

- 1a Can two computers that have a different implementation of the same protocol exchange messages?
Explain your answer. 5pt
Yes, the protocol prescribes the format of messages, and the precise rules for message exchange. You can easily have different implementations of the same protocol.
- 1b What are the different layers of the OSI reference model, and what does each layer do? 10pt
See book. You really have to mention all seven layers and be able to give the essence of each of them.
- 2a If a medium has a bandwidth of 1 MHz, what does this mean? 5pt
The range of frequencies that can be transmitted through the medium without being strongly attenuated, is 1 MHz.
- 2b What is the difference between amplitude modulation and frequency modulation. Why do we need such techniques? 5pt
Modulation is used for limited-bandwidth media, which prohibits the (undistorted) transmission of digital signals. Using amplitude modulation, the difference between a “0” and a “1” is encoded through a difference in the strength of a (analog) signal. With frequency modulation, the difference is encoded by using two different frequencies.
- 2c What is the purpose of a splitter in ADSL? Be precise in your answer. 5pt
In ADSL, the full bandwidth of the telephone wiring is used by dividing the bandwidth into multiple 4 KHz channels. One channel is used for the traditional voice telephone. A splitter separates this channel from the others, passing it on to the regular telephone devices. The other channels are passed on to the ADSL modem.
- 3 For a sliding window protocol, it is necessary to have the window size at most half of the range of sequence numbers. Why? 5pt
Suppose a receiver has just received frame #N, and it advances its window such that (a new) frame #N is allowed to be transmitted. If the acknowledgement for the receipt of frame #N was lost, then the sender will eventually retransmit the original frame, but which will now be considered as fresh frame by the receiver.
- 4a Instead of using Manchester encoding, we could also use +1 Volt to represent a “1,” and –1 Volt to represent a “0.” What nice property of Manchester encoding would we lose? 5pt
Manchester encoding ensures that there is a transition between high and low voltage for each transmitted bit. As a consequence, the receiver can more accurately dynamically synchronize its clock with that of the sender. This property is lost when using the proposed encoding scheme.
- 4b Explain the principle working of a virtual LAN (VLAN), assuming that only switches are used to connect (VLAN unaware) hosts. 5pt
See book. What you need to explain is where the tagging takes place, and how the routing/broadcasting is realized.

Grading: The final grade is calculated by accumulating the scores per question (maximum: 45 points), and adding 5 bonus points. The maximum total MT is therefore 50 points. The final exam consists of two parts. Part 1 covers the same material as the midterm. Let P1 be the number of points for part 1, and P2 the number of points for part 2 (each being at most 50 points). The final grade E is computed as $E = \max\{MT, P1\} + P2$. The midterm exam counts only for first full exam.