

AI1103-Assignment 3

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Python codes :

<https://github.com/Aayush-2492/Assignments/tree/main/Assignment3/code>

Latex codes :

<https://github.com/Aayush-2492/Assignments/tree/main/Assignment3>

Let B denote the event that out of last three coins, only one shows tail.

$$P(B) = \frac{3}{8} \quad (0.0.3)$$

Since tossing a coin and rolling a dice are independent events,

$$P((X_i = p) \cdot (Y = q)) = P(X = p) \cdot P(Y = q) \quad (0.0.4)$$

$p \in \{0, 1\}$ and $q \in \{1, 2, 3, 4, 5, 6\}$.

Let A denote the event that the score is 2.

Clearly,

$$\begin{aligned} P(A) &= P(Y = 2|X_1 = 0) \cdot P(X_1 = 0) \\ &\quad + P(B|X_1 = 1) \cdot P(X_1 = 1) \end{aligned} \quad (0.0.5)$$

$$= P((X_1 = 0) \cdot (Y = 2)) + P((X_1 = 1) \cdot B) \quad (0.0.6)$$

$$= P(X_1 = 0) \cdot P(Y = 2) + P(X_1 = 1) \cdot P(B) \quad (0.0.7)$$

$$= \frac{1}{2} \cdot \frac{1}{6} + \frac{1}{2} \cdot \frac{3}{8} \quad (0.0.8)$$

$$= \frac{13}{48} \quad (0.0.9)$$

We have to find $P(X_1 = 0|A)$

$$P(X_1 = 0|A) = \frac{P(A \cdot (X_1 = 0))}{P(A)} \quad (0.0.10)$$

$$= \frac{P(X_1 = 0) \cdot P(Y = 2)}{P(A)} \quad (0.0.11)$$

$$= \frac{\frac{1}{2} \cdot \frac{1}{6}}{\frac{13}{48}} \quad (0.0.12)$$

$$= \frac{4}{13} \quad (0.0.13)$$

$$= 0.31 \quad (0.0.14)$$

Let Y denote the random variable function for the dice.

$Y \in \{1, 2, 3, 4, 5, 6\}$ where 1 represents dice showing 1 and so on.

$$P(X_i = q) = \frac{1}{2} \quad (0.0.1)$$

$q \in \{0, 1\}$ and $i \in \{1, 2, 3, 4\}$.

$$P(Y = q) = \frac{1}{6} \quad (0.0.2)$$

$q \in \{1, 2, 3, 4, 5, 6\}$.

Therefore, required probability = 0.31