

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:

- $P(A | B)$
- $P(B | A)$

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

$$\Pr(X | Y) = \frac{\Pr(X \cap Y)}{\Pr(Y)} \quad (1)$$

Given, A and B are the events such that :

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

TABLE I
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1) Using (1),

$$\Pr(A | B) = \frac{\Pr(A \cap B)}{\Pr(B)} \quad (2)$$

$$\Rightarrow \Pr(A | B) = \frac{\left(\frac{1}{4}\right)}{\left(\frac{1}{3}\right)} \quad (3)$$

$$\Rightarrow \boxed{\Pr(A | B) = \frac{3}{4} = 0.75} \quad (4)$$

2) Using (1),

$$\Pr(B | A) = \frac{\Pr(A \cap B)}{\Pr(A)} \quad (5)$$

$$\Rightarrow \Pr(B | A) = \frac{\left(\frac{1}{4}\right)}{\left(\frac{1}{2}\right)} \quad (6)$$

$$\Rightarrow \boxed{\Pr(B | A) = \frac{1}{2} = 0.50} \quad (7)$$