

1. Define Experiment, Sample Space, Outcome and Event.

Ans:- Experiment:- An Experiment is an activity with an observable result.

Experimental Probability of Occurrence of tails =

No. of times tails occurs / Number of times coin is tossed.

Sample Space:- A set in which all of the possible outcomes of a

Statistical Experiment are represented as points.

Outcome:- The result of any random experiment is called an outcome.

Event:- In the case of a random experiment, an event is a set of possible outcomes of a specified condition.

2. Probability:- Probability is used to measure the uncertainty

There are 2 types of probabilities.

1) Theoretical probability :- ii) Experimental probability

1) Theoretical probability:- It is based on the possible chances of something to happen. The theoretical probability is mainly based on the reasoning behind probability.

ii) Experimental Probability:- It is based on observations of an experiment. The experimental probability can be calculated based on the number of possible outcomes by the total no. of trials.

3) In loan defaulters older people make up only 1.4%. Now the probability that someone defaults on a loan is 0.184. Find the probability of default on loan knowing that he is an old person. Older people make up only 0.8%.

Ans:-

$$P(\text{yes}) = 0.184$$

$$P(\text{old}/\text{person}) = 0.8\% = 0.008$$

$$P(\text{old}/\text{person}|\text{yes}) = 7.4\% = 0.14$$

$$P(\text{yes}/\text{old}/\text{person}) = \frac{P(\text{yes}) \cdot P(\text{old}/\text{person}|\text{yes})}{P(\text{old}/\text{person})} \Rightarrow \frac{(0.184) \times (0.14)}{0.008}$$

$$= 0.322$$

$$\therefore P(\text{yes}/\text{old}) = 0.322$$

4. Bayes' Theorem:- It states that conditional probability of an event, based on the occurrence of another event is equal to the likelihood of the second event given the 1st event multiplied by the probability of the first event.

$$P(A|B) = \frac{P(B|A) \times P(A)}{P(B)}$$

5. Solve the below prob using Bayes' Theorem?

Spam Assassin works by having users train the system. It looks for patterns in the words in emails marked as spam by the user.

For example, it may have learned that the word "free" appears in 30% of the emails marked as spam, i.e., $P(\text{Free}/\text{spam}) = 0.30$.

Assuming 1% of non-spam mail includes the word "free" and 50% of all mails received by the user are spam, find the probability that a mail is spam if the word "free" appears in it.

Ans:-

$$P(\text{spam}) = 50\% = 0.50$$

$$P(\text{free}/\text{spam}) = 30\% = 0.30$$

$$P(\text{free}/\text{Not spam}) = 1\% = 0.01$$

$$P(\text{Not spam}) = 5\% = 0.50$$

$$P(\text{Spam} | \text{free}) = \frac{P(\text{free} | \text{spam}) \cdot P(\text{spam})}{P(\text{free} | \text{spam}) \cdot P(\text{spam}) + P(\text{free} | \text{not spam}) \cdot P(\text{not spam})}$$

$$= \frac{(0.30) \cdot 0.50}{(0.30 \times 0.50) + (0.01 \times 0.50)}$$

$$P(\text{spam} | \text{free}) = \underline{\underline{0.967}}$$