Chapter-13 Probability

Excercise-5

Jay Vikrant
EE22BTECH11025

Question 12.13.5.6: A bag consists of 10 balls each marked with one of the digits 0 to 9. If four balls are drawn successively with replacement from the bag, what is the probability that none is marked with the digit 0?

Solution: Let, p_X be the sequence of independent Bernoulli random varibles.

$$X = \begin{cases} 0, & \text{non-zero marked ball} \\ 1, & \text{zero marked ball} \end{cases} \tag{1}$$

which means

$$p_X(0) = \frac{9}{10} \tag{2}$$

$$p_X(1) = \frac{1}{10} \tag{3}$$

Let, the total number of trials be n and Z be the random variable that represents the number of balls marked zero in n trials which is given by:

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

where,

$$Z = X_1 + X_2 + ... + X_n \tag{5}$$

For only non-zero marked balls in 4 trials,

$$p_X(Z = 0) = {}^{4}C_0 \left(\frac{9}{10}\right)^{4-0} \left(\frac{1}{10}\right)^{0} \tag{6}$$

$$= (1)\left(\frac{9}{10}\right)^{4}(1) \tag{7}$$

$$= \left(\frac{9}{10}\right)^{4} \tag{8}$$

$$= 0.6561 \tag{9}$$