Exercise – 13.1

1. The probability that it will rain tomorrow is 0.85. What is the probability that it will not rain tomorrow?

Sol:

Let E be the event of happening of rain

P(E) is given as 0.85

$\bar{E} \longrightarrow not\ happening\ of\ rain$

P($\bar{E}$) = 1 – P(E) = 1 – 0.85 = 0.15

∴ P(not happening of rain) = 0.15

2. A die is thrown. Find the probability of getting:
   (i) a prime number
   (ii) 2 or 4
   (iii) a multiple of 2 or 3
   (iv) an even prime number
   (v) a number greater than 5
   (vi) a number lying between 2 and 6

Sol:

(i) Total no of possible outcomes = 6 {1, 2, 3, 4, 5, 6}

E ⟶ Event of getting a prime no.

No. of favorable outcomes = 3 {2, 3, 5}

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

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

(ii) E ⟶ Event of getting 2 or 4.

No. of favorable outcomes = 2 {2, 4}

Total no.of possible outcomes = 6

Then, P(E) = $\frac{2}{6} = \frac{1}{3}$

(iii) E ⟶ Event of getting a multiple of 2 or 3

No. of favorable outcomes = 4 {2, 3, 4, 6}

Total no.of possible outcomes = 6

Then, P(E) = $\frac{4}{6} = \frac{2}{3}$

(iv) E ⟶ Event of getting an even prime no.

No. of favorable outcomes = 1 {2}

Total no.of possible outcomes = 6 {1, 2, 3, 4, 5, 6}

P(E) = $\frac{1}{6}$

(v) E ⟶ Event of getting a no. greater than 5.

No. of favorable outcomes = 1 {6}

Total no.of possible outcomes = 6

P(E) = $\frac{1}{6}$

(vi) E ⟶ Event of getting a no. lying between 2 and 6.

No. of favorable outcomes = 3 {3, 4, 5}

Total no.of possible outcomes = 6

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

3. In a simultaneous throw of a pair of dice, find the probability of getting:

(i) 8 as the sum

(ii) a doublet

(iii) a doublet of prime numbers

(iv) a doublet of odd numbers

(v) a sum greater than 9

(vi) an even number on first

(vii) an even number on one and a multiple of 3 on the other

(viii) neither 9 nor 1 1 as the sum of the numbers on the faces

(ix) a sum less than 6

(x) a sum less than 7

(xi) a sum more than 7

(xii) at least once

(xiii) a number other than 5 on any dice.

Sol:

In a throw of pair of dice, total no of possible outcomes = 36 (6×6) which are

(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)

(i) Let E be event of getting the sum as 8

No. of favorable outcomes = 5 {(2, 6) (3, 5) (4, 4) (5, 3) (6, 2)}

We know that, Probability P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$

P(E) = $\frac{5}{36}$

(ii) E ⟶ event of getting a doublet

No. of favorable outcomes = 5 {(1, 1) (2, 2) (3, 3) (4, 4) (5, 5) (6, 6)}

Total no. of possible outcomes = 36

P(E) = $\frac{6}{36} = \frac{1}{6}$

(iii) E ⟶ event of getting a doublet of prime no’s

No. of favorable outcomes = 3 {(2, 2) (3, 3) (5, 5)}

Total no. of possible outcomes = 36

P(E) = $\frac{3}{36} = \frac{1}{12}$

(iv) E ⟶ event of getting a doublet of odd no’s

No. of favorable outcomes = 3 {(1, 1) (3, 3) (5, 5)}

Total no. of possible outcomes = 36

P(E) = $\frac{3}{36} = \frac{1}{12}$

(v) E ⟶ event of getting a sum greater than 9

No. of favorable outcomes = 6 {(4, 6) (5, 5) (5, 6) (6, 4) (6, 5) (6, 6)}

Total no. of possible outcomes = 36

P(E) = $\frac{6}{36} = \frac{1}{6}$

(vi) E ⟶ event of getting an even no. on first

No. of favorable outcomes = 18 {(2, 1) (2, 2) (2, 3) (2, 4) (2, 5) (2, 6), (4, 1) , (4, 2) , (4, 3) , (4, 4) , (4, 5) , (4, 6) , (6, 1) , (6, 2) , (6, 3) , (6, 4) , (6, 5) , (6, 6)}

Total no. of possible outcomes = 36

P(E) = $\frac{18}{36} = \frac{1}{2}$

(vii) E ⟶ event of getting an even no. on one and a multiple of 3 on other

No. of favorable outcomes = 11 {(2, 3) (2, 6) (4, 3) (4, 6) (6, 3) (6, 6), (3, 2), (3, 4), (3, 4) , (3, 6) , (6, 2) , (6, 4)}

Total no. of possible outcomes = 36

P(E) = $\frac{11}{36}$

(viii) $\overline{E}$ ⟶ event of getting neither 9 nor 11 as the sum of numbers on faces

E ⟶ getting either 9 or 11 as the sum of no's on faces

No. of favorable outcomes = 6 {(3, 6) (4, 5) (5, 4) (6, 3) (5, 6) (6, 5)}

Total no. of possible outcomes = 36

P(E) = $\frac{6}{36} = \frac{1}{6}$

P$\left(\overline{E}\right) = 1 - P = 1 - \frac{1}{6} = \frac{5}{6}$

(ix) E ⟶ event of getting a sum less than 6

No. of favorable outcomes = 10 {(1, 1) (1, 2) (1, 3) (1, 4) (2, 1) (2, 2) , (2, 3) , (3, 1) , (3, 2) , (4, 1)}

Total no. of possible outcomes = 36

P(E) = $\frac{10}{36} = \frac{5}{18}$

(x) E ⟶ event of getting a sum less than 7

No. of favorable outcomes = 15 {(1, 1) (1, 2) (1, 3) (1, 4) (1, 5) (2, 1), (2, 2) (2, 3) (2, 4) (3, 1) (3, 2) (3, 3) (4, 1) (4, 2) (5, 1)}

Total no. of possible outcomes = 36

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

(xi) E ⟶ event of getting a sum more than 7

No. of favorable outcomes = 15 {(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)}

Total no. of possible outcomes = 36

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

(xii) E ⟶ event of getting a 1 at least once
No. of favorable outcomes = 11 {(1, 1) (1, 2) (1, 3) (1, 4) (1, 5) (1, 6), (2, 1) (3, 1) (4, 1) (5, 1) (6, 1)}
Total no. of possible outcomes = 36
P(E) = $\frac{11}{36}$

(xiii) E ⟶ event of getting a no other than 5 on any dice
No. of favourable outcomes = 25 {(1, 1) (1, 2) (1, 3) (1, 4) (1, 6) (2, 1), (2, 2) (2, 3) (2, 4) (2, 6) (3, 1) (3, 2) (3, 3) (3, 4) (3, 6) (4, 1) (4, 2) (4, 3) (4, 4) (4, 6) (6, 1) (6, 2) (6, 3) (6, 4) (6, 6)}
Total no. of possible outcomes = 36
P(E) = $\frac{25}{36}$

4. Three coins are tossed together. Find the probability of getting:
(i) exactly two heads
(ii) at least two heads
(iii) at least one head and one tail
(iv) no tails

Sol:
When 3 coins are tossed together,
Total no. of possible outcomes = 8 {HHH, HHT, HTH, HTT, THH,THT, TTH, TTT}

