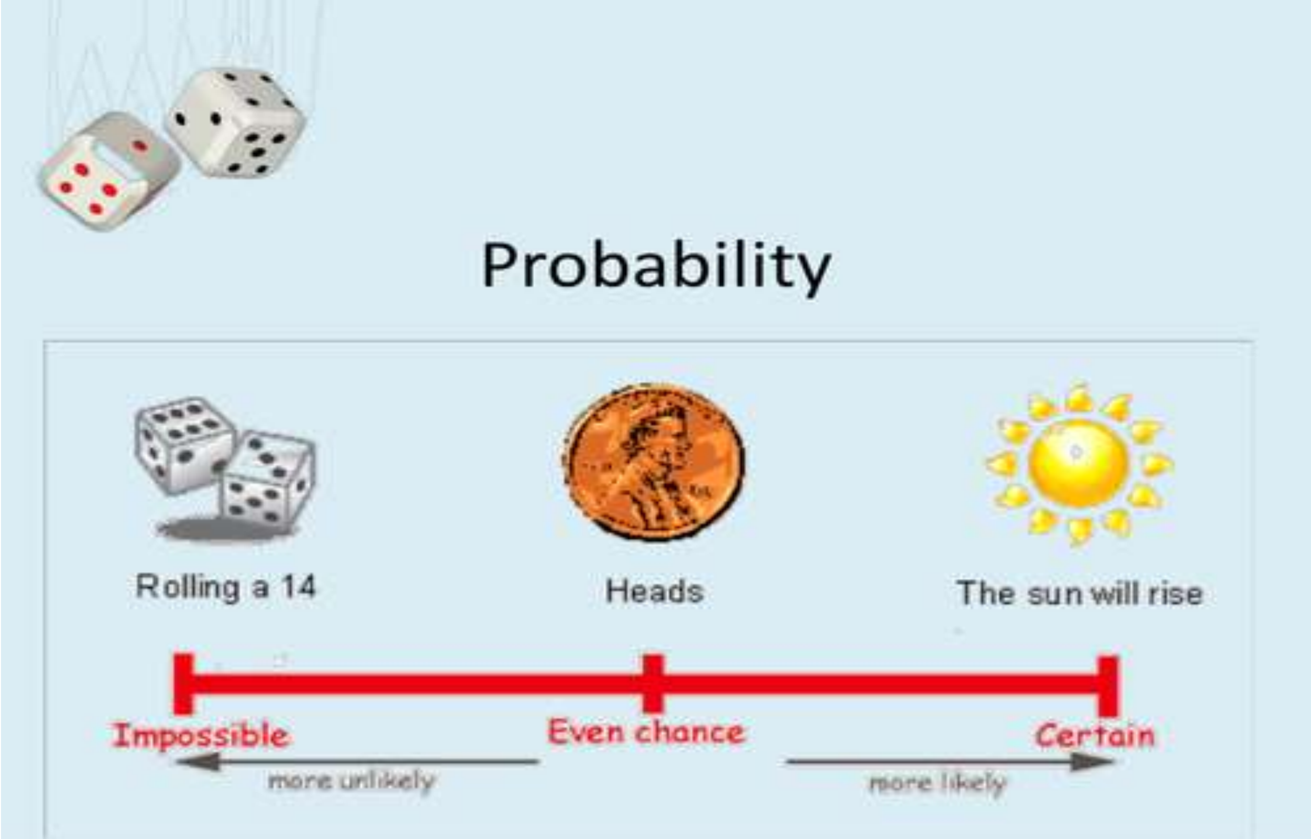
15. PROBABILITY

PROBABILITY :

The branch of mathematics that measures the uncertainty of the occurrence of event and outcome.



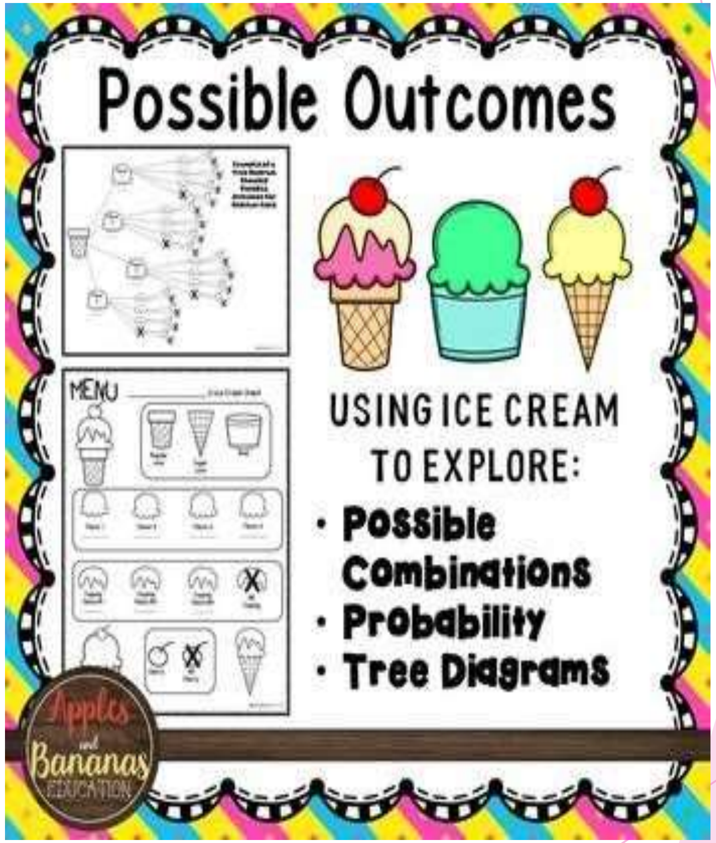
POSSIBLE OUTCOMES :

The chance that something will happen.

we can use words such as impossible, unlikely, possible, even chance, likely and certain.

Example: "It is unlikely to rain tomorrow".

As a number, probability is from 0 (impossible) to 1 (certain).



TRIAL :

A trial is when the experiment is performed once.

It is also known as **empirical probability**.

OUTCOME :

An **Outcome** is a result of a random experiment.

For example, when we roll a dice getting six is an outcome.

