Problem 2. «TwinPeaks»

On Bob's smartphone there is a program that encrypts messages with the algorithm `TwinPeaks`. It works as follows:

1. It takes an input message P that is a hexadecimal string of length 32 and represents it as a binary word X of length 128.
2. Then X is divided into four 32-bits words a, b, c, d.
3. Then 6 iterations of the following transformation are applied:

   $$(a, b, c, d) \leftarrow \big(a + c + S(c + d), a + b + d + S(c + d), a + c + d, b + d + S(c + d)\big),$$

   where S is a secret permutation from $\mathbb{F}_2^{32}$ to itself and $+$ denotes the coordinate-wise sum modulo 2.
4. The word Y is obtained as a concatenation of a, b, c, d.
5. Finally, Y is converted to the hexadecimal string C of length 32. The algorithm gives C as the ciphertext for P.

Agent Cooper caught the ciphertext $C =$ `59A0D027D032B394A0A47A9ED19C98A8` send from Bob to Alice and decided to decrypt it.

In order to solve this problem agent Cooper captured also Bob's smartphone with `TwinPeaks` realization! Here it is. Now Cooper (and you too) can encrypt any messages with `TwinPeaks` but still can not decrypt any one.

Help Cooper to decrypt C.