(i) Probability of an event = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
Let E ⟶ event of getting exactly two heads
No. of favourable outcomes = 3 {HHT, HTH, THH}
Total no. of possible outcomes = 8
P(E) = $\frac{3}{8}$

(ii) E ⟶ getting at least 2 Heads
No. of favourable outcomes = 4 {HHH, HHT, HTH, THH}
Total no. of possible outcomes = 8
P(E) = $\frac{4}{8} = \frac{1}{2}$

(iii) E⟶ getting at least one Head & one Tail
No. of favourable outcomes = 6 {HHT, HTH, HTT, THH, THT, TTH}
Total no. of possible outcomes = 8
P(E) = $\frac{6}{8} = \frac{3}{4}$

(iv) E ⟶ getting no tails
No. of favourable outcomes = 1 {HHH}
Total no. of possible outcomes = 8
P(E) = $\frac{1}{8}$

5. What is the probability that an ordinary year has 53 Sundays?

Sol:

Ordinary year has 365 days

365 days = 52 weeks + 1 day

That 1 day may be Sun, Mon, Tue, Wed, Thu, Fri, Sat

Total no. of possible outcomes = 7

Let E ⟶ event of getting 53 Sundays

No. of favourable outcomes = 1 {Sun}

P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{1}{7}$

6. What is the probability that a leap year has 53 Sundays and 53 Mondays?

Sol:

A leap year has 366 days

366 days = 52 weeks + 2 days

That 2 days may be (Sun, Mon) (Mon, Tue) (Tue, Wed) (Wed, Thu) (Thu, Fri) (Fri, Sat) (Sat, Sun)

Let E ⟶ event of getting 53 Sundays & 53 Mondays.

No. of favourable outcomes = 1 {(Sun, Mon)}

Since 52 weeks has 52 Sundays & 52 Mondays & the extra 2 days must be Sunday & Monday.

Total no. of possible outcomes = 7

P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{1}{7}$

7. A and B throw a pair of dice. If A throws 9, find B's chance of throwing a higher number.

Sol:

When a pair of dice are thrown, then total no. of possible outcomes = 6 × 6 = 36, which are

{ (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) }

E ⟶ event of throwing a no. higher than 9.

No. of favourable outcomes = 6 {(4, 6) (5, 5) (6, 4) (5, 6) (6, 5) (6, 6)}

We know that P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$

i.e., P(E) = $\frac{6}{36} = \frac{1}{6}$

8. Two unbiased dice are thrown. Find the probability that the total of the numbers on the dice is greater than 10.

Sol:

When a pair of dice are thrown, then total no. of possible outcomes = $6 \times 6 = 36$

let E $\longrightarrow$ event of getting sum on dice greater than 10

then no of favourable outcomes = 3 {(5, 6) (6, 5) (6, 6)}

we know that, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$

i.e., P(E) = $\frac{3}{36} = \frac{1}{12}$

9. A card is drawn at random from a pack of 52 cards. Find the probability that card drawn is

(i) a black king
(ii) either a black card or a king
(iii) black and a king
(iv) a jack, queen or a king
(v) neither a heart nor a king
(vi) spade or an ace
(vii) neither an ace nor a king
(viii) Neither a red card nor a queen.
(ix) other than an ace
(x) a ten
(xi) a spade
(xii) a black card
(xiii) the seven of clubs
(xiv) jack
(xv) the ace of spades
(xvi) a queen

Sol:

Total no. of outcomes = 52 {52 cards}

(i) E$\longrightarrow$ event of getting a black king

No of favourable outcomes = 2{king of spades & king of clubs}

We know that, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{2}{52} = \frac{1}{26}$

(ii) E$\longrightarrow$ event of getting either a black card or a king.

No. of favourable outcomes = 26 + 2 {13 spades, 13 clubs, king of hearts & diamonds}

P(E) = $\frac{26+2}{52} = \frac{28}{52} = \frac{7}{13}$

(iii) E$\longrightarrow$ event of getting black & a king.

No. of favourable outcomes = 2 {king of spades & clubs}

P(E) = $\frac{2}{52} = \frac{1}{26}$

(iv) E$\longrightarrow$ event of getting a jack, queen or a king

No. of favourable outcomes = 4 + 4 + 4 = 12 {4 jacks, 4 queens & 4 kings}

P(E) = $\frac{12}{52} = \frac{3}{13}$

(v) E$\longrightarrow$ event of getting neither a heart nor a king.

No. of favourable outcomes = 52 – 13 – 3 = 36 {since we have 13 hearts, 3 kings each of spades, clubs & diamonds}

P(E) = $\frac{36}{52} = \frac{9}{13}$

(vi) E⟶ event of getting spade or an all.
No. of favourable outcomes = 13 + 3 = 16 {13 spades & 3 aces each of hearts, diamonds & clubs}
P(E) = $\frac{16}{52} = \frac{4}{13}$

(vii) E⟶ event of getting neither an ace nor a king.
No. of favourable outcomes = 52 – 4 – 4 = 44 {Since we have 4 aces & 4 kings}
P(E) = $\frac{44}{52} = \frac{11}{13}$

(viii) E⟶ event of getting neither a red card nor a queen.
No. of favourable outcomes = 52 – 26 – 2 = 24 {Since we have 26 red cards of hearts & diamonds & 2 queens each of heart & diamond}
P(E) = $\frac{24}{52} = \frac{6}{13}$

(ix) E⟶ event of getting card other than an ace.
No. of favourable outcomes = 52 – 4 = 48 {Since we have 4 ace cards}
P(E) = $\frac{48}{52} = \frac{12}{13}$

(x) E⟶ event of getting a ten.
No. of favourable outcomes = 4 {10 of spades, clubs, diamonds & hearts}
P(E) = $\frac{4}{52} = \frac{1}{13}$

(xi) E⟶ event of getting a spade.
No. of favourable outcomes = 13 {13 spades}
P(E) = $\frac{13}{52} = \frac{1}{24}$

(xii) E⟶ event of getting a black card.
No. of favourable outcomes = 26 {13 cards of spades & 13 cards of clubs}
P(E) = $\frac{26}{52} = \frac{1}{2}$

(xiii) E⟶ event of getting 7 of clubs.
No. of favourable outcomes = 1 {7 of clubs}
P(E) = $\frac{1}{52}$

(xiv) E⟶ event of getting a jack.
No. of favourable outcomes = 4 {4 jack cards}
P(E) = $\frac{4}{52} = \frac{1}{13}$

(xv) E⟶ event of getting the ace of spades.
No. of favourable outcomes = 1{ace of spades}
P(E) = $\frac{1}{52}$

(xvi) E⟶ event of getting a queen.
No. of favourable outcomes = 4 {4 queens}
P(E) = $\frac{4}{52} = \frac{1}{13}$

(xvii) E⟶ event of getting a heart.

No. of favourable outcomes = 13 {13 hearts}

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

(xviii) E⟶ event of getting a red card.

No. of favourable outcomes = 26 {13 hearts, 13 diamonds}

P(E) = $\frac{26}{52} = \frac{1}{2}$

10. In a lottery of 50 tickets numbered 1 to 50, one ticket is drawn. Find the probability that the drawn ticket bears a prime number.

Sol:

Total no. of possible outcomes = 50 {1, 2, 3, …. , 50}

E⟶ event of getting a prime no.

