Assignment 3–probability and Random Variable

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

Table 1:

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

Solution:

Suppose 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

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

Table 2:

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

1 Part A

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

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

2 part B

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

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

3 part C

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

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