Task 7. «S-box masking»

To provide the security of a block cipher to the side channel attacks, some ideas on masking of elements of the cipher are exploited. Here we discuss masking of S-boxes.

Alice takes a bijective function S (S-box) that maps n bits to n bits. Bob claims that for every such a function S there exist two bijective S-boxes, say S' and S'', mapping n bits to n bits, such that it holds

$$S(x) = S'(x) \oplus S''(x) \text{ for all } x \in \mathbb{F}_2^n.$$

Hence, Alice is able to mask an arbitrary bijective S-box by "dividing it into parts" for realization. But Alice wants to see the proof of this fact. Please help to Bob in giving the arguments.