

Chapter-14: Probability

Question ► 1 A coin is thrown 3 times. [All Board-18]

- a. Show that, the value of probability of an event lie between 0 and 1. 2
- b. Determine the probability of getting three head and at least one tail drawing the probability tree of the possible events of the stem. 4
- c. Show that, if the coin is thrown n-times the event will support 2^n . 4

Solution to the question no. 1

a Let S be a finite sample space of a random experiment and A be an event associated with sample space.

Let, the total number of sample points of the sample space $S = n(S)$; The number of favourable sample points of an event $A = n(A)$

∴ According to the mathematical definition of probability we get, $P(A) = \frac{n(A)}{n(S)}$

It is clear that, the number of elements of event A will remain in $n(S)$ from 0.

That is, $0 \leq n(A) \leq n(S)$ or $\frac{0}{n(S)} \leq \frac{n(A)}{n(S)} \leq \frac{n(S)}{n(S)}$ [Divided by $n(S)$]

or $0 \leq P(A) \leq 1$ (Shown)

b See Example-7(b, c), Chapter 14 of your textbook.

c Since a coin has 2 sides, all possible outcomes of one tossing of a coin is 2.

Again, all possible outcomes of two tossing of a coin is 4.

Similarly,

all possible outcomes of 1 tossing = 2

" " " " 2 " = 4 = $2 \times 2 = 2^2$

" " " " 3 " = 8 = $2 \times 2 \times 2 = 2^3$

" " " " 4 " = 16 = $2 \times 2 \times 2 \times 2 = 2^4$

.....

.....

all possible outcomes of n tossing = 2^n

∴ If the coin is thrown n-times the event will support 2^n .

(Shown)

Question ► 2 An unbiased coin and an unbiased dice are tossed and thrown together once. [D.B.17]

- a. If the dice is thrown once rather than the coin determine the probability of getting a prime number on the upper side. 2

- b. Draw the probability tree and write down the sample space and then determine the probability of getting the head of the coin and an even number of the dice. 4
- c. If two dice are thrown once together, then draw the probability tree and find the probability of getting same number on the upper side from the sample space. 4

Solution to the question no. 2

a The possible outcomes of drawing a dice are:

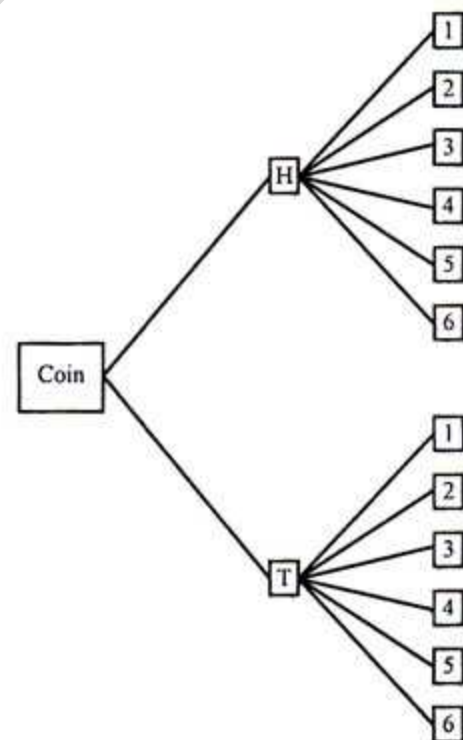
1, 2, 3, 4, 5, 6

∴ Number of total outcomes = 6

∴ Favorable outcomes for prime numbers = 2, 3, 5 and number of favorable outcomes = 3

∴ Probability of getting a prime number = $\frac{3}{6} = \frac{1}{2}$ (Ans.)

b Probability tree is shown below:



∴ Sample space will be : {H1, T1, H2, T2, H3, T3, H4, T4, H5, T5, H6, T6} (Ans.)