No. of favourable outcomes = 15

{2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47}

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

i.e. P(E) = $\frac{15}{50} = \frac{3}{10}$

11. An urn contains 10 red and 8 white balls. One ball is drawn at random. Find the probability that the ball drawn is white.

Sol:

Total no of possible outcomes = 18 {10 red balls, 8 white balls}

E ⟶ event of drawing white ball

No. of favourable outcomes = 8 {8 white balls}

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

= $\frac{8}{18} = \frac{4}{9}$

12. A bag contains 3 red balls, 5 black balls and 4 white balls. A ball is drawn at random from the bag. What is the probability that the ball drawn is:

(i) White (iii) Black

(ii) Red (iv) Not red

Sol:

Total number of possible outcomes = 12 {3 red balls, 5 black balls & 4 white balls}

(i) E ⟶ event of getting white ball

No. of favourable outcomes = 4 {4 white balls}

Probability, P(E) = $\frac{4}{12} = \frac{1}{3}$

(ii) E ⟶ event of getting red ball

No. of favourable outcomes = 5 {3 red balls}

P (E) = $\frac{3}{12} = \frac{1}{4}$

(iii) E ⟶ event of getting black ball
No. of favourable outcomes = 5 {5 black balls}
P (E) = $\frac{5}{12}$

(iv) E ⟶ event of getting red
No. of favourable outcomes = 3 {3 black balls}
P(E) = $\frac{3}{12} = \frac{1}{4}$
($\bar{E}$) ⟶ event of not getting red.
P($\bar{E}$) = 1 – P(E)
= 1 – $\frac{1}{4}$
= $\frac{3}{4}$

13. What is the probability that a number selected from the numbers 1, 2, 3, ..., 15 is a multiple of 4?
Sol:
Total no. possible outcomes = 15 {1, 2, 3, …. , 15}
E ⟶ event of getting a multiple of 4
No. of favourable outcomes = 3 {4, 8, 12}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{3}{15} = \frac{1}{5}$

14. A bag contains 6 red, 8 black and 4 white balls. A ball is drawn at random. What is the probability that ball drawn is not black?
Sol:
Total no. of possible outcomes = 18 {6 red, 8 black, 4 white}
Let E ⟶ event of drawing black ball.
No. of favourable outcomes = 8 {8 black balls}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{8}{18} = \frac{4}{9}$
$\bar{E}$ ⟶ event of not drawing black ball
$P(\bar{E}) = 1 - P(E)$
$= 1 - \frac{4}{9} = \frac{5}{9}$

15. A bag contains 5 white and 7 red balls. One ball is drawn at random. What is the probability that ball drawn is white?
Sol:
Total no. of possible outcomes = 12 {5 white, 7 red}
E ⟶ event of drawing white ball.
No. of favorable outcomes = 5 {white balls are 5}

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

P(E) = $\frac{5}{12}$

16. Tickets numbered from 1 to 20 are mixed up and a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 7?

Sol:

Total no. of possible outcomes = 20 {1, 2, 3, …. , 20}

E ⟶ event of drawing ticket with no multiple of 3 or 7

No. of favourable outcomes = 8 which are {3, 6, 9, 12, 15, 18, 7, 14}

Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{8}{20} = \frac{2}{5}$

17. In a lottery there are 10 prizes and 25 blanks. What is the probability of getting a prize?

Sol:

Total no. of possible outcomes = 35 {10 prizes, 25 blanks}

E ⟶ event of getting prize

No. of favourable outcomes = 10 {10 prizes}

Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{10}{35} = \frac{2}{7}$

18. If the probability of winning a game is 0.3, what is the probability of losing it?

Sol:

E ⟶ event of winning a game

P(E) is given as 0.3

$(\bar{E})$ ⟶ event of loosing the game

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

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

= 1 – 0.3 = 0.7

19. A bag contains 5 black, 7 red and 3 white balls. A ball is drawn from the bag at random. Find the probability that the ball drawn is:

(i) Red (ii) black or white (iii) not black

Sol:

Total no. of possible outcomes = 15

{5 black, 7 red & 3 white balls}

(i) E ⟶ event of drawing red ball

No. of favorable outcomes = 7 {7 red balls}

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

P(E) = $\frac{7}{15}$

(ii) E ⟶ event of drawing black or white
No. of favourable outcomes = 8 {5 black & 3 white}
P(E) = $\frac{8}{15}$

(iii) E ⟶ event of drawing black ball
No. of favourable outcomes = 5 {5 black balls}
P (E) = $\frac{5}{15} = \frac{1}{3}$
$\bar{E} \longrightarrow event\ of\ not\ drawing\ black\ ball$
P $(\bar{E}) = 1 - P(E)$
$= 1 - \frac{1}{3} = \frac{2}{3}$

20. A bag contains 4 red, 5 black and 6 white balls. A ball is drawn from the bag at random. Find the probability that the ball drawn is:
(i) White
(ii) Red
(iii) Not black
(iv) Red or white

Sol:
Total no. of possible outcomes = 15 {4 red, 5 black, 6 white balls}

(i) E ⟶ event of drawing white ball.
No. of favourable outcomes = 6 {6 white}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
P(E) = $\frac{6}{15} = \frac{2}{5}$

(ii) E ⟶ event of drawing red ball
No. of favourable outcomes = 4 {4 red balls}
P(E) = $\frac{4}{15}$

(iii) E ⟶ event of drawing black ball
No. of favourable outcomes = 5 {5 black balls}
P(E) = $\frac{5}{15} = \frac{1}{3}$
$\bar{E}$ ⟶ event of not drawing black ball
$P(\bar{E}) = 1 - \frac{1}{3} = \frac{2}{3}$

(iv) E ⟶ event of drawing red or white ball
No. of favourable outcomes = 10 {4 red & 6 white}
P(E) = $\frac{10}{15} = \frac{2}{3}$

21. A black die and a white die are thrown at the same time. Write all the possible outcomes. What is the probability?
(i) that the sum of the two numbers that turn up is 8?
(ii) of obtaining a total of 6?

(iii) of obtaining a total of 10?
(iv) of obtaining the same number on both dice?
(v) of obtaining a total more than 9?
(vi) that the sum of the two numbers appearing on the top of the dice is 13?
(vii) that the sum of the numbers appearing on the top of the dice is less than or equal to 12?

Sol:

Total no. of possible outcomes when 2 dice are thrown = $6 \times 6 = 36$ which are
{ (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) }

(i) E ⟶ event of getting sum that turn up is 8
No. of possible outcomes = 36
No. of favourable outcomes = 5 {(2, 6) (3, 5) (4, 4) (5, 3) (6, 2)}
P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{5}{36}$

(ii) Let E ⟶ event of obtaining a total of 6
No. of favourable outcomes = 5
{(1, 5) (2, 4) (3, 3) (4, 2) (5, 1)}
P(E) = $\frac{5}{36}$

(iii) Let E ⟶ event of obtaining a total of 10.
No. of favourable outcomes = 3 {(4, 6) (5, 5) (6, 4)}
P(E) = $\frac{3}{36} = \frac{1}{12}$

(iv) Let E ⟶ event of obtaining the same no. on both dice
No. of favourable outcomes = 6 {(1, 1) (2, 2) (3, 3) (4, 4) (5, 5) (6, 6)}
P(E) = $\frac{3}{36} = \frac{1}{12}$

(v) E ⟶ event of obtaining a total more than 9
No. of favourable outcomes = 6 {(4, 6) (5, 5) (6, 4) (5, 6) (6, 5) (6, 6)}
P(E) = $\frac{6}{36} = \frac{1}{6}$

(vi) The maximum sum is 12 (6 on 1st + 6 on 2nd)
So, getting a sum of no's appearing on the top of the two dice as 13 is an impossible event.
∴ Probability is 0

(vii) Since, the sum of the no's appearing on top of 2 dice is always less than or equal to 12, it is a sure event.
Probability of sure event is 1.

