

Assignment 3

Namita Kumari - CS20BTECH11034

Download all latex-tikz codes from

<https://github.com/ImNamitaKumari/Probability-and-Random-Variables/blob/main/Assignment3/Assignment3.tex>

1 PROBLEM

Let $P(E)$ denote the probability of the event E . Given $P(A)=1$, $P(B)=\frac{1}{2}$, the values of $P(A|B)$ and $P(B|A)$ respectively are

- 1) $\frac{1}{4}, \frac{1}{2}$
- 2) $\frac{1}{2}, \frac{1}{4}$
- 3) $\frac{1}{2}, 1$
- 4) $1, \frac{1}{2}$

2 SOLUTION

Let $X \in \{0,1\}$ be the random variable denoting the non-occurrence or occurrence of event A and $Y \in \{0,1\}$ be the random variable denoting the non-occurrence or occurrence of event B .

X	$\Pr(X)$	Y	$\Pr(Y)$
0	0	0	$\frac{1}{2}$
1	1	1	$\frac{1}{2}$

TABLE I: Random Variables and their probabilities

$$\begin{aligned}
 P(A|B) &= \Pr(X = 1|Y = 1) = \frac{\Pr(\{X = 1\}\{Y = 1\})}{\Pr(Y = 1)} \\
 &= \frac{1 \times \frac{1}{2}}{\frac{1}{2}} = 1
 \end{aligned}
 \tag{2.0.1}$$

$$\begin{aligned}
 P(B|A) &= \Pr(Y = 1|X = 1) = \frac{\Pr(\{Y = 1\}\{X = 1\})}{\Pr(X = 1)} \\
 &= \frac{\frac{1}{2} \times 1}{1} = \frac{1}{2}
 \end{aligned}
 \tag{2.0.2}$$

As evident from question too, A and B are independent events. So, $P(A|B) = P(A)$ and $P(B|A) = P(B)$.