

Coding Theory: Comprehensive Exam

To pass this exam, you need to solve completely at least four of the given six problems.

1. How many errors can the ternary linear code with a parity check matrix

$$H = \begin{pmatrix} 1000102 \\ 0100201 \\ 0010112 \\ 0001221 \end{pmatrix}$$

correct using the Maximum-Likelihood Decoding algorithm? Explain your answer.

2. Consider the binary code with a parity check matrix

$$\begin{pmatrix} 101111 \\ 011010 \\ 000111 \end{pmatrix}.$$

Assume that an unknown codeword x was transmitted over a noisy channel, and the vector 000111 was received. Use syndrome decoding to find the codeword x . Show supporting work.

3. Find the parameters of a Reed-Muller code of smallest length and smallest minimum distance that encodes at least five information symbols and corrects up to three errors.

4. Find a parity check matrix for the binary cyclic code of length 7 with a generator polynomial $x^3 + x^2 + 1$. Show supporting work.

5. Find the generator polynomial of the binary cyclic code of length 7 with an idempotent generator $1 + x^3 + x^5 + x^6$.

6. Give the check polynomial of a binary cyclic code of length 15 that can correct triple errors. Show supporting work.