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 know 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, $E \subseteq S$.
   $\therefore P(E) = \dfrac{n(E)}{n(S)}$.

6. **Results on Probability:**

   i. P(S) = 1

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

   iii. $P(\phi) = 0$

   iv. For any events A and B we have : $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

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

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
$\therefore P_{tail} = \dfrac{1}{2}$

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

(ii) Getting at least 1 tail means *HT, TH* and *TT*.
With at least one tail, total number of outcomes = 3
$\therefore \mathrm{P}_{(at\ \ least\ \ 1\ \ tail)} = \frac{3}{4}$

(iii) Getting at most 1 tail means *HH, HT* and *TH*.
The number of outcomes for at most 1 tail = 3
$\therefore \mathrm{P}_{(at\ \ most\ \ 1\ \ tail)} = \frac{3}{4}$

Q4.

Answer :

Total number of balls $= 4 + 5 = 9$
(i) Number of white balls = 4
$\therefore \mathrm{P}_{(white\ \ ball)} = \frac{4}{9}$

Number of blue balls = 5
$\therefore \mathrm{P}_{(blue\ \ ball)} = \frac{5}{9}$

Q5.

Answer :

Total number of balls $= 5 + 6 + 4 = 15$
(i) Number of green balls = 4
$\therefore \mathrm{P}_{(green\ \ ball)} = \frac{4}{15}$

(ii) Number of white balls = 5
$\therefore \mathrm{P}_{(white\ \ ball)} = \frac{5}{15} = \frac{1}{3}$

(iii) Number of balls that are not red (i.e., 5 white and 4 green)$= 9$
$\therefore \mathrm{P}_{(non-red\ \ balls)} = \frac{9}{15} = \frac{3}{5}$

Q6.

Answer :

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

Number of prize tickets = 10

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

Q7.

Answer :

Total number of bulbs in the box = 100
(i) Number of defective bulbs = 8
$\therefore \mathrm{P}_{(defective\ \ bulb)} = \frac{8}{100} = \frac{2}{25}$

(ii) Number of functioning bulbs$= 100 - 8 = 92$
$\therefore \mathrm{P}_{(non-defective\ \ bulb)} = \frac{92}{100} = \frac{23}{25}$

Q8.

Answer :

(b) 58
The wheel has a total of 5+3=8 sectors.
Number of green sectors = 5
Now, Pgetting 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) = 118200=59100

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

(ii) The even numbers between 1 and 19 are 2, 4, 6, 8, 10 ,12, 14, 16 and 18.
　Total number of even numbers$=6$
　$\therefore P_{(even\ number)} = \frac{9}{19}$

(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
　$\therefore P_{(number\ divisble\ by\ 3)} = \frac{6}{19}$

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 cloves)
Number of kings$=4$
$\therefore P_{(king)} = \frac{4}{52} = \frac{1}{13}$

(ii) There is a total of 13 spades cards.
Number of spades$=13$
$\therefore P_{(spades)} = \frac{13}{52} = \frac{1}{4}$

(iii) There are 2 red queens in a pack (queen of hearts and queen of diamonds)
Number of red queens $=2$
$\therefore P_{(red\ queen)} = \frac{2}{52} = \frac{1}{26}$

(iv) There are 2 black 8s in a pack (8 of cloves and 8 of spades)
Number of black 8s $=2$
$\therefore P_{(black\ 8)} = \frac{2}{52} = \frac{1}{26}$

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)

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

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

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

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

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

Q1.

Answer :

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

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

Number of green sectors = 5

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

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

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

Q4.

Answer :

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

Total number of outcomes $= 5$

Number of red balls $= 2$

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

Q5.

Answer :

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

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

Total number of outcomes $= 6$

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

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

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(queen)=452=113

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, $P_{(black\ 6)} = \frac{2}{52} = \frac{1}{26}$