Exercise 1.8

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Let N be the number of independent marbles drawn from the input space $X = \{Green, Red\}$. We denote the probability of picking a red marble at random μ a picking a green marble $(1 - \mu)$. After choosing N samples we denote the fraction of red marbles as v.

If $\mu = 0.9$, what is the probability that a sample of 10 marbles will have $v \leq 0.1$?

We use binomial distribution to calculate the probability.

$$\begin{aligned} f(k, N, p) &= Pr(Red = 1) \\ &= \binom{N}{k} p^k (1-p)^{N-k} \\ &= \binom{10}{1} 0.9^1 (1 - 0.9)^{10-1} \\ &= \frac{10!}{1(10-1)!} 0.9 * 0.1^9 \\ &= 10 * 0.9 * 0.1^9 \\ &= 9 * 10^{-9} \end{aligned}$$