KING ABDULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

ELECTRICAL ENGINEERING DEPARTMENT

Fall 2009

EE 242 Digital Communications and Coding

Home Work 1

(*due Sep. 26, 2009*)

Q1 Consider the sinusoidal signal g(t) = 2*cos 2*π*(100*t)

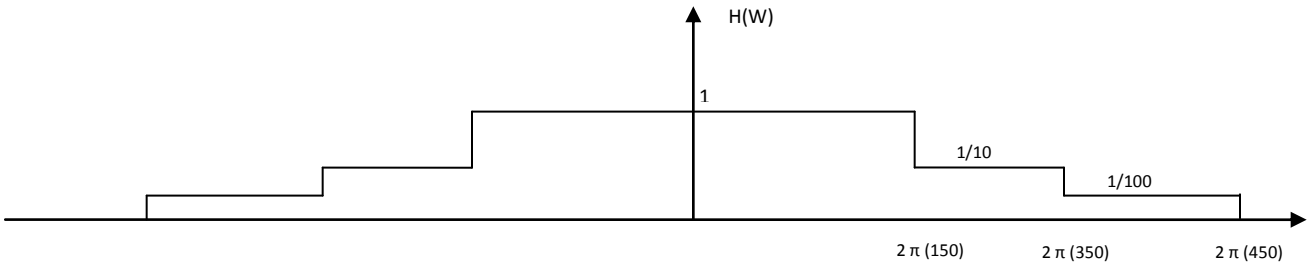
(a) Draw the spectrum (Fourier Transform) of this signal. What is the least sampling rate that guarantees that we can recover the signal from its samples? What is the sampling period?

(b) The signal is sampled at fs = 400 samples/sec. Find the values of the samples at t = 0, t = 2Ts, and t = 100 Ts.

(c) Draw the Fourier Transform of the sampled signal

(d) At the receiver, we use the filter shown in the figure to reconstruct the original signal. Let y(t) be the filter output.

i) Determine the output signal y(t). Why is y(t) different from g(t)?
ii) The signal y(t) consists of a desired component and an undesired one. Determine the powers in the desired and undesired parts (Pd and Pu).
iii) Calculate the signal to noise ratio in dB.
iv) The transmitter decides to increase the sampling rate to 500 samples/sec to improve the performance of the system. What is the new signal to noise ratio in dB. Is there another way to improve the SNR.



Q2 Consider the sinusoidal m(t) = 8*cos(2*π*3000*t). This signal is sampled and quantized according to the following

Sampling rate = 10 times the Nyquist rate

Quantized using a quantizer with 500 levels

Quantizer has a quantization range of -10 to 10 V.

(a) Find the SNR of the PCM signal in dB's
(b) How many bits are required to represent 900 sec of this signal
(c) The BW required to transmit this signal is large. What can we do to lower it without affecting the quality of the received signal?

Q3 In class, we covered the following examples of communication channels in class. The wireline channels (twin wire and coaxial cable), optical fiber channels, wireless channels (ground wave propagation, sky-wave propagation, line of sight), and storage channels. You can read about these channels in the text book. For each of these channels, indicate the following

The BW

The center frequency

The disturbances that affect the channel

The application of the communication media

Medium	BW	Center Freq	Disturbances	Applications	Other Observations