

M460 Information and Coding Theory

practice exam for the final exam

not graded, no solutions!

Exercise # 1

(0 points)

Can you reconstruct the following ISBN code (the missing digit is indicated by a question mark): 0-71?7-1480-9

Exercise # 2

(0 points)

Consider the linear code generated by

$$G = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 \end{pmatrix}.$$

Compute a generator matrix in standard form. Compute the corresponding check matrix. What is the minimum distance of this code? Compute the weight enumerator of this code.

Exercise # 3

(0 points)

Suppose you want to make a binary 2-error-correcting code of length 21. What dimension can you achieve?

Exercise # 4

(0 points)

What is the largest minimum distance of a binary $(11, 5)$ -code?

Exercise # 5

(0 points)

Determine all irreducible polynomials of degree 4 over \mathbb{F}_2 .

Exercise # 6 (0 points)
Let \mathbb{F}_8 be generated by α with $\alpha^3 = \alpha + 1$. Is α a primitive root? Let \mathbb{F}_{16} be generated by α with $\alpha^4 = \alpha + 1$. Is $\alpha^3 + \alpha^2$ a primitive root? Find $(\alpha^3 + \alpha^2)^{-1}$.

Exercise # 7 (0 points)
Determine a primitive 4-th root of unity over \mathbb{F}_3 .

Exercise # 8 (0 points)
Using the alphabet \mathbb{F}_{13} , make a Reed-Solomon code which corrects 5 errors.

Exercise # 9 (0 points)
Compute the 2-cyclotomic sets modulo 23.

Exercise # 10 (0 points)
Consider the ternary linear code generated by

$$G = \begin{pmatrix} -1 & 0 & 0 & 1 & 1 & 1 \\ -1 & -1 & 0 & 0 & 0 & 1 \\ -1 & -1 & -1 & -1 & 1 & 1 \end{pmatrix}.$$

Compute a generator matrix in standard form. Compute the corresponding check matrix.

Exercise # 11 (0 points)
Suppose you want to make a binary 2-error-correcting code of length 17. What dimension can you achieve?

Exercise # 12 (0 points)
Explain why, for a given length n and alphabet of size q , one cannot have both k and d large at the same time.

Exercise # 13 (0 points)
Determine a primitive 5-th root of unity over \mathbb{F}_2 .

Exercise # 14 (0 points)
Can you make a Reed-Solomon code which can correct two errors? Can you make a check matrix for that code?