Probability

Naseeb ka khel hai
Chance ki baat hai
Luck pr depend karega

Matlb

Probability

Probability

* **Definition** :-

→ It's the concept that numerically measures the degree of certainity / uncertainity of occurence of something (event).

→ It's the mathematics of chances.

Examples :- i) The chance of Indian Team winning the match is 50%.

ii) In train Y, the chances / probability of ticket confirmation is 30%.

Probability

* **Terms related to Probability :-**

i) **Experiment / Trial :-**

→ An operation which results in some well defined outcomes is called an experiment.

Eg : i) When Prince Sensei goes outside he shall meet Priya Mam randomly.

ii) When an unbiased die is thrown.

Probability

* **Terms related to Probability :-**

ii) **Random Experiment :-**

→ An experiment whose outcome can't be predicted with certainity is called a random experiment. (If an experiment is performed many times under similar conditions & the outcome each time is not the same, then this experiment is called a random experiment.)

Eg : i) Toss of a fair coin.

ii) Throwing a stone upward.

Probability

* **Terms related to Probability :-**

ii) **Sample Space :-**

→ The set of all possible outcomes of a random experiment is called the sample space for that experiment. Its usually denoted by 'S'.

Eg : i) When a fair die is rolled. $S = \{3, 5, 6, 1, 2, 4\}$

ii) When an unbiased coin is tossed. $S = \{Head, Tail\}$

Probability

* **Terms related to Probability :-**

iv) **Sample point / Event point :-**

→ Each element of the Sample Space is called a Sample point or an event point.

Eg : When a fair die is rolled. $S = \{1, 2, 3, 4, 5, 6\}$

Sample points

Probability

* **Terms related to Probability :-**

2) **Event :-**

→ Its the part of sample space (S).

Eg :- In case of roll of a fair die. $[S = \{1, 2, 3, 4, 5, 6\}]$

Let E_1 = event of getting 1. $E_1 = \{1\}$ → Simple/Elementary.

E_2 = event of getting an odd number. $E_2 = \{1, 3, 5\}$

E_3 = event of getting a number less than 8 $E_3 = \{1, 2, 3, 4, 5, 6\}$

} Compound

Probability

* **Terms related to Probability :-**

2015 **Simple / Elementary event :-**

→ If the event includes jst one outcome of 'S', its called elementary event.

Probability

* **Terms related to Probability** :-

viii) **Mixed / Compound / Composite Event** :-

→ When the event includes more than one outcome of 'S', it's called a compound event.

Probability

* **Terms related to Probability :-**

(iii) **Equally likely cases/ events :-**

→ Outcomes are said to be equally likely when we have no reason to believe that one is more likely to occur than the other.

Eg : On tossing an unbiased coin. $S = \{H, T\}$

Probability

* **Terms related to probability :-**

iv) **Compliment / Negation of an event :-**

→ Let 'E' be an event. Then, non occurrence of event 'E' is called compliment / negation of an event.

→ Denoted by E' / $\bar{E}$ / E^c / not E.

→ E & $\bar{E}$ can't occur simultaneously.

Eg : An roll of a fair die.

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

$E = \{2, 4, 6\}$ (3) ← E = event of occurrence of an even no. $P(E) = \frac{3}{6} = \frac{1}{2}$

← $\bar{E}$ = event of non occurrence of an even no. $\bar{E} = \{1, 3, 5\}$ (3) $P(\bar{E}) = \frac{3}{6} = \frac{1}{2}$

Probability

* Important formulaes :-

i) $P(E)$ → Probability / chance of occurrence of an event 'E'.

50% → $\frac{50}{100} = \frac{1}{2}$

$$P(E) = \frac{\text{No. of favorable outcomes}}{\text{Total no. of possible outcomes}}$$ → unitless

Eg : Find the probability of getting a head when an unbiased coin is tossed?

E = event of getting a head.

$E = \{H\}$

$S = \{H, T\}$

$P(E) = \frac{1}{2} = 0.5$ → $\frac{1}{2} \times 100 = 50\%$

Probability

ii) $0 \leq P(E) \leq 1$ → 100%, 0% ←

Probability × 100 = % Probability

Impossible event

Sure / Certain event

E, $\bar{E}$

iii) $n(E) + n(\bar{E}) = n(S)$

$\Rightarrow P(E) + P(\bar{E}) = 1$

QUESTION

$P(E)+P(\bar{E})=1$

Find the probability of getting a head when a coin is tossed once. Also find the probability of getting a tail.

