

Homework # $-\log_2 \sqrt{\Omega}$
RELEASE DATE: 01/07/2020

DUE DATE: SELF-GRADED

QUESTIONS ABOUT HOMEWORK MATERIALS ARE WELCOMED ON THE FACEBOOK
FORUM.

1. Consider a source ensemble (X, q) and a discrete memoryless channel (Y, Z, p) with capacity C . Use Shannon's source coding theorem and Shannon's channel coding theorem, prove that for any $0 < R < C$ and $\epsilon > 0$, there exists a pair (N, M) as well as an encoding function $\nu: X^N \rightarrow Y^M$ and a decoding function $\mu: Z^M \rightarrow X^N$ such that

$$\Pr[\mu(\mathbf{z}) \neq \mathbf{x} | \mathbf{y} = \nu(\mathbf{x})] < \epsilon$$

and $\frac{NH(X)}{M} > R$.*(Hint: Consider first proving for the special case where $R < H(X) < C$.)*