

Probability

1. Experiment:

An operation which can produce some well-defined outcomes is called an experiment.

2. Random Experiment:

An experiment in which all possible outcomes are known and the exact output cannot be predicted in advance, is called a random experiment.

Examples:

- i. Rolling an unbiased dice.
- ii. Tossing a fair coin.
- iii. Drawing a card from a pack of well-shuffled cards.
- iv. Picking up a ball of certain colour from a bag containing balls of different colours.

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 appears on its upper face.
- iii. A pack of cards has 52 cards.
It has 13 cards of each suit, name Spades, Clubs, Hearts and Diamonds.
Cards of spades and clubs are black cards.
Cards of hearts and diamonds are red cards.
There are 4 honours of each unit.
There are Kings, Queens and Jacks. These are all called face cards.

3. Sample Space:

When we perform an experiment, then the set S of all possible outcomes is called the sample space.

Examples:

1. In tossing a coin, $S = \{H, T\}$
2. If two coins are tossed, the $S = \{HH, HT, TH, TT\}$.
3. In rolling a dice, we have, $S = \{1, 2, 3, 4, 5, 6\}$.

4. Event:

Any subset of a sample space is called an event.

5. Probability of Occurrence of an Event:

Let S be the sample and let E be an event.

Then, $E \subseteq S$.

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

6. Results on Probability:

- i. $P(S) = 1$
- ii. $0 \leq P(E) \leq 1$
- iii. $P(\emptyset) = 0$
- iv. For any events 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 $P(\bar{A}) = 1 - P(A)$.

Q1.

Answer :

- (i) The possible outcomes are head (H) and tail (T).
- (ii) The possible outcomes are HH, HT, TH and TT.
- (iii) The possible outcomes are 1, 2, 3, 4, 5 and 6.
- (iv) The total number of possible outcomes is 52.

Q2.

Answer :

The possible outcomes in a coin toss are H and T.

Total number of outcomes = 2

Number of tails = 1

$\therefore P_{\text{tail}} = \frac{1}{2}$

Q3.

Answer :

The outcomes when two coins are tossed are HH, HT, TH and TT .
i.e., total no. of possible outcomes = 4

(i) Getting both tails means TT .

Number of outcomes with two tails = 1

$$\therefore P(\text{both tails}) = \frac{1}{4}$$

(ii) Getting at least 1 tail means HT, TH and TT .

With at least one tail, total number of outcomes = 3

$$\therefore P(\text{at least 1 tail}) = \frac{3}{4}$$

(iii) Getting at most 1 tail means HH, HT and TH .

The number of outcomes for at most 1 tail = 3

$$\therefore P(\text{at most 1 tail}) = \frac{3}{4}$$

Q4.

Answer :

Total number of balls = $4 + 5 = 9$

(i) Number of white balls = 4

$$\therefore P(\text{white ball}) = \frac{4}{9}$$

Number of blue balls = 5

$$\therefore P(\text{blue ball}) = \frac{5}{9}$$

Q5.

Answer :

Total number of balls = $5 + 6 + 4 = 15$

(i) Number of green balls = 4

$$\therefore P(\text{green ball}) = \frac{4}{15}$$

(ii) Number of white balls = 5

$$\therefore P(\text{white ball}) = \frac{5}{15} = \frac{1}{3}$$

(iii) Number of balls that are not red (i.e., 5 white and 4 green) = 9

$$\therefore P(\text{non-red balls}) = \frac{9}{15} = \frac{3}{5}$$

Q6.

Answer :

Total number of tickets = $10 + 20 = 30$

Number of prize tickets = 10

$$\therefore P(\text{getting a prize}) = \frac{10}{30} = \frac{1}{3}$$

Q7.

Answer :

Total number of bulbs in the box = 100

(i) Number of defective bulbs = 8

$$\therefore P(\text{defective bulb}) = \frac{8}{100} = \frac{2}{25}$$

(ii) Number of functioning bulbs = $100 - 8 = 92$

$$\therefore P(\text{non-defective bulb}) = \frac{92}{100} = \frac{23}{25}$$

Q8.

Answer :

(b) 58

The wheel has a total of $5+3=8$ sectors.

Number of green sectors = 5

Now, P(getting a green sector)=58

Q9.

Answer :

Total number of ladies surveyed =200

Number of ladies who dislike coffee =118

If chosen randomly, P(a lady that dislikes coffee) = $\frac{118}{200}=\frac{59}{100}$

Q10.

