PROBABILITY

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13.2.9 [1] If A and B are two events such that $\Pr(A) = \frac{1}{4}, \Pr(B) = \frac{1}{2}$ and $\Pr(AB) = \frac{1}{8}$. find $\Pr$(not A and not B).

Solution:

13.3.9

$$A'B' = (A+B)' \tag{13.3.9.1}$$
$$\implies \Pr(A'B') = \Pr\left((A+B)'\right) \tag{13.3.9.2}$$
$$= 1 - \Pr(A+B) \tag{13.3.9.3}$$

13.4.9

$$A + B = A(B+B') + B \tag{13.4.9.1}$$
$$= B(A+1) + AB' \tag{13.4.9.2}$$
$$= B + AB' \tag{13.4.9.3}$$
$$\implies \Pr(A+B) = \Pr(B+AB') \tag{13.4.9.4}$$
$$= \Pr(B) + \Pr(AB') \tag{13.4.9.5}$$
$$B(AB') = 0 \tag{13.4.9.6}$$

13.5.9

$$A = A(B+B') = AB + AB' \tag{13.5.9.1}$$

and

$$(AB)(AB') = 0, \tag{13.5.9.2}$$
$$BB' = 0 \tag{13.5.9.3}$$

Hence, AB and AB' are mutually exclusive and

$$\Pr(A) = \Pr(AB) + \Pr(AB') \tag{13.5.9.4}$$
$$\implies \Pr(AB') = \Pr(A) - \Pr(AB) \tag{13.5.9.5}$$

[1] Read question numbers as (CHAPTER NUMBER).(EXERCISE NUMBER).(QUESTION NUMBER)

13.6.9 Substituting (13.5.9.5) in (13.4.9.6),

$$\Pr(A+B) = \Pr(A) + \Pr(B) - \Pr(AB) \tag{13.6.9.1}$$

13.7.9 Substituting (13.6.9.1) in (13.3.9.3)

$$\Pr(A'B') = 1 - \{\Pr(A) + \Pr(B) - \Pr(AB)\} \tag{13.7.9.1}$$

$$= 1 - \left(\frac{1}{4} + \frac{1}{2} - \frac{1}{8}\right) \tag{13.7.9.2}$$

$$= \frac{3}{8} \tag{13.7.9.3}$$