UNIT 12

Probability

Students' Learning Outcomes

After completing this unit, the students will be able to:

- Calculate the probability of combined events using, where appropriate: sample space diagrams, possibility diagram, tree diagrams and Venn diagrams.
- Apply addition law of probability to solve problems involving mutually exclusive events (such as left and right-hand turns, tossing a coin, even and odd numbers on a dice, winning and losing a game)
- Apply the Multiplication law of probability to solve problems involving independent and dependent events (trading, flipping a coin, such as 2 cards being drawn one by one with replacement and without replacement etc.)

INTRODUCTION

This unit explores the foundational principles and practical methods for calculating the probability of combined events, a critical concept in understanding uncertainty and decision-making. Students will learn to visualize and solve probability problems using sample space diagrams, possibility diagrams, tree diagrams and Venn diagrams. Emphasis will be placed on applying the addition law of probability to mutually exclusive events, situations where two outcomes cannot occur simultaneously, such as flipping a coin or choosing between left and right-hand turns. Additionally, the unit will cover the multiplication law of probability for both independent and dependent events, helping students analyze real-world scenarios like drawing cards with or without replacement and understanding outcomes in games or trade activities.

History!

The earliest exploration of probability as a science was undertaken by Girolamo Cardano (1501–1576), an Italian physician and mathematician.

12.1 Probability

Probability helps us understand how likely something is to happen. We use it every day without even realizing it like guessing if it will rain, deciding whether to carry an umbrella or thinking about the chances of winning a game. It gives us a way to make smart guesses when we don't know for sure what will happen. Simply, probability is useful whenever we deal with uncertainty.

> **Do you know?**
> A statistical experiment is a type of random experiment where the outcomes are numerically measured and analyzed using statistical methods.
> All statistical experiments are random experiments, but all random experiments are not statistical experiments.

12.1.1 Random Experiment

A random experiment is an experiment in which:

(i) The set of all possible outcomes are known.

(ii) Exact outcome is not known.

For example, tossing a coin, rolling a dice.

12.1.2 Outcomes and Sample Space

The possible result of a random experiment is known as **outcome**.

The set of all possible outcomes in a random experiment is called a **sample space**. It is generally denoted by S.

For example, when we roll a dice, the possible outcomes are the face numbers 1, 2, 3, 4, 5, 6 of the dice. Therefore the sample space is $S = \{1, 2, 3, 4, 5, 6\}$.

Each element of a sample space is called a **sample point**.

12.1.3 Event

In a random experiment, each possible outcome is called an event. Thus, an event will be a subset of the sample space.

For example, getting two heads is an event when we toss two coins.

> **Remember!**
> Performing an experiment once is called a **trial**.
> When we toss a coin thrice, then each toss of a coin is a trial.

Events	Explanation	Example
Equally likely events	Two or more events are said to be equally likely if each one of them has an equal chance of occurring.	Numbers 1, 2, 3, 4, 5, 6 are equally likely events, when we roll a dice.
Certain events	In an experiment, the event which surely occurs is called certain event.	When we roll a dice, the event of getting any natural number from 1 to 6 is a certain event.
Impossible events	An impossible event is an event that cannot happen under any circumstances in a given situation.	When we toss two coins, the event of getting three heads is an impossible event.
Mutually exclusive events	Two or more events are said to be mutually exclusive if they don't have common sample points. i.e., events A and B are said to be mutually exclusive if $A \cap B = \phi$	When we roll a dice the events of getting odd numbers and even numbers are mutually exclusive events.
Exhaustive events	The collection of events whose union is the whole sample space is called exhaustive events.	When we toss a coin twice, the collection of events of getting two heads, exactly one head and no head are exhaustive events.
Complementary events	The complement of an event A is the event representing a collection of sample points not in A. It is denoted A' or A^c or $\bar{A}$. The event A and its complement A' are mutually exclusive and exhaustive.	When we toss a coin, the event 'Head' and the event 'Tail' are complementary events.

Remember!

