Assignment 5 12th Class

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https://github.com/GunjitMittal/Assignment4/tree/main/Assignment4/codes

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1 Question

Let A and B be independent events with $\Pr(A) = 0.3$ and $\Pr(B) = 0.4$. Find

(i) $\Pr(A \cap B)$
(ii) $\Pr(A \cup B)$
(iii) $\Pr(A|B)$
(iv) $\Pr(B|A)$

2 Solution

Solution:

$$\Pr(A+B) = \Pr(A) + \Pr(B) - \Pr(AB) \quad (2.1)$$

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \quad (2.2)$$

(i) $\Pr(AB) = \Pr(A) \times \Pr(B)$ cause A and B are independent events

$$\Pr(AB) = 0.3 \times 0.4 = 0.12 \quad (2.3)$$

(ii) Using(2.1)

$$\Pr(A+B) = 0.3 + 0.4 - 0.12 = 0.58 \quad (2.4)$$

(iii) Using(2.2)

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} = \frac{0.12}{0.4} = 0.3 \quad (2.5)$$

(iv) Using(2.2)

$$\Pr(B|A) = \frac{\Pr(AB)}{\Pr(A)} = \frac{0.12}{0.3} = 0.4 \quad (2.6)$$

Note: Derivation of (2.1) using Boolean Algebra: We note that for any events A and B we have the following:

$$\begin{aligned} A + B &= A(B + B') + B(A + A') \\ &= (AB + BA) + AB' + A'B \\ &= AB + AB' + A'B \end{aligned} \quad (2.7)$$

and

$$\Pr(A) = \Pr(AB') + \Pr(AB) \quad (2.8)$$

Thus, taking probabilities in (2.7), since all the events are mutually disjoint,

$$\begin{aligned} \Pr(A+B) &= \Pr(AB') + \Pr(AB) + \Pr(A'B) \\ &= \Pr(A) + \Pr(A'B) \\ &= \Pr(A) + \Pr(B) - \Pr(AB) \end{aligned} \quad (2.9)$$