

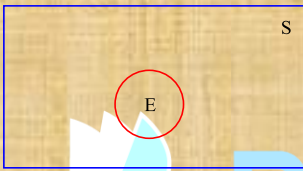
Chapter 13

PROBABILITY

Probability (Basic Definition):

If a random experiment results ' n ' exhaustive, exclusive and equally likely elementary events and ' m ' of them are favourable to an event ' E ' then probability of occurrence of ' E ' denoted by $P(E)$ is given by m/n .

As shown in the Venn diagram, ' S ' is the sample space and ' E ' is our event.



$$n(E) = m \text{ and } n(S) = n$$

$$P(E) = \frac{n(E)}{n(S)}$$

$$P(E) = \frac{\text{Number of cases favourable to event } E}{\text{Total number of cases}} = \frac{m}{n}.$$

Example:

When a coin is tossed, sample space $S = \{H, T\}$

Let E = The event of occurrence of a tail.

Then, $E = \{T\}$; $n(E) = 1$; $n(S) = 2$

$\therefore P(E)$ = Probability of occurrence of tail.

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{2}$$

- Probability of an event is always a number lying in between zero and unity, $0 \leq P(E) \leq 1$.

- If E is any event and E^1 be the complement of event E , then $P(E) + P(E^1) = 1$.

$$\begin{aligned} \text{(i) Odds in favour of event } E &= \frac{n(E)}{n(E^1)} \\ &= \frac{\text{Number of cases favourable of event } E}{\text{Number of cases against event } E} \end{aligned}$$

$$\begin{aligned} \text{(ii) Odds against an event } E &= \frac{n(E^1)}{n(E)} \\ &= \frac{\text{Number of cases against the Event } E}{\text{Number of cases favourable to event } E} \end{aligned}$$

NOTE:

$$\bullet \text{ Odds in favour of event } E = \frac{n(E)}{n(E^1)} = \frac{\frac{n(E)}{n(S)}}{\frac{n(E^1)}{n(S)}} = \frac{P(E)}{P(E^1)}$$

$$\text{And Odds against the Event } E = \frac{n(E^1)}{n(E)} = \frac{\frac{n(E^1)}{n(S)}}{\frac{n(E)}{n(S)}} = \frac{P(E^1)}{P(E)}.$$

Example:

What are the odds in favour of throwing at least 8 in a single throw with two dice?

Solution:

Throwing of two dice $n(S) = 36$. Throwing at least 8 with two dice means throwing 8 or 9 or 10 or 11 or 12.

$$E = \{(2, 6), (6, 2), (3, 5), (5, 3), (3, 6), (6, 3), (4, 4), (4, 5), (5, 4), (4, 6), (6, 4), (5, 5), (5, 6), (6, 5), (6, 6)\}$$

$$n(E) = 15, n(S) = 36$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{15}{36} = \frac{5}{12}$$

$$\therefore \text{Odds in favour of } E = \frac{n(E)}{n(E^c)} = \frac{15}{36-15} = \frac{15}{21} = \frac{5}{7}.$$

