AI1103 - Assignment 1

Monika Kharadi - CS20BTECH11026

PROBLEM

2.12. In a school, there are 1000 students, out of which 430 are girls. It is known that out of 430, 10 percent of girls study in class XII. What is the probability that a student chosen randomly studies in Class XII given that the chosen student is a girl ?

SOLUTION

Total number of students : 1000
Total number of girls : 430
Total number of girls in Class XII : 10 % of total girls

$$= \frac{10}{100} \times 430 = 43 \tag{1}$$

Let X $\in \{0, 1\}$ be the random variable such that 1 represents girl, 0 represents boy.

TABLE I: Probability distribution for values of X

X	P(X)
1	430/1000
0	570/100

Let Y $\in \{0, 1\}$ be the random variable such that 1 represents chosen student is in Class XII, 0 represents chosen student is not in Class XII.

TABLE II: Probability distribution for values of Y

Y	P(Y)
1	$\frac{1}{2}$
0	$\frac{1}{2}$

We require P(Y=1 | X=1) (using Baye's theorem)

$$= \frac{P(X = 1|Y = 1) \cdot P(Y = 1)}{\sum_{i=0}^{1} P(X = 1|Y = i) \cdot P(Y = i)} \tag{2}$$

$$= \frac{P(X=1|Y=1)P(Y=1)}{P(X=1|Y=0)P(Y=0)+P(X=1|Y=1)P(Y=1)}$$

TABLE III: Probability for different values of X,Y

Probability	Chosen Student	Value
$P(X = 1\|Y = 0)$	girl not in Class XII	$\frac{387}{1000}$
$P(X = 1\|Y = 1)$	girl in Class XII	$\frac{43}{1000}$

$$= \left[\frac{(\frac{43}{1000} \times \frac{1}{2})}{(\frac{387}{1000}) \times \frac{1}{2}) + (\frac{43}{1000} \times \frac{1}{2})}\right] \tag{3}$$

$$= \frac{1}{10} \tag{4}$$

$$= 0.1 \tag{5}$$

Hence, the probability that a student chosen randomly studies in Class XII given that the chosen student is a girl is 0.1.