STATISTICS-Probability-2

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Definitions

Favourable Cases : Cases which are related to happing of an event of random experiments are called favourable Cases.
Suppose we are interested in getting a prime no in a throwing of a die the the points $2, 3,$ and 5 are favourable cases.
Independent Event : Two or more events of a random experiment which can occur without affecting the occurrence of each other are called independent events.

Various definitions of Probability

Classical or Mathematical or Priori definition of Probability: Suppose, a trial of results n are mutually exclusive, exhaustive & equally likely cases. Let, out of it m-cases are favourable for the happening of an event A, then the probability of the happening of the event A denoted by $P(A)$ and is given by

$$P(A) = \frac{m}{n}$$

Remarks :

1. $P(A) = \frac{n(A)}{n(S)} = \frac{\textit{Favourable no. of cases}}{\textit{Total no. of Cases}}$
2. $P(\bar{A}) = P(A^c) = P(\textit{ non occurrence of } A) = \frac{n-m}{n} = 1 - \frac{m}{n} = 1 - P(A)$ which gives

$$P(A) + P(\overline{A}) = 1$$

3. $P(\phi) = 0$, $P(S) = 1$, ϕ is called impossible event and S is called certain event.
4. $0 \leq m \leq n \implies 0 \leq \frac{m}{n} \leq 1 \implies 0 \leq P(A) \leq 1$

Limitations : The classical probability suffers from many defects-

1. This definition preassumes that the sample points are equally likely or equally probable. Thus we are defining probability in terms of probability . Consequently this definition falls to answer the question what is probability.
2. This definition holds only when the sample points are finite in number

Statistical or empirical definition of Probability: Let a random experiment be repeated in m-times under identical conditions in which an event A is found to occur $m(A)$ times . Then the no. $m(A)$ is called the absolute frequency or frequency of event A and ratio $f_m(A) = \frac{ma}{m}$ is known as the relative frequency or the frequency ratio of A.
For a large no of observation the frequency ratio fluctuate about a fixed no. $P(A)$. This idealised no $P(A)$ is called the probability of the event A and is defined as

$$P(A) = \lim_{m\to\infty} \frac{m(A)}{m} = \lim_{m\to\infty} f_m(A)$$

Limitations:

1. This definition assumes that the experiment can be repeated which is not possible in many situation. e.g If we want to analysed the stock market in probability sense, then how is the condition of repeatation of experiment to it taken account.
2. we donot know whether there exist a limit or not.

Axiomatic definition of Probability: (1933, Kalomogorov) In an axiomatic approach to the probability $P(A)$ of an event A of a random experiment is a no. that satisfies the following conditions:

1. $P(A) \geq 0$
2. $P(S) = 1$, where S is the sample space
3. $P(\cup_i A_i) = \sum_i (A_i)$, for

Limitations:

1. The axiomatic definition assumes only that some probability $P(A)$ is associated with an event A but it donot say how the probability is to be determined in a given case.
2. The problem of assigning probability is not always simple in a sample space containing large no. of points.

Question: Two dies are thrown , find the probability

1. the sum of the two nos. is 8
2. Atleast one 6 appears
3. Both are prime nos.

Solution: Here, sample space $S = \{(x, y) : x, y \epsilon \{1, 2, 3, 4, 5, 6\}\}$ contains ( ) nos of sample space