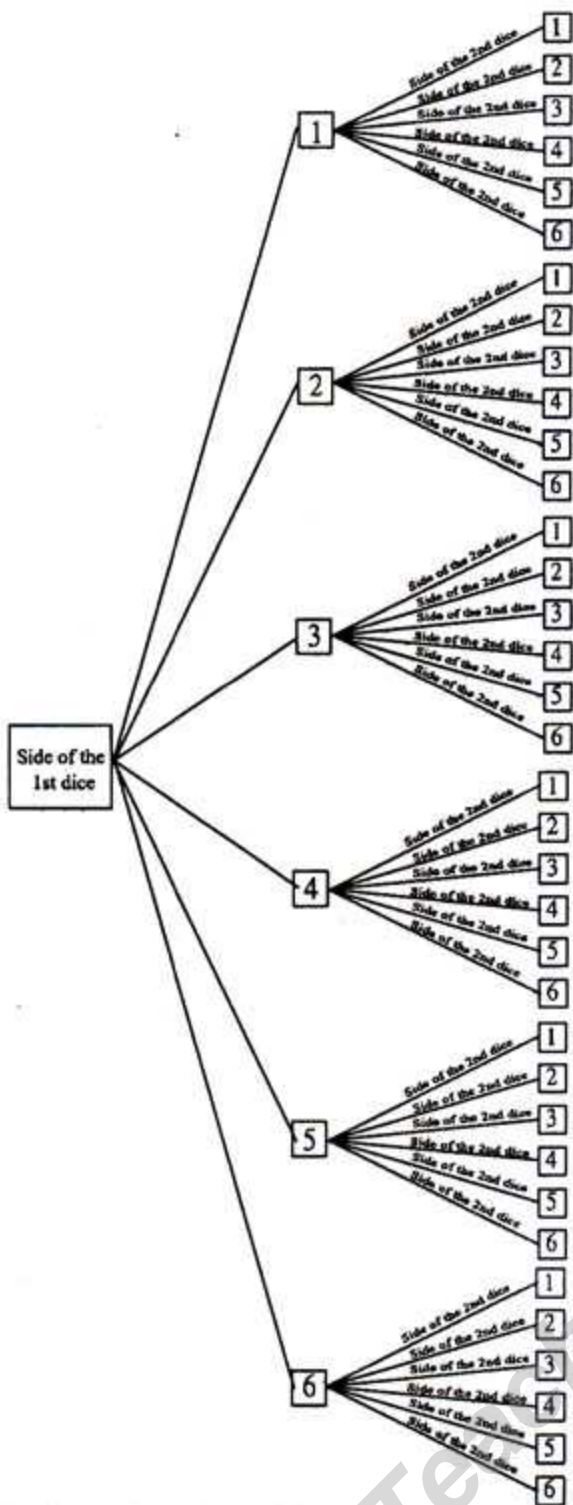
Total number of sample points = 12

Again, sample point of getting the head of the coin and an even number on the dice = H2, H4, H6

∴ Favorable sample points = 3

∴ The probability of getting the head of the coin and an even number on the dice = $\frac{3}{12} = \frac{1}{4}$ (Ans.)

- c** If two dice is thrown once together, then the probability tree will be:



∴ Total sample points = 36

Again, favorable sample space of getting same numbers on two dice = $\{(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$

∴ Number of favorable sample points = 6

∴ Probability of getting same numbers on two dice = $\frac{6}{36} = \frac{1}{6}$ (Ans.)

Question ▶ 3 Out of 90 days and 90 students in the class IX, the absent result in the class shown in the table below :

Number of absent days	Number of students
0	10
2	15
3	25
5	20
5 More	20

[R.B. 17]

- What is the probability that below 2 days absent? 2
- What is the probability that less than 3 days? 4
- Find the probability of getting 5 or a number greater than 5 days absent. 4

Solution to the question no. 3

a Given, total number of students = 90

Number of students that absent below 2 days = 10

∴ Probability of students that absent below 2 days = $\frac{10}{90} = \frac{1}{9}$ (Ans.)

b Number of students that absent below 3 days = 10 + 15 = 25

∴ Probability of getting students that absent below 3 days = $\frac{25}{90} = \frac{5}{18}$ (Ans.)

c Number of students that absent 5 or more days

$$= 20 + 20 = 40$$

∴ Probability of students that absent 5 or more days

$$= \frac{40}{90} = \frac{4}{9}$$
 (Ans.)

