Introduction

We must have understanding of the terms and concepts given below:

Experiment: An activity that can result in some well-defined outcomes is experiment. For ex. tossing a coin is an experiment.

Random experiment: It is an experiment in which all possible outcomes are known but not sure about specific outcome.

Event: The possible outcomes of an experiment is an event

Equally likely events: outcomes of an experiment are equally likely if each has the same chance of occurring

Probability of occurrence of an event: Suppose E is any event. Then Probability of occurrence of E is given by

$$P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

Some Experiments and their outcomes:

(a) Tossing a coin: when we toss a coin, all possible outcomes are Head (H) and Tail (T)

(b) Tossing two coins: when we toss two coins, all possible outcomes are {HH, HT, TH, TT}

(c) Throwing a die: when we throw a die, all possible outcomes are {1, 2, 3, 4, 5, 6}

(d) Drawing a card from a well shuffled deck of 52 cards:

Total number of cards in a deck = 52 cards

Red cards = 26 and Black cards = 26

There are 4 suits namely spades, clubs, hearts and diamonds each having 13 cards

Cards of spades and clubs are black cards and cards of heart and diamond are red cards.

Kings, queens and jacks are face cards. Thus there are 12 face cards in total.

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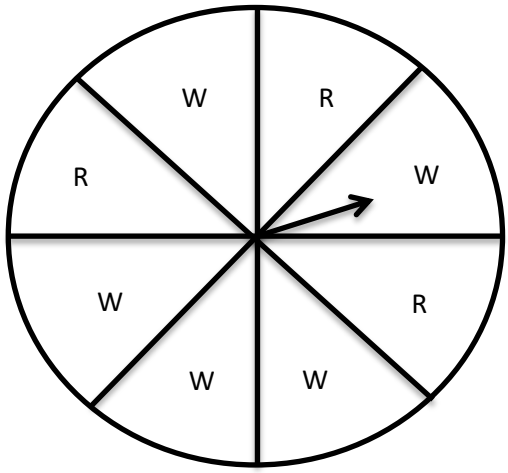
Examples:

Example 1 – The adjoining figure shows a spinning wheel divided into eight sectors. Three of these sectors are painted red and the remaining five are painted white, as shown. The wheel is spinned. What is the probability of getting (a) a white sector? (b) a red sector?



Solution - It is a spinning wheel divided into 8 sectors

Total sectors = 8

Number of sectors painted red = 3

Number of sectors painted white = 5

P (getting a white sector) = 5/8

P (getting a red sector) = 3/8

Example 2 – A coin is tossed. What is the probability of getting a head?

Solution - Possible outcomes in tossing of a coin = {H, T}

Total outcomes = 2

P (getting a head) = 1/2

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Example 3 – When 2 coins are tossed simultaneously, what are all possible outcomes? In a single throw of 2 coins, what is the probability of getting (a) both heads? (b) at least 1 head?

Solution - Possible outcomes in tossing two coins = {HH, HT, TH, TT}

Total outcomes = 4

(a) P (getting both heads) =?

Number of such outcomes = 1 (HH)

So, P (getting both heads) = 1/4

(b) P (getting at least 1 head) =?

Number of times at least 1 head occurs =3 (HH, HT, TH)

So, P (getting at least 1 head) = 3/4

Example 4 – There are 35 students in a class, of whom 20 are boys and 15 are girls. From these students, one is chosen at random. What is the probability that the chosen student is a (a) boy? (b) Girl?

Solution - Given that total number of students in a class = 35

Number of boys = 20

Number of girls = 15

(a) P (student is a boy) = 20/35 = 4/7

(b) P (student is a girl) = 15/35 = 3/7

Example 5 – A bag contains 6 red and 8 green balls. They are mixed thoroughly and one ball is drawn at random. Find the probability of getting (a) a red ball, (b) a green ball.

Solution - Total number of balls in a bag = 6+8 = 14

Number of red balls = 6

Number of green balls = 8

(a) P (getting a red ball) = 6/14 = 3/7

(b) P (getting a green ball) = 8/14 = 4/7

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Example 6 – A die is thrown. What is the probability of getting (a) a prime number? (b) a number greater than 4? (c) a number not greater than 5?

Solution - Possible outcomes when a die is thrown = {1, 2, 3, 4, 5, 6}

Total number of outcomes = 6

(a) P (prime numbers) =?

Prime numbers = 2, 3, 5

Number of prime numbers = 3

So, P (prime numbers) = 3/6 = 1/2

(b) P (number greater than 4) =?

Numbers greater than 4 are 5 and 6

So, P (number greater than 4) = 2/6 = 1/3

(c) P (number not greater than 5) =?

Numbers not greater than 5 are numbers that are smaller than or equal to 5 = 1, 2, 3, 4, and 5

So, P (number not greater than 5) = 5/6

Example 7 – Ten cards are numbered as 1, 2, 3, 4 ….10 respectively. They are kept in a box and mixed thoroughly. One card is chosen at random from the box. What is the probability of (a) getting the number 8 (b) getting a number less than 5 (c) getting a number greater than 4 (d) getting a 1-digit number

Solution - Ten cards numbered as 1, 2 ….10.

