0. Consider the distribution where with probability $1/2$ the result is $0^n$ and with probability $1/2$ it is uniform over $\{0, 1\}^n$. Compute the Shannon entropy of this distribution.

1. If a function $f: \{0, 1\}^n \mapsto \{0, 1\}^n$ is one-to-one as well as a one-way function then it is called a one-way permutation. Show that if $P = NP \cap \neg \text{co-NP}$ then there are no one-way permutations.

Recall that we showed that the problem of inverting one-way functions is in NP.

2. If $f: \{0, 1\}^n \mapsto \{0, 1\}^n$ is a one-way function, is $f_L$ where $f_L(x)$ consists of the first half of the bits of $f(x)$ necessarily a one-way function?

3. Show how to use a square-root computing routine to factor, while preserving the probability of success.