Question ▶ 4 An unbiased coin is tossed thrice. [Dj.B. 17]

- What do you mean by sample space and sample point? 2
- Draw the probability tree and write down the sample space. 4
- Show that in n times tossing of the coin the sample space will consist of 2^n sample points. 4

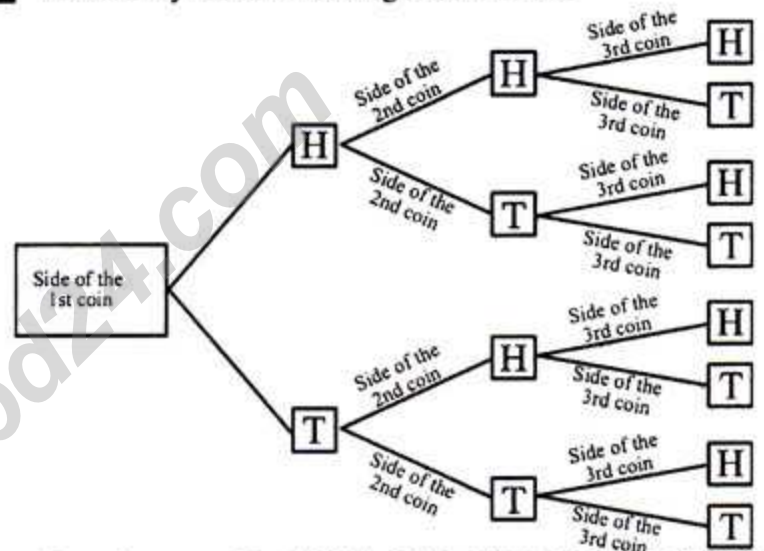
Solution to the question no. 4

a **Sample space:** The set of all possible outcomes of a random experiment is called the sample space.

If two coins are tossed simultaneously then the sample space is $S = \{HH, HT, TH, TT\}$

Sample Point : Every element of a sample space is called a sample point. In the preceding example, the sample consists of four sample points.

b Probability tree of throwing a coin thrice:



Sample space, $S = \{HHT, HTH, HTT, HHH, THT, TTH, THH, TTT\}$

c Since a coin has only two sides, all possible outcomes of one tossing of a coin is 2

Again, all possible outcomes of two tossing of a coin is 4

Similarly,

all possible outcomes of 1 tossing a coin = 2

" " " " " " 2 tossing = $4 = 2 \times 2 = 2^2$

" " " " " " 3 " = $8 = 2 \times 2 \times 2 = 2^3$

" " " " " " 4 " = $16 = 2 \times 2 \times 2 \times 2 = 2^4$

All possible outcomes of n tossing a coin = 2^n

∴ For n times tossing of the coin, the sample space will consist of 2^n points. (Shown)

Question ▶ 5 A coin is tossed four times by Shoishab. [C.B.17]

- What is the probability of getting an odd number or a number divisible by 2 in a single throw of a dice? 2
- Draw the probability tree and write down the sample space. 4
- What is the probability contains at least two heads and one tail? 4

Solution to the question no. 5

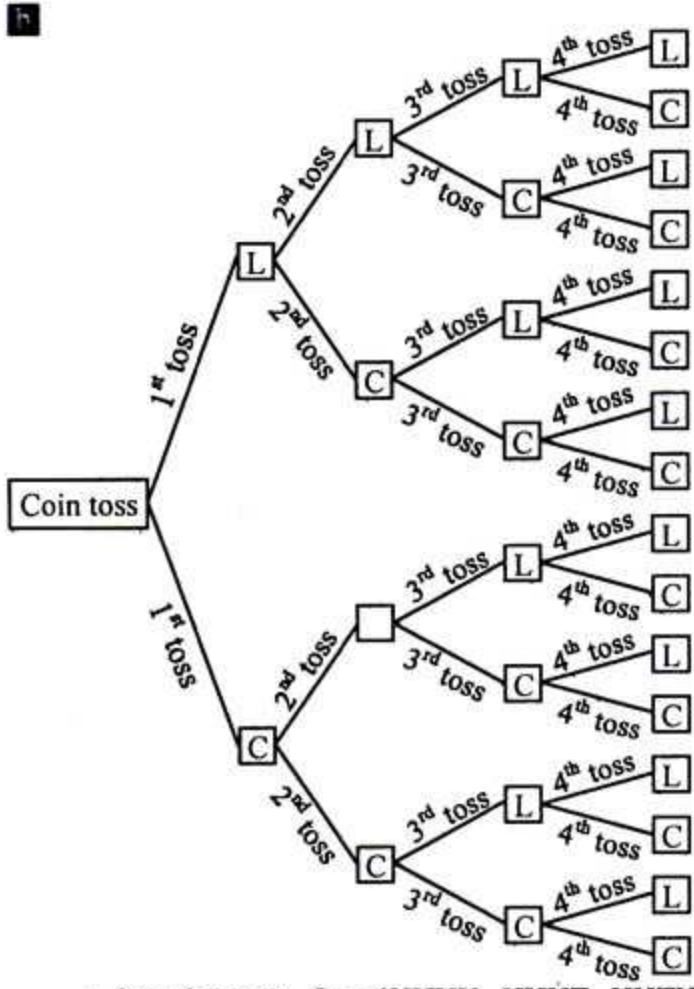
a The sample space of drawing a dice = $\{1, 2, 3, 4, 5, 6\}$

