Assignment 2

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Download all python codes from

https://github.com/VIB2020/AI1103/blob/main/Assignment%201/code/Assignment%202.py

and latex-tikz codes from

https://github.com/VIB2020/AI1103/blob/main/Assignment%201/Assignment%202.tex

1 Problem GATE 2009 (CS), Q.21

An unbalanced dice (with 6 faces, numbered from 1 to 6) is thrown. The probability that the face value is odd is 90% of the probability that the face value is even. The probability of getting any even numbered face is the same. If the probability that the face is even given that it is greater than 3 is 0.75, which one of the following options is closest to the probability that the face value exceeds 3?

A: 0.453
B: 0.468
C: 0.485
D: 0.492

2 Solution

Let X_i denote the independent event of number i appearing on the dice
To find: probability that the face value exceeds 3 i.e P(X ¿ 3) Sum of all probabilities = 1

$$\implies X_1 + X_2 + X_3 + X_4 + X_5 + X_6 = 1 \longrightarrow \quad (1)$$

Given X_2, X_4, X_6 are equally likely
Let $P(X_2) = P(X_4) = P(X_6) = x$

$$\implies 3x + X_1 + X_3 + X_5 = 1 \quad (2)$$

Given probability that the face value is odd is 90% of the probability that the face value is even

$$\implies P(X_1 + X_3 + X_5) = 0.9 \times P(X_2 + X_4 + X_6) \quad (3)$$
$$= 0.9 \times (3x) = 2.7x \quad (4)$$

From Eqn 1: 5.7x = 1

$$x = \frac{10}{57} \quad (5)$$

Given the probability that the face is even given that it is greater than 3 is 0.75
Let E_1 be the event where the face value X on the die is EVEN.
Let E_2 be the event where the face value X on the die is greater then three.

$$P\left(\frac{E_1}{E_2}\right) = 0.75 \quad (6)$$

$$P(E_2) = P(X_4) + P(X_5) + P(X_6) = 2x + P(X_5) \quad (7)$$

$$P\left(\frac{E_1}{E_2}\right) = \frac{P(E_1 \cap E_2)}{P(E_2)} \quad (8)$$

$$P(E_1 \cap E_2) = P(X_4) + P(X_5) + P(X_6) = 2x \quad (9)$$

$$\implies \frac{2x}{P(X_5) + 2x} = 0.75 \implies P(X_5) = \frac{x}{1.5} \quad (10)$$

$$\implies P(E_2) = 2x + P(X_5) = 2x + \frac{x}{1.5} \quad (11)$$

$$= x \times \frac{8}{3} = \frac{10}{57} \times \frac{8}{3} = 0.46755 \approx 0.468 \quad (12)$$

P(Face value > 3) = 0.468

Option B