Assignment4

CS20Btech11035 -NYALAPOGULA MANASWINI

Download python code from

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GATE 2021 XE-A QUESTION 7(PG:9)

A person who speaks truth 3 out of 4 times,throws a fair dice with six faces and informs the outcome is 5.The probability that the outcome is really 5 is

SOLUTION

Let $X \in \{0, 1\}$ represent the random variable,where 0 represents person speaking false,1 represents person speaking truth.

Let $Y \in \{0, 1\}$ represent random variable,where 0 represents person informs outcome of dice is not 5, 1 represents person informs outcome of dice is 5.

Event	definition
$\Pr(X = 1)$	Probability of person speaking truth
$\Pr(X = 0)$	Probability of person speaking false
$\Pr(Y = 1)$	Event that person informs outcome of dice is 5
$\Pr(Y = 1\|X = 1)$	Probability of person informing outcome is 5 if person speaks truth
$\Pr(Y = 1\|X = 0)$	Probability of person informing outcome is 5 if person speaks false
$\Pr(X = 1\|Y = 1)$	Probability of person speaking truth(outcome is 5)if person informs outcome is 5

TABLE 0: Table 1

Probability	value
$\Pr(X = 1)$	$\frac{3}{4}$
$\Pr(X = 0)$	$\frac{1}{4}$
$\Pr(Y = 1\|X = 1)$	$\frac{1}{6}$
$\Pr(Y = 1\|X = 0)$	$\frac{5}{6}$

TABLE 0: Table 2

From Baye's theorem

$$\Pr(Y = 1) = \Pr(Y = 1|X = 1) \times \Pr(X = 1) + \Pr(Y = 1|X = 0) \times \Pr(X = 0) \quad (0.0.1)$$

Substiting values from table (0) in (0.0.1)

$$\Pr(Y = 1) = \frac{1}{6} \times \frac{3}{4} + \frac{5}{6} \times \frac{1}{4} \quad (0.0.2)$$

$$= \frac{8}{24} \quad (0.0.3)$$

$$\Pr(X = 1 \cap Y = 1) = \Pr(Y = 1|X = 1) \times \Pr(X = 1) \quad (0.0.4)$$

$$= \frac{1}{6} \times \frac{3}{4} \quad (0.0.5)$$

$$= \frac{3}{24} \quad (0.0.6)$$

We need to find $\Pr(X = 1|Y = 1)$

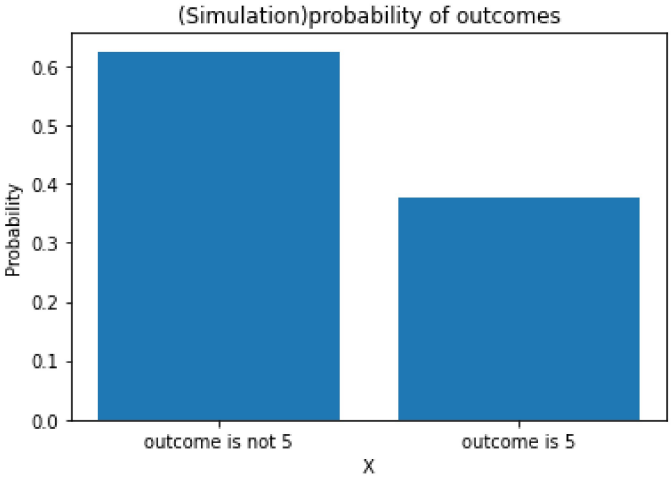
$$\Pr(X = 1|Y = 1) = \frac{\Pr(X = 1 \cap Y = 1)}{\Pr(Y = 1)} \quad (0.0.7)$$

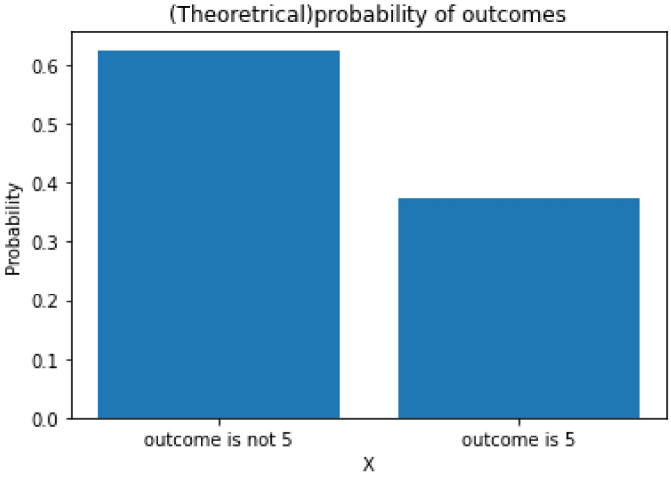
$$= \frac{\frac{3}{24}}{\frac{8}{24}} \quad (0.0.8)$$

$$= \frac{3}{8} \quad (0.0.9)$$

$\therefore$ The desired probability that outcome is really 5 $= \frac{3}{8} = 0.375$

P.T.O


(Simulation)probability of outcomes
Probability
0.0
0.1
0.2
0.3
0.4
0.5
0.6
outcome is not 5
outcome is 5
X


(Theoretrical)probability of outcomes
Probability
0.0
0.1
0.2
0.3
0.4
0.5
0.6
outcome is not 5
outcome is 5
X