Probability(NCERT)

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CLASS XI

16.4.6 [1] Three letters are dictated to three persons and an envelope is addressed to each of them, the letters are inserted into the envelopes at random so that each envelope contains exactly one letter. Find the probability that at least one letter is in its proper envelope.
Solution: Let X be the random variable denoting the number of letters in proper envelopes. We generate the set of events for different cases, i.e., when $X = \{0, 1, 3\}$ and use that to calculate the required probability. The link to the code to achieve this is given below.

https://github.com/ahilan22/fwc-2/tree/main/probability/assignment/codes/11-16-4-6.py

CLASS XII

13.2.3 A box of oranges is inspected by examining three randomly selected oranges drawn without replacement. If all the three oranges are good, the box is approved for sale, otherwise, it is rejected. Find the probability that a box containing 15 oranges out of which 12 are good and 3 are bad ones will be approved for sale.
Solution:

Event	Description
X_1	Selecting 1 good orange
X_2	Selecting 2 good oranges
X_3	Selecting 3 good oranges

Probability	Value
$\Pr(X_1)$	$\frac{12}{15}$
$\Pr(X_2 \mid X_1)$	$\frac{11}{14}$
$\Pr(X_3 \mid X_2 X_1)$	$\frac{10}{13}$

[1]Read question numbers as (CHAPTER NUMBER).(EXERCISE NUMBER).(QUESTION NUMBER)

Probability of the given box being approved for sale, (using multiplication rule)

$$= \Pr(X_1 X_2 X_3) \tag{13.2.3.1}$$
$$= \Pr(X_1)\Pr(X_2 \mid X_1)\Pr(X_3 \mid X_2 X_1) \tag{13.2.3.2}$$
$$= \frac{12 \times 11 \times 10}{15 \times 14 \times 13} = \frac{44}{91} \tag{13.2.3.3}$$

13.4.6 From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs.
Solution: Let X be the random variable denoting the number of defective bulbs. Let E_1 and E_2 be the event of drawing a non-defective bulb and a defective bulb.

$$\Pr(E_2) = p = \frac{6}{30}, \tag{13.4.6.1}$$
$$\Pr(E_1) = q = \frac{24}{30} \tag{13.4.6.2}$$

Since we replace the item after drawing out of the box, $\Pr(E_1)$ and $\Pr(E_2)$ remains same for each trial and each trials are independent. Also, we can see that $p + q = 1$. Therefore, the trials of our random experiment X are Bernoulli trials.
Hence, we can define our probability distribution as binomial distribution, $\mathrm{B}(n, p)$, where n is number of trials. The probability function of $\mathrm{B}\left(4, \frac{6}{30}\right)$ is

$$\Pr(X = x) = {}^nC_x p^x q^{n-x} \tag{13.4.6.3}$$

X	0	1	2	3	4
$\Pr(X)$	$\frac{256}{625}$	$\frac{256}{625}$	$\frac{96}{625}$	$\frac{16}{625}$	$\frac{1}{625}$

TABLE 13.4.6.1
PROBABILITY DISTRIBUTION OF X