Sol^n

$S=\{H,T\}$

E_1 = event of getting a head

$E_1=\{H\}$

$P(E_1)=\frac{1}{2}=0.5$

$\bar{E}_1$ = event of not getting a head. (event of getting tail.)

$P(\bar{E}_1)=1-P(E_1)$

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

$=\frac{1}{2}$

E_2 = event of getting a tail.

$E_2=\{T\}$ $P(E_2)=\frac{1}{2}=0.5$

QUESTION

A bag contains a red ball, a blue ball and a yellow ball, all the balls being of the same size. Kritika takes out a ball from the bag without looking into it. What is the probability that she takes out the

E_1 (i) yellow ball?

E_2 (ii) red ball?

E_3 (iii) blue ball?

Sol^n

$$P(E_1) = \frac{1}{3}$$

$$P(E_2) = \frac{1}{3}$$

$$P(E_3) = \frac{1}{3}$$

$S = \{\text{Red ball}, \text{blue ball}, \text{Yellow ball}\}$

$\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$

$= 1$ Ans

QUESTION

Suppose we throw a die once. (i) What is the probability of getting a number greater than 4? (ii) What is the probability of getting a number less than or equal to 4 ?

Sol^n

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

E_1 = event of getting a no. greater than 4.

$E_1 = \{5, 6\}$

$P(E_1) = \frac{2}{6} = \frac{1}{3}$

$\bar{E_1}$ = not getting a number greater than 4

$\bar{E_1} = \{1, 2, 3, 4\}$

$1 - \frac{1}{3} = \frac{2}{3}$

E_2 = event of getting a number less than or equal to 4.

$E_2 = \{1, 2, 3, 4\}$ $\quad P(E_2) = \frac{4}{6} = \frac{2}{3}$

Probability

52

4 suits

13 cards

black coloured

red coloured.

- Face cards (K, Q, J) → 3
- Ace → 1
- Numbered (2 - 10) → 9

13 cards in each suit.

QUESTION

One card is drawn from a well-shuffled deck of 52 cards. Calculate the probability that the card will

E_1 (i) be an ace,

E_2 (ii) not be an ace.

Soln

$$P(E_1) = \frac{4}{52} = \frac{1}{13}$$

$$P(E_2) = \frac{\quad}{52}$$

$$P(E_2) = 1 - P(E_1)$$

$$= 1 - \frac{1}{13}$$

$$= \frac{12}{13}$$

QUESTION

Two players, Sangeeta and Reshma, play a tennis match. It is known that the probability of Sangeeta winning the match is 0.62. What is the probability of Reshma winning the match?

Soln

$1 - 0.62$

$= 0.38$

→ Sangeeta win

Sangeeta win

Sangeeta loose

Reshma wins

QUESTION

40 cards

There are 40 students in Class X of a school of whom 25 are girls and 15 are boys. The class teacher has to select one student as a class representative. She writes the name of each student on a separate card, the cards being identical. Then she puts cards in a bag and stirs them thoroughly. She then draws one card from the bag. What is the probability that the name written on the card is the name of (i) a girl? (ii) a boy?

Soln

$$P(E_1) = \frac{25}{40} = \frac{5}{8}$$

E_1 E_2

not a girl

boy

$$P(E_2) = 1 - P(E_1)$$

$$= 1 - \frac{5}{8}$$

$$= \frac{3}{8}$$

QUESTION

H _ _ { H H

$2^2 \rightarrow 2^1 \rightarrow 2$

$2^n \rightarrow 2^2 \rightarrow 4$

$2^n \rightarrow 2^3 \rightarrow 8$

Harpreet tosses two different coins simultaneously (say, one is of ₹1 and other of ₹2). What is the probability that she gets at least one head?

E

Soln

$$P(E) = \frac{3}{4}$$

2 coins

S → H H, H T, T H, T T → 4

QUESTION

100 shirts — 88 good, 8 minor defects, 4 major defects

Jimmy → good

Sujatha → good or minor defect (88 + 8)

A carton consists of 100 shirts of which 88 are good, 8 have minor defects and 4 have major defects. Jimmy, a trader, will only accept the shirts which are good, but Sujatha, another trader, will only reject the shirts which have major defects. One shirt is drawn at random from the carton. What is the probability that

E_1 (i) it is acceptable to Jimmy?