∴ Total sample points = 6

Again, probable sample points of getting an odd number or a number divisible by 2 in a single throw of a dice = 1, 2, 3, 4, 5, 6

∴ Favorable sample point = 6

∴ Probability of getting an odd number or a number divisible by 2 = $\frac{6}{6} = 1$ (Ans.)



∴ Sample space, $S = \{HHHH, HHHT, HHTH, HHTT, HTHH, HTHT, HTTH, HTTT, THHH, THHT, THTH, THTT, TTHH, TTHT, TTTH, TTTT\}$

- c From 'b' we get,
 Total number of sample points = 16
 Favorable events contains at least 2 heads and one tail:
 HHHT, HHTH, HHTT, HTHH, HTHT, HTTH, THHH, THHT, THTH, TTHH
 ∴ Favorable sample point = 10

∴ Probability of getting at least 2 heads and one tail = $\frac{10}{16} = \frac{5}{8}$ (Ans.)

Question ► 6 A bag contains 10 red (R), 5 black (B), 8 white (W) and 6 yellow (Y) marbles. A marble is chosen at random from the bag. [Ctg.B.17]

- a. What is random experiment? 2
 b. What is probability that the marble will be yellow or black? 4
 c. Show that, the probability that the marble will be red or white or black is equal to the probability that the marble will not be yellow. 4

Solution to the question no. 6

a **Random experiment:** When all possible outcomes of any experiment are known in advance but the outcomes of any specific trial are unknown then it is called random experiment.

b Given, there are 10 red, 5 black, 8 white and 6 yellow marbles.
 Total marbles = $10 + 5 + 8 + 6 = 25$

∴ The probability of a marble to be black = $\frac{5}{25} = \frac{1}{5}$

∴ The probability of a marble to be yellow = $\frac{6}{25}$

So the probability of a marble to be black or yellow

= $\frac{6}{25} + \frac{1}{5} = \frac{6+5}{25} = \frac{11}{25}$ (Ans.)

- c The probability of a marble to be red = $\frac{10}{25}$
 The probability of a marble to be white = $\frac{8}{25}$
 The probability of a marble to be black = $\frac{5}{25}$

∴ The probability of a marble to be red or white or black = $\frac{10}{25} + \frac{8}{25} + \frac{5}{25} = \frac{19}{25}$

From 'b' we get,

The probability of a marble to be yellow = $\frac{6}{25}$

∴ The probability of a marble not to be yellow = $1 - \frac{6}{25} = \frac{19}{25}$

So, the probability that the marble to be red white or black is equal to the probability that the marble not to be yellow. (Shown)

Question ► 7 An unbiased dice and two unbiased coins are tossed at once. [S.B.17]

- a. What do you mean by sample space and sample point? 2
 b. Draw the probability tree of possible events and write down the sample space. 4
 c. Determine, $P(\text{even number and 2H}) + P(\text{prime number and 2T})$. 4

