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Assignment No. 02

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Topic: FDS (Conditional Probability & Bayes Theorem)

Course: MSc DSAI PART 1 : 2020-21 (SEM-1)
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(1) Suppose you draw two cards from a deck and you win if you get a jack followed by an ace (without replacement). What is the probability of winning, given we know that you got a jack in the first turn?

⇒ Lets,

P(Winning) = P(First card is a Jack) . P(Second card is a Ace)

$P(\text{First card is a jack}) = \frac{4}{52}$

∵ One card is pulled and not replaced then 51 total cards remaining for second selection.

$P(\text{Second card is a Ace}) = \frac{4}{51}$

$\therefore P(\text{Winning}) = \frac{4}{52} * \frac{4}{51}$

$\therefore P(\text{Winning}) = 0.006$

$\therefore = 0.60\%$

By Bayes Theorem, as we know that you got a jack in the first turn, the P(winning) is

$$= \frac{\left(\frac{4}{52} * \frac{4}{51}\right)}{(4/52)} = 0.078$$

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(2) Suppose you have a jar containing 6 marbles - 3 black and 3 white. What is the probability of getting a black given the first one was black too.

⇒

Given,

We have 6 marbles, 3 of them Black & 3 of them are white

Lets

E_A : Getting black marbel at first turn

$P(A) = 3/6$

E_B : Getting black marbel at second turn

$P(B) = 2/5$

∴ P (of getting both black marble)

i.e $P(A \cdot B) = \frac{3}{6} \times \frac{2}{5}$

$P(AB) = 0.2$

~~But as the~~

Given that, we know the first marble is black,

$\therefore P(B/A) = \frac{P(AB)}{P(A)}$

$= \frac{0.2}{3/6}$

$\therefore P(B/A) = 0.4$

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(3) A research group collected the yearly data of road accidents with respect to the conditions of following and not following the traffic rules of an accident prone area. Calculating the probability of accident given that a person followed the traffic rules.

The table of the data is given follows:

Condition	Follow Traffic Rule	Does not follow Traffic Rule
Accident	50	500
No Accident	2000	5000

⇒ Let's E is Event. Total Population = 7550

E_A : Person Follows traffic rule & accident happens.

$P(E_A) = \frac{50}{7550}$

E_B : People follow traffic Rule

$P(E_B) = \frac{2050}{7550}$

P(Accident happens when person follow Traffic rules) $= \frac{(50/7550)}{(2050/7550)}$

$= 0.024$

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(4) A bag I contain 4 white and 6 black balls while another Bag II contains 4 white and 3 black balls. One ball is drawn at random from one of the bags, and it is found to be black. Find the probability that it was drawn from Bag I.

⇒ Lets,

E is an Event

E_A : Choosing the bag I

E_B : Choosing the bag II

$\therefore P(E_A) = P(E_B) = 1/2 = 0.5$

Given that bag I contains 4 white & 6 Black balls.

$P(E_{Black}|B_I) = P(\text{Drawing a black ball from Bag I})$

$= 6/10$

~~$P(E_B$~~

Also, Bag II contains 4 white & 3 black balls

$\therefore P(E_{Black}|B_{II}) = P(\text{Drawing a black ball from Bag II})$

$= 3/7$

$\therefore P(\text{Black ball drawn out from bag I})$

$$= \frac{1/2 \times 6/10}{(1/2 \times 3/7) + (1/2 \times 6/10)}$$

$= 0.583$

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(5) A man is known to speak truth 2 out of 3 times He throws a die and reports that the number obtained is a four. Find the probability that the number obtained is actually a four.

⇒ Let's

Consider E as Events.

E_A: Event of getting a four

$P(E_A) = 1/6$

E_B: Event of not getting a four

$P(E_B) = 5/6$

E_1 : Event of speaking TRUTH

$P(E_1) = 2/3$

E_2 : Event of speaking false

$P(E_2) = 1/3$

∴ Probability of man telling truth that the number obtained is four.

$$= \left(\frac{1}{6} \times \frac{2}{3}\right) + \left(\frac{5}{6} \times \frac{1}{3}\right) = \frac{2}{18} + \frac{5}{18}$$

$$= \frac{7}{18}$$

∴ The probability that the number is actually 4 $= \left(\frac{1}{6} \times \frac{2}{3}\right) \Big/ \left(\frac{7}{18}\right) = \frac{2/18}{7/18}$

$$= \frac{2}{7}$$

$$= 0.286$$