Total number of outcomes = 10

(a) Since number 8 is only one in number

So, P (getting the number 8) = 1/10

(b) Numbers less than 5 are 1, 2, 3 and 4

Total = 4

So, P (getting a number less than 5) = 4/10 = 2/5

(c) Numbers greater than 4 are 5, 6, 7, 8, 9, and 10

Total = 6

So, P (getting a number greater than 4) = 6/10 = 3/5

(d) Out of given numbers, total one digit numbers = 9

So, P (getting a 1-digit number) = 9/10

Example 8 – From a well-shuffled deck of 52 cards, one card is drawn at random. What is the probability that the card drawn is (a) a diamond (b) an ace (c) 5 of club

Solution - Total number of cards = 52

(a) Number of diamonds = 13

So, P (getting a diamond) = 13/52 = 1/4

(b) Number of ace = 4

So, P (getting an ace) = 4/52 = 1/26

(c) Number of 5 of club = 1

So, P (getting 5 of club) = 1/52

Example 9 – From a well-shuffled deck of 52 cards, one card is drawn at random. Find the probability of getting (a) a red card (b) a 10 of black cards (c) a face card

Solution - Total number of cards = 52

(a) Number of red cards = 26

So, P (getting a red card) = 26/52 = 1/2

(b) Number of 10 of black cards = 2

So, P (getting a 10 of black card) = 2/52 = 1/26

(c) Number of face cards = 12

So, P (getting a face card) = 12/52 = 3/13

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Exercise 25A

Question 1 – (a) A coin is tossed. What are all possible outcomes?

(b) Two coins are tossed simultaneously. What are all possible outcomes?

(c) A die is thrown. What are all possible outcomes?

(d) From a well-shuffled deck of 52 cards, one card is drawn at random. What is the number of all possible outcomes?

Solution - (a) When a coin is tossed, possible outcomes are Head (H) and Tail (T)

(b) When we toss two coins, all possible outcomes are {HH, HT, TH, TT}

(c) When a die is thrown, possible outcomes are {1, 2, 3, 4, 5, 6}

(d) When a card is drawn from a well shuffled deck of 52 cards, then the number of all possible outcomes = 52

Question 2 – In a single throw of a coin, what is the probability of getting a tail?

Solution - Possible outcomes in tossing of a coin = {H, T}

Total outcomes = 2

P (getting a tail) = 1/2

Question 3 – In a single throw of two coins, find the probability of getting (a) both tails (b) at least 1 tail (c) at most 1 tail.

Solution - Possible outcomes in tossing two coins = {HH, HT, TH, TT}

Total outcomes = 4

(a) P (getting both tails) =?

Number of such outcomes = 1 (TT)

So, P (getting both tails) = 1/4

(b) P (getting at least 1 tail) =?

Number of times at least 1 tail occurs =3 (TT, HT, TH)

So, P (getting at least 1 tail) =3/4

(c) P (getting at most 1 tail) =?

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Number of times at most 1 tail occurs =3 (HH, HT, TH)

So, P (getting at most 1 tail) =3/4

Question 4 – A bag contains 4 white and 5 blue balls. They are mixed thoroughly and one ball is drawn at random. What is the probability of getting (a) a white ball (b) a blue ball?

Solution - Number of white balls = 4

Number of blue balls = 5

Total balls in bag = 4 +5 = 9

(a) P (white ball) = 4/9

(b) P (blue ball) = 5/9

Question 5 – A bag contains 5 white, 6 red and 4 green balls. One ball is drawn at random. What is the probability that the ball drawn is (a) green (b) white (c) non-red?

Solution - Number of white balls = 5

Number of red balls = 6

Number of green balls = 4

Total balls in a bag = 5+6+4 = 15

(a) P (green ball) = 4/15

(b) P (white ball) = 5/15 = 1/3

(c) Number of non-red balls = 15 – 6 = 9

Thus, P (non-red balls) = 9/15 = 3/5

Question 6 – In a lottery, there are 10 prizes and 20 blanks. A ticket is chosen at random. What is the probability of getting a prize?

Solution - Number of prizes in lottery = 10

Number of blanks in a lottery = 20

Total tickets in lottery = 10+20 = 30

P (getting a prize) = 10/30 = 1/3

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Question 7 – It is known that a box of 100 electric bulbs contains 8 defective bulbs. One bulb is taken out at random from the box. What is the probability that the bulb drawn is (a) defective (b) non-defective?

