

Computer Networks and Distributed Systems

Exercise Sheet 5

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Quiz questions

- Why do we introduce sequence numbers in the rdt protocol family?
- Why do we introduce timers in the rdt protocol family?
- Is it possible to have a reliable data link over UDP?
- Suppose the round trip time is known to the sender. Do we still need timers?

Exercise 5.1

UDP and TCP use one's complement to recognize errors.

- (a) For the following 8-bit bytes, what is the one's complement of their sum: 01010011, 01100110, 01110100?
- (b) How does the receiver recognize errors? Which kind of errors can be recognized, which cannot?

Exercise 5.2

Draw the extended Mealy automaton for the receiver of rdt3.0.

Exercise 5.3

The syntax for automata to describe protocol instances used by Kurose and Ross was discussed in the lecture. On the next page you find a problem from an old exam using an extended Mealy automaton to describe a simple transport protocol instance.

Complete the automaton.

Transport system and protocols, extended Mealy automaton

Consider a transport protocol instance S that has to transmit data to a remote transport protocol instance E. The underlying channel is unreliable and can lose packets. A combination of positive acknowledgments, timers and retransmissions is used in a stop-and-go manner to handle packet loss. If a data packet has been transmitted unsuccessfully for three times, instance S aborts its activity. No further mechanism are provided.

Addressing of the network service is only treated in an abstract manner, i.e. we only consider the payload tpdu of the packets. Furthermore we assume, that for packets sent from S to E we have $tpdu = \text{"payload d"}$. For packets sent from E to S we have $tpdu = \text{"ACK"}$.

S has the following inputs:

- TDatReq(d): Transfer data d from the application process to S
- NDatInd(tpdu): Transfer data tpdu from network service to S
- TimerAlert: Timer signals that it has elapsed

S has the following outputs:

- TAbortInd: Notify application process of abort of S
- NDatReq(tpdu): Transfer data pdu from S to network service
- TimerStart: Start timer (active timers are stopped prior to that)
- TimerStop: Stop timer

The behavior of S should be described using the following extended Mealy automaton. Complete the definition of variables, the initialization and the transitions in the diagram.

