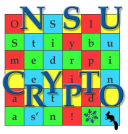

Problem 7. «Secret sharing»

Alena, Boris and Sergey developed the following secret sharing scheme to share a password $P \in \mathbb{F}_2^{32}$ into three parts to collectively manage money through online banking.

- Vectors $v_i^a, v_i^b, v_i^s \in \mathbb{F}_2^{32}$ and values $c_i^a, c_i^b, c_i^s \in \mathbb{F}_2$ are randomly generated for all $i = 1, \ldots, 32$.
- Vectors v_i^a, v_i^b, v_i^s are known to all participants of the scheme.
- Values $c_i^a, c_i^b, c_i^s \in \mathbb{F}_2$ are known only to Alena, Boris and Sergey respectively.
- Then the secret password P is calculated by the rule

$$P = \bigoplus_{i=1}^{32} c_i^a v_i^a \oplus \bigoplus_{i=1}^{32} c_i^b v_i^b \oplus \bigoplus_{i=1}^{32} c_i^s v_i^s.$$

What is the probability that Alena and Boris together can not get any information about the password P? What is the probability that they are able without Sergey to get a guaranteed access to online banking using not more than 23 attempts?