BSH-202 Mathematics - II

(Probability and Statistics)

Module - I :- Basic probability, independence. Discrete random variables, independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, Sums of independent random variables; Expectation of Discrete random variables, Moments, variance of a Sum, Correlation Coefficient, Chebyshev's Inequality.

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* **Random experiment :-** An experiment which can be repeated any no. of times under similar conditions & the outcome of any ~~positive~~ particular experiment can't be predicted from the past experience is known as a random experiment.

  e.g :- Tossing a coin, Throwing a die, taking out a card from a pack etc.

* **Sample space :-** The set of all possible outcomes of a random experiment is called the sample space for that random experiment and is denoted by S.

  e.g. if a fair die is thrown,

  then $S = \{1, 2, 3, 4, 5, 6\}$

* **Sample point :-** The elements of the sample space are called sample points.

Event :- Any subset of the sample space S is called an event. Thus an event consisting of a single point of S is called sample point.

* Mutually Exclusive Events :- Two or more event are said to be mutually exclusive or disjoint if occurrence of any one of them prevents the occurrence of all others.

1) Classical approach :-

* Defination of probability :- If an event can occur in an different ways out of a total no. of n possible ways, all of which are equally likely, then the probability of the event is m/n.

e.g. Tossing of a coin, $P(H) = \frac{1}{2}$

* Limitations :- Applicable only in finite and and discrete cases. e.g. height of a human being usually lies in the range [0ft, 7ft]. Hence if we want to find out the probability that height of a person is 5.5ft (or lies in the range 5ft to 6ft) the Sample Sp. is infinite. So this defination is not applicable.

2) Frequency approach :- If after n repetitions of an experiment, where n is very large, an event is observed to occur in h of these, then the prob. of the event is h/n

Limitations :- The term very large is value. According to this def if n=1000 is large and heads comes up 536 times in tossing a coin, then

then, $P(H) = 0.536$, which is wrong.

Q) what is the prob. that height of a person is 5.5 ft ?

(Ans. to such qns. can't be given directly with above defns. For that we need to introduce discrete and continuous random variable & also the axioms of probability)

⇒ So, prob. of an event may be 0 but it can still happen.

The Atomic Defn. of Probability :—

Let S be a Sample SP. To each event E, a real no. $P(E)$ is associated, called the prob. of E, satisfying the following axioms :

1) $0 \leq P(E) \leq 1$
2) $P(S) = 1$, (prob. of the entire sample space is 1)
3) For any set of mutually exclusive events $E_1, E_2, E_3, \ldots$ ($E_i \cap E_j = \phi$ when $i \neq j$), $P\left(\bigcup_{i=1}^{\infty} E_i\right) = \sum_{i=1}^{\infty} P(E_i)$

Q. P.T. $P(\text{'5'}) = \frac{1}{6}$ in throwing of a dice.

Some Properties of Probability :—

1) Prob. of the impossible event is zero, i.e. $P(\phi) = 0$
(e.g. getting is 7 in tossing a dice)

2) If A^c is the complement of A, then $P(A^c) = 1 - P(A)$

3) If A & B are any 2 events, then

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

4) If $B \subseteq A$, then $P(B) \leq P(A)$