So, the required probability is 1.

22. One card is drawn from a well shuffled deck of 52 cards. Find the probability of getting:
(i) a king of red suit
(ii) a face card
(iii) a red face card
(iv) a queen of black suit
(v) a jack of hearts
(vi) a spade

Sol:

Total no. of possible outcomes = 52 (52 cards)

(i) E ⟶ event of getting a king of red suit
No. of favourable outcomes = 2 {king heart & king of diamond}
P(E), = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{2}{52} = \frac{1}{26}$

(ii) E ⟶ event of getting face card
No. of favourable outcomes = 12 {4 kings, 4 queens & 4 jacks}
P(E) = $\frac{12}{52} = \frac{3}{13}$

(iii) E ⟶ event of getting red face card
No. favourable outcomes = 6 { kings, queens, jacks of hearts & diamonds}
P(E) = $\frac{6}{26} = \frac{3}{26}$

(iv) E ⟶ event of getting a queen of black suit
No. favourable outcomes = 6 { kings, queens, jacks of hearts & diamonds}
P(E) = $\frac{6}{26} = \frac{3}{26}$

(v) E ⟶ event of getting red face card
No. favourable outcomes = 6 { queen of spades & clubs}
P(E) = $\frac{1}{52}$

(vi) E ⟶ event of getting a spade
No. favourable outcomes = 13 {13 spades}
P(E) = $\frac{13}{52} = \frac{1}{4}$

23. Five cards—ten, jack, queen, king, and an ace of diamonds are shuffled face downwards. One card is picked at random.
(i) What is the probability that the card is a queen?
(ii) If a king is drawn first and put aside, what is the probability that the second card picked up is the ace?

Sol:

Total no. of possible outcomes = 5 {5 cards}

(i) E ⟶ event of drawing queen
No. favourable outcomes = 1 {1 queen card}
P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{1}{5}$

(ii) When king is drawn and put aside, total no. of remaining cards = 4
Total no. of possible outcomes = 4
E ⟶ event of drawing ace card
No. favourable outcomes = 1 {1 ace card}
P(E) = $\frac{1}{4}$

24. 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
(ii) Black

Sol:

Total no. of possible outcomes = 8 {3 red, 5 black}

(i) Let E ⟶ event of drawing red ball.
No. favourable outcomes = 1 {1 ace card}
P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{3}{8}$

(ii) Let E ⟶ event of drawing black ball.
No. favourable outcomes = 5 {5 black balls}
P(E) = $\frac{5}{8}$

25. A bag contains cards which are numbered from 2 to 90. A card is drawn at random from the bag. Find the probability that it bears.
(i) a two digit number
(ii) a number which is a perfect square

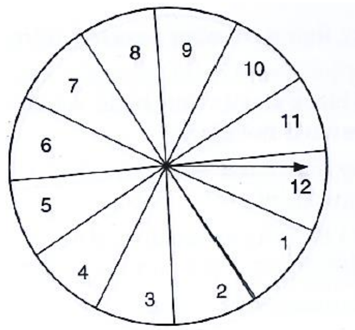
Sol:

Total no. of possible outcomes = 89 {2, 3, 4, …., 90}

(i) Let E ⟶ event of getting a 2 digit no.
No. favourable outcomes = 81 {10, 11, 12, 13, ….., 80}
P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{81}{89}$

(ii) E ⟶ event of getting a no. which is perfect square
No. favourable outcomes = 8 {4, 9, 16, 25, 36, 49, 64, 81}
P(E) = $\frac{8}{89}$

26. A game of chance consists of spinning an arrow which is equally likely to come to rest pointing to one of the number, 1, 2, 3, ..., 12 as shown in Fig. below. What is the probability that it will point to:



(i) 10?
(ii) an odd number?
(iii) a number which is multiple of 3?
(iv) an even number?

Sol:

Total no. of possible outcomes = 12 {1, 2, 3,…., 12}

(i) Let E ⟶ event of pointing 10
No. favourable outcomes = 1 {10}
$P(E) = \frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{1}{12}$

(ii) Let E ⟶ event of pointing at an odd no.
No. favourable outcomes = 6 {1, 3, 5, 7, 9, 11}
$P(E) = \frac{6}{12} = \frac{1}{2}$

(iii) Let E ⟶ event of pointing at a no. multiple of 3
No. favourable outcomes = 4 {3, 6, 9, 12}
$P(E) = \frac{4}{12} = \frac{1}{3}$

(iv) Let E ⟶ event of pointing at an even no.
No. favourable outcomes = 6 {2, 4, 6, 8, 10, 12}
$P(E) = \frac{6}{12} = \frac{1}{2}$

27. Two customers are visiting a particular shop in the same week (Monday to Saturday). Each is equally likely to visit the shop on any one day as on another. What is the probability that both will visit the shop on:

(i) the same day? (ii) different days? (iii) consecutive days?

Sol:

Total no. of days to visit the shop = 6 {Mon to Sat}
Total no. possible outcomes = $6 \times 6 = 36$
i.e. two customers can visit the shop in 36 ways

(i) E⟶ event of visiting shop on the same day.
No. of favourable outcomes = 6 which are (M, M) (T, T) (Th, Th) (F, F) (S, S)
Probability, $P(E) = \frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
$P(E) = \frac{6}{36} = \frac{1}{6}$

(ii) E⟶ event of visiting shop on the same day.

E⟶ event of visiting shop on the different days.

In above bit, we calculated P(E) as $\frac{1}{6}$

We know that, P(E) + P($\bar{E}$) = 1

P($\bar{E}$) = 1 – P(E)

= $1-\frac{1}{6}=\frac{5}{6}$

(iii) E⟶ event of visiting shop on c

No. of favourable outcomes = 6 which are (M, T) (T, W) (W, Th) (Th, F) (F, S)

P(E) = $\frac{5}{36}$

28. In a class, there are 18 girls and 16 boys. The class teacher wants to choose one pupil for class monitor. What she does, she writes the name of each pupil on a card and puts them into a basket and mixes thoroughly. A child is asked to pick one card from the basket. What is the probability that the name written on the card is:

(i) the name of a girl

(ii) the name of a boy

Sol:

Total no. of possible outcomes = 34 (18 girls, 16 boys)

(i) E ⟶ event of getting girl name

No. of favorable outcomes = 18 (18 girls)

Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}=\frac{18}{34}=\frac{9}{17}$

(ii) E ⟶ event of getting boy name

No. of favorable outcomes = 16 (16 boys)

P(E) = $\frac{16}{34}=\frac{8}{17}$

29. Why is tossing a coin considered to be a fair way of deciding which team should choose ends in a game of cricket?

Sol:

No. of possible outcomes while tossing a coin = 2 {1 head & 1 tail}

Probability = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$

P(getting head) = $\frac{1}{2}$

P(getting tail) = $\frac{1}{2}$

Since probability of two events are equal, these are called equally like events.

