# Homework 5 additional problem

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Consider the Ehrenfest chain with $N$ particles. Suppose $X_0 = 0$, i.e., initially all the particles are on the right. Let $T_0$ be the first time all the particles end up on the right again. Calculate $E_0(T_0) = E(T_0 \mid X_0 = 0)$, the conditional expectation of $T_0$ given $X_0 = 0$.

(For this problem, you may assume that the stationary distribution of the Ehrenfest chain is the binomial distribution $\text{Bin}(N, 1/2)$. This is can be checked directly from the definition of stationary distributions. I'll also discuss it in class when we talk about the detailed balance condition.)