Assignment 1 - Prob 2.8

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April 2021

1 Problem Statement

Two groups are competing for the position on the board of directors of a corporation.The probabilities that the first and the second groups will win are 0.6 and 0.4 respectively.Further,if the first group wins,the probability of introducing a new product is 0.7 and the corresponding probability is 0.3 if the second group wins.Find the probability that the new product introduced was by the second group.

2 Solution

Let $H \in \{0, 1\}$ be the random variable denoting which the group A wins, with $H = 0$ representing group A wins. Let $H \in \{0, 1\}$ be the random variable denoting whether the product being introduced, with $M = 0$ representing that the product is not introduced by A.

We are given that:

$$\begin{aligned} Pr(H = 0) &= 0.6 \\ Pr(M = 1|H = 0) &= 0.42 \\ Pr(M = 1|H = 1) &= 0.12 \end{aligned}$$

Therefore, by Bayes Theorem, we say that:

$$\begin{aligned} Pr(H = 1|M = 1) &= \frac{Pr(M = 1|H = 1) \cdot Pr(H = 1)}{\sum_{i=0}^{1} Pr(M = 1|H = i) \cdot Pr(H = i)} \\ &= \frac{(M = 1|H = 1) \cdot Pr(H = 1)}{Pr(M = 1|H = 1) \cdot Pr(H = 1) \\ &\qquad + Pr(M = 1|H = 0) \cdot Pr(H = 0)} \\ &= \frac{0.3 \cdot 0.4}{0.3 \cdot 0.4 + 0.6 \cdot 0.7} \\ &= \frac{12}{54} \\ &= 0.23 \end{aligned}$$

The probability that the new product introduced by the second group B is 0.23.