Problems: Ethernet

1. What is the smallest size of an Ethernet frame? What is the largest size of an Ethernet frame?

2. What is the ratio of useful data to the entire frame for the smallest Ethernet frame? What is the ratio for the largest frame?

3. One of the Ethernet standards is called 10Base5. It uses a bus topology and the data rate is 10 Mbps. The speed of propagation in a 10Base5 cable is 2/3 of the speed of light. How long in meters is a bit on a 10Base5 Ethernet?

4. The maximum length of a 10Base5 cable is 500 meters. How long does it take for a bit to travel from the beginning to the end of the network? Ignore any propagation delay in the equipment

5. Using the data in Exercise 4, find the maximum time it takes for a sender to detect a collision. The worst case occurs when data are sent from one end of the cable and the collision happens at the other end. Remember that the signal needs to make a roundtrip.

6. Why do you think that an Ethernet frame should have a minimum data size?

7. Using the data in Exercises 4 and 5, find the minimum size of an Ethernet frame for collision detection to work properly.

8. How long time does it take to create the smallest frame in a 10Base5 Ethernet?

9. A 10 Mbps Ethernet is sometimes said to perform well if the average offered load is no larger than 30% of the network capacity. If the load is larger, the collisions will be so frequent that too much time is spent on collisions, which in turn will result in large queueing delays in the connected computers. Now take a 100 Mbps Ethernet with the same length of the bus as in the 10 Mbps Ethernet examples and with the same offered load, i.e. 30%. Would the proportion of lost time compared to efficient time, be larger or smaller than in the case for the 10 Mbps network?

10. Given the same scenario as in Exercise 9. In order to show the same value regarding the proportion of lost time, how much shorter should the 100 Mbps Ethernet be compared to the 10 Mbps Ethernet?

11. The CSMA/CD protocol is a so-called contention protocol. When does it perform best compared to controlled access protocols (like Token Ring), during low loads or during high loads?

12. Below is an Ethernet-II frame, see lecture notes (slides). The Preamble, Start Frame Delimiter and CRC fields have been removed in the frame below. Two digits represent one

byte; e.g. 2E is one byte. The four left-hand side digits (including the colon) and the dashes are *not* parts of the frame.

```
0000:  08 00 20 7c 94 1c 00 00 - 39 51 90 37 08 00 45 00
0010:  00 3e 36 00 00 00 80 11 - da 4f 82 eb 12 7f 82 eb
0020:  12 0a 04 01 00 35 00 2a - ee 6a 00 01 01 00 00 01
0030:  00 00 00 00 00 00 06 67 - 65 6d 69 6e 69 03 6c 64
0040:  63 02 6c 75 02 73 65 00 - 00 01 00 01
```

(a) To which MAC-address is the frame addressed?

(b) From which MAC-address does the frame come?

(c) Give an explanation for the remaining field in the Ethernet-II header (PDU Type/Length field).

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