If an event E consists of only one outcome, then it is called an elementary event.

History!

In 1713, Bernoulli was the first to recognize the wide-range applicability of probability in fields outside gambling.

12.1.4 Combined Events

A combined event (or compound event) is an event that consists of two or more simple events happening together. Remember simple event is an event that has a single point of the sample space.

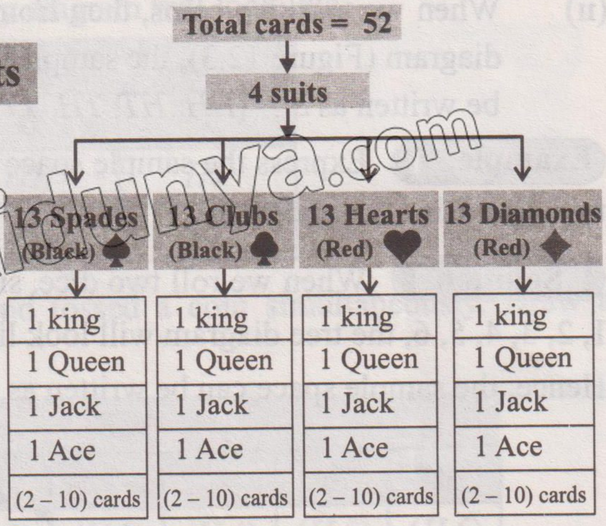
For example, flipping a coin twice and getting at least one head is a combined event.

12.1.5 Types of Combined Events

a Independent Events

Two or more events are said to be independent, if the outcome of one does not affect the outcome of the other.

For example, flipping a coin multiple times, each flip is independent of the others.



b Dependent Events

Two or more events are said to be dependent, if the outcome of one does affect the outcome of the other.

For example, drawing cards from a deck without replacement; the outcome of the first draw changes the probabilities for subsequent draws.

c Mutually Exclusive Events

Two or more events are called mutually exclusive events if they cannot happen at the same time. If one event occurs, the other cannot.

For example, when we roll a single dice, getting a 3 and a 5 at the same time is not possible.

d Non-Mutually Exclusive Events

Two or more events are called non-mutually exclusive events if they can happen at the same time. These events may overlap.

For example, drawing a card that is red or a king from a deck

12.1.6 Tree Diagram

A **tree diagram** is a visual representation used in probability to show all possible outcomes of one or more events. Each branch in a tree diagram represents a possible outcome.

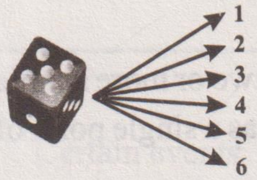


Figure 12.2

(i) When we throw a dice, then from the tree diagram (Figure 12.2), the sample space can be written as $S = \{1, 2, 3, 4, 5, 6\}$

