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Examination paper for **TMA4185 Coding Theory**

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Permitted examination support material: C: Simple calculator and the Textbook: Fundamentals of Error-Correcting Codes by Huffman and Pless.

Language: English

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Informasjon om trykking av eksamensoppgave	
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Problem 1 Let C be a binary convolution code with generating matrix $G = [1 + D, 1 + D + D^2, 1 + D + D^3]$.

a) Draw an encoding diagram for G and encode the sequence 10011100.

b) Is G a basic encoding matrix?

c) Decode the sequence 110 111 101 001 010 100 100 111 010 001 000 000 000 given that there are at most 2 errors.

Problem 2 Let F be a finte field and C_1 a linear $[n, k_1, d_1]$ code over F and C_2 a linear $[n, k_2, d_2]$ code over F. Prove that $C = \{(u, u+v) \in F^{2n} \mid u \in C_1, v \in C_2\}$ is a linear $[2n, k_1 + k_2, \min\{2d_1, d_2\}]$ code over F.

Problem 3 Let C be $[21, 18, 3]$ Hamming code.

a) What is the field this code is defined over, and how can one find a parity check matrix for this code.

b) The dual of this code is in the class of simplex codes. How many errors can this dual simplex code of C correct?

Problem 4

a) How many cyclic codes of length 17 exists over F_4?

b) Find the defining set of a BCH-code of length 17 of dimension 4 over F_4 and with minimum distance at least 12.

Problem 5

a) Let C be a binary linear $[n, k, 3]$ code with $k \geq 5$. Prove that $n \geq k + 3 + 1$. (Hint: Induction on k)

b) Let C be a binary linear $[n, k, d]$ code with $k \geq 5$ and $d \geq 3$. Prove that $n \geq k + d + 1$.