

MA : 202

Probability & Statistics

Books:

- ① Schaum's Outlines : Introduction to Probability & Statistics
- ② Schaum's Outlines : Probability
- ③ A first Course in Probability by Sheldon Ross

Answer:

Prerequisite:-

- ① Knowledge in Permutation & Combination
- ② Knowledge in Multiple Integration (Change of the order of integration).
- ③ Knowledge in descriptive statistics :
(Frequency table, Grouped data, Histogram, Ogive, Mean, Median, Mode, Variance, standard deviation etc.).

Basic Definitions :

Random Experiment :

An experiment (E) is said to be a random experiment (r.e.) if

- (i) all possible outcomes of E are known in advance
- (ii) it is impossible to predict which outcome will occur at a particular performance of E .
- (iii) E can be repeated, at least conceptually, under identical condition, for infinite no. of times.

Example of random experiment are :

- (i) tossing a coin
- (ii) throwing a die
- (iii) selecting a card from a pack of playing cards.
- (iv) selecting a family out of a given group of families.

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

Example: (i) Head & Tail \rightarrow H & T
(ii) 1, 2, 3, 4, 5, 6.

Here we have considered the examples given in P3 for r.e.

Sample Space: The set of all possible outcomes of a random experiment (E) is said to be the sample space for E and may be denoted by 'S' or ' Ω ' etc.

Example: (i) $S = \{H, T\}$
(ii) $S = \{1, 2, 3, 4, 5, 6\}$

Event: Any particular performance of a random experiment is called an event. A trial and outcome or combination of outcomes are termed as events.

Example: Let us consider the r.e of throwing a unbiased die.

Sample space: $S = \{1, 2, 3, 4, 5, 6\}$

Possible events are

(a) Odd no. points $\equiv A = \{1, 3, 5\}$

(b) Even numbered face $\equiv B = \{2, 4, 6\}$

(c) Getting a face numbered greater than 3 $\equiv C = \{4, 5, 6\}$.

Simple and Composite Event

Event is called simple if it corresponds to a single possible outcome of the experiment otherwise it is known as a compound or composite event.

Example : Simple event

- (i) Getting H or T in throwing a unbiased coin
- (ii) Getting '6' in rolling a unbiased die.

Composite event

- (i) Getting even numbered face in throwing a die.

Exhaustive Events

The total number of possible outcomes of a random experiment is known as the exhaustive events

Example : (i) Let us consider the r.e of throwing a unbiased coin.

The sample space is $S = \{H, T\}$.

Let A and B are the events associated with E denoting getting H and T respectively.

Then $A = \{H\}$ & $B = \{T\}$

$\Rightarrow A \cup B = S$. Here, A and B are exhaustive events.

Mutually Exclusive Events: $A_1 \cap A_2 = \phi$ or $\bigcap_{i=1}^n A_i = \phi$

Events are said to be mutually exclusive or incompatible if the happening of any one of the event precludes the happening of all the other events associated with the same r.e., i.e., if no two or more of the events can happen simultaneously in the same trial.

Example: In throwing a die the six faces numbered 1 to 6 are mutually exclusive since if any one of the face comes, the possibility of the occurrence of the other faces in the same trial is ruled out.

Equally Likely Events: $P(A_i) = \frac{1}{n} \forall A_i \in S, i=1, 2, \dots, n$

Outcomes of trial are said to be equally likely if taking into consideration of all the relevant evidences, there is no reason to expect one in preference to the others.

[Equally likely refers to the chances of each possible outcome among many is equal].

Example: In a random experiment of tossing a unbiased coin, event of getting H or T are equally likely.

Independent Event

If the happening (or non-happening) of an event is not affected by the occurrence of any number of remaining events, then the events are said to be independent events.

- (i) In tossing an unbiased coin, the event of getting a head in the first toss is independent of getting a head in second toss, third toss or any subsequent toss.
- (ii) If we draw a card from a pack of well-shuffled cards and replace it before drawing the second card (i.e., drawing a card with replacement), then the result (outcome) of the second draw is independent of the result (outcome) of the first draw.

However, if drawing a card is done without replacement, i.e., if first card drawn is not replaced then the result of second draw is dependent on the result of the first draw.