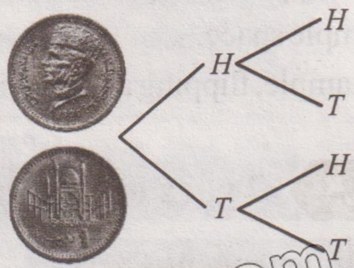


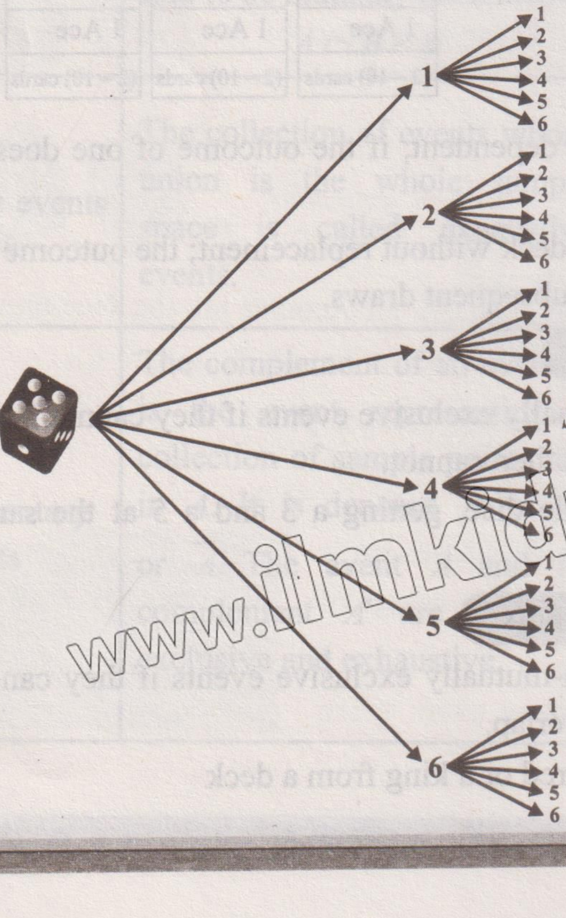
Figure 12.3

(ii) When we toss two coins, then from the tree diagram (Figure 12.3), the sample space can be written as $S = \{HH, HT, TH, TT\}$

Example 1 Express the sample space for rolling two dice using tree diagram.

Solution When we roll two dice, since each dice contains 6 faces marked with 1, 2, 3, 4, 5, 6, the tree diagram will look like.

Hence, the sample space can be written as



$$S = \left\{ \begin{array}{l} (1, 1), (1, 2), (1, 3) \\ (1, 4), (1, 5), (1, 6) \\ (2, 1), (2, 2), (2, 3) \\ (2, 4), (2, 5), (2, 6) \\ (3, 1), (3, 2), (3, 3) \\ (3, 4), (3, 5), (3, 6) \\ (4, 1), (4, 2), (4, 3) \\ (4, 4), (4, 5), (4, 6) \\ (5, 1), (5, 2), (5, 3) \\ (5, 4), (5, 5), (5, 6) \\ (6, 1), (6, 2), (6, 3) \\ (6, 4), (6, 5), (6, 6) \end{array} \right.$$

12.1.7 Sample Space Diagram

Sample space diagram is a representation that shows all possible outcomes of an experiment in list or table form.

When we toss two coins, then the sample space can be written as

$$S = \{HH, HT, TH, TT\}$$

12.1.8 Possibility Diagram

Possibility diagram is a representation in grid or table that shows all possible combinations of two events.

When we toss two coins, then the possibility diagram will look like

Coin 2 \ Coin 1	*H*	*T*
H	*HH*	*HT*
T	*TH*	*TT*

Example 2 Hashim rolled a dice and tossed a coin simultaneously. Draw a possibility diagram.

Solution

Coin \ Dice	1	2	3	4	5	6
H	$(H,1)$	$(H,2)$	$(H,3)$	$(H,4)$	$(H,5)$	$(H,6)$
T	$(T,1)$	$(T,2)$	$(T,3)$	$(T,4)$	$(T,5)$	$(T,6)$

12.1.9 Probability of an Event

In a random experiment, let S be the sample space and $E \subseteq S$. Then if E is an event, the probability of occurrence of E is defined as:

$$P(E) = \frac{\text{Number of outcomes favourable to occurence of } E}{\text{Number of all possible outcomes}} = \frac{n(E)}{n(S)}$$

This way of defining the probability is applicable only to finite sample spaces. So, in this unit, we will be dealing problems only with finite sample spaces.

Remember!

- $0 \le P(E) \le 1$ (The probability value always lies from 0 to 1).
- If $P(E) = 1$, then the event is certain.
- If $P(E) = 0$, then the event is impossible.
- The complement event of E is $\overline{E}$.

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

Example 3 A bag contains 5 blue balls and 4 green balls. Abu Bakar draws a ball at random from the bag. Find the probability that the ball drawn is (i) blue (ii) not blue.

Solution Total number of possible outcomes $n(S) = 5 + 4 = 9$

(i) Let A be the event of getting a blue ball.

