Assignment 1
AI1110: Probability and Random Variables

Rishitha Surineni

cs22btech11050

12.13.1.15: Question:
Consider the experiment of throwing a die,if a multiple of 3 comes up,throw the die again and if any other number comes,toss a coin.Find the conditional probability of the event 'the coin shows a tail',given that 'at least one die shows a 3'.

Answer:0.

Solution:
Given that a die is thrown and if the outcome is a multiple of 3 i.e.,3 or 6 then another die is thrown, else a coin is tossed.
Let S be the sample space of the experiment then

$$S = \{(1, H), (1, T), (2, H), (2, T), (4, H), (4, T),$$
$$(5, H), (5, T), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5),$$
$$(3, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$$

Let A be the event that 'the coin shows a tail'.
B be the event that 'atleast one die shows 3'.
Need to Find, Conditional Probability of the event 'the coin shows a tail',given that 'at least one die shows a 3', i.e., $\Pr(A|B)$

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \tag{1}$$

$$A = \{(1, T), (2, T), (4, T), (5, T)\}$$
$$B = \{(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (6, 3)\}$$

Let n(E) represents the number of favorable outcomes of the event E.
Here, the events A and B are disjoint(as no ordered pair is common to both the events).
Hence, n(AB)=0

$$\Pr(AB) = \frac{n(AB)}{n(S)} \tag{2}$$

$$\Pr(AB) = \frac{0}{20} \tag{3}$$

$$\Pr(AB) = 0 \tag{4}$$

Similarly,

$$\Pr(B) = \frac{n(B)}{n(S)} \tag{5}$$

$$\Pr(B) = \frac{7}{20} \tag{6}$$

Therfore,
From eq(1),eq(4),eq(6)

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \tag{7}$$

$$\Pr(A|B) = \frac{0}{\frac{7}{20}} \tag{8}$$

$$\Pr(A|B) = 0 \tag{9}$$

Hence,
Probability of the event 'the coin shows a tail',given that 'at least one die shows a 3' is 0.