ASSIGNMENT 3

CS21BTECH11053

Abstract—**From NCERT Mathematics Class 12, Chapter 13**

Problem (Example 3). *Ten cards numbered 1 to 10 are placed in a box, mixed up thoroughly and then one card is drawn randomly. If it is known that the number on the drawn card is more than 3, what is the probability that it is an even number?*

Solution:

We will define three random variables X, Y, Z such that $X, Y, Z \in 0, 1$. $X = 1$ is assigned an even card and $X = 0$ to odd cards. $Y = 1$ is assigned to cards which are greater than 3, $Y = 0$ otherwise. $Z = 1$ is assigned to cards which have $X = 1$ and $Y = 1$ and $Z = 0$ otherwise. In other words, any even card greater than 3 is assigned $Z = 1$. Based on the above definitions, we obtain the following table (I).

Card Nos	X	Y	$Z = X \wedge Y$
1	0	0	0
2	1	0	0
3	0	0	0
4	1	1	1
5	0	1	0
6	1	1	1
7	0	1	0
8	1	1	1
9	0	1	0
10	1	1	1

TABLE I
RANDOM VARIABLES FOR VARIOUS EVENTS

There are a total of 10 cards. Hence for the sample place S of the experiment,

$$n(S) = 10 \tag{1}$$

Using equation (1) and table (I) the probability

that $Y = 1$ is given by

$$P(Y = 1) = \frac{n(Y = 1)}{n(S)} = \frac{7}{10} \tag{2}$$

Similarly the probability that $Z = 1$ is given by

$$P(Z = 1) = \frac{n(Z = 1)}{n(S)} = \frac{4}{10} \tag{3}$$

The probability that event A occurs given that event B is given as

$$P(A|B) = \frac{P(A \wedge B)}{P(B)} \tag{4}$$

Hence the probability that we get an even card given that the card is greater than 3 is given by

$$P((X = 1)|(Y = 1)) = \frac{P((X = 1) \wedge (Y = 1))}{P(Y = 1)} \tag{5}$$

$$\implies P((X = 1)|(Y = 1)) = \frac{P(Z = 1)}{P(Y = 1)} \tag{6}$$

Using (2) and (3) in (6) we get

$$P((X = 1)|(Y = 1)) = \frac{\frac{4}{10}}{\frac{7}{10}} = \frac{4}{7} = \boxed{0.57143} \tag{7}$$

Code Output:

```
ravi@ravi-Legion-5-Pro-16ACH6H:~/Desktop/Python$ python3 cond.py
The required probability is 0.5714285714285715
ravi@ravi-Legion-5-Pro-16ACH6H:~/Desktop/Python$
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