$n(A) = 5$

Therefore, $P(A) = \frac{n(A)}{n(S)} = \frac{5}{9}$

(ii) $\overline{A}$ be the event of not getting a blue ball.

So $P(\overline{A}) = 1 - P(A) = 1 - \frac{5}{9} = \frac{4}{9}$

Activity

- Divide students into groups.
- Ask the students to take a coin, toss it 5 times, 10 times, 15 times or 20 times and record their observations.
- What proportion of the number of tosses shows heads? a tails? What is the probability that the outcome is head?

Example 4 Two dice are rolled. Find the probability that the sum of outcomes is (i) equal to 4 (ii) greater than 10 (iii) less than 13.

Solution When we roll two dice, the sample space is given by:

$$S = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6)$$
$$(2,1), (2,2), (2,3), (2,4), (2,5), (2,6)$$
$$(3,1), (3,2), (3,3), (3,4), (3,5), (3,6)$$
$$(4,1), (4,2), (4,3), (4,4), (4,5), (4,6)$$
$$(5,1), (5,2), (5,3), (5,4), (5,5), (5,6)$$
$$(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\};\ n(S) = 36$$

Challenge!
What is the complement event of an impossible event?

(i) Let A be the event of getting the sum of outcomes equal to 4.

Then $A = \{(1, 3), (2, 2), (3, 1)\}$; $n(A) = 3$

Probability of getting the sum of outcomes equal to 4 is

$$P(A) = \frac{n(A)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

(ii) Let B be the event of getting the sum of outcomes greater than 10.

Then $B = \{(5, 6), (6, 5), (6, 6)\}$; $n(B) = 3$

Probability of getting the sum of outcomes greater than 10 is

$$P(B) = \frac{n(B)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

(iii) Let C be the event of getting the sum of outcomes less than 13.
Here all the 36 outcomes have the sum value less than 13. Hence $C = S$.
Therefore, $n(C) = n(S) = 36$

Probability of getting the total value less than 13 is $P(C) = \dfrac{n(C)}{n(S)} = \dfrac{36}{36} = 1$

Example 5 Two coins are tossed together. What is the probability of getting different faces on the coins?

Solution When two coins are tossed together, the sample space is

$$S = \{HH, HT, TH, TT\}; n(S) = 4$$

Let A be the event of getting different faces on the coins.

$$A = \{HT, TH\} \qquad n(A) = 2$$

Probability of getting different faces on the coins is $P(A) = \dfrac{n(A)}{n(S)} = \dfrac{2}{4} = \dfrac{1}{2}$

Example 6 A dice is rolled and a coin is tossed simultaneously. Find the probability that the dice shows an odd number and the coin shows a head.

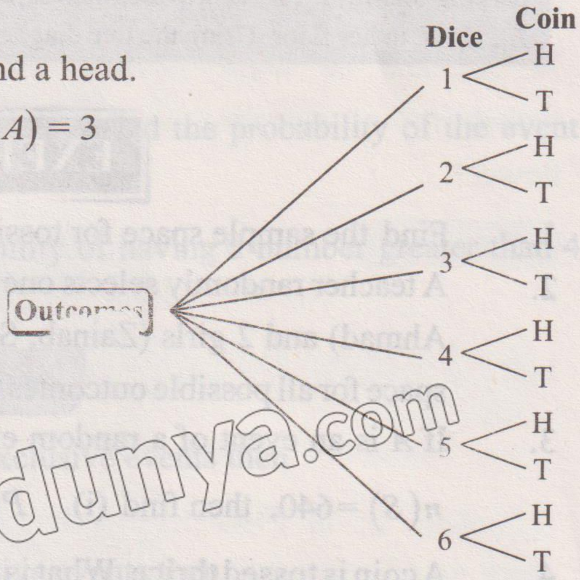
Solution Sample space

$S = \{(1, H), (1, T), (2, H), (2, T), (3, H), (3, T), (4, H), (4, T), (5, H), (5, T), (6, H), (6, T)\}$; $n(S) = 12$

Let A be the event of getting an odd number and a head.

