EX: A company that launches satellites is wondering whether the likelihood of successful launches is really $p = 0.9$. They decide to do a 1-sided hypothesis test with significance level $\alpha = 10\% = 0.10$.

The following information about launches is gathered:

$n = 3$ $\quad x = 2$ successful launches $\quad \overline{x} = x / n = 2 / 3$

The null and alternate hypotheses are as follows:

H_0: $p = p_0$ (the Null hypothesis)
H_A: $p < p_0$ (the Alternative hypothesis)

Determine whether the null hypothesis should be rejected.

SOL'N: We use the binomial distribution to compute the probability that there would be two or fewer successful launches if $p = 0.9$. Note: $q = 0.1$.

$$P(X \le 2) = \sum_{i=0}^{2} P(X = i) = {}_3C_0 p^0 q^3 + {}_3C_1 p^1 q^2 + {}_3C_2 p^2 q^1$$

or

$$P(X \le 2) = 1 \cdot 0.1^3 + 3 \cdot 0.9^1 \cdot 0.1^2 + 3 \cdot 0.9^2 \cdot 0.1$$

or

$$P(X \le 2) = 0.001 + 0.027 + 0.243 = 0.271$$

Because $0.271 > \alpha$, we do not reject H_0.