Probability

(1) An operation which can produce some well-defined outcome(s) is a deterministic experiment.

(2) An experiment which when performed produces one of the several possible outcomes is called a random experiment.

For Example: In the tossing of a coin one is not sure if a Head or Tail will be obtained, so it is a random experiment. Similarly, rolling an unbiased die is an example of a random experiment.

(3) When we perform an experiment it is called a trial of the experiment.

For Example: If a coin is tossed 10 times, then each toss is called a trial. If a die is thrown 5 times, then each throw is called a trial.

(4) An outcome of a trial of an experiment is an elementary event.

For Example: When two coins are tossed simultaneously, the possible outcomes are HH, HT, TH and TT. Any one outcome like {HH} is called an Elementary event of the sample space {HH, HT, TH, TT}.

(5) A collection of two or more possible outcomes (elementary events) of an experiment is called a compound event.

For Example: Consider the random experiment of tossing two coins simultaneously. If we define the event "getting exactly one head", then HT and TH are two elementary events associated to it. So, it is a compound event.

(6)An events is aid to happen in trial if any one of the elementary events (or outcomes) satisfying its conditions is an outcome.

(7)In n trials of a random experiments, if an event A happens m times, then the probability of happening of A is given by P(A) = m/n

For Example: A coin is tossed 1000 times with the following frequencies: Head: 455, Tail: 545 Compute the probability for each event. **Solution:** Total number of trials = 1000 Number of heads = 455Number of tells = 545 Let E be the event of getting a head: P(E) = Number of head/ Total number of trials P(E) = 455/1000 P(E) = 91/200P(E) = 0.455Let E_1 be the event of getting a Tail. $P(E_1) =$ Number of Tail/ Total number of trials $P(E_1) = 545/1000$ $P(E_1) = 109/200$ $P(E_1) = 0.545$

Thus, Probability of occurrence of head and tail are 0.455 and 0.545 respectively.

(8) For any event a associated to an experiment, we have $0 \leq P \; (A) \leq 1$

For Example: As shown above example, the value of P(E) is between 0 and $1(0 \le P(E) \le 1)$.

(9) If E1,E2,...,En are n elementary events associated to a random experiment, then P(E1) + P(E2) + ... + P(En) = 1

For Example: Two coins are tossed simultaneously 500 times with the following frequencies of different outcomes: Two heads : 95 times One tail: 290 times No head: 115 times Find the probability of occurrence of each of these events. **Solution:** Total no. of tosses = 500 No. of two heads appear = 95 times No. of one heads appear = 290 times No. of no head appear = 115 times Let E_1 be the event of getting two heads- $P(E_1) = No.$ of two heads appear/ No. of total tosses $P(E_1) = 95/500$ $P(E_1) = 19/100$ $P(E_1) = 0.19$ Let E_2 be the event of getting one tail- $P(E_2) = No.$ of one tail appear/ No. of total tosses $P(E_2) = 290/500$ $P(E_2) = 58/100$ $P(E_2) = 0.58$ Let E_3 be the event of getting no head- $P(E_3) = No.$ of no head appear/ No. of total tosses $P(E_3) = 115/500$ $P(E_3) = 23/500$ $P(E_3) = 0.23$ Here P(E1)+P(E2)+P(E3)=1.