Exercise 19. There are four so called weak DES keys. One of those is the key

\[ K = 00011111 \ 00011111 \ 00011111 \ 00011111 \ 00001110 \ 00001110 \ 00001110 \ 00001110. \]

What happens if you use this key? Can you find the other three weak keys?

Exercise 20. A block cipher is a cryptosystem where plaintext and ciphertext space are the set \( A^n \) of words of length \( n \) over an alphabet \( A \). The number \( n \) is called the block length.

Show that the encryption functions of block ciphers are permutations. How many different block ciphers exist if \( A = \{0, 1\} \) and the block length is \( n = 6 \)?

Exercise 21. Consider the following AES-128 key given in hexadecimal notation:

\[ K = 2d \ 61 \ 72 \ 69 \ 65 \ 00 \ 76 \ 61 \ 6e \ 00 \ 43 \ 6c \ 66 \ 66 \]

a) What is the round key \( K_0 \)?

b) What are the first 4 bytes of round key \( K_1 \)?