

# Assignment -2<sub>3</sub>in $\text{\LaTeX}$

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**Question 11.16.3.12:** Check whether the following probabilities  $\Pr(A)$  and  $\Pr(B)$  are consistently defined

$$1) \Pr(A) = 0.5, \Pr(B) = 0.7, \Pr(AB) = 0.6$$

$$2) \Pr(A) = 0.5, \Pr(B) = 0.4, \Pr(A + B) = 0.8$$

**Solution:** The given probabilities are consistently defined if it satisfies the following properties:

$$\Pr(AB) \leq \Pr(A), \Pr(B) \quad (1)$$

$$0 \leq \Pr(A), \Pr(B), \Pr(AB), \Pr(A + B) \leq 1 \quad (2)$$

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

Proof of (??):

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

$$\implies \Pr(A) = \Pr(AB) + \Pr(AB') \quad (5)$$

$$\text{Therefore, } \Pr(AB) \leq \Pr(A) \quad (6)$$

$$\text{On Interchanging A and B, we get :} \quad (7)$$

$$\Pr(AB) \leq \Pr(B) \quad (8)$$

1) Given:

$$\Pr(A) = 0.5, \quad (9)$$

$$\Pr(B) = 0.7, \quad (10)$$

$$\Pr(AB) = 0.6 \quad (11)$$

Since

$$\Pr(AB) \geq \Pr(A) \quad (12)$$

$\Pr(A)$  and  $\Pr(B)$  are not consistently defined.

2) Given:

$$\Pr(A) = 0.5, \quad (13)$$

$$\Pr(B) = 0.4, \quad (14)$$

$$\Pr(A + B) = 0.8 \quad (15)$$

From (??),

$$\Pr(AB) = 0.5 + 0.4 - 0.8 \quad (16)$$

$$= 0.1 \quad (17)$$

This also satisfies (??) and (??)

Therefore  $\Pr(A)$  and  $\Pr(B)$  are consistently defined.