Basics of Probability

Subject: Statistical Methods

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Basic Terminology

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1.) **Random Experiment**: If in each trial of an experiment conducted under identical conditions, the outcome is not unique, but may be any of the possible outcomes, then such an experiment is called a random experiment.

Ex.) Tossing a coin. Here the possible outcome is either Head or Tail. The possible outcomes are $\{H, T\}$

Ex.) <u>Throwing a die.</u>

Plural of die is dice. A die has six faces, dots are marked as

{ ⚀ ⚁ ⚂ ⚃ ⚄ ⚅ }.

The above six faces are the possible outcomes.

Ex.) Selecting a card from a pack of playing cards.

Playing cards

Spades (♠) 13 (Black)

Club (♣) 13 (Black)

Heart (♥) 13 (Red)

Diamond (♦) 13 (Red)

Out of 13 in each 4 categories :-

A, 2 – 10, Jack, Queen, King
(1) (11) (12) (13)

Total = 52 cards
Black = 26 cards
Red = 26 cards

2. Outcome :- The result of a random experiment will be called an outcome.

~~3.) Exhaustive Events or Cases~~

3.) Trial and Event :- Any particular performance of a random experiment is called a trial; and outcome or combination of outcomes are termed as events.

Ex.) If a coin is tossed repeatedly, the result is not unique. We may get any of the two faces, head or tail.

Thus tossing a coin is a random experiment or Trial; and getting a head or tail is an event.

4.) Exhaustive Events or Cases :- The total number of possible outcomes of a random experiment is known as the ~~exah~~ exhaustive events or cases.

Ex.) In tossing of a coin, there are two exhaustive cases.

Ex.) In throwing a die, there are six exhaustive cases.

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5.) **Favourable Events** :- The events which ensure the required happening, are said to be favourable events.

Ex.) In throwing a die, to have the even numbers: 2, 4 and 6 are favourable cases.

Similarly, to have the odd numbers: 1, 3 and 5 are favourable cases.

6.) <u>Mutually Exclusive Events</u>:- Events are said to be mutually exclusive or incompatible, if the happening of any one of them precludes the happening of all the others,

i.e.. if no two or more of them can happen simultaneously in the same trail.

Ex.) In tossing a coin, the events head and tail are mutually exclusive.

Ex.) In throwing a die, all the 6 faces numbered 1 to 6 are mutually exclusive, since if any one of these faces comes, the possibility of others in the same trial, is ruled out.

1.) <u>Equally likely Events</u>.

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

Ex.) In a random toss of coin, head and tail are equally likely events.

Ex.) In throwing a die, all the six faces are equally likely to come.

Probability

Def.) The probability 'p' of occurrence (or happening) of an event E, usually denoted by P(E), is given by

$$p = P(E) = \frac{\text{Number of favourable cases}}{\text{Total number of exhaustive cases}}$$

$$= \frac{\text{Number of favourable cases}}{\text{Total number of possible outcomes}}$$

Def.) **Sample Space** :- Sample space 'S' of an experiment is the set of all possible outcomes of that experiment.

Ex1.) A coin is tossed, Find the probability of

(i) getting a Head

(ii) getting a Tail.

Sol.)

Here $S = \{H, T\}$

(i) $P(\text{getting a Head}) = \dfrac{\text{No. of favourable cases}}{\text{Total no. of possible outcomes}}$

$$= \frac{1}{2}$$

(ii) $P(\text{getting a tail}) = \dfrac{1}{2}$

Ex 2.) A die is thrown, Find the probality of

(i) getting 5

(ii) getting an even number.

Sol.) Here $S = \{1, 2, 3, 4, 5, 6\}$

(i) $P(\text{getting } 5) = \dfrac{1}{6}$.

(ii) $P(\text{getting an even number}) = \dfrac{3}{6} = \dfrac{1}{2}$

Ex. 3) Find the probability of throwing 9 with two dice.

Sol.)

Here
$$S = \begin{bmatrix} 11 & 12 & 13 & 14 & 15 & 16 \\ 21 & 22 & 23 & 24 & 25 & 26 \\ 31 & 32 & 33 & 34 & 35 & 36 \\ 41 & 42 & 43 & 44 & 45 & 46 \\ 51 & 52 & 53 & 54 & 55 & 56 \\ 61 & 62 & 63 & 64 & 65 & 66 \end{bmatrix}_{6 \times 6}$$

Here S has total '36' entries.

Number of ways getting 9 i.e.

$$(3+6),\ (4+5),\ (5+4),\ (6+3) = 4$$

so, $p(\text{throwing } 9) = \frac{4}{36} = \frac{1}{9}$

Ex 4.) From a pack of 52 cards, one is drawn at random. Find the probability of getting a King.

Sol.) A King can be chosen in 4 ways.

Here S = Total no. of cards = 52

So, $P(\text{Selecting a King}) = \dfrac{4}{52} = \dfrac{1}{13}$.