10.3.3.3.5

EE24BTECH11036 - Krishna Patil

Question: In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that the student has opted neither NCC nor NSS.

Solution: Define events A and B as shown in the table 0,

Event	Denotation
A'	Student does not opt for NCC
A	Student opts for NCC
B'	Student does not opt for NSS
B	Student opts for NSS

TABLE 0: defining events

For any two event A and B, for proving $\Pr(A' \cdot B') = \Pr(A') + \Pr(B') - \Pr(A' + B')$

$$\Pr(A' \cdot B') = \Pr(A') + \Pr\left(B' + (A')'\right) \tag{1}$$

Using the distributive property in Boolean algebra, $\Pr(B' + (A')')$ can be rewritten as:

$$\Pr\left(B' + (A')'\right) = \Pr(B') - \Pr(A' + B') \tag{2}$$

$$\Pr(A' \cdot B') = \Pr(A') + \Pr(B') - \Pr(A' + B') \tag{3}$$

$\therefore \Pr(A' \cdot B') = \Pr(A') + \Pr(B') - \Pr(A' + B')$

From the given data in question,

$$\Pr(A') = \frac{30}{60} = \frac{1}{2} \tag{4}$$

$$\Pr(B') = \frac{28}{60} = \frac{7}{15} \tag{5}$$

$$\Pr(A' + B') = \frac{36}{60} = \frac{3}{5} \tag{6}$$

Now using axioms of probability (boolean logic), Thus, we write

$$\begin{aligned}
\Pr(A' \cdot B') &= \Pr(A') + \Pr(B') - \Pr(A' + B') && (7)\\
&= \frac{1}{2} + \frac{7}{15} - \frac{3}{5} && (8)\\
&= \frac{11}{30} && (9)\\
&= 0.36667 && (10)
\end{aligned}$$

So, the probablity $\Pr(X = 0,\ Y = 0)$ i.e., the probability that the student has opted neither NCC nor NSS is $\frac{11}{30} = 0.36667$. Also after verifying using computational method to get the probability as 0.36680.