6: ALOHA *1+1+1 = 3 points*

In chapter 5 beginning with slide 21 the ALOHA protocol was presented.

a) Is it possible to reduce/prevent collisions, if the transmitter blocks sending when it detects another transmission?
b) What is the advantage of Slotted ALOHA over ALOHA
c) With static channel allocation (TDMA, FDMA, ...) it is possible to completely prevent collisions. What is the point in using ALOHA instead of static allocation?

a total of 20 points