Information Theory. 9th Chapter Problems

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Problems

1. Assume that the binary inputs of the discrete-time channel without memory with additive Gaussian noise with zero mean and variance $N_0/2$ are values of binary set $\{-\sqrt{E}, \sqrt{E}\}$. These signals correspond to 0 and 1. Hard decisions are made on the output of the channel: 0, if the output signal $y > 0$, and 1 otherwise. Thus, we have Discrete Stationary Channel (DSC). Draw a plot of the throughput of this channel as a signal-to-noise ratio function E/N_0. Compare it with throughput of an original channel (without signal quantization at the input and output).

2 Consider $T > 0$, which is called *erasure threshold*. Let decisions be made according to the rule:

$$\hat{x} = \begin{cases} 0, & y < -T; \\ \text{erasure}, & -T \leq y \leq T; \\ 1, & y > T. \end{cases}$$

Obtain an expression for T, which allows to achieve a maximum throughput of corresponding Discrete Channel with Erasure.
Draw a plot of throughput of this channel as a function of signal-to-noise ratio. Compare throughput of this channel and throughput of Gaussian channel.

Problems

3 Write an expression for the throughput of channel with binary input and continuous output. Using numerical integration, draw a plot of dependence between throughput of binary half-continuous and signal-to-noise ratio. Compare these results with the results for the Discrete Stationary channel, Discrete Channel with Erasure and Continuous Input Channel.