

Assignment 2

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Download all python codes from

<https://github.com/tanmaygoyal258/AI1103---Probability/blob/main/Assignment2/code.py>

and latex-tikz codes from

<https://github.com/tanmaygoyal258/AI1103---Probability/blob/main/Assignment2/main.tex>

1 PROBLEM

(Prob 5.18) An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of accident is 0.01, 0.03 and 0.15 respectively. One of the insured persons meets with an accident. What is the probability that it is a scooter driver?

2 SOLUTION

By definition

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \quad (2.0.1)$$

Also, by Bayes' Theorem

$$\Pr(A) = \sum_{i=1}^n \Pr(A|E_i) \Pr(E_i) \quad (2.0.2)$$

where $E_1, E_2 \dots E_n$ are partitions of the complete sample set.

Let X be a random variable taking the following values:

$X = 0$	Scooter Drivers
$X = 1$	Car Drivers
$X = 2$	Truck Drivers

where $X \in \{0, 1, 2\}$ represent all the partitions of the sample set.

Let Y be a random variable taking the following values:

$Y = 0$	Involved in an accident
$Y = 1$	Not involved in an accident

Also, the following values are known:

$$\Pr(X = 0) = \frac{2000}{2000 + 4000 + 6000} = \frac{1}{6} \quad (2.0.3)$$

$$\Pr(X = 1) = \frac{4000}{2000 + 4000 + 6000} = \frac{1}{3} \quad (2.0.4)$$

$$\Pr(X = 2) = \frac{6000}{2000 + 4000 + 6000} = \frac{1}{2} \quad (2.0.5)$$

$$\Pr(Y = 0|X = 0) = 0.01 \quad (2.0.6)$$

$$\Pr(Y = 0|X = 1) = 0.03 \quad (2.0.7)$$

$$\Pr(Y = 0|X = 2) = 0.15 \quad (2.0.8)$$

We have to find:

$$\Pr(X = 0|Y = 0) = \frac{\Pr(X = 0 \cap Y = 0)}{\Pr(Y = 0)} \quad (2.0.9)$$

Using (2.0.1) and (2.0.2), we get:

$$\begin{aligned} \Pr(X = 0|Y = 0) &= \frac{\Pr(Y = 0|X = 0) \Pr(X = 0)}{\Pr(Y = 0|X = 0) \Pr(X = 0) + \Pr(Y = 0|X = 1) \Pr(X = 1) + \Pr(Y = 0|X = 2) \Pr(X = 2)} \\ &= \frac{\frac{0.01}{6}}{\frac{0.01}{6} + \frac{0.03}{3} + \frac{0.15}{2}} = \frac{1}{52} \quad (2.0.10) \end{aligned}$$