Assignment3(Q.11.16.3.13)
NCERT EXAMPLER
Probability And Random Processes

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I. Q.11.16.3.13

A bag contains 8 red and 5 white balls. Three balls are drawn at random. Find the Probability that
(a) All the three balls are white
(b) All the three balls are red
(c) One ball is red and two balls are white

Solution:

Using multinomial distribution formula :

$$\text{P}(\text{X}_1 = x_1, X_2 = x_2, \ldots, X_k = x_k) = \frac{n!}{x_1! \cdot x_2! \cdot \ldots \cdot x_k!} \cdot p_1^{x_1} \cdot p_2^{x_2} \cdot \ldots \cdot p_k^{x_k}$$

Where:

n is the total number of trials (in this case, the number of balls drawn).

k is the number of classes (in this case, the number of ball colors).

$x_1, x_2, \ldots, x_k$ are the numbers of observations for each class.

$p_1, p_2, \ldots, p_k$ are the probabilities of drawing each class of ball. (0)

We know that there are 8 red balls and 5 white balls in the bag.
Let,
$\text{p}_1 = \text{P(W)} = 5/13$
$\text{p}_2 = \text{P(R)} = 8/13$

a) All three balls are white:

$$P(\text{All three balls are white}) = \frac{3!}{3! \cdot 0!} \left(\frac{5}{13}\right)^3 \left(\frac{8}{13}\right)^0$$

$$= 0.05689$$

(b) All three balls are red:

$$P(\text{All three balls are red}) = \frac{3!}{0! \cdot 3!} \left(\frac{5}{13}\right)^0 \left(\frac{8}{13}\right)^3$$

$$= 0.233045061$$

(c) One ball is red and two balls are white:

$$P(\text{One ball is red and two balls are white}) = \frac{3!}{2! \cdot 1!}$$

$$= 0.273099681$$