$$A = \{(1, H), (3, H), (5, H)\};\ n(A) = 3$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{3}{12} = \frac{1}{4}$$



Activity

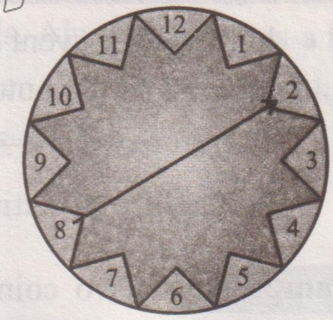
Ask students to collect the details and find the probabilities of

(i) selecting a boy from your class.
(ii) selecting a girl from your class.
(iii) selecting a boy from 10^{th} class in your school.
(iv) selecting a girl from 10^{th} class in your school.

Example 7 A game of chance consists of spinning an arrow which is equally likely to come to rest pointing to one of the numbers 1, 2, 3, …, 12. What is the probability that it will point to:

(i) 7 (ii) a prime number (iii) a composite number?

Solution



Sample space $S = \{1,2,3,4,5,6,7,8,9,10,11,12\}; n(S) = 12$

(i) Let A be the event of resting in 7, $n(A) = 1$

$$P(A) = \frac{n(A)}{n(S)} = \frac{1}{12}$$

(ii) Let B be the event that the arrow will come to rest in a prime number.

$$B = \{2, 3, 5, 7, 11\}\ ;\ n(B) = 5$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{5}{12}$$

(iii) Let C be the event that arrow will come to rest in a composite number.

$$C = \{4, 6, 8, 9, 10, 12\}\ ;\ n(C) = 6$$

$$P(C) = \frac{n(C)}{n(S)} = \frac{6}{12} = \frac{1}{2}$$

Activity

There are four routes R_1, R_2, R_3 and R_4 from Huria's home to her place of work. There are three parking lots P_1, P_2, P_3 and two entrances B_1, B_2 into the office building. There are three elevators E_1, E_2, E_3 to her floor. Using the tree diagram explain how many ways can she reach her office.

EXERCISE 12.1

1. Find the sample space for tossing three coins using tree diagram.
2. A teacher randomly selects one boy and one girl from a group of 2 boys (Hamid, Ahmad) and 2 girls (Zainab, Samia). Draw a tree diagram and list the sample space for all possible outcomes.
3. If A is an event of a random experiment such that $P(A) : P(\overline{A}) = 17:15$ and $n(S) = 640$, then find (i) $P(\overline{A})$ (ii) $n(A)$
4. A coin is tossed thrice. What is the probability of getting two consecutive tails?
5. A dice is rolled and coin is tossed together.
   (i) Find sample space by drawing possibility diagram.
   (ii) Find sample space by sketching tree diagram.
   (iii) What is a probability of getting a tail and an even number?

6. Two unbiased dice are rolled once.
   (i) Find sample space by sketching tree diagram.
   (ii) Find sample space by drawing possibility diagram.
   (iii) Find the probability of getting
      (a) same number on both dice.
      (b) the product as a prime number.
      (c) the sum as an even number.
      (d) the sum as 13.

7. Three fair coins are tossed together. Find the probability of getting
   (i) all tails (ii) at least one head
   (iii) at most two tails (iv) 2 heads
   (v) at most 2 heads (vi) no head

8. A bag contains 4 red balls, 5 white balls, 6 green balls and 3 black balls. Ali draws a ball at random from the bag. Find the probability that the ball drawn is
   (i) white (ii) red
   (iii) not white (iv) not black

9. A number is selected at random from the set of whole numbers 1 to 15, both inclusive. Find the probability that the number selected is:
   (i) odd (ii) a multiple of 5 (iii) the square of 2
   (iv) prime (v) 20