EVENT :

An **Event** is a set of outcomes.

For example : when we roll a die, the probability of getting a number less than five is an event.

Note : An Event can have a single outcome.

ELEMENTARY EVENT

An event having only one outcome of the experiment is called an elementary event.

Example:

One trial of this experiment has two possible outcomes: Heads(H) or Tails(T).

So for an individual toss, it has only one outcome, i.e Head or Tail

IMPOSSIBLE EVENT

An event that has no chance of occurring is called an Impossible event, i.e. P(E) = 0. E.g: Probability of getting a 7 on a roll of a die is 0. As 7 can never be an outcome of this trial.

SURE EVENT

An event that has a 100% probability of occurrence is called a sure event.

The probability of occurrence of a sure event is 1.

E.g: What is the probability that a number obtained after throwing a die is less than 7? So, P(E) = P(Getting a number less than 7) = 6/6= 1

EXPERIMENTAL PROBABILITY :

Experimental probability can be applied to any event associated with an experiment that is repeated a large number of times.

Experimental or empirical probability:

$$P(E) = \frac{\text{Number of trials where the event occurred}}{\text{Total Number of Trials}}$$

THEORETICAL PROBABILITY

Theoretical Probability :

$$P(E) = \frac{\text{Number of Outcomes Favourable to E}}{\text{Number of all possible outcomes of the experiment}}$$

SUM OF ALL PROBABILITIES OF ALL THE EVENTS :

The sum of the probabilities of all the elementary events of an experiment is 1.

Example: **Take the coin-tossing experiment.**

$$P(Heads) + P(Tails) = (1/2) + (1/2) = 1$$

RANGE OF PROBABILITY OF AN EVENT :

The range of probability of an event lies between 0 and 1 inclusive of 0 and 1, i.e. $0 \le P(E) \le 1$**.**

COMPLEMENTARY EVENT :

.$P(E)+P(\bar{E}) = 1$**, where E and** $\bar{E}$ **are complementary events.**

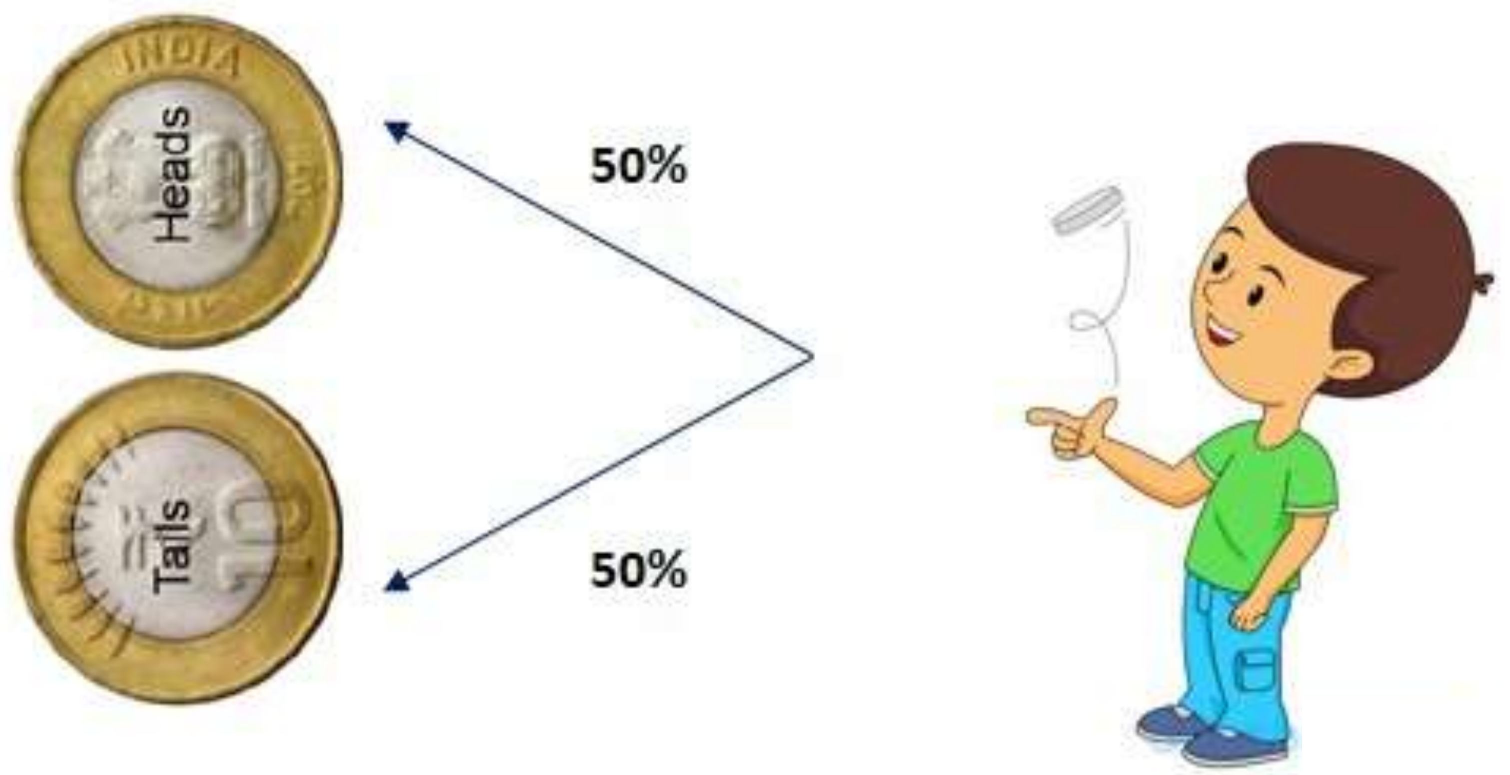
The event $\bar{E}$**, representing 'not E', is called the complement of the event E.**

APPLICATIONS OF PROBABILITY IN REAL LIFE :

