

PRINCIPLES OF COMMUNICATION SYSTEMS

ELEN E3701

**Columbia University
Spring Semester- 2008**

Problem Set # 8

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Principles of Communication Systems
Columbia University
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Problems Due: 8 April 2008

Problem # 1

In class, we discussed the use of optimum filtering for a binary Nyquist PAM system using Nyquist signals with square-root raised cosine filtering, at both the transmitter and receiver to maximize the signal-to-noise ratio at the point of sampling at the receiver.

We stated that the use square-root Nyquist filters at both ends of the system, was the optimum solution. The complete system is shown below.

Using the square-root Nyquist filters at both ends of the system, show that the signal-to-noise ratio at the sampling instant is equal to $2E_{b,\text{transmitted}}/N_0$, where $E_{b,\text{transmitted}}$ is the transmitted energy per bit (T is the time of a bit).

$$P_T = E_{b,\text{transmitted}}/T.$$

This is exactly the same value as the value found for the zero percent rolloff Nyquist system.

