

Solution for exercise 3.2.7 in Pitman

We define the indicator variables I_i which are 1 if switch i is closed 0 otherwise. We have $X = I_1 + I_2 + \cdots + I_n$, such that

$$E(X) = E(I_1 + I_2 + \cdots + I_n) = E(I_1) + E(I_2) + \cdots + E(I_n) = p_1 + p_2 + \cdots + p_n = \sum_{i=1}^n p_i$$