Assignment

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Question 12.13.3.60

If A and B aret two events such that $\Pr(A) = \frac{1}{2}$ $\Pr(B) = \frac{1}{3}$, $\Pr(A|B) = \frac{1}{4}$, Then $\Pr(A'B')$ equals

1) $\frac{1}{1^2}$
2) $\frac{3}{4}$
3) $\frac{1}{4}$
4) $\frac{3}{16}$

Solution:

from De Morgan's Law

$$\Pr((A+B)') = \Pr(A'B') \tag{1}$$

$$1 - \Pr(A+B) = \Pr(A'B') \tag{2}$$

So,

$$\implies \Pr(A+B) = \Pr(A) + \Pr(B) - \Pr(AB) \tag{3}$$

Finding $\Pr(AB)$ by,

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

$$\tag{5}$$

by substituting the values $\Pr(B) = \frac{1}{3}$ and $\Pr(A|B) = \frac{1}{4}$

$$\implies \Pr(AB) = \frac{1}{12} \tag{6}$$

$$\Pr(A+B) = \frac{1}{2} + \frac{1}{3} - \frac{1}{12} \tag{7}$$

$$= \frac{3}{4} \tag{8}$$

Then,

$$\Pr(A'B') = 1 - \Pr(A+B) \tag{9}$$

$$= 1 - \frac{3}{4} \tag{10}$$

$$= \frac{1}{4} \tag{11}$$