Ex. 11-1: User Datagram Protocol (UDP)

a) Name the most important properties of UDP. For what purposes is UPD suited? Name at least one example where UDP is better suited than TCP.

b) Instead of using UDP, applications can also use the IP protocol directly to send data. What offers UDP more in contrast to IP, i.e., what additional services are offered?

Ex. 11-2: Transmission Control Protocol (TCP)

a) TCP uses for the connection establishment a so called 3-way handshake. Why are not simply two packets sent (link connection request and confirmation)?

b) Even four packets are used for the connection termination. Both hosts send a FIN (disconnect) request and confirm the FIN of the other one afterwards due to reliability. Using a simpler connection termination, how could data packets get lost?

c) Which of the following protocols is used by TCP?

   a) Stop-and-Wait
   b) Go-Back N without buffering
   c) Go-Back N with buffering
   d) Selective Repeat

d) TCP recognizes lost packets by missing sequence numbers. However, the order of packets can change on the network layer using IP. Because TCP offers a reliable transport service, it must distinguish if a packet was lost or is just reordered, i.e., it will probably arrive later. Is that decision making possible? If so, how?

e) Sequence numbers in TCP have a width of 32 bit. How long does it take until sequence numbers recur when hosts continuously send with the speed stated below? In which case can this be a problem?

f) How many bits are used in TCP for the sliding window size?

g) Up to which bandwidth does the maximum window size not limit the reachable data rate? Assume a round trip time (the time until a packet gets to the receiver and from there back to the sender) of 70 ms (commonly used in the Internet).

h) What does the congestion window cwnd specify?

   i) The maximum amount of packets that the receiver can accept before its buffer congests.
   ii) The maximum amount of own packets that can be in the network at the same time.
   iii) The TCP data flow rate.

i) How does the actual data rate of TCP depend on cwnd?

j) Find out what the principle of "Conservation of Packets" means.