CENG 3331 Intro to Telecommunication and networks

Homework 2
Due at the beginning of class, 9/28/2022

Q1. (10) A digital signaling system is required to operate at 9600 bps (data rate as well as channel capacity).
  a. If a signal element encodes a 4-bit word, what is the minimum required bandwidth of the channel?
  b. Repeat part (a) for the case of 8-bit words.

Q2. (10) What is the thermal noise level of a channel with a bandwidth of 10 kHz carrying 1000watts of power operating at 50ºC (0ºC = 273K)? What is the signal to noise ratio in dBW? What is the channel capacity?

Q3. (10) Study the works of Shannon and Nyquist on channel capacity. Each places an upper limit on the bit rate of a channel based on two different approaches. How are the two related?

Q4: (15) Consider a channel with a 1MHz capacity and an SNR of 63.
  a. What is the upper limit to the data rate that the channel can carry? (hint: Shannon capacity)
  b. Assume we choose a data rate of 2/3 as the maximum theoretical limit. How many signal levels are needed to achieve this data rate? (hint: Nyquist capacity)

Q5: (15) If the received signal level for a particular digital system is -151dBW and the receiver system effective noise temperature is 1500K, what is Eb/N0 for a link transmitting 2400 bps?

Q6: (20) For the bit stream 01001110, sketch the waveforms for each of the codes as shown in example given in lecture. Assume that the signal level for the preceding bit for NRZI was high; the most recent preceding bit 1 (AMI) has a negative voltage; and the most recent preceding bit 0 (pseudoternary) has a negative voltage.

Q7: (10) The waveform of figure below belongs to a Manchester-encoded binary data stream. Give the data sequence.

Q8: (10) The bipolar-AMI waveform representing the binary sequence 0100101011 is transmitted over a noisy channel. The received waveform is shown in figure below; it contains a single error. Locate the position of this error and explain your answer.
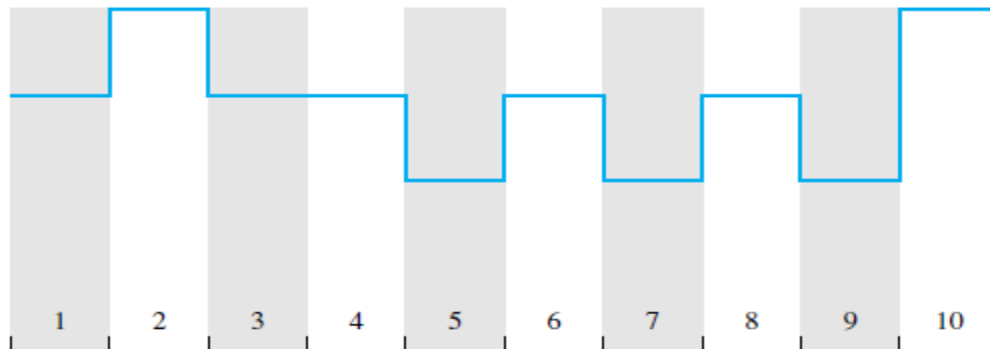
Q9: (Extra 10) Join the discussion of Quantum Communication on Blackboard. Attach only the screenshot of your answer from Blackboard.