1) *** Experiment:-** An experiment with a known set of possible outcomes is called a experiment.

* Sample space:- It defines all the possible outcomes of a random variable

* Outcomes:- 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 uncertanity
There are 2 types of probabilities

i) Theoretical * Probability:-

It is based on the possible chaces of something to happen. The theoretical probability is mainly based on the reasoning behind probability.

ii) Experimental * Probability:-

It is based on the basis of the observations of an experiment. The experimental probability can be calculated based on the number of possible outcomes by the total number 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%

$P(yes) = 0.184$

$P(old\ per\ person) = 0.8\% = 0.008$

$P(older\ person/yes) = 1.4\% = 0.14$

$P(yes/older\ person) = \dfrac{P(yes) \cdot P(older\ person/yes)}{P(older\ person)}$

$= \dfrac{(0.184) \times (0.14)}{0.008}$

$= 0.322$

$\therefore P(yes/older\ person) = 0.322$

4) Bayes theorem:-

Bayes theorem states that conditional probability of an event, based on the occurance of another event is equal to the likelihood of the second event given the first event multiplied by the probability of the first event

$P(A/B) = \dfrac{P(B/A) \times P(A)}{P(B)}$

5) Solve the below problem 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 mails marked as spam, i.e P(Free/Spam) = 0.30. Assuming 1% of non-spam mail includes the word "free" and 50% of all mails recevied by the user are spam, find the probability that a mail is spam if the word "free" appers in it.

$$P(spam) = 50\% = 0.50$$

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

$$P(Free/Not\ spam) = 1\% = 0.01$$

$$P(Not\ spam) = 5\% = 0.50$$

$$P(spam/free) = \frac{P(Free/spam) \cdot P(spam)}{P(Free/spam) \cdot P(spam) + P(Free/notspam) \cdot P(spam)}$$

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

$$P(spam/free) = 0.967$$