E_2 (ii) it is acceptable to Sujatha?

Soln

$$P(E_1) = \frac{88}{100} = 0.88$$

$$P(E_2) = \frac{96}{100} = 0.96$$

QUESTION

$S \rightarrow (2 - 12)$

Two dice, one blue and one grey, are thrown at the same time. Write down all the possible outcomes. What is the probability that the sum of the two numbers appearing on the top of the dice is

E_1 (i) 8?

E_2 (ii) 13?

E_3 (iii) less than or equal to 12?

Soln $P(E_1) = \frac{5}{36}$

$P(E_2) = 0$

$P(E_3) = 1$

(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	~~(2,6)~~
(3,1)	(3,2)	(3,3)	(3,4)	~~(3,5)~~	(3,6)
(4,1)	(4,2)	(4,3)	~~(4,4)~~	(4,5)	(4,6)
(5,1)	(5,2)	~~(5,3)~~	(5,4)	(5,5)	(5,6)
(6,1)	~~(6,2)~~	(6,3)	(6,4)	(6,5)	(6,6)

36 outcomes

QUESTION

Complete the following statements:

(i) Probability of an event E + Probability of the event 'not E' = _____1_____.

Soln

QUESTION

Complete the following statements:

(ii) The probability of an event that cannot happen is 0. Such an event is called impossible event.

QUESTION

Complete the following statements:

(iii) The probability of an event that is certain to happen is ___1___ Such an event is called _sure event_
certain event

QUESTION

Complete the following statements:

(iv) The sum of the probabilities of all the elementary events of an experiment is ____1____.

QUESTION

Complete the following statements:
(v) The probability of an event is greater than or equal to ___0___ and less than or equal to ____1___.

$$0 \leq P(E) \leq 1$$

QUESTION

Which of the following cannot be the probability of an event?

(A) 2/3 → 0.- -

(B) -1.5

(C) 15%

(D) 0.7

QUESTION

If P(E) = 0.05, what is the probability of "not E'?

Soln

$$P(E) + P(\text{not } E) = 1$$

$$P(\text{not } E) = 1 - P(E)$$

$$= 1 - 0.05$$

$$= \boxed{0.95}$$

QUESTION

A bag contains lemon flavoured candies only. Malini takes out one candy without looking into the bag. What is the probability that she takes out

E_1 (i) an orange flavoured candy?

E_2 (ii) a lemon flavoured candy?

Soln

$$P(E_1) = 0$$

$$P(E_2) = 1$$

QUESTION

It is given that in a group of 3 students, the probability of 2 students not having the same birthday is 0.992. What is the probability that the 2 students have the same birthday?

Soln

b'day same day ✗ ⟶ 0.992

b'day same day ✓ ⟶ 1 − 0.992

= 0.008

QUESTION

8 balls — Red (3), Black (5)

A bag contains 3 red balls and 5 black balls. A ball is drawn at random from the bag. What is the probability that the ball drawn is (i) red? (E_1) (ii) not red? (E_2)

Soln

$$P(E_1) = \frac{3}{8}$$

$$P(E_2) = 1 - \frac{3}{8}$$

$$= \frac{5}{8}$$

QUESTION

180 coins — 50p (100), ₹1 (50), ₹2 (20), ₹5 (10) ×

A piggy bank contains hundred 50p coins, fifty ₹ 1 coins, twenty ₹2 coins and ten ₹ 5 coins. If it is equally likely that one of the coins will fall out when the bank is turned upside down, what is the probability that the coin (i) will be a 50p coin? (ii) will not be a ₹5 coin?

Soln

E_1 E_2

$$P(E_1) = \frac{100}{180} = \frac{5}{9}$$

$$P(E_2) = \frac{170}{180} = \frac{17}{18}$$

₹5 ✓

$$P = \frac{10}{180} = \frac{1}{18}$$

$$1 - \frac{1}{18}$$

QUESTION

13 fishes — M(5), F(8)

Gopi buys a fish from a shop for his aquarium. The shopkeeper takes out one fish at random from a tank containing 5 male fish and 8 female fish (see Fig.). What is the probability that the fish taken out is a male fish?