VOTE

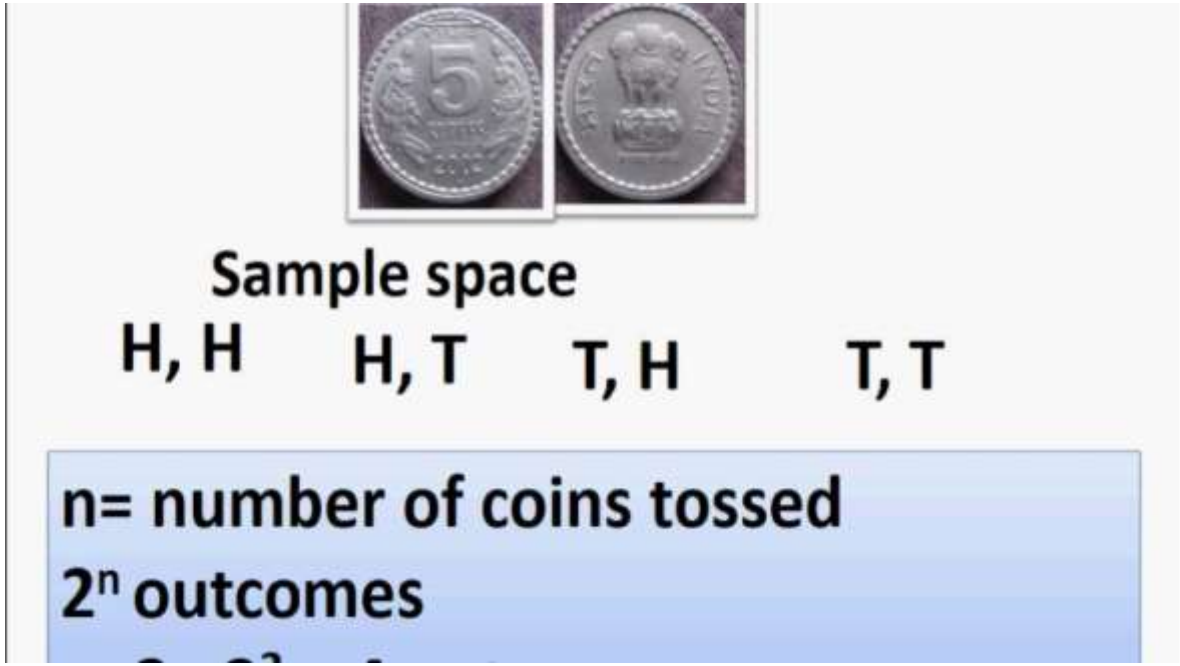
FLIPPING A COIN

TOSSING A COIN :



HEAD OR TAIL = 2 outcomes

TOSSING 2 COINS



TOSSING 3 COINS :

If I toss three coins, what are the possible combinations?

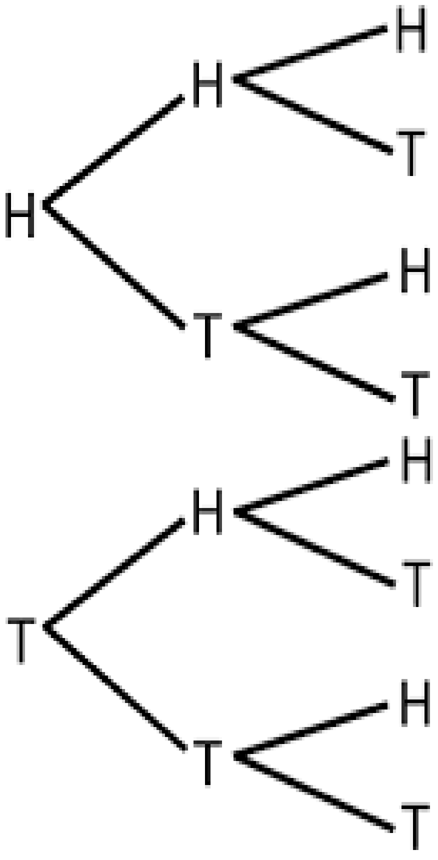
T T T – 0 Heads (3 Tails)

H T T
T H T
T T H
} 1 Head (2 Tails)

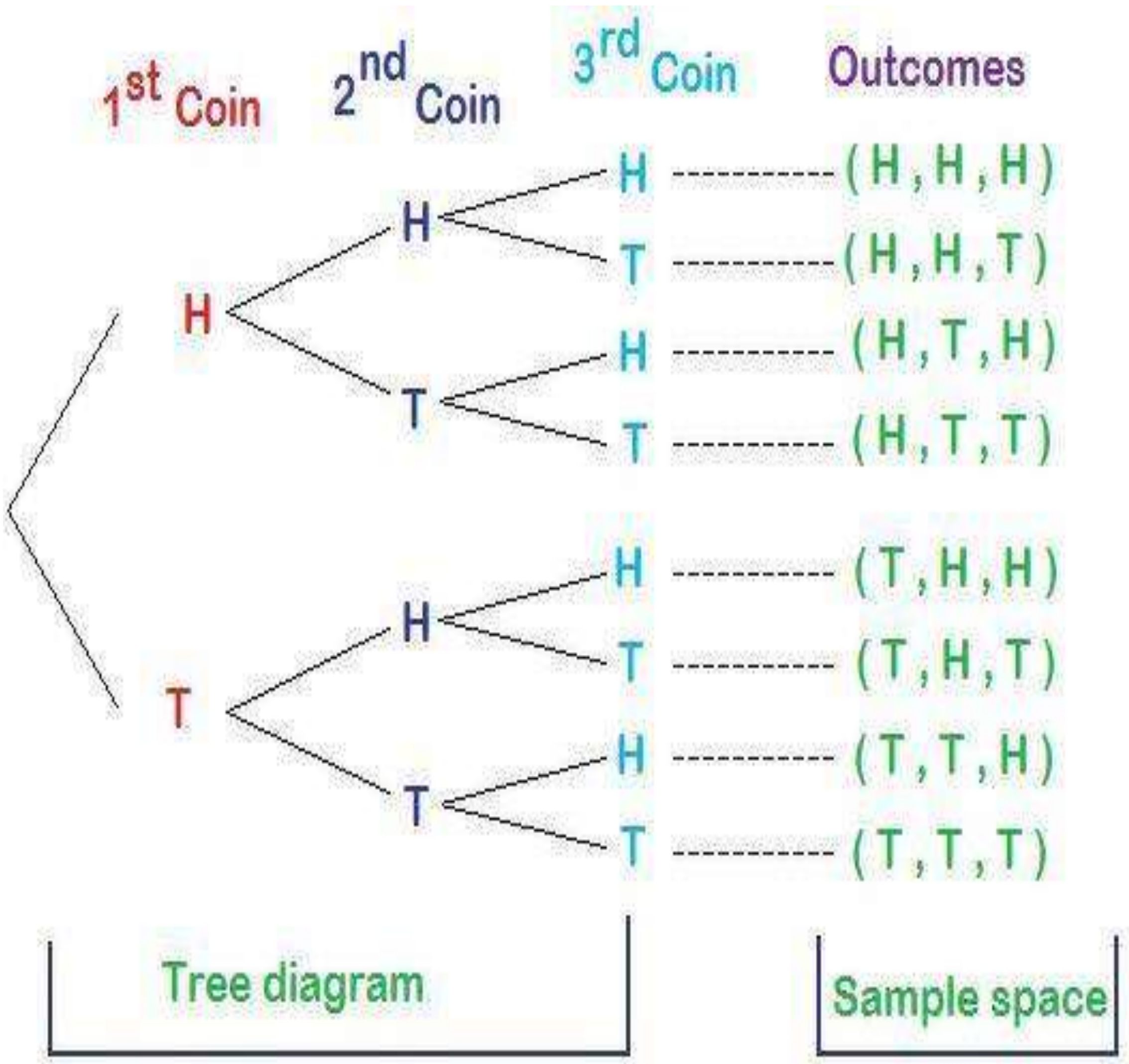
H H T
H T H
T H H
} 2 Heads (1 Tail)

