

# Statistics & Probability

## Lecture # 08

### Probability:-

"Measurement of uncertainty is called Probability."

OR

"Measure of certainty is called probability."

- To measure uncertainty we did experiment.

### Experiment:-

"It is practical work to get an observation."

The practical work can be done by anything it may be done by looking for e.g. Teacher stand in class room to get observation also come in experiment. So experiment is not just related to machinery.

- Other examples.

1.  $\rightarrow$  Coin a toss.
2.  $\rightarrow$  Throwing a dice.
3.  $\rightarrow$  Combining hydrogen & Oxygen.

## Types of Experiment:-

### 1. Deterministic Experiment:-

Those experiments when you repeat them you get fixed result all time  
⇒ No randomness in result.

(\*) Given same result all time.

Here output is fixed & result is unique

#### Example:-

This type of experiments are for verification purposes.

E.g combining hydrogen & oxygen in laboratory we get water all time at fixed proportion.

### 2. Random Experiment:-

When you repeat experiment we may get different result.

• Outcome vary or not unique.

Example:- In tossing a coin the result may be head or tail so comes in random experiment.

## Outcome:-

"Every possible result of random experiment is known as outcome"

- We are interested in number of outcomes.
- No. of outcomes are important.

## Different Experiments.

~~is~~ ~~the~~ ~~coin~~ → Related to Coin:-

i- Tossing a coin:-

Two outcomes.

H, T

ii. Tossing 2 coins:-

4 outcomes.

HT, HH, TH, TT

→ Tossing a coin n-times:-

$2^n$  outcomes.

or Tossing n-coins at a times.

• Related to Dice:-

Throwing a dice:- 6 possible outcomes.

1, 2, 3, 4, 5 & 6

### i. Throwing two Dice:-

(1,1), (1,2), (1,3), ... (1,6)

(2,1), (2,2), (2,3) ... (2,6)

(6,1), (6,2) ... (6,6)

1  
11 12 ... 16  
21 22 ... 26  
31  
61 66

possible outcomes =  $6^2 = 36$

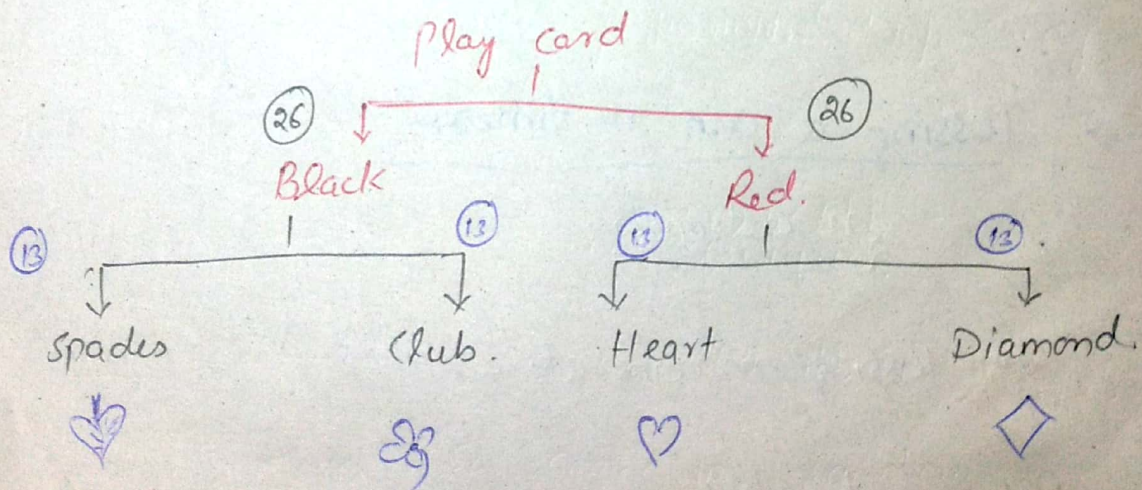
### Throwing a dice n times:-

Then possible outcomes will be  $6^n$

### 3) Playing Card:-

Total cards = 52

Two colours are used Red & Black



There are 3 face cards i.e. J, K & Q in each one

Total face cards = 12.

## Experiment Perform :-

i. Drawing one card.

If we draw one card from deck of cards

Poker hand = It has 5 cards.

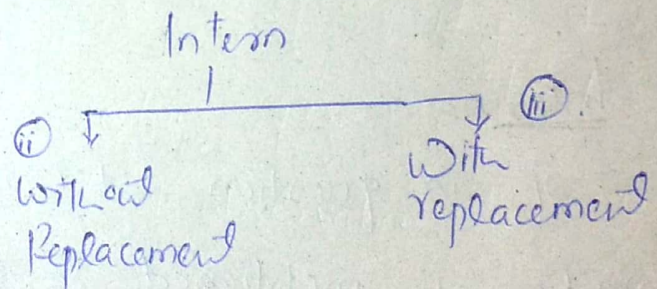
Total possible outcomes will be 52.

or possible way that card (one) can be picked = 52.

ii. Drawing two cards:-

There are 3 kinds of experiments

i. Simultaneous Experiment.



i. Simultaneous:-

When two cards are simultaneously pick from deck of cards.

→ Here order if change, for example if we select randomly two cards. So if change

its order there will be no effect on  
Selected card.

So here we used Combination.

So no. of possible way to pick two  
cards simultaneously is,

$$= {}^{52}C_2$$

→ Not to observe Initially.

• Combination as no effect of change in order.

Note:-

Here in this case if used one card,  
two card so we will consider that it  
is simultaneous experiment.

Inter:-

If in question 1st card, 2nd card etc i.e.  
position is mentioned so it will be intern  
experiment.

Without replacement:-

Let we have 40 students so first way  
to select one student is 40 ways.

& selection of second student = 39

So according to principle counting the total

Possibilities will be;

$$40 \times 39 = 1560$$

$$\text{or } {}_2P_{40} = 1560$$

For Cards it will be;

$$52P_2$$

(iii) With replacement:-

Now the selected card will again be placed in deck so for second card to be selected the possibilities are

$$= 52^2$$

→ Same concept is used for picking 3, 4 & so on cards.

e.g. for 3 cards.

$$52C_3$$

$$52P_3$$

$$\text{or } 52^3$$