Hence, tossing a coin is considered to be a fair way of deciding which team should choose ends in a game of cricket.

30. What is the probability that a number selected at random from the number 1,2,2,3,3,3, 4, 4, 4, 4 will be their average?
Sol:
Given no's are 1, 2, 2, 3, 3, 3, 4, 4, 4, 4
Total no. of possible outcomes = 10
Average of the no's = $\frac{sum\ of\ no's}{total\ no's} = \frac{1+2+2+3+3+3+4+4+4+4}{10} = \frac{30}{10} = 3$
E $\longrightarrow$ event of getting 3
No. of favourable outcomes = 3 {3, 3, 3}
P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
P(E) = $\frac{3}{10}$

31. The faces of a red cube and a yellow cube are numbered from 1 to 6. Both cubes are rolled. What is the probability that the top face of each cube will have the same number?
Sol:
Total no. of outcomes when both cubes are rolled = $6 \times 6 = 36$ which are
{ (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) }
E $\longrightarrow$ event of getting same no. on each cube
No. of favourable outcomes = 6 which are
{ (1, 1) (2, 2) (3, 3) (4, 4) (5, 5) (6, 6)}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{6}{36} = \frac{1}{6}$

32. The probability of selecting a green marble at random from a jar that contains only green, white and yellow marbles is $\frac{1}{4}$. The probability of selecting a white marble at random from the same jar is $\frac{1}{3}$. If this jar contains 10 yellow marbles. What is the total number of marbles in the jar?
Sol:
Let the no. of green marbles = x
The no. of white marbles = y
No. of yellow marbles = 10
Total no. of possible outcomes = x + y + 10 (total no. of marbles)
Probability P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
Probability (green marble) = $\frac{1}{4} = \frac{x}{x+y+10}$

⇒ x + y + 10 = 4x
⇒ 3x – y – 10 = 0 …..(i)
Probability (white marble) = $\frac{1}{3} = \frac{y}{x+y+10}$
⇒ x + y 10 = 3y
⇒ x – 2y + 10 = 0 ….(ii)
⇒ 3x – 6y + 30 = 0 ….(iii)
Multiplying by 3,
Sub (i) from (iii), we get
−6y + y + 30 + 10 = 0
⇒ $-5y + 40 = 0$
⇒ $5y = 40$
⇒ $y = 8$
Subs. Y in (i), 3x – 8 – 10 = 0
3x – 18 = 0
$x = \frac{18}{3} = 6$
Total no. of marbles in jar = $x + y + 10 = 6 + 8 + 10 = 24$

33. There are 30 cards, of same size, in a bag on which numbers 1 to 30 are written. One card is taken out of the bag at random. Find the probability that the number on the selected card is not divisible by 3.

Sol:
Total no. of possible outcomes = 30 {1, 2, 3, … 30}
E ⟶ event of getting no. divisible by 3.
No. of favourable outcomes = 10 {3, 6, 9, 12, 15, 18, 21, 24, 27, 30}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
P(E) = $\frac{10}{30} = \frac{1}{3}$
$\bar{E}$ ⟶ event of getting no. not divisible by 3.
P($\bar{E}$) = 1 – P(E)
= 1 - $\frac{1}{3} = \frac{2}{3}$

34. A bag contains 5 red, 8 white and 7 black balls. A ball is drawn at random from the bag. Find the probability that the drawn ball is
(i) red or white
(ii) not black
(iii) neither white nor black.

Sol:
Total no. of possible outcomes = 20 {5 red, 8 white & 7 black}
(i) E ⟶ event of drawing red or white ball

No. of favourable outcomes = 13 {5 red, 8 white}

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

P(E) = $\frac{13}{20}$

(ii) Let E ⟶ be event of getting black ball

No. of favourable outcomes = 13 {5 red, 8 white}

P(E) = $\frac{7}{20}$

$(\bar{E})$⟶ event of not getting black ball

$P(\bar{E})$ = 1 – P(E)

$= 1 - \frac{7}{20} = \frac{13}{20}$

(iii) Let E ⟶ be event of getting neither white nor black ball

No. of favourable outcomes = 20 – 8 – 7 = 5 {total balls – no. of white balls – no. of black balls}

P(E) = $\frac{5}{20} = \frac{1}{4}$

35. Find the probability that a number selected from the number 1 to 25 is not a prime number when each of the given numbers is equally likely to be selected.

Sol:

Total no. of possible outcomes = 25 {1, 2, 3, … 25}

E ⟶ event of getting a prime no.

No. of favourable outcomes = 9 {2, 3, 5, 7, 11, 13, 17, 19, 23}

Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{9}{25}$

$(\bar{E}) \longrightarrow event\ of\ not\ getting\ a\ prime\ no.$

$P(\bar{E}) = 1 - P(E) = 1 - \frac{9}{25} = \frac{16}{25}$

36. A bag contains 8 red, 6 white and 4 black balls. A ball is drawn at random from the bag. Find the probability that the drawn ball is

(i) Red or white

(ii) Not black

(iii) Neither white nor black

Sol:

Total no. of possible outcomes = 8 + 6 + 4 = 18 {8 red, 6 white, 4 black}

(i) E ⟶ event of getting red or white ball

No. of favourable outcomes = 4 {4 black balls}

P(E) = $\frac{4}{18} = \frac{2}{9}$

$(\bar{E}) \longrightarrow event\ of\ not\ getting\ black\ ball$

P$(\bar{E}) = 1 - P(E) = 1 - \frac{2}{9} = \frac{7}{9}$

(ii) E ⟶ event of getting neither white nor black.
No. of favourable outcomes = 15 – 6 – 4 = 8 {Total balls – no. of white balls – no. of black balls}
P(E) = $\frac{8}{18} = \frac{4}{9}$

37. Find the probability that a number selected at random from the numbers 1, 2, 3, ..., 35 is a
(i) Prime number (ii) Multiple of 7 (iii) Multiple of 3 or 5

Sol:
Total no. of possible outcomes = 35 {1, 2, 3, …. 35}
(i) E ⟶ event of getting a prime no.
No. of favourable outcomes = 11 {2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{11}{35}$
(ii) E ⟶ event of getting no. which is multiple of 7
No. of favourable outcomes = 5 {7, 14, 21, 28, 35}
P(E) = $\frac{5}{35} = \frac{1}{7}$
(iii) E ⟶ event of getting no which is multiple of 3 or 5
No. of favourable outcomes = 16 {3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 5, 10, 20, 25, 35}
P(E) = $\frac{16}{35}$

38. From a pack of 52 playing cards Jacks, queens, kings and aces of red colour are removed. From the remaining, a card is drawn at random. Find the probability that the card drawn is
(i) A black queen
(ii) A red card
(iii) A black jack
(iv) a picture card (Jacks, queens and kings are picture cards)

Sol:
Total no. of cards = 52
All jacks, queens & kings, aces of red colour are removed.
Total no. of possible outcomes = 52 – 2 – 2 – 2 – 2 = 44 {remaining cards}
(i) E ⟶ event of getting a black queen
No. of favourable outcomes = 2 {queen of spade & club}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
P(E) = $\frac{2}{44} = \frac{1}{22}$
(ii) E ⟶ event of getting a red card
No. of favourable outcomes = 26 – 8 = 18 {total red cards – jacks, queens, kings, aces of red colour}

P(E) = $\frac{18}{44} = \frac{9}{22}$

(iii) E ⟶ event of getting a black jack

No. of favourable outcomes = 2 {jack of club & spade}

P(E) = $\frac{2}{44} = \frac{1}{22}$

(iv) E ⟶ event of getting a picture card

No. of favourable outcomes = 6 {2 jacks, 2 kings & 2 queens of black colour}

P(E) = $\frac{6}{44} = \frac{3}{22}$

39. 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

(i) an orange flavoured candy?

