

AI1103 Assignment-4

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Download all python codes from

<https://github.com/vrahul02/AI1103-Probability-and-Random-Variables/tree/main/Assignment-4/Codes>

and latex-tikz codes from

<https://github.com/vrahul02/AI1103-Probability-and-Random-Variables/tree/main/Assignment-4/Assignment-4.tex>

PROBLEM GATE 2021 (ST), Q.15

A fair die is rolled twice independently. Let X and Y denote the outcomes of the first and second roll, respectively. Then $E(X + Y | (X - Y)^2 = 1)$ equals

SOLUTION

X and Y are two independent random variables that can take the values 1, 2, 3, 4, 5, 6.

$$(X - Y)^2 = 1 \quad (0.0.1)$$

$$X - Y = +1, X - Y = -1 \quad (0.0.2)$$

$X+Y=n$	3	5	7	9	11
Outcomes	(1,2), (2,1)	(2,3), (3,2)	(3,4), (4,3)	(4,5), (5,4)	(5,6), (6,5)

$$E(X + Y | (X - Y)^2 = 1)$$

$$= \sum n \times \Pr(X + Y = n | (X - Y)^2 = 1) \quad (0.0.3)$$

$$= \sum n \times \frac{\Pr(X + Y = n, (X - Y)^2 = 1)}{\Pr((X - Y)^2 = 1)} \quad (0.0.4)$$

$$= 3 \times \frac{2}{10} + 5 \times \frac{2}{10} + 7 \times \frac{2}{10} + 9 \times \frac{2}{10} + 11 \times \frac{2}{10} \quad (0.0.5)$$

$$= 7 \quad (0.0.6)$$