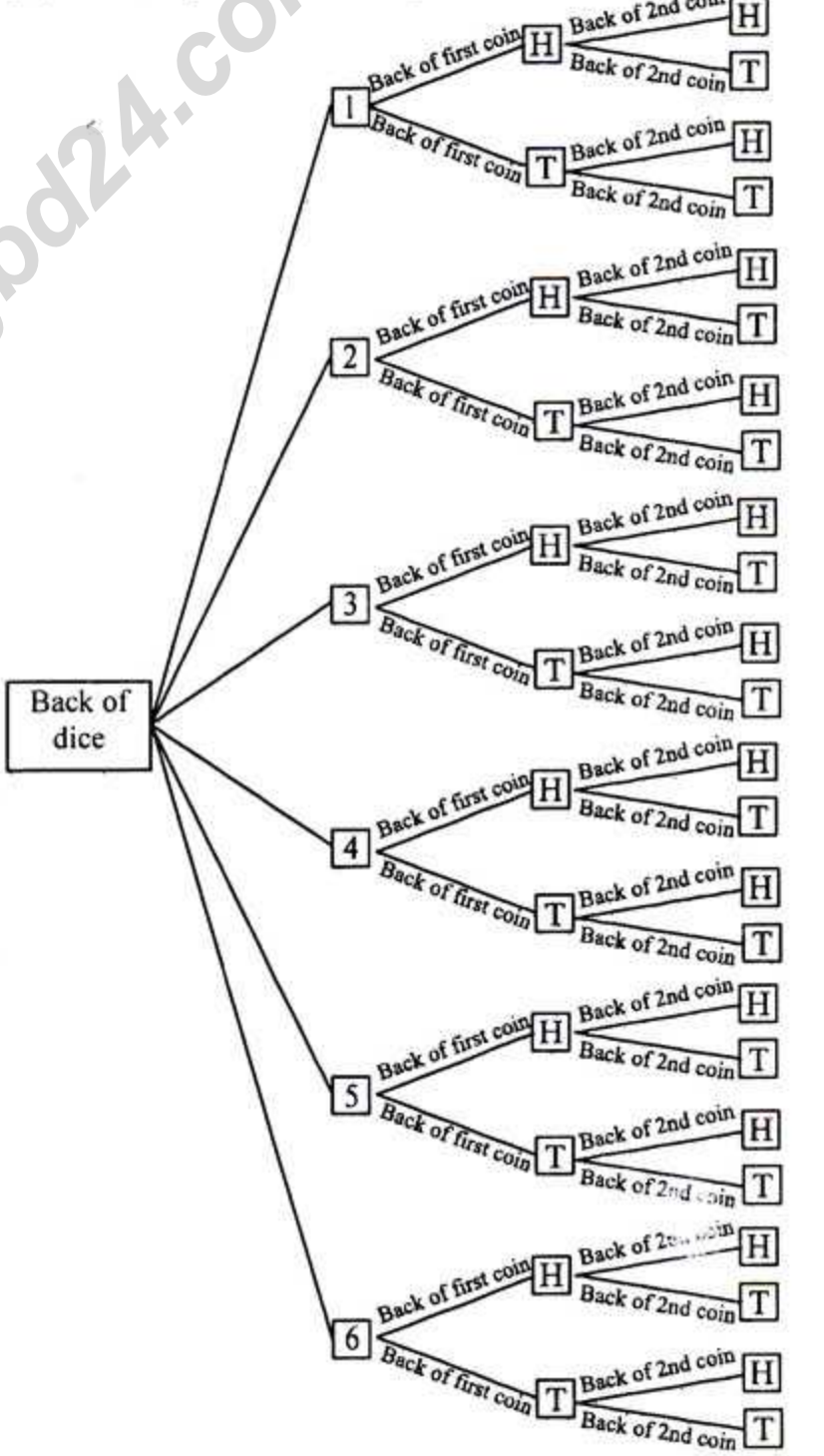
Solution to the question no. 7

a **Sample space:** The set of all possible outcomes of a random experiment is called the sample space.

If two coins are tossed simultaneously then the sample space is $S = \{HH, HT, TH, TT\}$

Sample Point: Every element of a sample space is called a sample point. In the preceding example, the sample consists of four sample points.

b Probability tree of throwing a dice and two coins together:



Sample space, $S = \{1HH, 1HT, 1TH, 1TT, 2HH, 2HT, 2TH, 2TT, 3HH, 3HT, 3TH, 3TT, 4HH, 4HT, 4TH, 4TT, 5HH, 5HT, 5TH, 5TT, 6HH, 6HT, 6TH, 6TT\}$ (Ans.)

c Total sample points = 24

Favorable sample point to get even numbers on dice and two heads on coins: 2HH, 4HH, 6HH

\therefore Favorable sample points = 3

$$\therefore P(\text{even number and 2H}) = \frac{3}{24} = \frac{1}{8}$$

Again, favorable sample point to get prime number on dice and two tails on coins: 2TT, 3TT, 5TT

