BCIT

**COMP 3721** **Assignment 2**

**Note:**

- Submit a single PDF file.
- Answer the questions according to textbook, lecture notes and class discussions, not ChatGPT or Google.

**Q1 (10 marks):**

Assume we have a line coding scheme that works as follows. There are two voltage levels at both sides of time axis. A positive voltage level indicates 0 and a negative voltage level indicates 1.

(a) What is the type (category) of this line coding scheme? Explain why.
(b) Explain if baseline wandering is an issue in this encoding.
(c) If we change this encoding scheme such that the signal rate is decreased, what will be the impact on the required bandwidth?
(d) If the bit rate is doubled and the number of bits per signal element remains the same, what will be the impact of the baud rate?
(e) If we change the scheme so that three bits are carried by one signal element and the modulation rate is 300 MBaud, what is the bit rate of the digital signal? Assume $c = 1/2$.

**Q2 (10 marks):**

We have sampled a low-pass signal with a bandwidth of 300 kHz using 128 levels of quantization, using a minimum sampling rate that can reproduce the original analog signal.

(a) Calculate the bit rate of the digitized signal.
(b) Calculate the minimum PCM bandwidth of this signal. Assume $c = 1/2$ and $r = 1$.

**Q3 (15 marks):**

A uniform quantization is performed in the range of $(-2, 2)$ with 4 levels. The sequence of sampled amplitudes is $\{-1.2, -0.2, 0.5, 0.75\}$. No normalization is done.

(a) What is the height of each zone, $\Delta$?
(b) What are the ranges for each zone?
(c) What is the sequence of the quantized values?
(d) What is the sequence of the quantization codes?
(e) What is the sequence of the encoded words?

**Q4 (15 marks):**

We want to modulate our digital data to an analog signal. Answer the following questions.

(a) What is the number of bits per signal element if we use ASK with 16 different amplitudes?
(b) What is the number of bits per signal element if we use QAM with a constellation of 128 points?
(c) How many signal elements are needed in the constellation diagram if 8 bits are encoded by one signal element?

**— End of Assignment 2 —**