PROBABILITY

Presented
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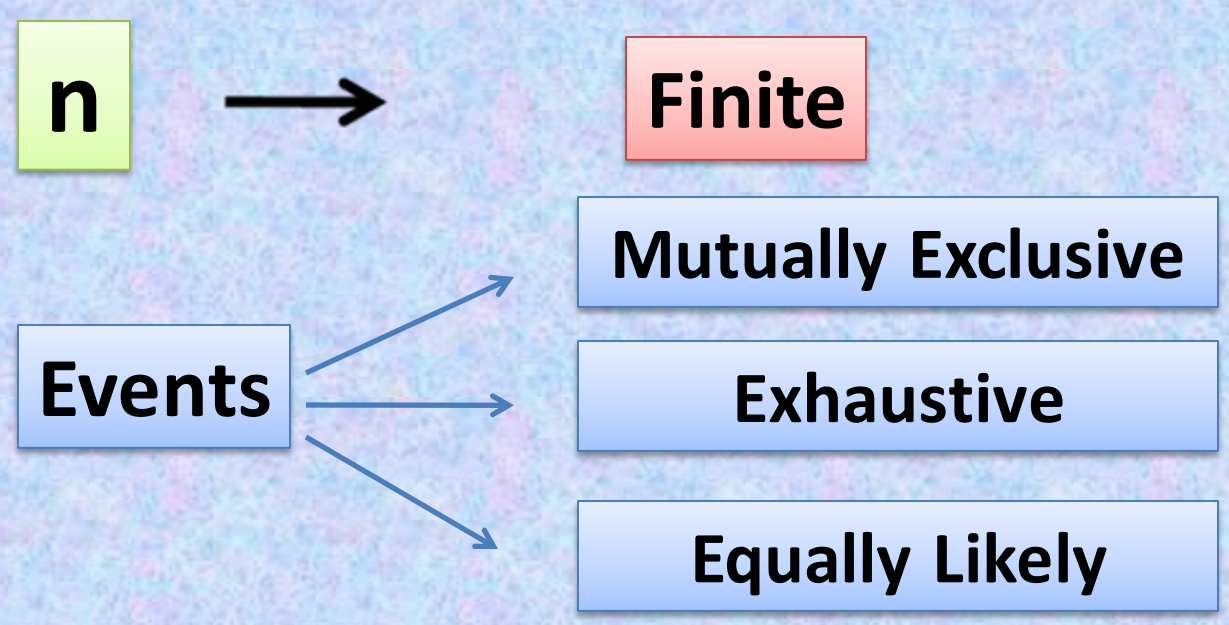
CLASSICAL DEFINITION OF PROBABILITY

Let there be n no. of elementary events in the sample space of a random experiment.



n(E) out of n are favourable to an event E

$$P(E) = n(E) / n$$

PROPERTIES

- $0 \leq P(A) \leq 1$

Proof:

Since, $0 \leq n(A) \leq n$

So, $$\frac{0}{n} \leq \frac{n(A)}{n} \leq \frac{n}{n}$$

Or, $$0 \leq P(A) \leq 1$$

➢ If $A \subseteq B$ then P(A) ≤ P(B)

Proof: Since, $A \subseteq B$ therefore n(A) ≤ n(B)

