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, the truth table boolean logic0 for proving $\Pr(A' \cdot B') = \Pr(A') + \Pr(B') - \Pr(A' + B')$ is as follows:

A	B	A'	B'	$A' \cdot B'$	$A' + B'$
0	0	1	1	1	1
0	1	1	0	0	1
1	0	0	1	0	1
1	1	0	0	0	0

TABLE 0: boolean logic

From the truth table: From the truth table:

- $Pr(A')$: Fraction of rows where $A = 1$.

$$Pr(A') = \frac{\text{Number of rows where } A' = 1}{\text{Total rows}} = \frac{2}{4} = 0.5.$$

- $Pr(B')$: Fraction of rows where $B' = 1$.

$$Pr(B') = \frac{\text{Number of rows where } B' = 1}{\text{Total rows}} = \frac{2}{4} = 0.5.$$

- $Pr(A' \cdot B')$: Fraction of rows where $A' \cdot B' = 1$.

$$Pr(A' \cdot B') = \frac{\text{Number of rows where } A' \cdot B' = 1}{\text{Total rows}} = \frac{1}{4} = 0.25.$$

- $Pr(A' + B')$: Fraction of rows where $A' + B' = 1$.

$$Pr(A' + B') = \frac{\text{Number of rows where } A' + B' = 1}{\text{Total rows}} = \frac{3}{4} = 0.75.$$

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

  newline From the given data in question,

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

$$\Pr(B') = \frac{28}{60} = \frac{7}{15} \tag{2}$$

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

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

$$\Pr(A' \cdot B') = \Pr(A') + \Pr(B') - \Pr(A' + B') \tag{4}$$

$$= \frac{1}{2} + \frac{7}{15} - \frac{3}{5} \tag{5}$$

$$= \frac{11}{30} \tag{6}$$

$$= 0.36667 \tag{7}$$

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.