Assignment 3-probability and Random Variable

Aravind-BM19MTECH11007

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problem statement: Suppose we have four box A,B,C and D containing coloured marbles as given below:

Box	Red	White	Black
A	1	6	3
B	6	2	2
C	8	1	1
D	0	6	4

one of the box has been selected at random and a single marble is drawn from it.If the marble is red.What is the probability that it was drawn from box A?Box B?Box C?

Solution:

Suppose

R	Event that Red marble is drawn
A	Event that marble is drawn from Box A
B	Event that marble is drawn from Box B
C	Event that marble is drawn from Box C
D	Event that marble is drawn from Box D

P(A): probability that Box A is selected $= \frac{1}{4}$
P(R/A): probability that Red marble is selected from Box A $= \frac{1}{10}$
P(B): probability that Box B is selected $= \frac{1}{4}$
p(R/B): probability that Red marble is selected from Box B $= \frac{6}{10}$
P(C): probability that Box C is selected $= \frac{1}{4}$
P(R/C): probability that Red marble is selected from Box C $= \frac{8}{10}$
P(D): probability that Box D is selected $= \frac{1}{4}$
P(R/D): probability that Red marble is selected from Box D $= 0$
P(R):Probability of getting a Red marble

$$\begin{aligned}
&= P(A)P(R/A) + P(B)P(R/B) \\
&\quad + P(C)P(R/C) + P(D)P(R/D) \\
&= \frac{1}{4} \times \frac{1}{10} + \frac{1}{4} \times \frac{6}{10} + \frac{1}{4} \times \frac{8}{10} \\
&= \frac{1}{4}(\frac{1}{10} + \frac{6}{10} + \frac{8}{10}) \\
&= \frac{1}{4} \times \frac{3}{2}
\end{aligned}$$

1 Part A

P(A/R):probability that marble is drawn from box A given it is Red marble

$$\begin{aligned}
&= \frac{p(R/A).P(A)}{P(R)} \\
&= \frac{\frac{1}{10} \times \frac{1}{4}}{\frac{1}{4} \times \frac{3}{2}} \\
&= \frac{1}{15}
\end{aligned}$$

2 part B

P(B/R):probability that marble is drawn from box B given it is Red marble

$$
\begin{aligned}
&= \frac{p(R/B).P(B)}{P(R)} \\
&= \frac{\frac{6}{10} \times \frac{1}{4}}{\frac{1}{4} \times \frac{3}{2}} \\
&= \frac{2}{5}
\end{aligned}
$$

3 part c

P(C/R):probability that marble is drawn from box C given it is Red marble

$$
\begin{aligned}
&= \frac{p(R/C).P(C)}{P(R)} \\
&= \frac{\frac{8}{10} \times \frac{1}{4}}{\frac{1}{4} \times \frac{3}{2}} \\
&= \frac{8}{15}
\end{aligned}
$$