Or, $\frac{n(A)}{n} \leq \frac{n(B)}{n}$ Or, $P(A) \leq P(B)$

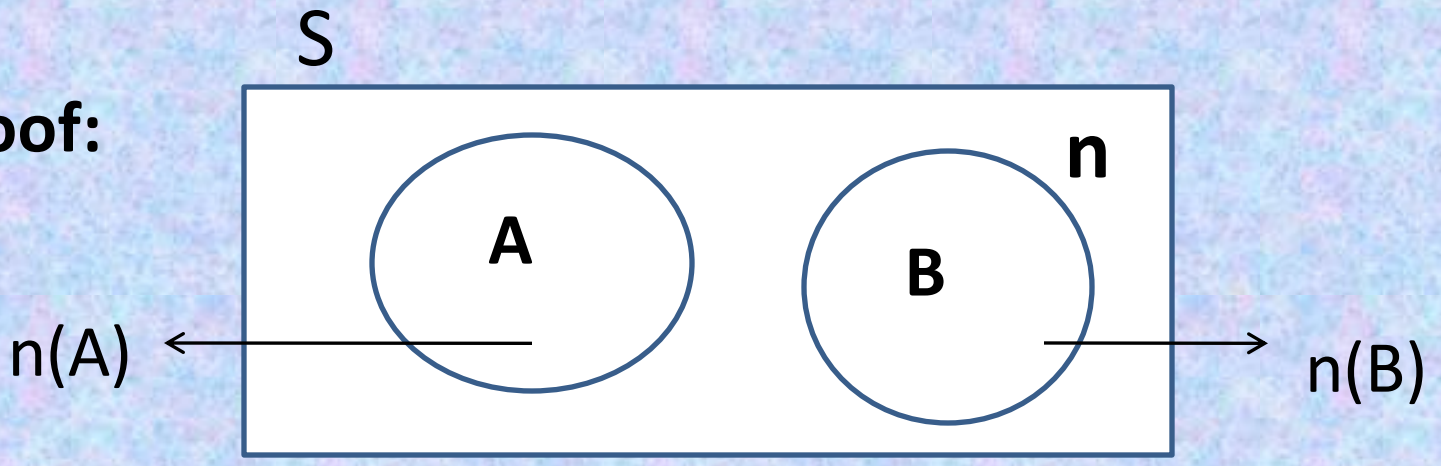
n(A) be the total no. of elementary events favourable to A

n(B) be the total no. of elementary events favourable to B

n be the total no. of elementary events in the sample space of a random experiment.

➢**If A and B are two mutually exclusive events then** $P(A \cup B)$ **= P(A) + P(B)**

Proof:

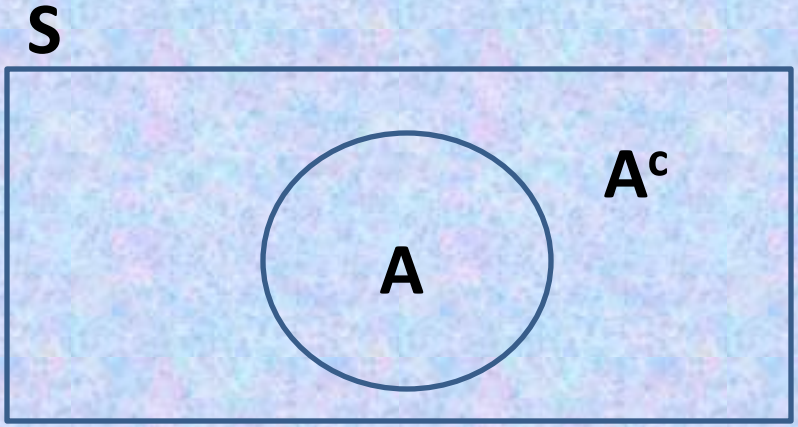


$$P(A \cup B) = \frac{n(A \cup B)}{n} = \frac{n(A)}{n} + \frac{n(B)}{n}$$

Or, $P(A \cup B)$ = P(A) + P(B)

➢ **P(A) = 1 - P(A^c)**

Proof:



$$P(A \cup A^c) = P(S)$$

Or, $P(A) + P(A^c) = 1$

Or, $P(A) = 1 - P(A^c)$

LIMITATIONS

- This definition is not applicable if the total number of elementary events of a random experiment is infinite.

- Application of this definition is not possible if the elementary events are not equally likely.

- This definition suffers from the fact that it uses the concept of probability in defining probability, because “equally likely” means “equally probable”.

AXIOMATIC DEFINITION OF PROBABILITY

Let S be the sample space of a random experiment E and A be any event connected with E .

P(A) is a number associated with A, such that the following axioms are satisfied:

- $P(A) \geq 0$
- $P(A) = 1$
- $P(A_1 \cup A_2 \cup \ldots\ldots\ldots\ldots\ldots) = P(A_1) + P(A_2) + \ldots\ldots\ldots\ldots\ldots\ldots$

THE FREQUENCY DEFINITION(OR STATISTICAL DEFINITION) OF PROBABILITY

If a random experiment is repeated n times under identical conditions and an event A occurs f(A) times out of n repeated trials , then the probability of occurrence of event A, P(A) is defined as the limiting value of f(A) / n i.e. , the relative frequency of occurrence of event A, when n becomes indefinitely large, assuming that the limiting relative frequency exists.

$$P(A) = \lim_{n \to \infty} \frac{f(A)}{n}$$

DRAWBACKS

- This is a limiting concept, In practice, it is impossible to determine the exact probabilities using this definition.
- It is assumed that the limiting relative frequency exists and it is finite and unique.
- Here, the number of repetitions(n) must be very high.