

31. PROBABILITY

IMPORTANT FACTS AND FORMULA

1.Experiment :An operation which can produce some well-defined outcome is called an experiment

2.Random experiment: An experiment in which all possible outcome are known and the exact out put cannot be predicted in advance is called an random experiment

Eg of performing random experiment:

- (i)rolling an unbiased dice
- (ii)tossing a fair coin
- (iii)drawing a card from a pack of well shuffled card
- (iv)picking up a ball of certain color from a bag containing ball of different colors

Details:

- (i)when we throw a coin. Then either a **head(h)** or a **tail (t)** appears.
- (ii)a dice is a solid cube, having 6 faces ,marked 1,2,3,4,5,6 respectively when we throw a die , the outcome is the number that appear on its top face .
- (iii)a pack of cards has 52 cards it has 13 cards of each suit ,namely spades, clubs ,hearts and diamonds
 - Cards of spades and clubs are black cards
 - Cards of hearts and diamonds are red cards
 - There are 4 honors of each suit
 - These are **aces ,king ,queen and jack**
 - These are called face cards

3.Sample space :When we perform an experiment ,then the set S of all possible outcome is called the sample space

eg of sample space:

- (i)in tossing a coin , $s = \{h,t\}$
- (ii)if two coin are tossed ,then $s = \{hh,tt,ht,th\}$.
- (iii)in rolling a die we have, $s = \{1,2,3,4,5,6\}$.

4.event:Any subset of a sample space.

5.Probability of occurrence of an event.

let S be the sample space and E be the event .

then, $E \subseteq S$.

$P(E) = n(E)/n(S)$.

6.Results on Probability:

(i) $P(S) = 1$ (ii) $0 \leq P(E) \leq 1$ (iii) $P(\phi) = 0$

(iv)For any event a and b, we have:

$P(a \cup b) = P(a) + P(b) - P(a \cap b)$

(v) If \bar{A} denotes (not-a), then $P(\bar{A})=1-P(A)$.

SOLVED EXAMPLES

Ex 1. In a throw of a coin, find the probability of getting a head.

sol. Here $s=\{H,T\}$ and $E=\{H\}$.

$$P(E)=n(E)/n(S)=1/2$$

Ex2. Two unbiased coin are tossed .what is the probability of getting atmost one head?

sol. Here $S=\{HH,HT,TH,TT\}$

Let E =event of getting one head

$E=\{TT,HT,TH\}$

$$P(E)=n(E)/n(S)=3/4$$

Ex3. An unbiased die is tossed .find the probability of getting a multiple of 3

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

Let E be the event of getting the multiple of 3

then , $E=\{3,6\}$

$$P(E)=n(E)/n(S)=2/6=1/3$$

Ex4. In a simultaneous throw of pair of dice .find the probability of getting the total more than 7

sol. Here $n(S)=(6*6)=36$

let E =event of getting a total more than 7

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

$$P(E)=n(E)/n(S)=15/36=5/12.$$

Ex5. A bag contains 6 white and 4 black balls .2 balls are drawn at random. find the probability that they are of same colour.

Sol .let S be the sample space

Then $n(S)$ =no of ways of drawing 2 balls out of $(6+4)=10$ $c_2=(10*9)/(2*1)=45$

Let E =event of getting both balls of same colour

Then $n(E)$ =no of ways(2 balls out of six) or(2 balls out of 4)

$$=({}^6c_2+{}^4c_2)=(6*5)/(2*1)+(4*3)/(2*1)=15+6=21$$

$$P(E)=n(E)/n(S)=21/45=7/15$$

Ex6. Two dice are thrown together .What is the probability that the sum of the number on the two faces is divided by 4 or 6

sol. Clearly $n(S)=6*6=36$

Let E be the event that the sum of the numbers on the two faces is divided by 4 or 6. Then

$E = \{(1,3), (1,5), (2,2), (2,4), (2,6), (3,1), (3,3), (3,5), (4,2), (4,4), (5,1), (5,3), (6,2), (6,6)\}$

$n(E) = 14$.

Hence $p(e) = n(e)/n(s) = 14/36 = 7/18$

Ex7. Two cards are drawn at random from a pack of 52 cards. what is the probability that either both are black or both are queen?

sol. We have $n(s) = {}^{52}C_2 = (52 \cdot 51) / (2 \cdot 1) = 1326$.

Let A = event of getting both black cards

B = event of getting both queens

$A \cap B$ = event of getting queen of black cards

$n(A) = {}^{26}C_2 = (26 \cdot 25) / (2 \cdot 1) = 325$,

$n(B) = {}^4C_2 = (4 \cdot 3) / (2 \cdot 1) = 6$ and

$n(A \cap B) = 2C_2 = 1$

$P(A) = n(A)/n(S) = 325/1326$;

$P(B) = n(B)/n(S) = 6/1326$ and

$P(A \cap B) = n(A \cap B)/n(S) = 1/1326$

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = (325 + 6 - 1)/1326 = 330/1326 = 55/221$



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