H H H – 3 Heads

There are 8 possible outcomes because 2 x 2 x 2 = 8



COINS



1st Coin
2nd Coin
3rd Coin
Outcomes
H
T
H
T
H
T
H
T
H
T
H
T
H
T
(H, H, H)
(H, H, T)
(H, T, H)
(H, T, T)
(T, H, H)
(T, H, T)
(T, T, H)
(T, T, T)
Tree diagram
Sample space

ROLLING A DIE

OUTCOMES = { 1, 2, 3, 4, 5, 6}

TOTAL NO. OF OUTCOMES = 6

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

EX : 15. 1

1. **Which of the following experiments have equally likely outcomes? Explain.**

   (i) A driver attempts to start a car. The car starts or does not start.

   (ii) A player attempts to shoot a basketball. She/he shoots or misses the shot.

   (iii) A trial is made to answer a true-false question. The answer is right or wrong.

   (iv) A baby is born. It is a boy or a girl.

   Solution:

   (i) It is **not an equally likely** outcome because car will not start only when it is out of order.

   (ii) It is **not an equally likely** outcome because this game depends on many factors.

   (iii) It is an **equally likely** outcome because both have equal chances to happen.

   (iv) It is an **equally likely** outcome because both have equal chances to happen.

EX : 15. 1

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EX : 15. 1

2. Complete the following statements:

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

(ii) The probability of an event that cannot happen is ……… Such an event is called ………

(iii) The probability of an event that is certain to happen is ………. Such an event is called ………

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

(v) The probability of an event is greater than or equal to …………. and less than or equal to ………..

SOLUTION :

(i) Probability of an event E + Probability of the event 'not E' = **1**.

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

(iii) The probability of an event that is certain to happen is **1**. Such an event is called **sure event**.

(iv) The sum of the probabilities of all the elementary events of an experiment is **1**.

(v) The probability of an event is greater than or equal to **0** and less than or equal to **1**.

EX : 15. 1

3. Why is tossing a coin considered to be a fair way of deciding which team should get the bail at the beginning of a football game?

Solution :

Since on tossing a coin, the outcomes 'head' and 'tail' are equally likely, the result of tossing a coin is completely unpredictable and so it is a fair way.

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

(A) $\frac{2}{3}$

(B) –1.5
(C) 15%
(D) 0.7

Sol.

Since, the probability of an event cannot be negative,
∴ (B) –1.5 cannot be the probability of an event.

EX : 15. 1

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

Sol. $\because P_{(E)} + P_{(\text{not } E)} = 1$

$\therefore 0.05 + P_{(\text{not } E)} = 1 \Rightarrow P_{(\text{not } E)} = 1 - 0.05$

$= 0.95$

Thus, probability of 'not E' = 0.95.

EX : 15. 1

6. 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) Since, there are lemon flavoured candies only in the bag,
∴ Taking out any orange flavoured candy is not possible.
⇒ Probability of taking out an orange flavoured candy = 0.

(ii) Also, probability of taking out a lemon flavoured candy = 1.

EX : 15. 1

7. 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?

Sol.

Let the probability of 2 students having same birthday = $P_{(SB)}$

Probability of 2 students not having the same birthday = $P_{(nSB)}$

$\therefore P_{(nSB)} + P_{(nSB)} = 1$

$\Rightarrow P_{(SB)} + 0.992 = 1$

$\Rightarrow P_{(SB)} = 1 – 0.992 = 0.008$

So, the required probability of 2 boys having the same birthday = 0.008.

EX : 15. 1

8. 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?

Solution:

Number of red balls = 3

Number of black balls = 5

Total number of balls = 3 + 5 = 8

(i) $P(\text{red ball}) = \dfrac{\text{Number of red balls}}{\text{Total number of balls}} = \dfrac{3}{8}$

(ii) $P(\text{not red}) = 1 - \dfrac{3}{8} = \dfrac{5}{8}$

EX : 15. 1

9. A box contains 5 red marbles, 8 white marbles and 4 green marbles. One marble is taken out of the box at random. What is the probability that the marble taken out will be(i) red?(ii) white?(iii) not green?

Solution:

Total number of marbles = 5 + 8 + 4 = 17

(i) Number of red marbles = 5

$$\text{Probability of getting a red marble} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{5}{17}$$

(ii) Number of white marbles = 8

$$\text{Probability of getting a white marble} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{8}{17}$$

(iii) Number of green marbles = 4

$$\text{Probability of getting a green marble} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{4}{17}$$

$$\text{Probability of not getting a green marble} = 1 - \frac{4}{17} = \frac{13}{17}$$

EX : 15. 1

10. A piggy bank contains hundred 50 p 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 50 p coin?
(ii) will not be a ₹ 5 coin?

