

AI5002 - Assignment 7

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Download code and LaTeX from below hyperlinks

1. [Codes/MiscDist_5_17.py](#)
2. [LaTeX](#)

Problem 5.17

Suppose a girl throws a dice. If she gets a 5 or 6, she tosses a coin three times and notes the number of heads. If she gets 1, 2, 3 or 4, she tosses a coin once and notes whether a head or tail is obtained. If she obtained exactly one head, what is the probability that she threw 1, 2, 3 or 4 with the dice?

Solution

Let A be the event of getting a 5 or 6 and A^c be the event of getting a 1, 2, 3, or 4 after rolling a dice.

$$P(A) = \frac{2}{6} = \frac{1}{3} \quad (0.0.1)$$

$$P(A^c) = 1 - \frac{1}{3} = \frac{2}{3} \quad (0.0.2)$$

Let B be the event of getting exactly one head when a coin is tossed any number of times.

Probability of exactly one head shows up when coin is tossed thrice is given by:

$$P(B|A) = P(\{HTT, THT, TTH\}) = 3/8 \quad (0.0.3)$$

Probability of exactly one head shows up when coin is tossed once is given by:

$$P(B|A^c) = P(\{H\}) = 1/2 \quad (0.0.4)$$

Given that she obtained exactly one head, then the probability that she threw 1, 2, 3 or 4 with the dice is given by:

$$P(A^c|B) = \frac{P(A^c) * P(B|A^c)}{P(A^c) * P(B|A^c) + P(A) * P(B|A)} \quad (0.0.5)$$

$$P(A^c|B) = \frac{\frac{2}{3} * \frac{1}{2}}{\frac{2}{3} * \frac{1}{2} + \frac{1}{3} * \frac{3}{8}} \quad (0.0.6)$$

$$P(A^c|B) = \frac{\frac{1}{3}}{\frac{1}{3} + \frac{1}{8}} \quad (0.0.7)$$

$$P(A^c|B) = \frac{8}{11} \approx 0.73 \quad (0.0.8)$$