

# Solution to 11.16.3.24

Sameer kendal - EE22BTECH11044

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:**

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

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

$$\implies [\Pr(A) - \Pr(AB)] + [\Pr(B) - \Pr(AB)] = 0 \quad (3)$$

But,

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \quad (4)$$

Also,

$$0 \leq \Pr(A|B) \leq 1 \quad (5)$$

$$\implies 0 \leq \frac{\Pr(AB)}{\Pr(B)} \leq 1 \quad (6)$$

$$\implies 0 \leq \Pr(AB) \leq \Pr(B) \quad (7)$$

Similarly,

$$0 \leq \Pr(AB) \leq \Pr(A) \quad (8)$$

$$\therefore \Pr(A) - \Pr(AB) \geq 0 \quad (9)$$

$$\Pr(B) - \Pr(AB) \geq 0 \quad (10)$$

$$\implies \Pr(A) - \Pr(AB) = 0 \quad (11)$$

$$\implies \Pr(A) = \Pr(AB) \quad (12)$$

Also,

$$\Pr(B) - \Pr(AB) = 0 \quad (13)$$

$$\implies \Pr(B) = \Pr(AB) \quad (14)$$

From (12) and (14), it can be said that

$$\Pr(A) = \Pr(B) \quad (15)$$