Solution:

Total number of coins in a piggy bank = 100 + 50 + 20 + 10 = 180

(i) Number of 50 p coins = 100

$$\text{Probability that the coin will be a 50p coin} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{100}{180} = \frac{5}{9}$$

(ii) Number of Rs 5 coins = 10

$$\text{Probability that the coin will be a Rs 5coin} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

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

$$\text{Probability that the coin will not be a Rs 5 coin} = 1 - \frac{1}{18} = \frac{17}{18}$$

EX : 15. 1

11.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 figure). What is the probability that the fish taken out is a male fish?

Solution:

Total number of fishes in the tank = 5 + 8 = 13

$$\text{Probability that a male fish is taken out} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{5}{13}$$

EX : 15. 1

12. 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 figure.), and these are equally likely outcomes. What is the probability that it will point at
(i) 8?(ii) an odd number?(iii) a number greater than 2?(iv) a number less than 9?

Solution:

Total number of possible outcomes = 8

(i) Probability of getting 8 $= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{1}{8}$

(ii) Total odd numbers on spinner = 4

Probability of getting an odd number $= \frac{\text{Number of favourable outcom}}{\text{Total number of outcomes}}$

$= \frac{4}{8} = \frac{1}{2}$

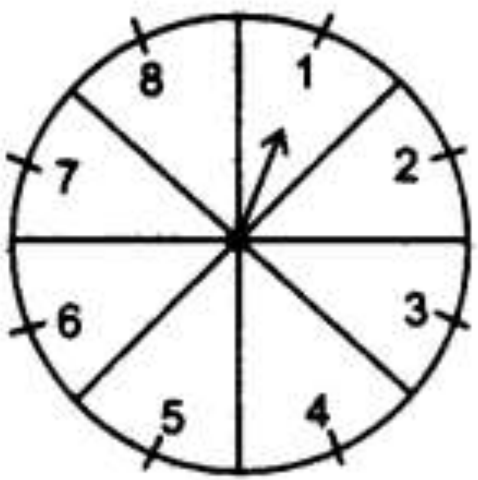
(iii) Total numbers that are greater than 2 = 6

Probability of getting a number greater than 2 =

$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{6}{8} = \frac{3}{4}$

(iv) Total numbers less than 9 = 8

Probability of getting a numbers less than 9 $= \frac{8}{8} = 1$



EX : 15. 1

13. A die is thrown once. Find the probability of getting
(i) a prime number
(ii) a number lying between 2 and 6
(iII) an odd number

Solution:

When a die is thrown, the possible outcomes are 1, 2, 3, 4, 5, 6.
Number of possible outcomes = 6

(i) Prime numbers are 2, 3 and 5.

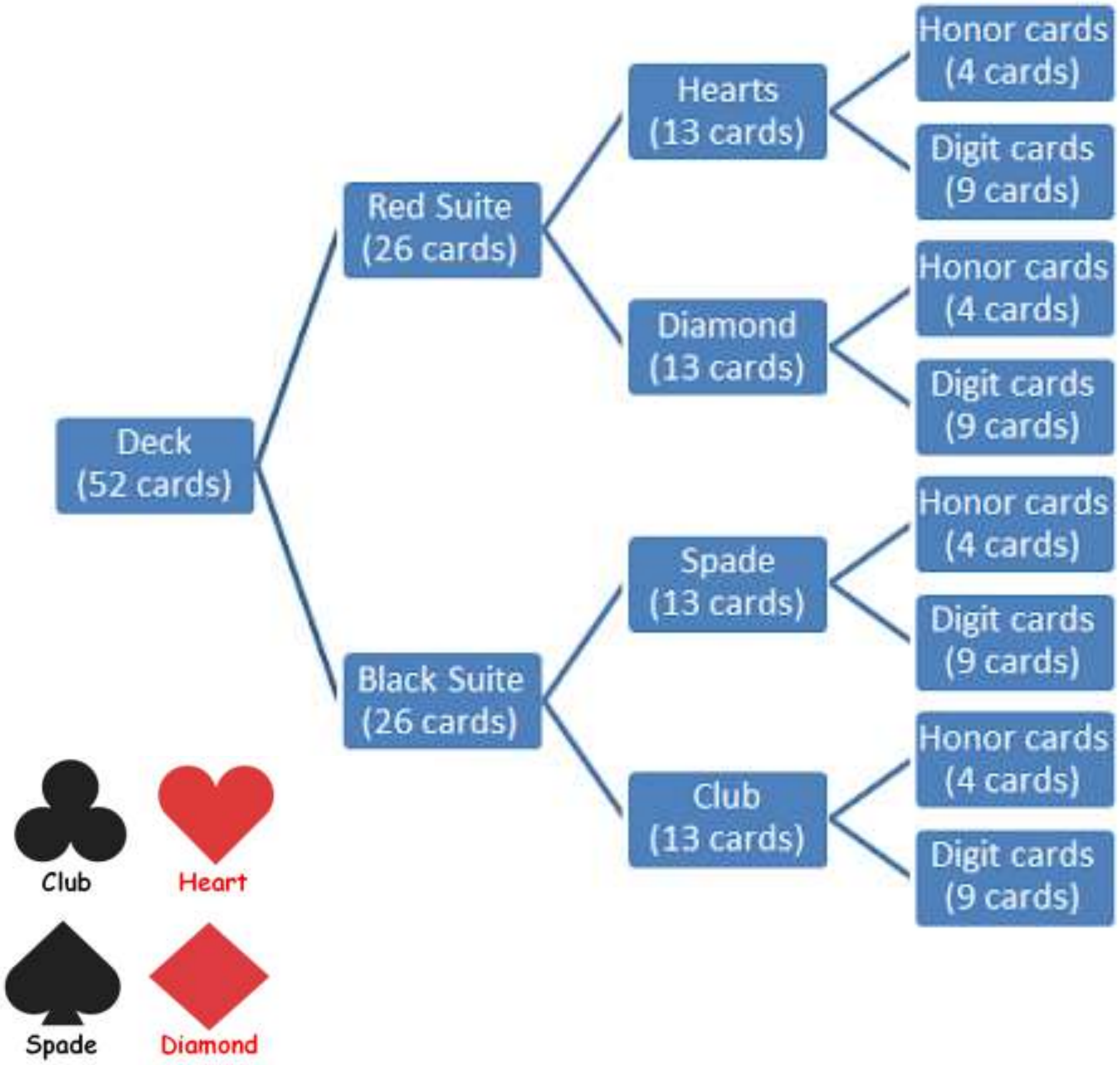
Probability of getting a prime number = $\frac{3}{6} = \frac{1}{2}$

