Exercise 1: Introduction

Your fellow student in Kaiserslautern is in urgent need of a 4 GB large backup. You would like to help him by transmitting the backup from Saarbrücken to Kaiserslautern (distance 70km). While you can use the fairly fast university network, the receiver has the following options:

- ISDN with 64kBit/s
- A DSL connection with 20MBit/s
- You use your car with the backup stored on a USB stick (90km/h on average)

Hints: 1KB = 1024 bytes
       1KBit = 1000 bits

We assume that there is no overhead for network protocols and no congestion within the network.

Signals travel with 200000 km/s on a copper wire

(1) How long does each transmission take?

(2) If we observed a cable and would see the bits running over it, how long would a single bit be in cm for the ISDN and DSL connection above?

(3) What is the transmission speed of the car in Mbit/s?

Exercise 1.2: Antenna length

The length of a full phase of a wave (think of a sine wave between 0 and 2xPI) will be denoted with lambda. It is known from communications engineering that a sender’s optimal efficiency is achieved at an antenna length of 1/4 of the wave length. Note that the signal travels approx. at the speed of light (300.000 km/s). How long should an antenna of the radio transceiver be if it sends at a frequency of 868 MHz?