

Assignment of Chapter 2

1. Consider a channel with probability transition matrix

$$P_{y|x} = \begin{bmatrix} \frac{2}{3} & \frac{1}{3} & 0 \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\ 0 & \frac{1}{3} & \frac{2}{3} \end{bmatrix}.$$

In the matrix, X and Y represent the rows and columns, respectively.

- (a) Please draw the trellis for this channel.
 - (b) Please determine capacity of this channel and the corresponding distribution of X .
2. Consider a channel, shown in Figure 1, with binary input. This channel results in both erasures and errors, and the receiver. Let the crossover probability be ε and the erasure probability be α . Please determine capacity of the channel and the corresponding input distribution.

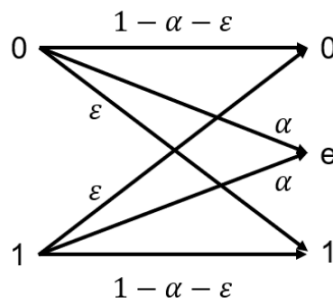


Figure 1: The trellis of the proposed channel.

3. Consider a binary-input discrete memoryless channel (B-DMC) with additive noise, as shown in Figure 2.

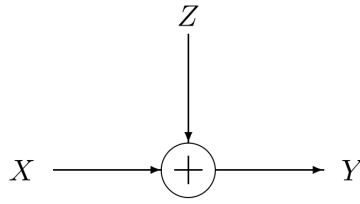


Figure 2: The B-DMC with additive noise.

Let $X \in \{0, 1\}$ and Y denote discrete input signal and output signal, respectively. Let Z denote the additive noise, where $\Pr\{Z = 0\} = \Pr\{Z = a\} = 1/2$. Assume that Z is independent of X . Please determine capacity of the B-DMC.