AI1103 - Assignment 2

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download latex-tikz codes from

https://github.com/rajasekhar156/assignment−2−AI1103

QUESTION:
If P and Q are two random events, then the following is TRUE:

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

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

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

(D) $\Pr(PQ) \leq \Pr(P)$

ANSWER:

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

$$\Pr(P/Q) = \Pr(P) \tag{0.0.1}$$
$$\frac{\Pr(PQ)}{\Pr(Q)} = \Pr(P) \tag{0.0.2}$$
$$\implies \Pr(PQ) = \Pr(P).\Pr(Q) \tag{0.0.3}$$

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

2) As

$$\Pr(P+Q) = \Pr(P) + \Pr(Q) - \Pr(PQ) \tag{0.0.4}$$
$$\Pr(P+Q) + \Pr(PQ) = \Pr(P) + \Pr(Q) \tag{0.0.5}$$
$$\Pr(PQ) \geq 0 \tag{0.0.6}$$
$$\implies \Pr(P) + \Pr(Q) \geq \Pr(P+Q) \tag{0.0.7}$$

Hence (B) is also wrong

3) 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. Mutually exclusive refers

$$\Pr(PQ) = 0 \tag{0.0.8}$$
$$\Pr(PQ) \neq \Pr(P).\Pr(Q) \tag{0.0.9}$$

Hence, mutually exclusive events may not be independent.
Hence (C) is also wrong

4) As

$$\Pr(Q/P) = \frac{\Pr(PQ)}{\Pr(P)} \tag{0.0.10}$$

And

$$\Pr(Q/P) \leq 1 \tag{0.0.11}$$
$$\frac{\Pr(PQ)}{\Pr(P)} \leq 1 \tag{0.0.12}$$
$$\Pr(PQ) \leq \Pr(P) \tag{0.0.13}$$

Hence (D) is correct.