(ii) a lemon flavoured candy?

Sol:

(i) The bag contains lemon flavoured candies only. So, the event that malini will take out an orange flavoured candy is an impossible event. Since, probability of impossible event is O, P(an orange flavoured candy) = 0

(ii) The bag contains lemon flavoured candies only. So, the event that malini will take out a lemon flavoured candy is sure event. Since probability of sure event is 1, P(a lemon flavoured candy) = 1

40. It is given that m 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?

Sol:

Let E ⟶ event of 2 students having same birthday P(E) is given as 0.992

Let $(\bar{E})$ ⟶ event of 2 students not having same birthday.

We know that, P(E) + P$(\bar{E}) = 1$

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

= 1 – 0.992

= 0.008

41. 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? (ii) not red?

Sol:

Total no. of possible outcomes = 8 {3 red, 5 black}

(i) E ⟶ event of getting red ball.

No. of favourable outcomes = 3 {3 red}

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

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

(ii) $\bar{E}$ $\longrightarrow$ event of getting no red ball.

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

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

$= 1 - \frac{3}{8} = \frac{5}{8}$

42. (i) A lot of 20 bulbs contain 4 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is defective?

(ii) Suppose the bulb drawn in

(a) is not defective and nõt replaced. Now bulb is drawn at random from the rest. What is the probability that this bulb is not defective?

Sol:

Total no. of possible outcomes = 20 {20 bulbs}

(i) E $\longrightarrow$ be event of getting defective bulb.

No. of favourable outcomes = 4 {4 defective bulbs}

$\text{Probability, P(E)} = \frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}} = \frac{4}{20} = \frac{1}{5}$

(ii) Bulb drawn in is not detective & is not replaced remaining bulbs = 15 good + 4 bad bulbs = 19

Total no. of possible outcomes = 19

E $\longrightarrow$ be event of getting defective

No. of favorable outcomes = 15 (15 good bulbs)

$\text{P(E)} = \frac{15}{9}$

43. A box contains 90 discs which are numbered from 1 to 90. If one discs is drawn at random from the box, find the probability that it bears

(i) a two digit number

(ii) a perfect square number

(iii) (iii) a number divisible by 5.

Sol:

Total no. of possible outcomes = 90 {1, 2, 3, … 90}

(i) E $\longrightarrow$ event of getting 2 digit no.

No. of favourable outcomes = 81 {10, 11, 12, …. 90}

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

P(E) = $\frac{81}{90}$

(ii) E $\longrightarrow$ event of getting a perfect square.

No. of favourable outcomes = 9 {1, 4, 9, 16, 25, 26, 49, 64, 81}

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

(iii) E ⟶ event of getting a no. divisible by 5.
No. of favourable outcomes = 18 {5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90}
P(E) = $\frac{18}{90} = \frac{1}{5}$

44. A lot consists of 144 ball pens of which 20 are defective and others good. Nun will buy a pen if it is good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that
(i) She will buy it? (ii) She will not buy it?
Sol:
No. of good pens = 144 – 20 = 24
No. of detective pens = 20
Total no. of possible outcomes = 144 {total no pens}
(i) E ⟶ event of buying pen which is good.
No. of favourable outcomes = 124 {124 good pens}
P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
P(E) = $\frac{124}{144} = \frac{31}{36}$
(ii) $\bar{E}$ ⟶ event of not buying a pen which is bad P(E) + P($\bar{E}$) = 1
$P(E) + P(\bar{E}) = 1$
P($\bar{E}$) = 1 - P(E)
$= 1 - \frac{31}{36} = \frac{5}{36}$

45. 12 defective pens are accidently mixed with 132 good ones. It is not possible to just look at 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 good one.
Sol:
No. of good pens = 132
No. of defective pens = 12
Total no. of possible outcomes = 12 + 12 {total no of pens}
E ⟶ event of getting a good pen.
No. of favourable outcomes = 132 {132 good pens}
P (E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
∴ P(E) = $\frac{132}{144} = \frac{66}{72} = \frac{33}{36} = \frac{11}{2}$

46. 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 a side, what is the probability that the second card picked up is
a. an ace?
b. a queen?

Sol:

Total no. of possible outcomes = 5 {5 cards}

(i) E ⟶ event of getting a good pen.
No. of favourable outcomes = 132 {132 good pens}
P (E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
∴ P(E) = $\frac{1}{5}$

(ii) If queen is drawn & put aside,
Total no. of remaining cards = 4
(a) E ⟶ event of getting a queen.
No. of favourable outcomes = 1 {1 ace card}
Total no. of possible outcomes = 4 {4 remaining cards}
P(E) = $\frac{1}{4}$
(b) E ⟶ event of getting a good pen.
No. of favourable outcomes = 0 {there is no queen}
P(E) = $\frac{0}{4} = 0$
∵ E is known as impossible event.

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

Sol:

Total no. of possible outcomes = 4 which are{HT, HH, TT, TH}
E ⟶ event of getting at least one head
No. of favourable outcomes = 3 {HT, HH, TH}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
P(E) = $\frac{3}{4}$

48. Two dice, one blue and one grey, are thrown at the same time. Complete the following table:

Event: 'Sum on two dice'	2	3	4	5	6	7	8	9	10	11	12
Probability											

From the above table a student argues that there are 1 1 possible outcomes 2,3,4,5,6,7, 8, 9, 10, 11 and 12. Therefore, each of them has a probability j-j . Do you agree with this argument?

Sol:

Total no. of possible outcomes when 2 dice are thrown = $6 \times 6 = 36$ which are

{ (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) }

E ⟶ event of getting sum on 2 dice as 2

No. of favourable outcomes = 1{(1, 1)}

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

P(E) = $\frac{1}{36}$

E ⟶ event of getting sum as 3

No. of favourable outcomes = 2 {(1, 2) (2, 1)}

P(E) = $\frac{2}{36}$

E ⟶ event of getting sum as 4

No. of favourable outcomes = 3 {(3, 1) (2, 2) (1, 3)}

P(E) = $\frac{3}{36}$

E ⟶ event of getting sum as 5

No. of favourable outcomes = 4 {(1, 4) (2, 3) (3, 2) (4, 1)}

P(E) = $\frac{4}{36}$

E ⟶ event of getting sum as 6

No. of favourable outcomes = 5 {(1, 5) (2, 4) (3, 3) (4, 2) (5, 1)}

P(E) = $\frac{6}{36}$

E ⟶ event of getting sum as 7

No. of favourable outcomes = 6 {(1, 6) (2, 5) (3, 4) (4, 3) (5, 2) (6, 1)}

P(E) = $\frac{6}{36}$

E ⟶ event of getting sum as 8

No. of favourable outcomes = 5 {(2, 6) (3, 5) (4, 4) (5, 3) (6, 2)}

P(E) = $\frac{5}{36}$

E ⟶ event of getting sum as 9

No. of favourable outcomes = 4 {(3, 6) (4, 5) (5, 4) (6, 3)}

P(E) = $\frac{4}{36}$

E ⟶ event of getting sum as 10

No. of favourable outcomes = 3 {(4, 6) (5, 5) (6, 4)}

P(E) = $\frac{3}{36}$

E ⟶ event of getting sum as 11

No. of favourable outcomes = 2 {(5, 6) (6, 5)}

P(E) = $\frac{2}{36}$

E ⟶ event of getting sum as 12

No. of favourable outcomes = 1 {(6, 6)}

P(E) = $\frac{1}{36}$

Event 'Sum on two dice'	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

No, the outcomes are not equally likely from the above table we see that, there is different probability for different outcome

