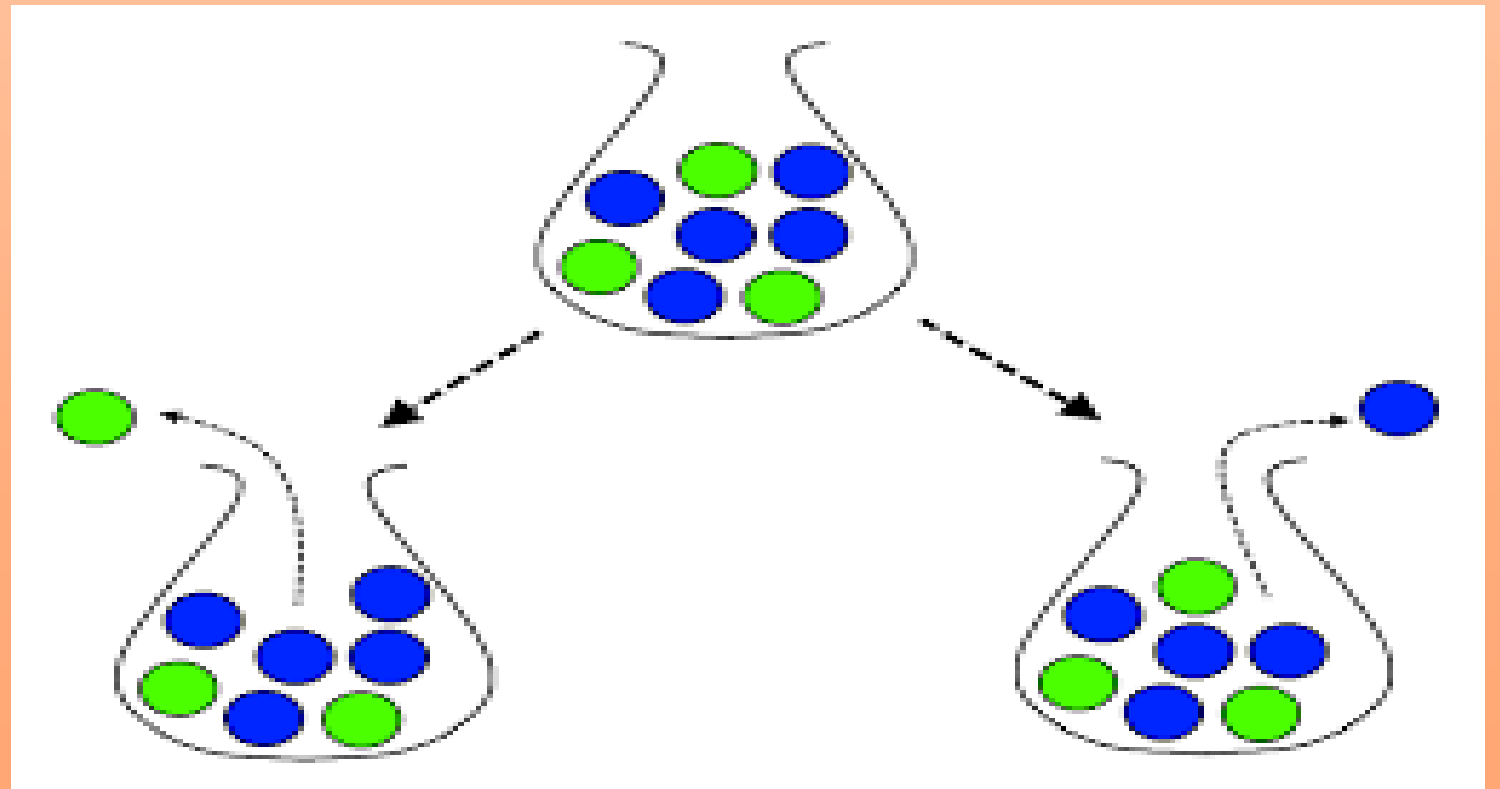




PROBABILITY

DEFINITION OF PROBABILITY

The Chance that a particular event will occur when we perform an experiment is called the probability of occurrence of an event.