10. If the probability of an event A is $\frac{7}{10}$, then find the probability of the event "not A".

11. A dice is rolled twice. Find the probability of having a number greater than 4 on each roll.

12.2 Addition Law of Probability

(i) If A and B are any two non mutually exclusive events then

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

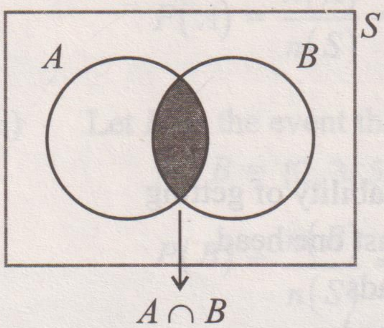
(ii) If A and B are any two mutually exclusive events then

$$P(A \cup B) = P(A) + P(B)$$

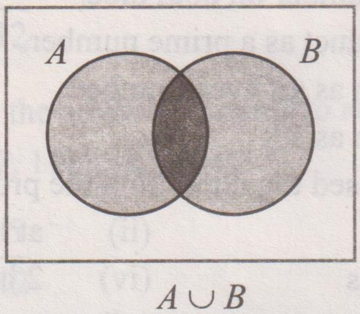
12.2.1 Venn Diagram

In a random experiment, let S be the sample space. Let $A \subseteq S$ and $B \subseteq S$ be the events in S. we say that

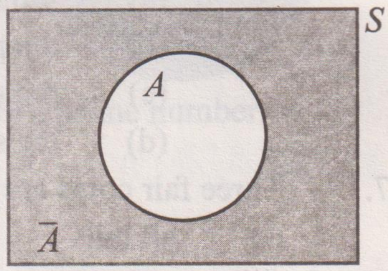
(i) $(A \cap B)$ is an event that occurs only when both A and B occurs.



(ii) $(A \cup B)$ is an event that occurs when either one of A or B occurs.



(iii) $\overline{A}$ is an event that occurs only when A doesn't occur.



Example 8 If $P(A) = 0.37$, $P(B) = 0.42$, $P(A \cap B) = 0.09$, then find $P(A \cup B)$.

Solution Given that: $P(A) = 0.37$, $P(B) = 0.42$, $P(A \cap B) = 0.09$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A \cup B) = 0.37 + 0.42 - 0.09 = 0.7$$

> **Challenge!**
> What is addition of $P(A \cup B)$ and $P(A \cap B)$?

Example 9 A flower is selected at random from a basket containing 50 yellow, 70 red and 80 white flowers. Find the probability of selecting a yellow or red flower?

Solution Total number of flowers, $n(S) = 50 + 70 + 80 = 200$

No. of yellow flowers, $n(Y) = 50$

$$\therefore \quad P(Y) = \frac{n(Y)}{n(S)} = \frac{50}{200}$$

No. of red flowers, $n(R) = 70$

$$\therefore \quad P(R) = \frac{n(R)}{n(S)} = \frac{70}{200}$$

Y and R are mutually exclusive events, so probability of drawing either a yellow or red flower is

$$P(Y \cup R) = P(Y) + P(R)$$

$$\therefore \quad P(Y \cup R) = \frac{50}{200} + \frac{70}{200} = \frac{120}{200} = \frac{3}{5}$$

Example 10 Two dice are rolled together. Find the probability of getting a same number on the both dice or sum of faces as 10.

Solution Let S be the sample space, then $n(S) = 36$

Let A be the event of getting a same number on the both dice and B be the event of getting face sum 10.

$$\text{Then } A = \{(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$$

$$B = \{(4, 6), (5, 5), (6, 4)\}$$

$$\therefore \quad A \cap B = \{(5,5)\}$$

$$n(A) = 6, n(B) = 3, n(A\cap B) = 1$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{6}{36}$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{3}{36}$$

$$P(A\cap B) = \frac{n(A\cap B)}{n(S)} = \frac{1}{36}$$

$\therefore$ P(getting a same number on the both dice or a total of 10) $= P(A\cup B)$

$$= P(A) + P(B) - P(A\cap B)$$

$$= \frac{6}{36} + \frac{3}{36} - \frac{1}{36} = \frac{8}{36} = \frac{2}{9}$$

Hence, the required probability is $\frac{2}{9}$.