49. Cards marked with numbers 13, 14, 15, ..., 60 are placed in a box and mixed thoroughly. One card is drawn at random from the box. Find the probability that number on the card drawn is

(i) divisible by 5

(ii) a number is a perfect square

Sol:

Total no. of possible outcomes = 48 {13, 14, 15, …., 60}

(i) E ⟶ event of getting no divisible by 5

No. of favourable outcomes = 10{15, 20, 25, 30, 35, 40, 45, 50 55, 60}

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

P(E) = $\frac{10}{48} = \frac{5}{24}$

(ii) E ⟶ event of getting a perfect square.

No. of favourable outcomes = 4 {16, 25, 36, 49}

P(E) = $\frac{4}{48} = \frac{1}{12}$

50. A bag contains 6 red balls and some blue balls. If the probability of drawing a blue ball the bag is twice that of a red ball, find the number of blue balls in the bag.

Sol:

No of red balls = 6

Let no. of blue balls = x

Total no. of possible outcomes = 6 + x(total no. of balls)

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

P(blue ball) = 2 P(red ball)

⇒ $\frac{x}{x+6} = \frac{2(6)}{x+6}$

⇒ x = 2(6)

x = 12

∴ No of blue balls = 12

51. A bag contains tickets numbered 11, 12, 13,..., 30. A ticket is taken out from the bag at random. Find the probability that the number on the drawn ticket
(i) is a multiple of 7
(ii) is greater than 15 and a multiple of 5.

Sol:

Total no. of possible outcomes = 20 {11, 12, 13, ….., 30}

(i) E ⟶ event of getting no. which is multiple of 7
No. of favorable outcomes = 3 {14, 21, 28}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
P(E) = $\frac{3}{20}$

(ii) E ⟶ event of getting no. greater than 15 & multiple of 5
No. of favorable outcomes = 3 {14, 21, 28}
P(E) = $\frac{3}{20}$

52. The king, queen and jack of clubs are removed from a deck of 52 playing cards and the remaining cards are shuffled. A card is drawn from the remaining cards. Find the probability of getting a card of
(i) heart
(ii) queen
(iii) clubs.

Sol:

Total no. of remaining cards = 52 – 3 = 49

(i) E⟶ event of getting hearts
No. of favorable outcomes = 3 {4 – 1}
Probability, P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$
P(E) = $\frac{13}{49}$

(ii) E ⟶ event of getting queen
No. of favorable outcomes = 3 (4 – 1) {Since queen of clubs is removed}
P(E) = $\frac{3}{49}$

(iii) E ⟶ event of getting clubs
No. of favorable outcomes = 10 (13 – 3) {Since 3 club cards are removed}
P(E) = $\frac{10}{49}$

53. Two dice are thrown simultaneously. What is the probability that:
(i) 5 will not come up on either of them?

(ii) 5 will come up on at least one?

(iii) 5 wifi come up at both dice?

Sol:

Total no. of possible outcomes when 2 dice are thrown = $6 \times 6 = 36$ which are

{ (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) }

(i) E ⟶ event of 5 not coming up on either of them

No. of favourable outcomes = 25 which are

{ (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) }

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

P(E) = $\frac{25}{36}$

(ii) E ⟶ event of 5 coming up at least once {(1, 5) (2, 5) (3, 5) (4, 5) (5, 5) (5, 1) (5, 2) (5, 3) (5, 4) (5, 6) (6, 5)}

P(E) = $\frac{11}{36}$

(iii) E ⟶ event of getting 5 on both dice

No. of favourable outcomes = 1 { (5, 5) }

P(E) = $\frac{1}{36}$

54. Fill in the blanks:

(i) Probability of a sure event is...........

(ii) Probability of an impossible event is...........

(iii) The probability of an event (other than sure and impossible event) lies between……

(iv) Every elementary event associated to a random experiment has .... probability.

(v) Probability of an event A + Probability of event 'not A' —...........

(vi) Sum of the probabilities of each outcome m an experiment is ....

Sol:

(i) 1, ∵ P(sure event) = 1

(ii) 0, ∵ P(impossible event) = 0

(iii) 0 & 1, ∵ O ∠ P(E) ∠ 1

(iv) Equal

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

(vi) 1

55. Examine each of the following statements and comment:

(i) If two coins are tossed at the same time, there are 3 possible outcomes—two heads, two tails, or one of each. Therefore, for each outcome, the probability of occurrence is 1/3

(ii) (ii) If a die is thrown once, there are two possible outcomes—an odd number or an even number. Therefore, the probability of obtaining an odd number is 1 /2 and the probability of obtaining an even number is $\frac{1}{2}$.

Sol:

(i) Given statement is incorrect. If 2 coins are tossed at the same time,

Total no. of possible outcomes = 4 {HH, HT, TH, TT}

P(HH) = P(HT) = P(TH) = P(TT) = $\frac{1}{4}$ {$\because$ Probability = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$}

I.e. for each outcome, probability of occurrence is $\frac{1}{4}$

Outcomes can be classified as (2H, 2T, 1H & 1T) P(2H) = $\frac{1}{4}$, P(2T) = $\frac{1}{4}$, P(1H & 1T) = $\frac{2}{4}$

Events are not equally likely because the event 'one head & 1 tail' is twice as likely to occur as remaining two.

(ii) This statement is true

When a die is thrown; total no. of possible outcomes = 6 {1, 2, 3, 4, 5, 6}

These outcomes can be taken as even no. & odd no.

P(even no.) = P(2, 4, 6) = $\frac{3}{6} = \frac{1}{2}$

P(odd no.) = $p(1, 3, 5)$ = $\frac{3}{6} = \frac{1}{2}$

$\therefore$ Two outcomes are equally likely

56. A box contains loo red cards, 200 yellow cards and 50 blue cards. If a card is drawn at random from the box, then find the probability that it will be

(i) a blue card

(ii) not a yellow card

(iii) neither yellow nor a blue card.

Sol:

Total no. of possible outcomes = 100 + 200 + 50 = 350 {100 red, 200 yellow & 50 blue}

(i) E $\longrightarrow$ event of getting blue card.

