Assignment 6

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Problem-CBSE-12 Q)Example-20

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Problem

Q)A doctor is to visit patient. Form the past experience, it is known that the probabilities that he will come by train, bus, scooter or by other means of transport are respectively $\frac{3}{10}$, $\frac{1}{5}$, $\frac{1}{10}$ and $\frac{2}{5}$. The probabilities that he will be late are $\frac{1}{4}$, $\frac{1}{3}$ and $\frac{1}{12}$, if he comes by train, bus and scooter respectively, but if he comes by other means of trasnsport, then he will not be late. When he arrives,he is late. What is the probability that he comes by the train?

Solution

Let E be the event that the doctor visits the patient late and let T_1, T_2, T_3 and T_4 be the events that the doctor comes by train, bus, scooter and other means of transport respectively.

Then, probability that doctor chooses particular mode of transport

- Probability of choosing train $\implies Pr(T_1) = \frac{3}{10}$
- Probability of choosing bus $\implies Pr(T_2) = \frac{1}{5}$
- Probability of choosing scooter $\implies Pr(T_3) = \frac{1}{10}$
- Probability of choosing other means $\implies Pr(T_4) = \frac{2}{5}$

Probability that doctor late by that particular mode of transport

- Probability of being late by train $\implies Pr(E|T_1) = \frac{1}{4}$
- Probability of being late by bus $\implies Pr(E|T_2) = \frac{1}{3}$
- Probability of being late by scooter $\implies Pr(E|T_3) = \frac{1}{12}$
- Probability of being late by other means $\implies Pr(E|T_4) = 0$

$\therefore$ by Baye's Theorem, we have
$Pr(T_1|E) =$ Probability that the doctor arriving late comes by train

$$Pr(T_1|E) = \frac{Pr(T_1)Pr(E|T_1)}{\sum_{i=0}^{4} Pr(T_i)Pr(E|T_i)} \tag{1}$$

$$Pr(T_1|E) = \frac{\frac{3}{10} \times \frac{1}{4}}{\frac{3}{10} \times \frac{1}{4} + \frac{1}{5} \times \frac{1}{3} + \frac{1}{10} \times \frac{1}{12} + \frac{2}{5} \times 0} \tag{2}$$

$$= \frac{3}{40} \times \frac{120}{18} \tag{3}$$

$$= \frac{1}{2} \tag{4}$$

Hence, the required probability is $\frac{1}{2}$

PMF Graph

The PMF graph is:

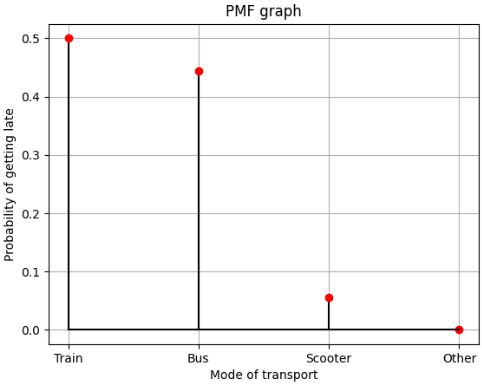

Figure: Probability Mass Function

CODES

Python

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