

Question: Suppose that 90% of people are right-handed. What is the probability that at most 6 of a random sample of 10 people are right-handed?

**Solution:** Calculating Probability Using Bernoulli Distribution

Given that 90% of people are right-handed, let  $p = \frac{9}{10}$  be the probability of success (right-handed), and  $(1 - p) = \frac{1}{10}$  be the probability of failure (left-handed).

TABLE 0

TABLE-1

Parameters	values	Description
$X_i$	1	if right-handed
	0	if not right-handed
$n$	10	Total people
$k$	6	People right-handed
$p$	0.9	probability of being right-handed

$$X \sim \text{Ber}(p) \quad (1)$$

Suppose  $X_i, 1 \leq i \leq n$  represent each of the  $n$  draws. Define  $Y$  as

$$Y = \sum_{i=1}^n X_i \quad (2)$$

Then, since the  $X_i$  are iid, the pmf of  $Y$  is given by

$$Y \sim \text{Bin}(n, p) \quad (3)$$

The cdf of  $Y$  is given by

$$F_Y(k) = \Pr(Y \leq k) \quad (4)$$

$$= \begin{cases} 0 & k < 0 \\ \sum_{i=1}^k \binom{n}{i} p^i (1-p)^{n-i} & 1 \leq k \leq n \\ 1 & k \geq n \end{cases} \quad (5)$$

1) We require  $\Pr(Y \leq 6)$ . Since  $n = 10$ ,

$$\Pr(Y \leq 6) = 0.01279 \quad (6)$$