IV054 Coding, Cryptography and Cryptographic Protocols
2016 - Exercises III.

1. Which of the following binary codes are cyclic? Explain your reasoning.
   (a) $C_1 = \{0000, 1001, 1111, 0110\}$
   (b) $C_2 = \{000, 100, 010, 001\}$
   (c) $C_3 = \{000, 110, 011, 101\}$
2. Find the generator polynomial of a binary cyclic code C of length 12 and dimension 8 such that $110110011011 \in C$.
3. Find cyclic codes equivalent to the following binary codes:
   (a) $C_1 = \{0000, 1001, 0110, 1111\}$
   (b) $C_2 = \{100, 010, 001\}$
   (c) $C_3 = \{11111\}$
4. Consider a binary cyclic code C of odd length n with generator polynomial $g(x)$. Prove that if $1 + x \mid g(x)$ then $11\ldots1 \notin C$.
5. Determine the number of
   (a) all ternary cyclic codes of length 11. For each code write down the generator polynomial and determine its dimension;
   (b) all binary cyclic codes of length 24;
   (c) all ternary cyclic codes of length 24.
6. Find the generator polynomial of the binary single-parity-check code (a code consisting of all codewords with parity 0) of length $n \geq 2$.
7. Consider binary codes of length 7 containing 16 codewords. Count the number of
   (a) all such codes;
   (b) such linear codes;
   (c) such cyclic codes.