Winter 2010 CSE3213 Communication Networks

Assignment # 2

Instructor: Foroohar Foroozan

Review chapter 3 (Sections 3.1- 3.5) Garcia before attempting the assignment.

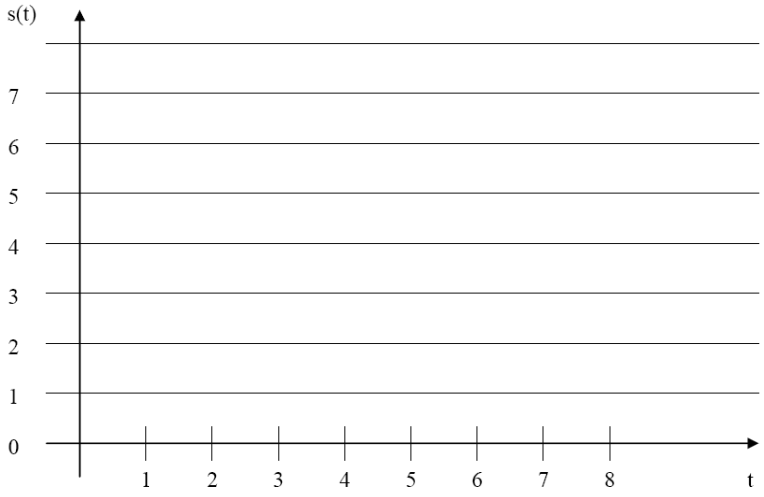
1. Consider an analog repeater system in which the signal has power σ_x^2 and each stage adds noise with power σ_n^2. For simplicity assume that each repeater recovers the original signal without distortion but that the noise accumulates. Find the SNR after n repeater links. Write the expression in decibels: SNR dB = 10 $\log_{10}$SNR.

2. Suppose a baseband transmission system is constrained to a maximum signal level of ± 1 volt and that the additive noise that appears in the receiver is uniformly distributed between [–1/16, 1/16]. How many levels of pulses can this transmission system use before the noise starts introducing errors?

3. Assume a pulse code modulation (PCM) scheme that uses 3 bits to differentiate between 8 different levels of a PAM (i.e. analog) signal.
The following bit string, generated with the given PCM, has been received at time t=1:

000001010011100100011010

Sketch the analog signal that is represented by the string.



4. A link is to be operated at a bandwidth efficiency of B=9, i.e. at a rate of 9 bps for each Hz of bandwidth. Obtain the minimum SNR required at the receiver to allow, in theory, error-free transmission with this bandwidth efficiency. Express your answer in dB's.

5. What is the maximum reliable bit rate possible over a telephone channel with the following parameters?

a. W = 2.4 kHz SNR = 40 dB

b. W = 3.0 kHz SNR = 20 dB

c. W = 3.0 kHz SNR = 40 dB

6. Suppose we wish to transmit at a rate of 64 kbps over a 3 kHz telephone channel. What is the minimum SNR required to accomplish this?

7. Suppose that a low-pass communications system has a 1 MHz bandwidth. What bit rate is attainable using 8-level pulses? What is the Shannon capacity of this channel if the SNR is 20 dB? 40 dB?