Bayes Theorem formula:

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

$$P(E_i/A) = \frac{P(E_i) \cdot P(A/E_i)}{\sum_{k=1}^{n} P(E_k) \cdot P(A/E_k)}$$

Bayes Theorem Questions

Q. Given three identical Boxes A, B and C. Box A contains 2 gold and 1 silver coins, Box B contains 1 gold and 2 silver coins and Box C contains 3 silver coins. A person chooses a Box at random and takes out a coin. If the coin drawn is of silver find the probability that it has been drawn from the box which has the remaining two coins also of silver.

Sol^n. E_1 = be the event of ~~drawing from~~ choosing Box A.

E_2 = " " " " " " " B

E_3 = " " " " " " " C.

$$P(E_1) = P(E_2) = P(E_3) = \frac{1}{3}$$

A_2 be the event of drawing a silver coin

We have to find $P(E_3/A)$?

$$P(A/E_1) = \frac{1}{3}, \quad P(A/E_2) = \frac{2}{3}, \quad P(A/E_3) = 1$$

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$$P(E_3/A) = \frac{P(A/E_3) \cdot P(E_3)}{P(A) = \left[P(A/E_1) \cdot P(E_1) + P(A/E_2) \cdot P(E_2) + P(A/E_3) \cdot P(E_3) \right]}$$

$$= \frac{1 \cdot 1/3}{1/3 \cdot 1/3 + 2/3 \cdot 1/3 + 1 \cdot 1/3}$$

$$= \frac{1/3}{\frac{1+2+2}{3}} = \frac{3}{5} = \frac{1}{2} \quad \text{Ans}$$

Q. There are 3 boxes:

Box A has 2 gold coins

Box B has 2 Silver coins

Box C has 1 gold, 1 Silver

You pick one box at random, then draw one coin at random - it's gold. What is the probability the other coin in that box is also gold

$$P = \frac{\frac{1}{3} \times 1}{\frac{1}{3} \times 1 + \frac{1}{3} \times 0 + \frac{1}{3} \times \frac{1}{2}}$$

$$= \frac{1/3}{1/3 + 1/6} = \frac{1/3}{3/6} = \frac{2}{3}$$ Ans.