Experiment:

An operation which can produce some well-defined outcomes

Random Experiment:

An Experiment is called Random Experiment, If

- (i) It has more than one possible outcome.
- (ii) It is not possible to predict the outcome in advance.

Trial:

An experiment which is repeated under similar conditions and it does not give the same result each time but may result in anyone of the several possible outcomes is called Trial.

Sample Space

*A possible result of a random experiment is called its outcome and set of all is called a **SAMPLE SPACE** and denoted by S .*

E.g. Two coins are tossed represent the Sample Space for this experiment by making a list ,a table and a tree diagram.

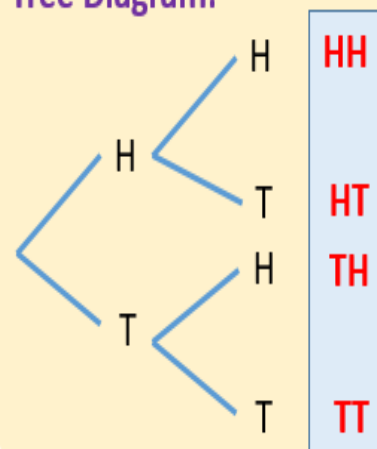
List:

HH HT TH TT

Table:

	H	T
H	HH	HT
T	TH	TT

Tree Diagram:

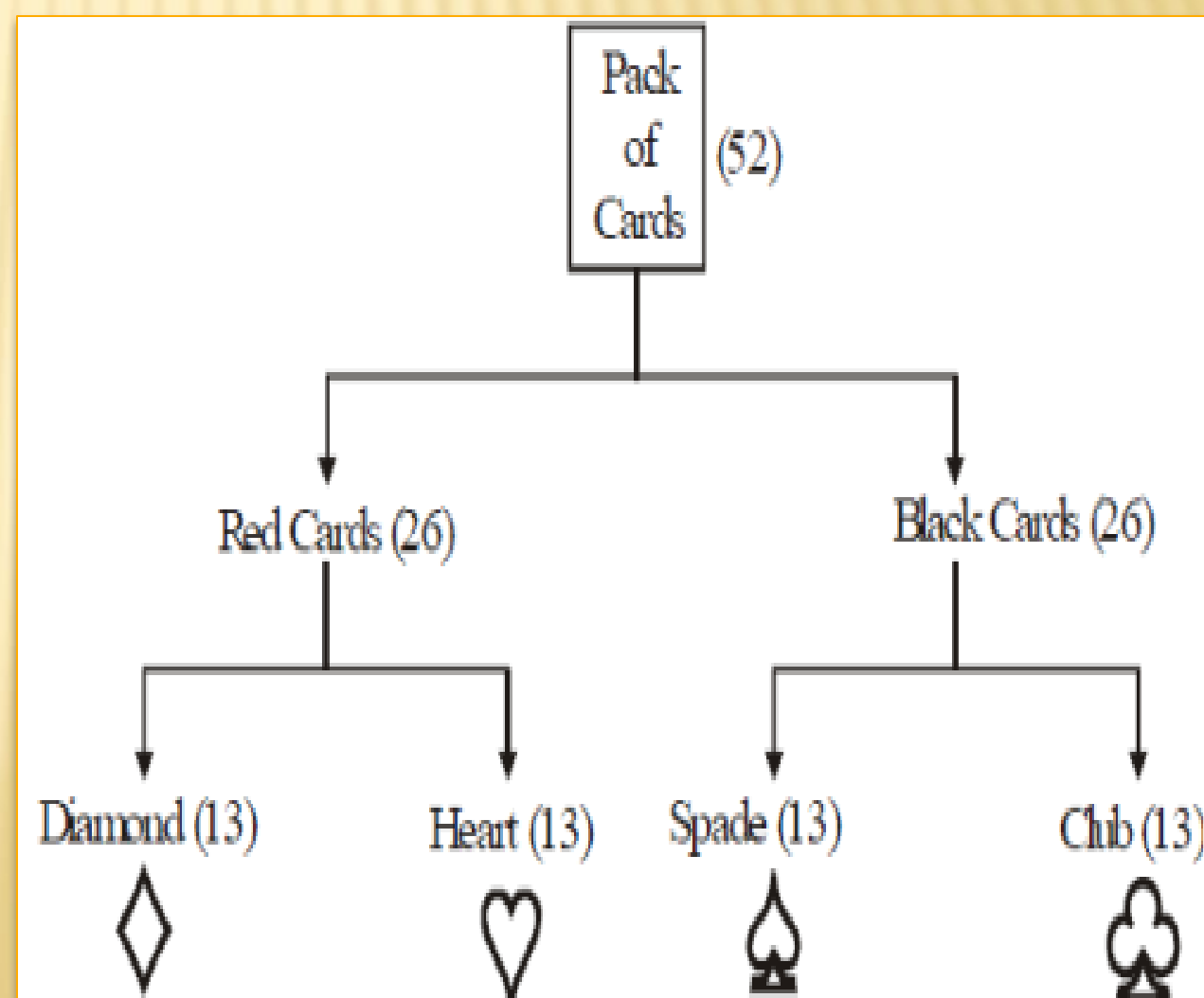


The Sample Space

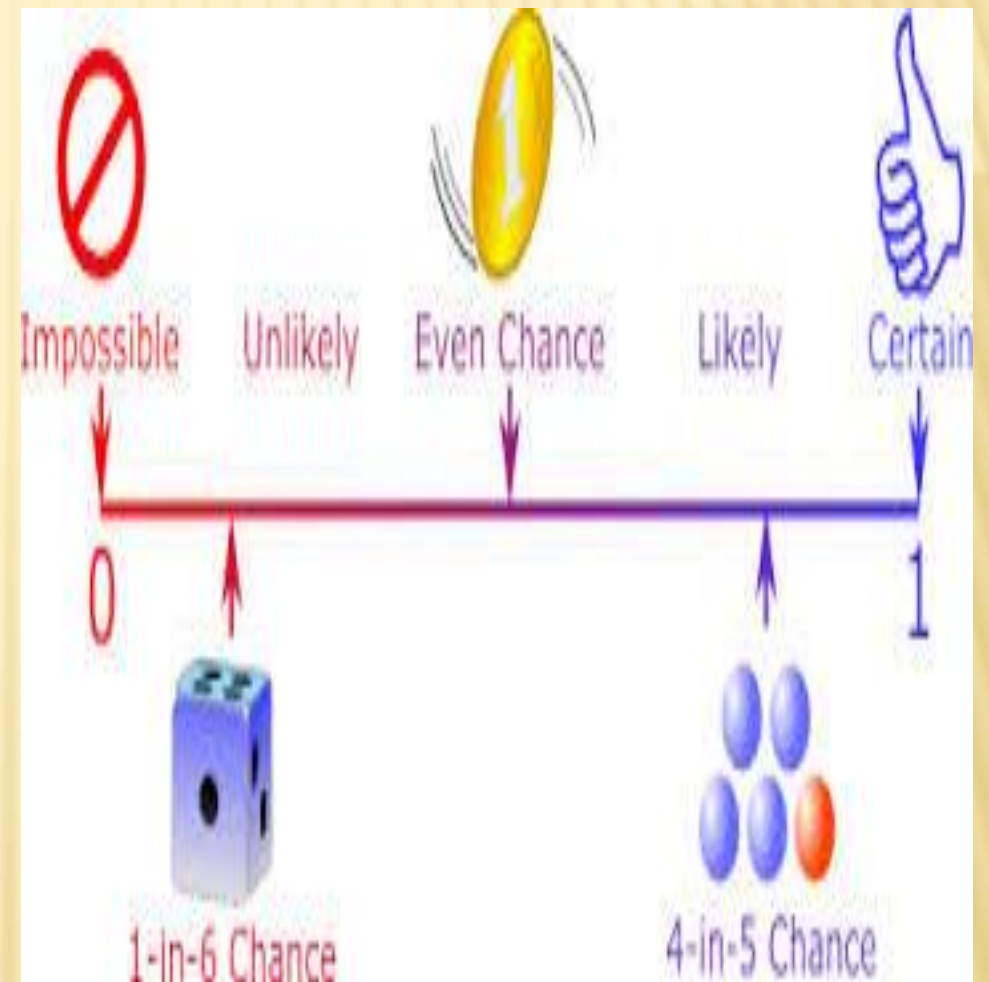
$$S = \{HH, HT, TH, TT\}$$



		second dice					
		1	2	3	4	5	6
first dice	1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
	2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
	3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
	4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
	5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
	6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)



Event



Every subset of a sample space is called an event.

Types of event

1.

- *Sure/Certain Event:*
- Whole space S is subset of S and it represent an event, which is called Sure / Certain Event.

2.

- *Impossible Event:*
- Empty Set ϕ is subset of S and it represents an impossible event.
E.g getting 7 number on a Die.

3.

- *Simple/ Elementary Event:*
- An event have only one sample point is called Simple /Elementary Event. These events are always Mutually Exclusive events.

Equally Likely Events

Events are said to be Equally Likely, if none of them is expected to occur in preference of the other.

Exhaustive Events:

A set of events $\{E_1, E_2, E_3, \dots, E_n\}$ is said to be exhaustive, if one of them is necessarily occurs whenever the experiment is performed.

$$\text{i.e. } E_1 \cup E_2 \cup \dots \cup E_n = S$$

E.g Let $S = \{1, 2, 3, 4, 5, 6\}$

$$E_1 = \text{Odd numbers} = \{1, 3, 5\}$$

$$E_2 = \text{Even numbers} = \{2, 4, 6\}$$

$$E_1 \cup E_2 = S$$

Mutually Exclusive Events

Two or more events are said to be mutually exclusive, if no two of them occur together.

E.g. For events E_1, E_2 then $E_1 \cap E_2 = \phi$

Independent Event

Events A and B are said to be independent, if occurrence of one of them does not depend upon the occurrence of the others.