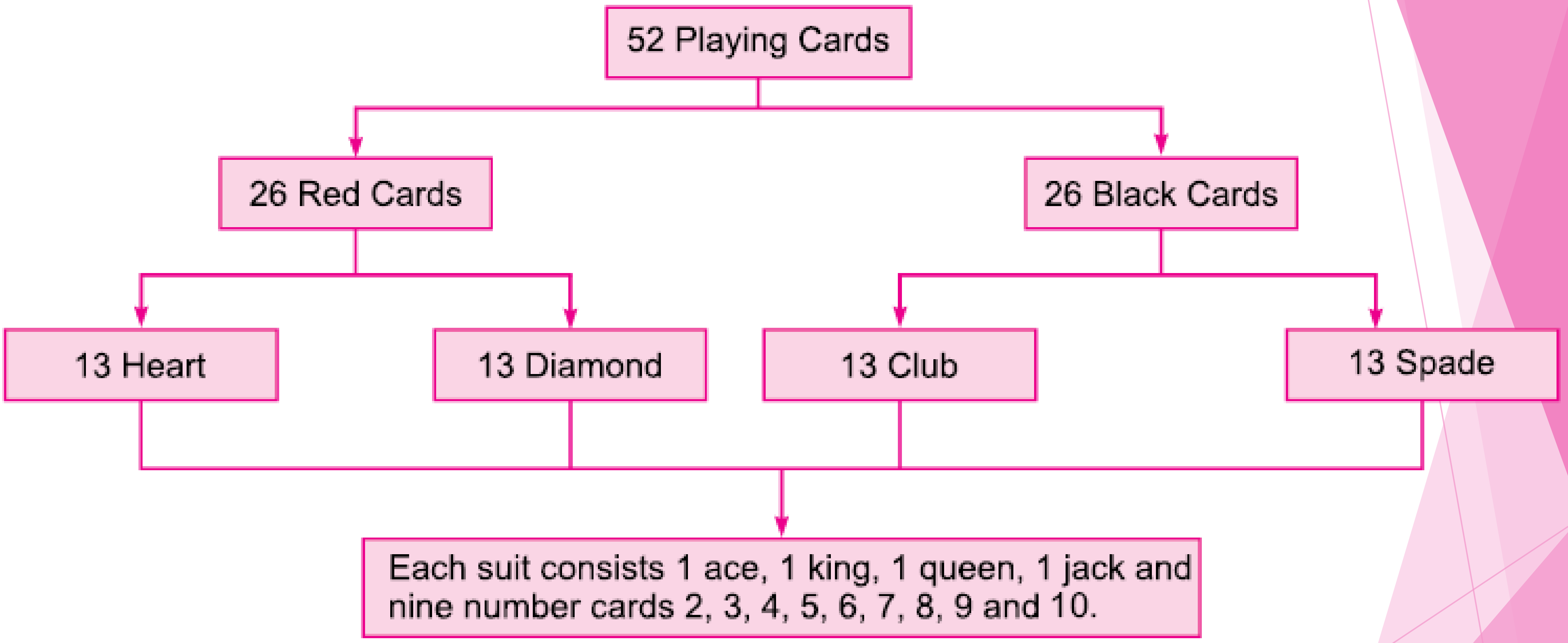
(ii) Numbers lying between 2 and 6 are 3, 4 and 5.

Probability of getting a number lying between 2 and 6 = $\frac{3}{6} = \frac{1}{2}$

(iii) Odd numbers are 1, 3 and 5.

Probability of getting an odd number = $\frac{3}{6} = \frac{1}{2}$


Deck
(52 cards)
Red Suite
(26 cards)
Black Suite
(26 cards)
Hearts
(13 cards)
Diamond
(13 cards)
Spade
(13 cards)
Club
(13 cards)
Honor cards
(4 cards)
Digit cards
(9 cards)
Honor cards
(4 cards)
Digit cards
(9 cards)
Honor cards
(4 cards)
Digit cards
(9 cards)
Honor cards
(4 cards)
Digit cards
(9 cards)
Club
Heart
Spade
Diamond


52 Playing Cards
26 Red Cards
26 Black Cards
13 Heart
13 Diamond
13 Club
13 Spade
Each suit consists 1 ace, 1 king, 1 queen, 1 jack and nine number cards 2, 3, 4, 5, 6, 7, 8, 9 and 10.

EX : 15. 1

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

Solution: Total number of cards = 52

(i) Total number of kings of red colour = 2

$$P\text{(getting a king of red colour)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{2}{52} = \frac{1}{26}$$

(ii) Total number of face cards = 12

$$P\text{(getting a face card)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{12}{52} = \frac{3}{13}$$

(iii) Total number of red face cards = 6

$$P\text{(getting a red face card)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{6}{52} = \frac{3}{26}$$

(iv) Total number of Jack of hearts = 1

$$P\text{(getting a Jack of hearts)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{1}{52}$$

EX : 15. 1

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

Solution:

(v) Total number of spade cards = 13

$$P\text{ (getting a spade card)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{13}{52} = \frac{1}{4}$$

(vi) Total number of queen of diamonds = 1

$$P\text{ (getting a queen of diamond)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{1}{52}$$

EX : 15. 1

15. 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?

Solution:

Total number of outcomes = 5

(There are five cards only)

(i) Number of favourable outcomes

= 1 (only one queen is there)

$\therefore$ P(getting the queen) = $\frac{1}{5}$.

