2.2 *A fair coin is flipped three times. What is the probability that the second flip is tails, given that there is at most one tails among the three flips?*
Let $A :=$ { the second flip is tails } and $B :=$ { there is at most one tails among the three flips }. We want to compute $\mathbb{P}(A|B)$. Therefore by the multiplication rule $\mathbb{P}(A|B) = \frac{\mathbb{P}(AB)}{\mathbb{P}(B)}$. Note that $\mathbb{P}(B) = \frac{1}{2}$, as there are four three digit binary sequences with at max a single 1. For $\mathbb{P}(AB)$, the probability would be $\frac{1}{8}$ as $A \subset B$. Therefore $\mathbb{P}(A|B) = \frac{1}{4}$.