Solution - Total electric bulbs on a box = 100

Number of defective bulbs = 8

Number of non-defective bulbs = 100 – 8 = 92

(a) P (bulb is defective) = 8/100 = 2/25

(b) P (bulb is non-defective) = 92/100 = 46/50 = 23/25

Question 8 – A die is thrown at random. Find the probability of getting (a) 2 (b) a number less than 3 (c) a composite numbers (d) a number not less than 4

Solution - When a die is thrown, possible outcomes = {1, 2, 3, 4, 5, 6}

Total outcomes = 6

(a) P (getting 2) = 1/6

(b) Numbers less than 3 are 1 and 2

P (a number less than 3) = 2/6 = 1/3

(c) Composite numbers = 4 and 6

P (composite number) = 2/6 = 1/3

(d) Numbers not less than 4 = numbers greater than or equal to 4 = 4, 5 and 6

P (a number not less than 4) = 3/6 =1/2

Question 9 – In a survey of 200 ladies, it was found that 82 like coffee while 118 dislike it. From these ladies, one is chosen at random. What is the probability that the chosen lady dislike coffee?

Solution - Total ladies in a survey = 200

Number of ladies like coffee = 82

Number of ladies dislike coffee = 118

P (a lady who dislike coffee) = 118/200 = 59/100

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Question 10 – A box contains 19 balls bearing numbers 1, 2, 3 ….19 respectively. A ball is drawn at random from the box. Find the probability that the number on the ball is (a) a prime number (b) an even number (c) a number divisible by 3

Solution - Total number of balls bearing numbers 1, 2 …19 in a box = 19

(a) Prime numbers = 2, 3, 5, 7, 11, 13, 17, 19

Number of prime numbers = 8

P (ball bearing prime number) = 8/19

(b) Even numbers = 2, 4, 6, 8, 10, 12, 14, 16, 18

Number of even numbers = 9

P (ball bearing an even number) = 9/19

(c) Number divisible by 3 = 3, 6, 9, 12, 15, and 18

P (ball bearing number divisible by 3) = 6/19

Question 11 – One card is drawn at random from a well-shuffled deck of 52 cards. Find the probability that the card drawn is (a) a king (b) a spade (c) a red queen (d) a black 8

Solution - Total cards in a deck = 52

(a) Number of kings = 4

P (card is king) = 4/52 = 1/13

(b) Number of spades = 13

P (card is spade) = 13/52 =1/4

(c) Number of red queen = 2

P (card is a red queen) = 2/52 = 1/26

(d) Number of black 8 = 2

P (card is a black 8) = 2/52 = 1/26

Question 12 – One card is drawn at random from a well-shuffled deck of 52 cards. Find the probability that the card drawn is (a) 4 (b) a queen (c) a black card.

Solution - Total cards in a deck = 52

(a) Number of 4 in total cards = 4

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P (card is 4) = 4/52 = 1/13

(b) Number of queens = 4

P (card is a queen) = 4/52 = 1/13

(c) Number of black cards = 26

P (card is a black card) = 26/52 = ½

Exercise 25 B

Question 1 – In a spinning wheel, there are 3 white and 5 green sectors. It is spinned. What is the probability of getting a green sector?

Solution - Number of white sectors in a spinning wheel = 3

Number of green sectors in spinning wheel = 5

Total sectors = 3+5 = 8

P (getting a green sector) = 5/8

Question 2 – 8 cards are numbered as 1, 2, 3, 4, 5, 6, 7, 8 respectively. They are kept in a box and mixed thoroughly. One card is chosen at random. What is the probability of getting a number less than 4?

Solution - Total number of cards numbers as 1, 2….8 = 8

Number less than 4 = 1, 2, and 3

P (a number less 4) = 3/8

Question 3 – Two coins are tossed simultaneously. What is the probability of getting one head and one tail?

Solution - Possible outcomes in tossing two coins = {HH, HT, TH, TT}

Total outcomes = 4

Number of outcomes of getting one head and one tail = 2

P (getting 1 head and 1 tail) = 2/4 = 1/2

Question 4 – A bag contains 3 white and 2 red balls. One ball is drawn at random. What is the probability that the ball drawn is red?

Solution - Number of white balls = 3

Number of red balls = 2

Total balls = 3+2 = 5

P (ball is red) = 2/5

Question 5 – A die is thrown. What is the probability of getting 6?

Solution - Possible outcomes when a die is thrown = {1, 2, 3, 4, 5, 6}

Total number of outcomes = 6

P (getting 6) = 1/6

Question 6 – A die is thrown. What is the probability of getting an even number?

Solution - Possible outcomes when a die is thrown = {1, 2, 3, 4, 5, 6}

Total number of outcomes = 6

Even numbers = 2, 4, 6

P (getting an even number) = 3/6 = 1/2

Question 7 – From a well-shuffled deck of 52 cards, one card is drawn at random. What is the probability that the drawn card is a queen?

Solution - Total cards in a deck = 52

Number of queens = 4

P (card is a queen) = 4/52 =1/13

Question 8 – From a well-shuffled deck of 52 cards, one card is drawn at random. What is the probability that the drawn card is a black 6?

Solution - Total cards in a deck = 52

Number of black 6 in cards = 2

P (card is a black 6) = 2/52 = 1/26

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