No. of favourable outcomes = 50 {50 blue cards}

P(E) = $\frac{50}{350} = \frac{1}{7}$

(ii) E ⟶ event of getting yellow card

No. of favourable outcomes = 200 {200 yellow}

P(E) = $\frac{200}{350} = \frac{4}{7}$

$\bar{E}$ ⟶ event of not getting yellow card

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

$= 1 - \frac{4}{7} = \frac{3}{7}$

(iii) E ⟶ getting neither yellow nor a blue card

No. of favourable outcomes = 350 – 200 – 50 = 100 {removing 200 yellow & 50 blue cards}

P(E) = $\frac{100}{350} = \frac{2}{7}$

57. A number is selected at random from first 50 natural numbers. Find the probability that it is a multiple of 3 and 4.

Sol:

Total no. of possible outcomes = 50 {1, 2, 3 …. 50}

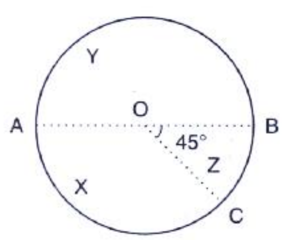
No. of favourable outcomes = 4 {12, 24, 36, 48}

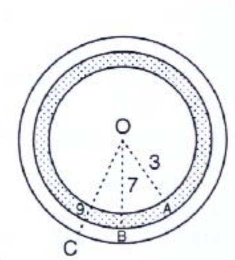
P(E) = $\frac{\text{No.of favorable outcomes}}{\text{Total no.of possible outcomes}}$

P(E) = $\frac{4}{50} = \frac{2}{25}$

Exercise – 13.2

1. In the accompanying diagram a fair spinner is placed at the center O of the circle. Diameter AOB and radius OC divide the circle into three regions labelled X, Y and Z. If ∠BOC = 45°. What is the probability that the spinner will land in the region X? (See fig)





Sol:

Given ∠BOC = 45°

∠AOC = 180 – 45 = 135°

Area of circle = πr^2

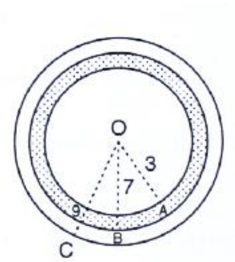
Area of region $\times = \frac{\theta}{360°} \times \pi r^2$

$= \frac{135}{360} \times \pi r^2 = \frac{3}{8}\pi r^2$

Probability that the spinner will land in the region

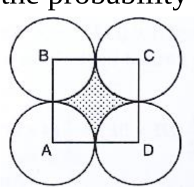
X = $\frac{Area\ of\ region\ x}{total\ area\ of\ circle} = \frac{\frac{3}{8}\pi r^2}{\pi r^2} = \frac{3}{8}$

2. A target shown in Fig. below consists of three concentric circles of radii, 3, 7 and 9 cm respectively. A dart is thrown and lands on the target. What is the probability that the dart will land on the shaded region?



Sol:
1^{st} circle ⟶ with radius 3
2^{nd} circle ⟶ with radius 7
3^{rd} circle ⟶ with radius 9
Area of 1^{st} circle = $(3)^2 = 9\pi$
Area of 2^{nd} circle= $(7)^2 = 49\pi$
Area of 3^{rd} circle = $(9)^2 = 81\pi$
Area of shaded region = Area of 2^{nd} circle – area of 1^{st} circle
$= 49\pi - 9\pi$
$= 40\pi$
Probability that will land on the shaded region = $\frac{area\ of\ shaded\ region}{area\ of\ 3rd\ circle} = \frac{40\pi}{81\pi} = \frac{40}{81}$

3. In below Fig., points A, B, C and D are the centers of four circles that each have a radius of length one unit. If a point is selected at random from the interior of square ABCD. What is the probability that the point will be chosen from the shaded region?



Sol:
Radius of circle = 1cm
Length of side of square = 1 + 1 = 2cm
Area of square = 2 × 2 = $4cm^2$
Area of shaded region = area of square – 4 × area of quadrant
= $4 - 4\left(\frac{1}{4}\right)\pi(1)^2$
= $(4 - \pi)\ cm^2$

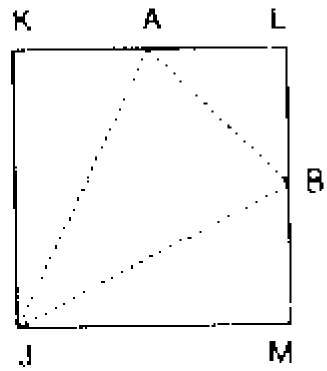
Probability that the point will be chosen from the shaded region = $\frac{Area\ of\ shaded\ region}{Area\ of\ square\ ABCD}$

$= \frac{4-\pi}{4} = 1 - \frac{\pi}{4}$

Since geometrical probability,

P(E) = $\frac{Measure\ of\ specified\ part\ of\ region}{Measure\ of\ the\ whole\ region}$

4. In the Fig. below, JKLM is a square with sides of length 6 units. Points A and B are the mid- points of sides KL and LM respectively. If a point is selected at random from the interior of the square. What is the probability that the point will be chosen from the interior of ΔJAB?



Sol:

Length of side of square JKLM = 6 cm

Area of square JKLM = 6^2 = 36 cm^2

Since A & B are the mid points of KL & LM

KA = AL = LB = LM = 3 cm

Area of Δ AJB = area of square – area of Δ AKJ – area of Δ ALB – area of Δ BMJ

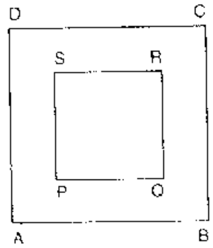
$= 36 - \frac{1}{2} \times 6 \times 3 - \frac{1}{2} \times 6 \times 3$

$= 36 - 9 - 4.5 - 9$

$= 13.5\ sq.units$

Probability that the point will be chosen from the interior of ΔAJB = $\frac{Area\ of\ \Delta AJB}{Area\ of\ square}$

5. In the Fig. below, 13, a square dart board is shown. The length of a side of the larger square is 1.5 times the length of a side of the smaller square. If a dart is thrown and lands on the larger square. What is the probability that it will land in the interior of the smaller square?



Sol:

Let length of side of smaller square = a

Then length of side of bigger square = 1.5a

Area of smaller square = a^2

Area of bigger square = $(1.5)^2a^2 = 2.25a^2$.

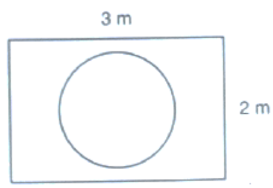
Probability that dart will land in the interior of the smaller square = $\frac{Area\ of\ smaller\ square}{Area\ of\ bigger\ square}$

$= \frac{a^2}{2.25a^2} = \frac{1}{2.25}$

∵ Geometrical probability,

$P(E) = \frac{measure\ of\ specified\ region\ part}{measure\ of\ the\ whole\ region}$

6. Suppose you drop a tie at random on the rectangular region shown in Fig. below. What is the probability that it will land inside the circle with diameter 1 m?



Sol:

Area of circle with radius 0.5 m

A circle = $(0.5)^2 = 0.25\ \pi m^2$

Area of rectangle = $3 \times 2 = 6m^2$

Probability (geometric) = $\frac{measured\ of\ specified\ region\ part}{measure\ of\ whole\ region}$

Probability that tie will land inside the circle with diameter 1m

$= \frac{area\ of\ circle}{area\ of\ rectangle}$

$= \frac{0.25\pi m^2}{6\ m^2}$

$= \frac{1}{4} \times \frac{\pi}{6}$

$= \frac{\pi}{24}$