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 $X \rightarrow (Y_1, Y_2)$ 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 $\rho$:

(a) $\rho = 1$;

(b) $\rho = 0$;

(c) $\rho = -1$. 

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Additional Problems for MATH 874 students:

(8) Problem 5.3.

(9) Problem 5.14.

(10) Problem 5.15.