ASSIGNMENT-2

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Question 12.13.5.10 : A person buys a lottery ticket in 50 lotteries in each of which his chance of winning a prize is $\frac{1}{100}$. What is the probability that he will win a prize

(a) atleast once
(b) exactly once
(c) atleast twice ?

Solution: Let X be number of winning prizes in 50 lotteries. The trials are Bernoulli trials.X has binomial distribution with n = 50 and p = $\frac{1}{100}$

TABLE 3
PARAMETERS FOR CDF

parameter	value
n	50
p	$\frac{1}{100}$
q	$\frac{99}{100}$

$$q = 1 - p = 1 - \frac{1}{100} \tag{1}$$

$$q = \frac{99}{100} \tag{2}$$

$$p_X(k) = \Pr(X = k) \tag{3}$$

$$p_X(k) = {}^{n}C_k q^{n-k} p^k \tag{4}$$

$$= {}^{50}C_k \left(\frac{99}{100}\right)^{50-k} \left(\frac{1}{100}\right)^{k} \tag{5}$$

The Cdf for the following pmf :

$$F_X(k) = \sum_{i=0}^{k} {}^{5}C_i \left(\frac{99}{100}\right)^{50-i} \left(\frac{1}{100}\right)^{i} \tag{6}$$

(a)

$$\Pr(X \geq 1) = 1 - \Pr(X < 1) \tag{7}$$

$$= 1 - F_X(0) \tag{8}$$

$$= 1 - {}^{50}C_0 \left(\frac{99}{100}\right)^{50} \tag{9}$$

$$= 0.394 \tag{10}$$

(b)

$$\Pr(X = 1) = {}^{50}C_1 \left(\frac{99}{100}\right)^{49} \left(\frac{1}{100}\right)^{1} \tag{11}$$

$$= 0.3055 \tag{12}$$

(c)

$$\Pr(X \geq 2) = 1 - \Pr(X < 2) \tag{13}$$

$$= 1 - F_X(1) \tag{14}$$

$$= \left(1 - \frac{99}{100}\right)^{50} - \frac{1}{2}\left(\frac{99}{100}\right)^{49} \tag{15}$$

$$= 0.0894 \tag{16}$$