

Solution to 11.16.3.24

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Question: If $\Pr(A + B) = \Pr(AB)$ for any two events A and B , then

- A) $\Pr(A) = \Pr(B)$
- B) $\Pr(A) > \Pr(B)$
- C) $\Pr(A) < \Pr(B)$
- D) none of these

Solution:

$$\Pr(A + B) = \Pr(A) + \Pr(B) - \Pr(AB) \quad (1)$$

$$\Pr(AB) = \Pr(A) + \Pr(B) - \Pr(AB) \quad (2)$$

$$\Pr(AB) + \Pr(AB) = \Pr(A) + \Pr(B) \quad (3)$$

Considering boolean logics,

$$\Pr(AB) = \Pr(A) + \Pr(B) \quad (4)$$

Considering A and B to be independent events ,

$$\Pr(A) \cdot \Pr(B) = \Pr(A) + \Pr(B) \quad (5)$$

Cases for Boolean logic :

1)

$$\Pr(A) = \Pr(B) = 1 \quad (6)$$

2)

$$\Pr(A) = 0, \Pr(B) = 1 \quad (7)$$

3)

$$\Pr(A) = 1, \Pr(B) = 0 \quad (8)$$

4)

$$\Pr(A) = \Pr(B) = 0 \quad (9)$$

Equations (6) and (9) are satisfying the required equation (5), whereas equation (9) is the trivial solution. Hence, from the given data it can be concluded that

$$\Pr(A) = \Pr(B) \quad (10)$$