

S-38.115 Signaling Protocol, Exercise 1

Brax/Ilvesmäki: Networking laboratory 2003

Deadline: Wed 29.1.2003 at 8:25 before the beginning of the exercise lecture

All late answers will be disregarded. Please, adhere to the deadline.

The answers are to be returned either to the exercise assistant (in person or via email to zhouyi@netlab.hut.fi) or, preferably, to a box underneath the lab's notice board on G-wing 2nd floor. Please write your name, student number and exercise number clearly in each answer page

Attention: for those who will return the exercises via email, please use the "Exercise x" as the subject in your email, where x is the series number of the exercise. And also write your name, student number and exercise number clearly in each answer page.

Task 1

Following the Nyquist sampling theorem, what is the sampling rate of the following systems:

- a 4-kHz voice channel,
- a 7,5-kHz program channel,
- a 4,2-MHz video channel.

Task 2

Which voltage levels are the following A law PCM Coded numbers respecting.

- 1 000 0011
- 1 001 0011
- 1 111 0011
- 0 000 0011
- 0 001 0011
- 0 111 0011

Task 3

In the case of A law PCM, how big is the companding improvement in the case of small signal levels? Give the calculation steps.

Task 4

a) What is the quantization error for a single sample (in volts) in a PCM-system with 8 bit A/D converter with a step size of 0.38V.

b) A 2V peak signal (peak values at +2 and -2 volts) with 0V dc offset is to be sampled. Assuming a 4 bit codeword, size the A/D-converter, compute the step size and quantization error. Remember, you need a sign bit to represent the negative (and positive) signal values.