Assignment 2

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Question:

If A and B are events such that $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{4}$, then find:

a) $P(A \mid B)$

b) $P(B \mid A)$

Solution: Let X and Y be two events such that

$$\Pr(X) = x \tag{1}$$

$$\Pr(Y) = y \tag{2}$$

$$\Pr(X \cap Y) = z \tag{3}$$

We know that

$$\Pr(X \mid Y) = \frac{\Pr(X \cap Y)}{\Pr(Y)} \tag{4}$$

$$\implies \Pr(X \mid Y) = \frac{z}{y} \tag{5}$$

Now, It is given that

$$\Pr(A) = \frac{1}{2} \tag{6}$$

$$\Pr(B) = \frac{1}{3} \tag{7}$$

$$\Pr(A \cap B) = \frac{1}{4} \tag{8}$$

1) Using (4)

$$\Pr(A \mid B) = \frac{\Pr(A \cap B)}{\Pr(B)} \tag{9}$$

$$\implies \Pr(A \mid B) = \frac{\frac{1}{4}}{\frac{1}{3}} \tag{10}$$

$$\implies \Pr(A \mid B) = \frac{3}{4} = 0.75 \tag{11}$$

2) Using (4)

$$\Pr(B \mid A) = \frac{\Pr(A \cap B)}{\Pr(A)} \tag{12}$$

$$\implies \Pr(B \mid A) = \frac{\frac{1}{4}}{\frac{1}{2}} \tag{13}$$

$$\implies \Pr(B \mid A) = \frac{1}{2} = 0.50 \tag{14}$$