AI1103 Assignment-2

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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 $\Pr(X + Y = 2 \mid X - Y = 0)$?

1) 0
2) $\frac{1}{16}$
3) $\frac{1}{6}$
4) 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
$\Pr(Y)$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$

$$\Pr(X - Y = 0) = \frac{1}{2} \times \frac{1}{2} + \frac{1}{4} \times \frac{1}{4} + \frac{1}{4} \times \frac{1}{4} = \frac{6}{16}$$
$$(0.0.1)$$

$$\Pr((X + Y = 2) + (X - Y = 0)) = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$$
$$(0.0.2)$$

$$\Pr(X + Y = 2 \mid X - Y = 0)$$
$$= \frac{\Pr((X + Y = 2) + (X - Y = 0))}{\Pr(X - Y = 0)}$$
$$= \frac{\frac{1}{16}}{\frac{6}{16}} = \frac{1}{6} \qquad (0.0.3)$$

Thus option c) is correct