AI1103: Assignment 2

Chitneedi Geetha Sowmya
CS20BTECH11011

Download all latex codes from

https://github.com/Geetha495/Assignment2/blob/main/Assignment2.tex

1 Problem

Suppose A and B are two independent events with probabilities $\Pr(A) \neq 0$ and $\Pr(B) \neq 0$. Let $\widetilde{A}$ and $\widetilde{B}$ be their complements. Which one of the following statements is FALSE?

1) $\Pr(A \cap B) = \Pr(A)\Pr(B)$
2) $\Pr(A|B) = \Pr(A)$
3) $\Pr(A \cup B) = \Pr(A) + \Pr(B)$
4) $\Pr(\widetilde{A} \cap \widetilde{B}) = \Pr(\widetilde{A})\Pr(\widetilde{B})$

2 Solution

1) As A, B are independent events, By definition,

$$\Pr(A \cap B) = \Pr(A)\Pr(B)$$

Thus option 1 is true.

2)

$$\begin{aligned}\Pr(A|B) &= \frac{\Pr(A \cap B)}{\Pr(B)} \\ &= \frac{\Pr(A)\Pr(B)}{\Pr(B)} \\ &= \Pr(A)\end{aligned}$$

Thus option 2 is true.

3)

$$\begin{aligned}\Pr(A \cup B) &= \Pr(A) + \Pr(B) - \Pr(A \cap B) \\ &= \Pr(A) + \Pr(B) - \Pr(A)\Pr(B)\end{aligned}$$

Thus option 3 is false.

4)

$$\begin{aligned}\Pr(\widetilde{A} \cap \widetilde{B}) &= \Pr(\widetilde{A \cup B}) \\ &= 1 - \Pr(A \cup B) \\ &= 1 - \Pr(A) - \Pr(B) + \Pr(A \cap B) \\ &= (1 - \Pr(A))(1 - \Pr(B)) \\ &= \Pr(\widetilde{A})\Pr(\widetilde{B})\end{aligned}$$

Thus option 4 is true.

Hence, FALSE statement is option 3.