Answer :

Total number of possible outcomes= 19

(i) The prime numbers between 1 and 19 are 2, 3, 5, 7, 11, 13, 17 and 19.

Total number of primes = 8

$$\therefore P(\text{prime number}) = \frac{8}{19}$$

(ii) The even numbers between 1 and 19 are 2, 4, 6, 8, 10, 12, 14, 16 and 18.

Total number of even numbers= 6

$$\therefore P(\text{even number}) = \frac{9}{19}$$

(iii) The numbers between 1 and 19 which are divisible by 3 are 3, 6, 9, 12, 15 and 18.

Total number of possible outcomes = 6

$$\therefore P(\text{number divisible by 3}) = \frac{6}{19}$$

Q11.

Answer :

Total number of possible outcomes= 52

(i) There are 4 kings cards (king of hearts, king of diamonds, king of spades and king of clubs)

Number of kings= 4

$$\therefore P(\text{king}) = \frac{4}{52} = \frac{1}{13}$$

(ii) There is a total of 13 spades cards.

Number of spades= 13

$$\therefore P(\text{spades}) = \frac{13}{52} = \frac{1}{4}$$

(iii) There are 2 red queens in a pack (queen of hearts and queen of diamonds)

Number of red queens = 2

$$\therefore P(\text{red queen}) = \frac{2}{52} = \frac{1}{26}$$

(iv) There are 2 black 8s in a pack (8 of clubs and 8 of spades)

Number of black 8s = 2

$$\therefore P(\text{black 8}) = \frac{2}{52} = \frac{1}{26}$$

Q12.

Answer :

Total number of possible outcomes = 52

(i) There are 4 cards of with the number 4 (4 of hearts, 4 of diamonds, 4 of spades and 4 of cloves)

$$\therefore P_{(4 \text{ card})} = \frac{4}{52} = \frac{1}{13}$$

(ii) There are 4 queens in a pack of cards (queen of hearts, queen of diamonds, queen of spades and queen of cloves)

$$\therefore P_{(\text{queen})} = \frac{4}{52} = \frac{1}{13}$$

(iii) There are a total of 26 black cards (13 spade cards and 13 clove cards)

$$\therefore P_{(\text{black card})} = \frac{26}{52} = \frac{1}{2}$$

Q1.

Answer :

(b) $\frac{5}{8}$

The wheel has a total of $5 + 3 = 8$ sectors.

Number of green sectors = 5

Now, $P_{(\text{getting a green sector})} = \frac{5}{8}$

Q2.

Answer :

(c) $\frac{3}{8}$

Total number of cards = 8

Number of cards with numbers less than 4 = 3 (cards with numbers 1, 2 and 3)

Now, $P_{(\text{getting a number less than 4})} = \frac{3}{8}$

Q3.

Answer :

(b) $\frac{1}{2}$

When two coins are tossed, the possible outcomes are *HH, HT, TH* and *TT*.

Total number of outcomes = 4

Number of outcomes with one head and one tail = 2

Now, $P_{(\text{one head and one tail})} = \frac{2}{4} = \frac{1}{2}$

Q4.

Answer :

(d) $\frac{2}{5}$

Total number of outcomes = 5

Number of red balls = 2

Now, $P_{(\text{red ball})} = \frac{2}{5}$

Q5.

Answer :

(b) $\frac{1}{6}$

The possible outcomes are 1, 2, 3, 4, 5 and 6.

Total number of outcomes = 6

Now, $P_{(\text{getting 6})} = \frac{1}{6}$

Q6.

Answer :

(a) $\frac{1}{2}$

Total number of outcomes = 6 (Numbers: 1, 2, 3, 4, 5 and 6)

The even numbers are 2, 4, and 6.

Number of favourable outcomes = 3

Now, $P_{(\text{even number})} = \frac{3}{6} = \frac{1}{2}$

Q7.

Answer :

(c) 113

Total number of cards = 52

Number of queens = 4 (i.e., queen of hearts, queen of diamonds, queen of cloves and queen of spades)

Now, $P(\text{queen}) = \frac{4}{52} = \frac{1}{13}$

Q8.

Answer :

(b) $\frac{1}{26}$

Total number of cards = 52

Total number of black 6 cards = 2 (6 of spades, 6 of cloves)

Now, $P(\text{black 6}) = \frac{2}{52} = \frac{1}{26}$