

CSE 718 – Performance Evaluation of Computer Networks Course

Marmara University, Istanbul, Turkey

November 23, 2014

Homework 1

Depending on the engineering perspective, bandwidth is described as either a quantity measured in Hz or the maximum data rate of a channel, in other words, a quantity measured in bits/sec. Actually, these two are related with each other. This homework is about finding the relation between each other and calculating the maximum data rate of a channel, which is essential in this course and information theory. The maximum data rate is not only dependent to the available bandwidth (in term of hertz, Hz) but also some factors e.g. the levels of signals in use, or the level of random noise (thermodynamic noise). Please answer the following questions after reading the related material.

1. Define the Nyquist Theorem and give the bandwidth formulation. What are considered in the formulation? When is it used for?
2. Define the Shannon's Theorem and give the bandwidth formulation. What are considered in the formulation? When is it used for?
3. Define the Signal-to-Noise Ratio (SNR). What is the scale for SNR? Why? What are the factors those affect the SNR?
4. Calculate the maximum data rate of a noiseless channel with the following parameters.
 - a. Bandwidth 6 MHz, 4 signal levels
 - b. Bandwidth 18 MHz, 8 signal levels
 - c. Bandwidth 56 KHz, 2 signal levels
5. Calculate the maximum data rate of a noisy channel with the following parameters.
 - a. Bandwidth 3 KHz, SNR is 20 dB
 - b. Bandwidth 6 MHz, SNR is 30 dB
 - c. Bandwidth 20 MHz, SNR is equal to 1000
6. What is the appropriate bit rate and signal level for a channel with a 2 MHz bandwidth and the SNR 63?

This is an individual homework for students. Group study, collaboration, and cooperation are not allowed.

Due date is December 01, 2014.

Ask any unclear matter to the lecturer. Good luck...

Mujdat Soyturk, Ph.D.

Asst.Prof.