MTHE - MATH 474/874 - Information Theory
Fall 2019

Homework # 5

Due Date: Friday November 29, 2019

Material: *Joint source-channel coding, differential entropy and Gaussian channels.*

Readings: Section 4.6 and Chap. 5 of the textbook.

The referred problems are from the textbook.

(1) Problem 4.29.

(2) Problem 5.1.

(3) Problem 5.4.

(4) Problem 5.7.

(5) Problem 5.11.

(6) Problem 5.12.

(7) Consider the channel $X \to (Y_1, Y_2)$ with $Y_1 = X + Z_1$ and $Y_2 = X + Z_2$. Assume that X is independent of (Z_1, Z_2) and that Z_1 and Z_2 are zero-mean dependent Gaussian random variables with covariance matrix

$$\begin{pmatrix} N & N\rho \\ N\rho & N \end{pmatrix}.$$

By applying a power constraint on the input, i.e., $E[X^2] \leq S$. Find the channel's capacity for the following values of ρ:

(a) $\rho = 1$;

(b) $\rho = 0$;

(c) $\rho = -1$.

Additional Problems for MATH 874 students:

(8) Problem 5.3.

(9) Problem 5.14.

(10) Problem 5.15.