

# AI1103 - Assignment 2

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(C) When P and Q are mutually exclusive, then either P occurs or Q occurs but not both simultaneously. So if P happens, chance of Q happening gets ruled out and vice-versa. Hence, mutually exclusive events are dependent. Hence (C) is also wrong

QUESTION:

If P and Q are two random events, then the following is TRUE: (D)As

(A) Independence of P and Q implies that  $\Pr(P \cap Q) = 0$

(B)  $\Pr(P \cup Q) \geq \Pr(P) + \Pr(Q)$

(C) If P and Q are mutually exclusive, then they must be independent.

(D)  $\Pr(P \cap Q) \leq \Pr(P)$

$$\Pr(Q/P) = \frac{\Pr(P \cap Q)}{\Pr(P)} \quad (0.0.8)$$

And

$$\Pr(Q/P) \leq 1 \quad (0.0.9)$$

$$\frac{\Pr(P \cap Q)}{\Pr(P)} \leq 1 \quad (0.0.10)$$

$$\Pr(P \cap Q) \leq \Pr(P) \quad (0.0.11)$$

Hence (D) is correct.

ANSWER:

(A) Independence of P and Q means if P happens, then outcome of Q won't be affected by that. so

$$\Pr(P/Q) = \Pr(P) \quad (0.0.1)$$

$$\frac{\Pr(P \cap Q)}{\Pr(Q)} = \Pr(P) \quad (0.0.2)$$

$$\Rightarrow \Pr(P \cap Q) = \Pr(P) \cdot \Pr(Q) \quad (0.0.3)$$

This is what we can say hence (A) is wrong

(B)As

$$\Pr(P \cup Q) = \Pr(P) + \Pr(Q) - \Pr(P \cap Q) \quad (0.0.4)$$

$$\Pr(P \cup Q) + \Pr(P \cap Q) = \Pr(P) + \Pr(Q) \quad (0.0.5)$$

$$\Pr(P \cap Q) \geq 0 \quad (0.0.6)$$

$$\Rightarrow \Pr(P) + \Pr(Q) \geq \Pr(P \cup Q) \quad (0.0.7)$$

Hence (B) is also wrong