Introduction to Information Theory, Fall 2020

Practice problems for exercise class #12

You do **not** have to hand in these exercises, they are for your practice only.

1. **Reed-Solomon encoding:** Consider the Reed-Solomon code with parameters $q = 7$, $N = 4$, $K = 2$, and $\alpha = 3$.

   (a) Compute the generator polynomial G.
   (b) Write down the codeword $[x_1, x_2, x_3, x_4]$ for a general message $[s_1, s_2] \in \mathbb{F}_7^2$.

2. **Reed-Solomon decoding with erasure errors:** Consider the Reed-Solomon code from the lecture with parameters $K = 1$, $N = 3$, $q = 5$ and $\alpha = 2$.

   (a) Suppose we receive $y^N = [2, 1, \perp]$. Fix the erasure error and decode the message.

   Now consider the Reed-Solomon code of the first question, with parameters $q = 7$, $N = 4$, $K = 2$, and $\alpha = 3$.

   (b) Suppose we receive $y^N = [1, 4, \perp, \perp]$. Fix the erasure errors and decode the message.

3. **Reed-Solomon decoding with general errors:** We will now study the Reed-Solomon decoding algorithm for case where we have $C \leqslant \lceil \frac{T}{2} \rceil$ errors at *unknown* locations.

   (a) Watch the part of the lecture of last year about decoding Reed-Solomon codes with errors at unknown locations.
   (b) Consider again the Reed-Solomon code from the lecture with parameters $K = 1$, $N = 3$, $q = 5$ and $\alpha = 2$. Suppose we receive $y^N = [1, 1, 2]$. Fix the error (if any) and decode the message.