S-38.110 Telecommunication Switching Technology I, Exercise 2
Brax/Ilvesmäki, 3.2.2000

The answers are to be returned before the exercise begins either to the exercise assistant (in person or via email to lynx@tct.hut.fi) or to a box underneath the lab's noticeboard.

Task 1

In the case of two national networks being synchronized by using Primary Reference Clocks (with Free Run Accuracy 10^{-11}), how often a slip occurs? If exchanges have to work without any synchronization, what slip rates can be expected? (Use the equation for MRTIE from the lectures.) (Lecture)

Task 2

The velocity of propagation for optical fibre is $2 \cdot 10^8$ m/s. A data source is transmitting at 1Gbit/s. How many bits will there be on a 1000 km of fibre optic cable? (Freeman: 9/29)

Task 3

Let us study the echo effect for packetized voice:
A) Consider the transport of 64 kbit/s voice over data network, which delivers packets of 1000 bits. What is the packetization delay?
B) Now suppose we want to call to someone on an analog telephone, assuming digital/analog gateway between the the data network and the telephone network. Unfortunatelly, echoes are generated at the far end (say 6000 km away) of the telephone connection. Calculate the echo delay, assuming that the analog signal travels at the speed of light (300000 km/s).
(Hui: Chapter 2. Exercise 1)

Task 4

Assume there is queing delay within the packet network, which fluctuates randomly between 2 to 20 packet durations for each packet. Compute the bounds for the queing delay for a transmission speed of 10 Mbit/s, or 150 Mbit/s. How does this delay compare with the delay considered in the previous problem?
(Hui: Chapter 2. Exercise 2)

Task 5

Explain the principles of time and space switching from the PCM-system point of view. What do the switches actually do to a timeslot? Draw simple illustrations of both methods of switching.