AXIOMATIC APPROACH TO PROBABILITY

Let S be the sample space
containing outcomes
 $E_1, E_2, \dots, E_n$

then, from

axiomatic definition of
probability



(i) $0 \leq P(E_i) \leq 1$,
all E_i 's $\in S$

(ii)
 $P(E_1) + P(E_2) + P(E_3) + \dots$
 $+ P(E_n) = 1$

(iii) For any event A then

$$P(A) = \sum_{i=1}^n P(E_i), E_i \text{'s } \in A$$

Probability of an Event

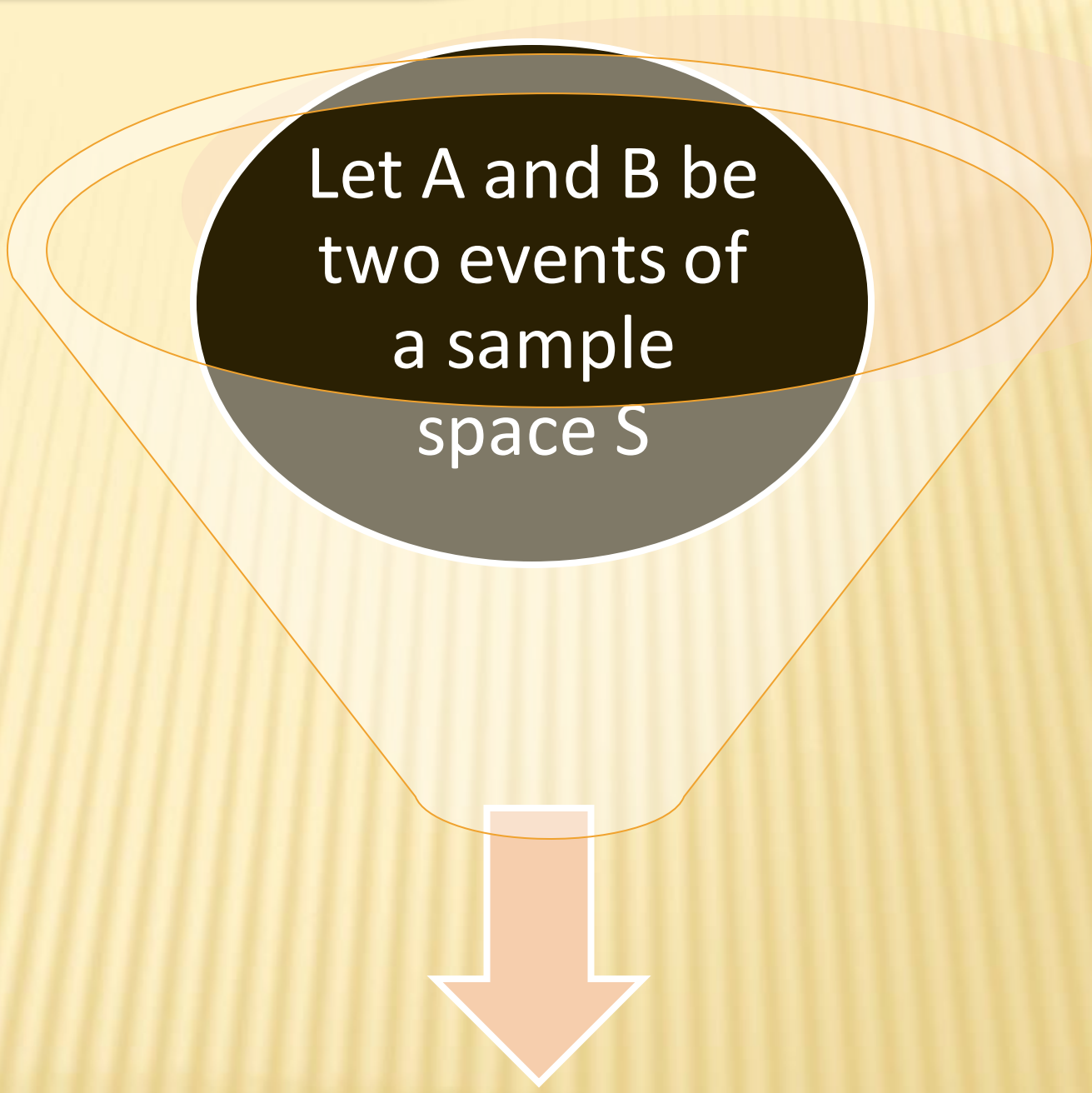
Let S be a sample space and E be an event, then if each outcome is equally likely, then

$$P(E) = \frac{\text{Number of outcomes favorable to E}}{\text{Total possible outcomes}}$$

Let S be the sample space and E be an event, then

$$P(E) = \frac{\text{Number of elements in set E}}{\text{Number of elements in set S}}$$
$$= \frac{n(E)}{n(S)}$$

Addition Theorem Of Probability



Let A and B be
two events of
a sample
space S

$$P(A \text{ or } B) = P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Probability of complementary Event

Let E be any event and $\overline{E}$ be its complementary event. Then,

$$P(\overline{E}) = 1 - P(E)$$

ALGEBRA OF EVENTS

(I) E' or not E , is called the complementary event to E .

$$\text{Not } E = E' = S - E$$

(II) Let E_1 and E_2 be two events associated with S ,
then

The event either E_1 or E_2 or both $= E_1 \cup E_2$

The event E_1 and $E_2 = E_1 \cap E_2$

The event E_1 but not $E_2 = E_1 - E_2$ or $E_1 \cap \overline{E_2}$

$$(III) \quad P(E_1' \cap E_2') = P(E_1 \cup E_2)' = 1 - P(E_1 \cup E_2)$$

$$(IV) \quad P(E_1 \cap E_2') = P(E_1) - P(E_1 \cap E_2)$$

$$(V) \quad P(E_2 \cap E_1') = P(E_2) - P(E_1 \cap E_2)$$