Statistics

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Probability is a study of experiments which are performed randomly. We must be able to run this experiment for an indefinite number of times with very similar conditions. On the basis of chance, a particular event A either occurs or does not occur. Historically probability theory was associated to games of chance. The starting point is an experiment that has a certain number of outcomes which are equally likely and mutually exclusive in nature (web.hku.hk).

In order to assess approaches available to probability, there are certain terminologies to be understood. Probabilities are applied to events which are results of certain experiments. These experiments must be random in nature. One example of a random experiment is the coin toss having two outcomes namely head and tail. A sample space is a set of all the possible outcomes of any experiment. The data provided in scenario shows a probability distribution with respect to number of planes sold and respective number of weeks. A probability distribution is a function that shows all possible outcomes of a random experiment and likelihoods of their occurrences. The probability of any event can vary between zero and one. In order to analyze probability distribution, following three approaches are used:

# **Classical approach**

 An experiment having a specified number of outcomes which is denoted by n, this method will assign a probability of 1/n to each event. Each outcome is assumed to have an equal chance of occurrence under this approach. Another name of this method is axiomatic approach. Examples include rolling a die or tossing a coin. In order to use this approach, the events must be mutually exclusive and collectively exhaustive. Mutually exclusive events are those which can occur one at a time e.g. it will either be a head or a tail on a coin when it is tossed once. Collectively exhaustive events are those which form the whole of sample space. An example can be given related to the dice thrown in which events recorded from 1 to 6 show the complete possible range. Thus, these events are collectively exhaustive as well as mutually exclusive. For this approach, there are two laws of probability which are stated as under:

P (AUB) =P (A) +P (B)

P (A∩B) = P (A).P (B)

# **Relative Frequency Approach**

 In this approach, probabilities are assigned based on current experiment or historical data. If there is an event A which is the result of a repeated number of same experiment. It is related to the relative frequency with which events occur in the long run (Hofer-Szabo). The number of experiments has been denoted by n and this is the same number of times that event A could happen. nA is the number of times that event A has actually occurred then the probability of event A is given as nA/n. This is an attempt to find probabilities because there is only a limited number of times that experiment can be actually repeated. If there are two different number of times one same experiment has been performed, there will be two different ratios extracted as a result of applying the above formula. In this approach, a large value of n will minimize the chances of any discrepancy. For large number of experiments, this approach is appropriate.

# **Subjective approach**

 In this approach, probability is defined keeping in view the belief that is held in occurrence of any particular event. Thus, mere judgment is the basis of assigning probabilities to events. Classical approach that assigns equal probabilities to all events is also based on judgment. This approach is applied to the experiments which are not repeatable by their nature. If we take an example of a horse race, initially there is an equal chance for all the horses to win the race. Thus, we can assign equal probabilities to all horses taking part in the race. People bet on these one-time events because they see all the horses differently on the basis of their experiences. The betting process is possible because of difference in judgments made by different people. Judgmental method is only used in onetime events where no other probability technique can be used appropriately (personal.utdallas.edu).

|  |  |  |
| --- | --- | --- |
| Planes sold | Number of Weeks | Probability |
| 0 | 40 | 40/50 |
| 1 | 8 | 8/50 |
| 2 | 1 | 1/50 |
| 3 | 1 | 1/50 |

 The above scenario relates to probability because it satisfies probability axioms and it can be accessed mathematically. It is clear from the above table that relative frequency approach has been applied to this scenario. If we consider classical probability as an option, it does not make sense if we assign equal probabilities to this scenario because number of planes sold cannot be exactly the same for all weeks. Further, these events of sales are neither mutually exclusive nor collectively exhaustive in their nature. Judgmental approach can be used to ascertain the probability in this case on the basis of past data but since past data is not given to us, the most appropriate technique is the relative frequency approach. Answers reveal that there is an 80% chance that there will be no plane sold by the company. The least probabilities are assigned to sale of 2 or 3 planes. If there are some planes with GPS facility, the company may change to subjective approach for calculation of probabilities. The reason for this change is that it is easier to judge the sale of planes with GPS system installed.

# **References**

Hofer-Szabo, G. (n.d.). *http://hps.elte.hu/~gszabo/Preprints/Frequency\_interpretation\_presentation.pdf.* Retrieved from http://hps.elte.hu: http://hps.elte.hu/~gszabo/Preprints/Frequency\_interpretation\_presentation.pdf

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