Book Problems Do problems 7.4(abcd),7.6,7.9,8.8,8.10,8.12,9.1,10.2

For problem 7.4d, compute the probability of the sequence ω₁ω₂...ωₙ which is then followed by any arbitrary sequence, where

Ω = \sum_{p: \mathcal{U}(p) \text{ halts}} 2^{-\ell(p)}, \text{ and } \Omega = \omega₁ω₂... .

Also, do not do 7.4e.

(note: a good break in this problem set is to be done with all chapter 7 problems, problem 1 and 2 below, and 1/2 of the chapter 8 problems by Friday).

Other Problems

Problem 1:

(The Ternary Confusion Channel): Consider a discrete memoryless channel with input alphabet \( \mathcal{X} \) and output alphabet \( \mathcal{Y} \), where \( \mathcal{X} = \{0,1,?\} \) and \( \mathcal{Y} = \{0,1\} \). The stochastic matrix \( W \) given by \( W(y|x) = 1 \) if \( x = 0, y = 0 \) or if \( x = 1, y = 1 \), and \( W(y|x) = 1/2 \) if \( x = ?, y = 0 \) or if \( x = ?, y = 1 \). Compute the capacity of this channel, and determine the maximizing mass function over the input alphabet.

Problem 2:

In class and above, we defined the amazing incredible and unknowable number \( 0 < \Omega < 1 \). In this problem, you are to choose a normally unsolvable problem (it can be one from mathematics, or even any general world problem you wish you could solve), and show how that if you have \( \Omega \) available to you, you can compute a (guaranteed halting) solution to this problem. Be as precise as possible, in that you give a explicit algorithm for how, when \( \Omega \) is given, you can compute an answer to your problem. Argue why your algorithm is correct, and why the problem you choose is normally unsolvable.