Principles of Communication Systems
Columbia University
ELEN E3701
Spring Semester- 2008

Problem Set # 11

Problems Due: 30 April 2008

Problem #1

a) The S/N (=P/N_0W) ratio at the receiver, on the old analog telephone lines was designed to be above 28 dB in a bandwidth of about 3 kHz. Find the minimum capacity (using the 28 dB) for this channel, using Shannon's capacity equation.

b) For the same P/N_0 ratio used in part (a) find the capacity of the telephone line if the bandwidth had been infinite and not 3 kHz? How much capacity could have been gained, compared to the 3 kHz channel, by having an infinite bandwidth channel?

c) Find how much bandwidth is required to achieve 99% of the capacity of the infinite bandwidth channel, for the value of P/N_0 used in part (b)?

Discuss the results above , in terms of the importance of bandwidth and power in determining channel capacity for a real channel?