Discussion 1

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Question:
In the achievability part of the BSC coding theorem, we choose the random codebook ensemble $\mathsf{P}_{\mathbb{C}}$ such that entries of $\mathbb{C}$ are i.i.d $\mathsf{Ber}(\frac{1}{2})$.
It turns out the achievable rate is optimal by the converse part.
But suppose you could not prove the converse and wonder if i.i.d $\mathsf{Ber}(q)$ can be better, q may not be $\frac{1}{2}$. Repeat the analysis and find achievable rate as the function of (p, q).