Soln

E

$$P(E) = \frac{5}{13}$$

QUESTION

A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1,2,3,4,5,6,7,8 (see Fig.), and these are equally likely outcomes. What is the probability that it will point at

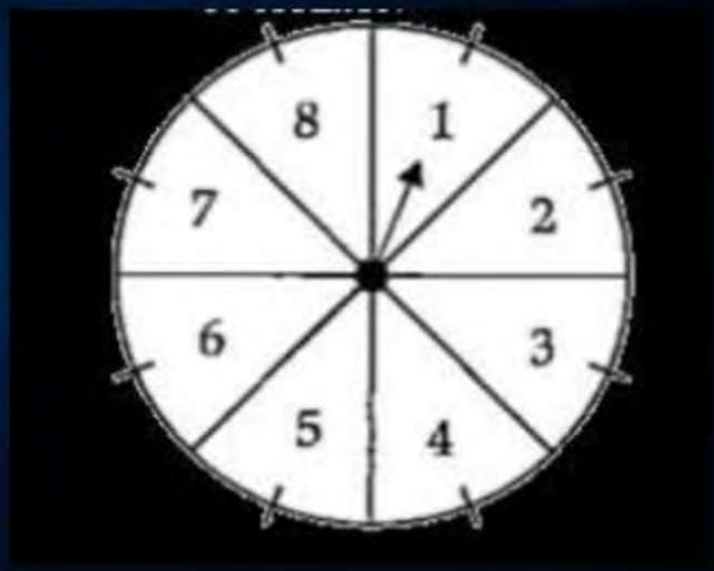
E_1 (i) 8?
E_2 (ii) an odd number?
E_3 (iii) a number greater than 2?
E_4 (iv) a number less than 9?

Soln $P(E_1) = \frac{1}{8}$

$P(E_2) = \frac{4}{8_2} = \frac{1}{2}$

$P(E_3) = \frac{3}{8_4}$

$P(E_4) = 1$



QUESTION

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

A die is thrown once. Find the probability of getting

E_1 (i) a prime number;

E_2 (ii) a number lying between 2 and 6;

E_3 (iii) an odd number.

Soln

$$P(E_1) = \frac{3}{6} = \frac{1}{2}$$

$$P(E_2) = \frac{3}{6} = \frac{1}{2}$$

$$P(E_3) = \frac{3}{6} = \frac{1}{2}$$

QUESTION

One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting

E_1 (i) a king of red colour
E_2 (ii) a face card
E_3 (iii) a red face card
E_4 (iv) the jack of hearts
E_5 (v) a spade
E_6 (vi) the queen of diamonds

Soln

$P(E_1) = \frac{2}{52} = \frac{1}{26}$, $P(E_4) = \frac{1}{52}$

$P(E_2) = \frac{12}{52} = \frac{3}{13}$, $P(E_5) = \frac{13}{52} = \frac{1}{4}$

$P(E_3) = \frac{6}{52} = \frac{3}{26}$, $P(E_6) = \frac{1}{52}$

QUESTION

5 cards

10, J, Q, K, A → Diamonds

4 cards

Five cards-the ten, jack, queen, king and ace of diamonds, are well-shuffled with their face downwards. One card is then picked up at random.

(i) What is the probability that the card is the queen?

(ii) If the queen is drawn and put aside, what is the probability that the second card picked up is (a) an ace? (b) a queen?

E_1 E_2 E_3

Soln

$$P(E_1) = \frac{1}{5}$$

$$P(E_2) = \frac{1}{4}$$

$$P(E_3) = \frac{0}{4} = 0$$

QUESTION

144 Pens — [Good (132) / Defective (12)]

12 defective pens are accidentally mixed with 132 good ones. It is not possible to just look at a pen and tell whether or not it is defective. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.

E

Soln

$$P(E) = \frac{132}{144} \quad \frac{66}{72} \quad \frac{11}{12} \longrightarrow \boxed{\frac{11}{12}}$$

12

QUESTION

A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears (i) a two-digit number (ii) a perfect square number (iii) a number divisible by 5.

E_1 E_2 E_3

1, 4, 9, 16, 25, 36, 49, 64, 81

Soln

1, 2, 3, 4, 5, 6, 7, 8, 9

$\times$ (9)

$$P(E_1) = \frac{81}{90} = \frac{9}{10}$$

$$P(E_2) = \frac{9}{90} = \frac{1}{10}$$

$$P(E_3) = \frac{18}{90} = \frac{1}{5}$$

18 terms

5, 10, 15, 20, ... (90) T_n T_{18}

$T_n = 90$

$5 + 5(n-1) = 90$

$5(n-1) = 85$

$n - 1 = 17$

$n = 18$