(ii) Keeping queen aside, four cards are left.

Then total number of outcomes = 4

(a) P(getting an ace) = $\frac{1}{4}$.

(b) P(getting a queen) = $\frac{0}{4} = 0$.

EX : 15. 1

16. 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.

Solution:

Total number of pens = 12 + 132 = 144

Total number of good pens = 132

$$P(\text{getting a good pen}) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{132}{144} = \frac{11}{12}$$

EX : 15. 1

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

Solution:

(i) Total number of outcomes

= Total number of bulbs = 20

Number of favourable outcomes

= Number of defective bulbs = 4

$\therefore$ P(getting a defective bulb) $= \frac{4}{20} = \frac{1}{5}$.

(ii) When one good bulb is kept aside, the total number of outcomes = 19

Number of favourable outcomes

= Number of good bulbs = 15

$\therefore$ P(getting a good bulb) $= \frac{15}{19}$.

EX : 15. 1

18. 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.

Solution:

Total number of discs = 90

(i) Total number of two digit numbers between 1 and 90 = 81

$$P(\text{getting a two digit number}) = \frac{81}{90} = \frac{9}{10}$$

(ii) Perfect squares between 1 and 90 are 1, 4, 9, 16, 25, 36, 49, 64, and 81.

∴ Total number of perfect squares between 1 and 90 is 9.

$$P(\text{getting a perfect square}) = \frac{9}{90} = \frac{1}{10}$$

(iii) Numbers between 1 and 90 that are divisible by 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, and 90.

∴ Total numbers divisible by 5 = 18

$$\text{Probability of getting a number divisible by 5} = \frac{18}{90} = \frac{1}{5}$$

EX : 15. 1

19. A child has a die whose six faces show the letters as given below:

A	B	C	D	E	A

The die is thrown once. What is the probability of getting:

(i) A?
(ii) D?

SOLUTION :

Total number of outcomes = 6

(i) Number of favourable outcomes = 2

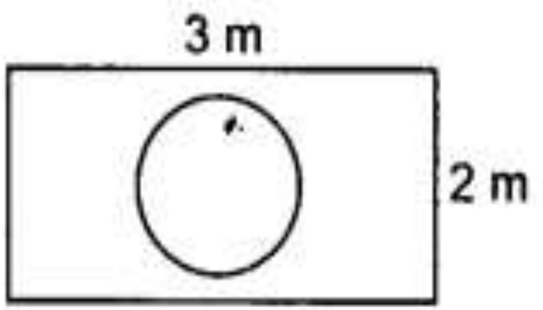
$\therefore$ P(getting A) $= \frac{2}{6} = \frac{1}{3}$.

(ii) Number of favourable outcomes = 1

$\therefore$ P(getting D) $= \frac{1}{6}$.

EX : 15. 1

20. Suppose you drop a die at random on the rectangular region shown in figure. What is the probability that it will land inside the circle with diameter 1 m?



Solution:

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

$$\text{Area of circle} = \pi\left(\frac{1}{2}\right)^2 = \frac{\pi}{4}\ \text{m}^2$$

$$\therefore\ P(\text{the die drops inside the circle}) = \frac{\pi/4}{6} = \frac{\pi}{24}$$

EX : 15. 1

21. A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri 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?

Solution:

Total number of ballpens = 144

Number of defective ballpens = 20

Then the number of good pens = 144 – 20 = 124

(i) P(getting a good pen) $= \frac{124}{144} = \mathbf{\frac{31}{36}}$.

(ii) P(getting a defective pen)

$= 1 - P$ (getting a good pen)

$= 1 - \frac{31}{36} = \mathbf{\frac{5}{36}}$.

EX : 15. 1

22. Refer to example 13.

(i) Complete the following table:

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

(ii) A student argues that 'there are 11 possible outcomes 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. Therefore each of them has a probability 1/11.

Do you agree with this argument? Justify your answer.

SOLUTION :

Total favourable outcomes of throwing two dice 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)

Total number of favourable outcomes = 36

EX : 15. 1

22.

(i) Favourable outcomes of getting the sum as 3 = (1,2), (2,1) = 2

Hence P (getting the sum as 3) = $\frac{2}{36} = \frac{1}{18}$

Favourable outcomes of getting the sum as 4 = (1,3), (2,2), (3,1) = 3

Hence P (getting the sum as 4) = $\frac{3}{36} = \frac{1}{12}$

Favourable outcomes of getting the sum as 5 = (1,4), (2,3), (3,1) , (4,1) = 4

Hence P (getting the sum as 5) = $\frac{4}{36} = \frac{1}{9}$

Favourable outcomes of getting the sum as 6 = (1,5), (2,4), (3,3), (4,2), (5,1) = 5

Hence P (getting the sum as 6) = $\frac{5}{36}$

$\frac{4}{36} = \frac{1}{9}$

EX : 15. 1

22.

Favourable outcomes of getting the sum as 7 = (1,6), (2,5), (3,4), (4,3), (5.2), (6,1), = 6

Hence P (getting the sum as 7) = $\frac{6}{36}=\frac{1}{6}$

Favourable outcomes of getting the sum as 9 = (3,6), (4,5) (5,4) (6,3) = 4

Hence P (getting the sum as 9) = $\frac{4}{36}=\frac{1}{9}$

Favourable outcomes of getting the sum as 10 = (4,6), (5,5) (6,4) = 3

Hence P (getting the sum as 10) = $\frac{3}{36}=\frac{1}{12}$

Favourable outcomes of getting the sum as 11 = (5,6), (6,5) = 2

Hence P (getting the sum as 11) = $\frac{2}{36}=\frac{1}{18}$

EX : 15. 1

22.

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

(ii) I do not agree with the argument given here. Justification has already been given in part (i).

EX : 15. 1

23. A game consists of tossing a one rupee coin 3 times and nothing its outcome each time. Hanif wins if all the tosses give the same result, i.e. three heads or three tails, and loses otherwise. Calculate the probability that Hanif will lose the game.