EXERCISE 12.2

1. If A and B are two events such that $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{8}$, find $P(A \cup B)$.
2. In an apartment, selecting a house from door numbers 1 to 50 randomly, find the probability of getting the door number of the house to be an even number or a perfect square number.
3. The probability of a team winning any match is $\frac{3}{10}$ and the probability of losing any match is $\frac{2}{10}$. What is the probability that

   (i) the team wins or loses a particular match.

(ii) the team neither wins nor loses a match.

4. In a single throw of two dice, find the probability of having sum of 7 or 11.
5. Find the probability of getting a sum of 5 or 7 in a throw of two dice.
6. A card is taken out at random from a standard pack of 52 cards. Find the probability of taking out.
   (i) A king or a Jack. (ii) Neither a king nor a Jack.
7. A dice is thrown twice. What is the probability that at least one of the two throws comes up with number 3.
8. There are 15 cards in a bag marked as 1, 2, 3, …., 15. Find the probability of picking a card at random, the number written on which is a multiple of 5 or of 7.
9. Two fair coins are tossed once. What is the probability of getting at least one head or two heads.
10. At a busy intersection, 50% of vehicles turn right, 30% turn left and 20% go straight. What is the probability that a randomly selected vehicle turn left or right?
11. Two fair coins are tossed. What is the probability of getting either two heads or two tails?
12. If A and B are two mutually exclusive events of a random experiment and $P(\text{not } A) = 0.45$, $P(A \cup B) = 0.65$, then find $P(B)$.
13. If $P(A) = \frac{2}{3}$, $P(B) = \frac{2}{5}$, $P(A \cup B) = \frac{1}{3}$ then find $P(A \cap B)$.
14. A and B are two events such that, $P(A) = 0.42$, $P(B) = 0.48$, and $P(A \cap B) = 0.16$.
   Find: (i) $P(\bar{A})$ (ii) $P(\bar{B})$ (iii) $P(A \cup B)$

12.3 Multiplication Law of Probability

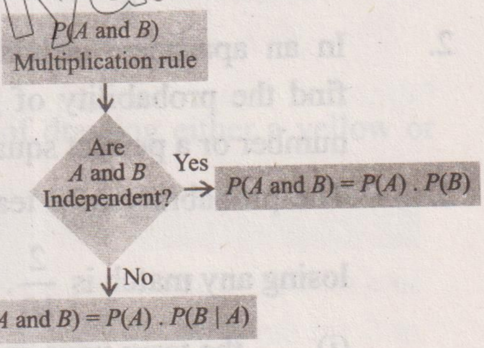
(i) If A and B are independent events, then

$P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B)$

(ii) **Conditional Probability**

If A and B are dependent events, then

$P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B \mid A)$



where $P(B \mid A)$ represents the probability of event B occurring after it is assumed that event A has already occurred (read $B \mid A$ as "B given A").

Example 11 A bag contains 4 red and 3 green balls. Kabeer draw two balls one after the other with replacement (the second is drawn after the first is replaced). Find the probability that the first ball is red and the second ball is also red.

Solution Let A be the event that first ball is red and B be the event that second ball is also red.

Then $P(A)=\frac{4}{7}$ and $P(B)=\frac{4}{7}$ (Since the ball is replaced, the sample space is not affected).

$$P(A \text{ and } B)=P(A\cap B)=P(A)\times P(B)$$
$$=\frac{4}{7}\times\frac{4}{7}=\frac{16}{49}$$

Example 12 A bag contains 3 white and 2 black marbles. Two marbles are drawn one after the other without replacement. Find the probability that the first marble is white and the second marble is also white.

Solution Let A be the event that first marble is white and B be the event that second marble is also white.

