# 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

Table 1:

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

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:** Here we are having 4 boxes with 10 balls each.There is a equal likelihood of selecting four boxes

Suppose P(A): probability that Box A is se-

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 |

lected $= \frac{1}{4}$

We are having 1 red balls in box A,so probability of getting the red ball from box A is given by

P(R/A): probability that Red marble is selected given it is from Box A $= \frac{1}{10}$

P(B): probability that Box B is selected $= \frac{1}{4}$
We are having 6 red balls in box B,so probability of getting the red ball from box B is given by
P(R/B): probability that Red marble is selected from Box B $= \frac{6}{10}$
P(C): probability that Box C is selected $= \frac{1}{4}$
We are having 8 red balls in box C,so probability of getting the red ball from box C is given by
P(R/C): probability that Red marble is selected from Box C $= \frac{8}{10}$
P(D): probability that Box D is selected $= \frac{1}{4}$.
We are having 0 red balls in box D,so probability of getting the red ball from box D is given by
P(R/D): probability that Red marble is selected from Box D $= 0$
Since red balls are in all the three boxes.The probability that selected ball is red is given by

P(R):Probability of getting a Red marble

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

# 1 Part A

P(A/R):probability that marble is drawn from box A given it is Red marble.By using bayes theorem

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

# 2 Part B

P(B/R):probability that marble is drawn from box B given it is Red marble.By using bayes theorem

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

# 3 part C

P(C/R):probability that marble is drawn from box C given it is Red marble.By using bayes theorem

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