Solution:

Total outcomes are HHH, TTT, HHT, HTH, THH, TTH, THT, HTT

so, there are 8 outcomes

Hanif will lose the game if outcomes are HHT, HTH, THH, TTH, THT, HTT

So, favourable outcomes = 6

$\therefore$ P(Hanif will lose the game) $= \frac{6}{8} = \frac{3}{4}$.

EX : 15. 1

24.A die is thrown twice. What is the probability that
(i) 5 will not come up either time?
(ii) 5 will come up at least once?

[Hint: Throwing a die twice and throwing two dice simultaneously are treated as the same experiment.]

Solution:

Total outcomes = 36

Number of outcomes in favour of 5 is (1, 5) (2, 5) (3, 5) (4, 5) (5, 5) (6, 5) (5, 1) (5, 2) (5, 3) (5, 4) (5, 6) = 11

(i) P (5 will not come up either time) = $\frac{25}{36}$

(ii) P (5 will come up at least once) = $\frac{11}{36}$

EX : 15. 1

25. Which of the following arguments are correct and which are not correct? Give reasons for your answer.

(i) If two coins are tossed simultaneously there are three possible outcomes- two heads, two tails or one of each. Therefore, for each of these outcomes, the probability is .

(ii) If a die is thrown, there are two possible outcomes- an odd number or an even number. Therefore, the probability of getting an odd number is .

Solution:

(i) Total possible outcomes are HH, HT, TH, TT = 4

P(getting two heads) $= \frac{1}{4}$

P(getting two tails) $= \frac{1}{4}$

P(getting one head and one tail) $= \frac{2}{4} = \frac{1}{2}$

Hence, this argument is **incorrect**.

(ii) Total possible outcomes are 1, 2, 3, 4, 5, 6 = 6

P(getting an odd number) $= \frac{3}{6} = \frac{1}{2}$

P(getting an even number) $= \frac{3}{6} = \frac{1}{2}$

Hence, this argument is **correct**.

EX : 15. 2

1. Two customers Shyam and Ekta are visiting a particular shop in the same week (Tuesday to Saturday). Each is equally likely to visit the shop on any day as on another day. What is the probability that both will visit the shop on
   (i) the same day?
   (ii) consecutive days?
   (iii) different days?

Solution:

Since there are 5 days and both can go to the shop in 5 ways each so,

The total number of possible outcomes = 5 × 5 = 25

The number of favourable events = 5 = (Tue., Tue.), (Wed., Wed.), (Thu., Thu.), (Fri., Fri.), (Sat., Sat.)

P (both visiting on the same day) :

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

= 5/25 = ⅕

EX : 15. 2

1.

(ii) consecutive days?

ii) The number of favourable events = 8 (Tue., Wed.), (Wed., Thu.), (Thu., Fri.), (Fri., Sat.), (Sat., Fri.), (Fri., Thu.), (Thu., Wed.), and (Wed., Tue.)

P(both visiting on the consecutive days) :

P(E) = Number of favourable outcomes / Total number of outcomes)

= 8/25

(iii) different days?

(iii) P (both visiting on the different days) = 1 - P (both visiting on the same day)

P (both visiting on the different days) = $1 - \frac{1}{5} = \frac{4}{5}$

EX : 15. 2

2. A die is numbered in such a way that its faces show the numbers 1, 2, 2, 3, 3, 6. It is thrown two times and the total score in two throws is noted. Complete the following table which gives a few values of the total score on the two throws:

What is the probability that the total score is
(i) even?
(ii) 6?
(iii) at least 6?

Solution:

+	1	2	2	3	3	6
1	2	3	3	4	4	7
2	3	4	4	5	5	8
2	3	4	4	5	5	8
3	4	5	5	6	6	9
3	4	5	5	6	6	9
6	7	8	8	9	9	12

EX : 15. 2

The total number of outcome = 6×6 = 36

(i) E (Even) = No. of outcomes = 18

P (Even) :

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes)}} = 18/36 = ½$$

(ii) E (sum is 6) = No. of outcomes = 4

P (sum is 6) :

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes)}} = 4/36 = 1/9$$

(iii) E (sum is atleast 6) = 15

P (sum is atleast 6) :

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes)}} = 15/36 = 5/12$$

EX : 15. 2

3. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball is double that of a red ball, determine the number of blue balls in the bag.

Solution:

Total number of red balls = 5
Let the total number of blue balls = x
So, the total no. of balls = x + 5

P(E) = Number of favourable outcomes / Total number of outcomes)

P (drawing a blue ball) = [x/(x + 5)] ——-(i)

Similarly,

P (drawing a red ball) = [5/(x + 5)] ——-(ii)

From equation (i) and (ii)

[x/(x + 5)] = 2 [5/(x + 5)]

x = 10

So, the total number of blue balls = 10

EX : 15. 2

4. A box contains 12 balls out of which x are black. If one ball is drawn at random from the box, what is the probability that it will be a black ball? If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before. Find x

Solution:

Total number of black balls = x

Total number of balls = 12

P(E) = Number of favourable outcomes / Total number of outcomes)

P (getting black balls) = x / 12 ————–––-(i)

Now, when 6 more black balls are added,

Total balls become = 18

∴ Total number of black balls = x + 6

Now, P (getting black balls) = (x + 6)/18 ————–––-(i)

EX : 15. 2

4. A box contains 12 balls out of which x are black. If one ball is drawn at random from the box, what is the probability that it will be a black ball? If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before. Find x

ATQ

Solving equation (i) and (ii)

$$(x + 6)/18 = 2(x/12)$$

$$\frac{x+6}{3} = \frac{2(x)}{2}$$

$$3x = x + 6$$

$$2x = 6$$

$$x = 3$$

EX : 15. 2

5. A jar contains 24 marbles, some are green and others are blue. If a marble is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$. Find the number of blue balls in the jar.

Solution:

Total marbles = 24

Let the total green marbles = x

So, the total blue marbles = 24 - x

P(getting green marble) = x/24

From the question,

$$\frac{x}{24} = \frac{2}{3}$$

$$3x = 2 \times 24 = 48$$

$$x = 48/3$$

So, the total green marbles = 16

And, the total blue marbles = 24 - x = 24 - 16 = 8

CHAPTER PROBABILITY

COMPLETED