Total marbles = 3 + 2 = 5

Then $P(A)=\frac{3}{5}$ and $P(B\,|\,A)=\frac{2}{4}$ (Since the marble is not replaced, the sample space is affected).

$$P(A \text{ and } B)=P(A)\times P(B\,|\,A)$$
$$=\frac{3}{5}\times\frac{2}{4}=\frac{6}{20}=\frac{3}{10}$$

Example 13 Majid dealt two cards successively (without replacement) from a well shuffled deck of 52 playing cards. Find the probability that the first card is a king and the second card is a queen.

Solution Let A be the event that drawing card is a king and B be the event that drawing card is a queen. Remember that we must take care for the sample space of event B, that event A has already occurred.

$$P(A)=\frac{4}{52}=\frac{1}{13}\quad;\quad P(B\,|\,A)=\frac{4}{51}$$
$$P(A \text{ and } B)=P(A)\times P(B\,|\,A)$$
$$=\frac{1}{13}\times\frac{4}{51}=\frac{4}{663}$$

EXERCISE 12.3

1. Two numbers are randomly chosen from 1 to 10 with replacement. Find the probability that:
   (i) both are prime (ii) their product is even
2. One letter is chosen from the word PUNJAB and another from LAHORE. What is the probability that:
   (i) both are vowels
   (ii) one is consonant and other is vowel
3. A single dice is rolled twice. Find the probability that one roll is a multiple of 3 and the other is a 5.
4. Two dice are rolled. Find the probability of getting an odd number on one and a multiple of 2 on other.
5. From a pack of well shuffled cards, two cards are drawn at random one by one with replacement. Find the probability that the first is heart and second is king.
6. If two cards are selected from a standard deck of 52 cards without replacement, find the probability that
   (i) Both are black. (ii) Both are queens.
   (iii) Both are spades. (iv) Both are diamonds.
7. Saleem draws two cards one by one without replacement from a well shuffled pack of 52 playing cards. What is the probability that first card is jack and the second card is queen.

REVIEW EXERCISE 12

1. Four possible answers are given for the following questions. Choose the correct answer.
   (i) The probability of impossible event is:
   (a) 0 (b) 1 (c) 2 (d) –1
   (ii) What is the probability of getting a head when a fair coin is tossed once?
   (a) 0 (b) 0.25 (c) 0.5 (d) 1
   (iii) The sum of probabilities of all possible outcomes of an experiment is:
   (a) 0.5 (b) 0.25 (c) 1 (d) 0.4

(iv) If $P(A) = 0.6$, then the probability of event A not happening is:
(a) 0.4 (b) 0.6 (c) 1 (d) 1.6

(v) Two events are said to be mutually exclusive if:
(a) they can happen at the same time.
(b) one affects the other.
(c) they cannot happen together.
(d) they are always equal.

(vi) If one coin is tossed and one dice is rolled, then the number of sample point are:
(a) 3 (b) 6 (c) 2 (d) 12

(vii) What is the probability of sure event?
(a) 1 (b) 0 (c) $\frac{2}{3}$ (d) $\frac{4}{5}$

(viii) The probability of getting a number greater than 6 on dice is:
(a) 0.33 (b) 1 (c) 0 (d) 0.5

(ix) ________ outcomes are possible when we draw a card from deck of cards.
(a) 13 (b) 1 (c) 52 (d) 26

(x) If $P(E) = 0.07$, then the probability of 'not E' is:
(a) 0.95 (b) 0.89 (c) 0.93 (d) 0.90

2. Arshia selects a day from (Tuesday, Wednesday) and a time from (Morning, Evening). Draw a possibility diagram. Also sketch a tree diagram.

3. A card is drawn from a deck of cards. Find the probability of getting an ace or a spade card.

4. Fatima dealt two cards successively (without replacement) from a shuffled deck of 52 playing cards. Find the probability that both cards are red.

5. If two dice are rolled, then find the probability of getting the product of face values 6 or the difference of face values 5.

6. A bag contains 7 orange and 5 purple marbles. Two marbles are drawn one after the other without replacement. Find the probability that the first marble is orange and the second marble is also orange.