Concordia University
Department of Electrical and Computer Engineering
ELEC462: Digital Transmission Systems
Midterm Exam
Fall 2000

1) A white Gaussian random process with two-sided power spectral density $\frac{N_0}{2}$ is applied to the circuit of Figure1.

a) Find the power spectral density of the output process. (3 Marks.)

b) Find the autocorrelation function of the output process (2 Marks.)

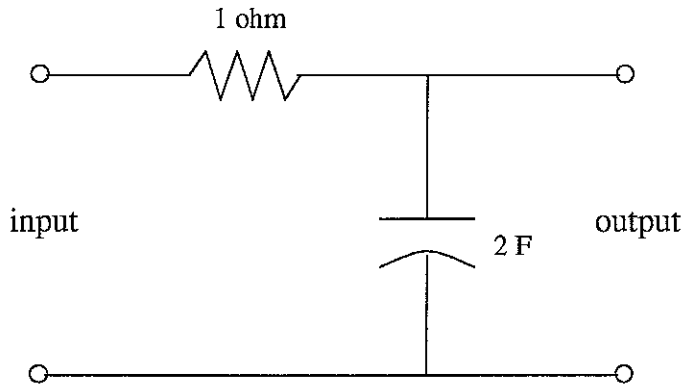

Figure 1

2) Ten analog sources each with a highest frequency component of 4.5 kHz. are to be sampled, quantized (using a uniform quantizer) and time multiplexed.

a) Find the minimum number of samples (per second) required to represent each source (1 Mark.)

b) If the required Signal-to-Quantization-Noise-Ratio is 38 dB determine the number of bits required to quantize each sample (2 Marks). Make any reasonable assumptions you deem necessary.

c) Find the frame duration, the number of bits in each frame and the bit rate at the output of the demultiplexer (3 Marks).

3) Information is being transmitted from point A to point C via point B. At point B, data is demodulated and modulated again and then is sent to point C. If the probability of bit error between A and B is $P_{AB} = 0.1$ and from point B to C is $P_{BC} = 0.2$ what is the overall probability of error, i.e., the probability of error from A to C (3 Marks).

4- A stationary process x(t) has the following values for its auto-correlation function:

$$R_x(0) = 1.$$

$$R_x(1) = 0.9.$$

$$R_x(2) = 0.81.$$

a) Calculate the coefficients of the optimum linear predictor with two unit delays (2 Marks.)
b) Calculate the resulting prediction error (1 Marks.)
5- For the signal $s(t)$ of Figure 2,
a) Find the matched filter (1 Mark).
b) Plot the output of the matched filter as a function of time (2Marks.)

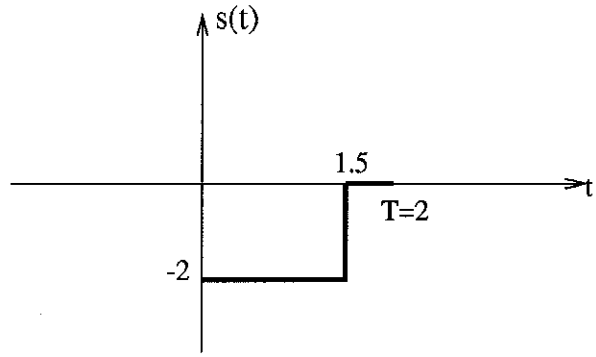

Figure 2