

AI1103 Assignment-2

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Download all python codes from

<https://github.com/vrahul02/AI1103-Probability-and-Random-Variables/tree/main/Assignment-2/Codes>

and latex-tikz codes from

<https://github.com/vrahul02/AI1103-Probability-and-Random-Variables/tree/main/Assignment-2/Assignment-2.tex>

The outcomes where $X+Y=2$ is given by set

$$A = \{(0, 2), (1, 1), (2, 0)\} \quad (0.0.2)$$

The outcomes where $X-Y=0$ is given by set

$$B = \{(0, 0), (1, 1), (2, 2)\} \quad (0.0.3)$$

$$A + B = \{(1, 1)\} \quad (0.0.4)$$

$$\Pr(A + B) = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16} \quad (0.0.5)$$

$$\begin{aligned} \Pr(B) &= \frac{1}{2} \times \frac{1}{2} + \frac{1}{4} \times \frac{1}{4} + \frac{1}{4} \times \frac{1}{4} \\ &= \frac{1}{4} + \frac{1}{16} + \frac{1}{16} = \frac{6}{16} \end{aligned} \quad (0.0.6)$$

$$\Pr(A | B) = \frac{\Pr(A + B)}{\Pr(B)} = \frac{\frac{1}{16}}{\frac{6}{16}} = \frac{1}{6} \quad (0.0.7)$$

Thus option c) is correct

PROBLEM GATE-28

Consider two independent random variables X and Y with identical distributions. The variables X and Y take value 0,1 and 2 with probabilities $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{4}$ respectively. What is the conditional probability $\Pr(X + Y = 2 | X - Y = 0)$?

- a) 0
- b) $\frac{1}{16}$
- c) $\frac{1}{6}$
- d) 1

SOLUTION

The values that the random variable X can take along with its probabilities are given by

X	0	1	2
Pr(X)	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$

The values that the random variable Y can take along with its probabilities are given by

Y	0	1	2
Pr(Y)	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$

X and Y are independent random variables
Possible outcomes of the event are

$$\begin{aligned} S = \{ & (0, 0), (0, 1), (0, 2), \\ & (1, 0), (1, 1), (1, 2), \\ & (2, 1), (2, 2), (2, 3) \} \end{aligned} \quad (0.0.1)$$