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: If X and Y are two events in a sample space S, then The Conditional Probability of X given Y is defined as

$$\Pr(X \mid Y) = \frac{\Pr(X \cap Y)}{\Pr(Y)} \tag{1}$$

Given, A and B are the events such that :

Probability	**Value**
$\Pr(A)$	$\frac{1}{2}$
$\Pr(B)$	$\frac{1}{3}$
$\Pr(A \cap B)$	$\frac{1}{4}$
$\Pr(A \mid B)$	?
$\Pr(B \mid A)$	?

TABLE I
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1) Using (1),

$$\Pr(A \mid B) = \frac{\Pr(A \cap B)}{\Pr(B)} \tag{2}$$

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

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

2) Using (1),

$$\Pr(B \mid A) = \frac{\Pr(A \cap B)}{\Pr(A)} \tag{5}$$

$$\implies \Pr(B \mid A) = \frac{\frac{1}{4}}{\frac{1}{2}} \tag{6}$$

$$\implies \Pr(B \mid A) = \frac{1}{2} = 0.50 \tag{7}$$