\therefore Favorable sample points = 3

$$\therefore P(\text{prime number and 2T}) = \frac{3}{24} = \frac{1}{8}$$

$$\therefore P(\text{even number and 2H}) + P(\text{prime number and 2T}) = \frac{1}{8} + \frac{1}{8} = \frac{1}{4} \text{ (Ans.)}$$

Question ► 8 20 tickets are numbered serially from 11 to 30. The tickets are mixed thoroughly and one ticket is drawn at random. [J.B.17]

- What do you mean by mutually exclusive events? 2
- Find the probability that the drawn is multiple of 2 and divisible by 3. 4
- Show that, the probability of the drawn that is prime number or multiple of 7 is less than that of odd or divisible by 4. 4

Solution to the question no. 8

a **Mutually exclusive events:** Two or more possible outcomes of a random experiment are called mutually exclusive event if the occurrence of one of those events, precludes the possibility of the other events. In the tossing of a coin, the occurrence of head and tail are two mutually exclusive events. Because head and tail cannot occur together.

b Total number of tickets = 20

The numbers which are multiple of 2 and divisible by 3 are: 12, 18, 24 and 30

\therefore Number of favorable sample point = 4

\therefore The probability that the drawn is multiple of 2 and divisible by 3 = $\frac{4}{20} = \frac{1}{5}$ (Ans.)

c The numbers which are prime are:

11, 13, 17, 19, 23, 29

\therefore Number of prime numbers = 6

Again, multiples of 7 are : 14, 21, 28

\therefore Number of multiples of 7 are = 3

\therefore The probability of the drawn to be prime or multiple of 7 is $\frac{6}{20} + \frac{3}{20} = \frac{6+3}{20} = \frac{9}{20}$

The numbers which are odd:

11, 13, 15, 17, 19, 21, 23, 25, 27, 29

\therefore Number of odd numbers = 10

Again, the numbers which are divisible by 4 are : 12, 16, 20, 24, 28

\therefore Number of divisible by 4 = 5

\therefore The probability of the drawn of odd or divisible by 4

$$= \frac{10}{20} + \frac{5}{20} = \frac{10+5}{20} = \frac{15}{20}$$

$$\text{Here, } \frac{9}{20} < \frac{15}{20}$$

Therefore, probability of the drawn to be prime or multiple of 7 is less than that of odd or divisible by 4. (Shown)

Question ► 9 The number of examinee answered the different number of questions in an examination are as follows :

Number of answered question	Number of examinee
1	5
2	45
3	150
4	500
5	800
6 or more	500

A student is selected at random. [B.B.17]

- What do you mean by sample space? 2
- What is the probability that the student answered at most 4 questions? 4
- Show that, the probability of the student answered at most 5 questions is more than that of at least 6 questions. 4

Solution to the question no. 9

a **Sample space:** The set of all possible outcomes of a random experiment is called the sample space. If two coins are tossed simultaneously then the sample space is $S = \{HH, HT, TH, TT\}$

b Here, total number of examinee = $5 + 45 + 150 + 500 + 800 + 500 = 2000$

Number of examinee that answered at most 4 questions = $5 + 45 + 150 + 500 = 700$

\therefore The probability that the student answered at most 4 questions = $\frac{\text{Number of examinee that answered at most 4 questions}}{\text{total number of examinee}} = \frac{700}{2000} = \frac{7}{20}$ (Ans.)

c Total number of examinee = 2000
Number of examinee that answered at most 5 questions = $5 + 45 + 150 + 500 + 800 = 1500$

The probability that the student answered at most 5 questions = $\frac{\text{Number of examinee that answered at most 5 questions}}{\text{total number of examinee}} = \frac{1500}{2000} = \frac{3}{4}$

Again, Number of examinee that answered at least 6 questions = 500

\therefore The probability that the student answered at least 6 questions = $\frac{\text{Number of examinee that answered at least 6 questions}}{\text{total number of examinee}} = \frac{500}{2000} = \frac{1}{4}$

$$= \frac{500}{2000} = \frac{1}{4}$$

$$\text{Since, } \frac{3}{4} > \frac{1}{4}$$

So, the probability of the student answered at most 5 questions is more than that of at least 6 questions. (Shown)

Question ► 10 An unbiased coin is tossed thrice. [D.B.16]

- What are equally likely event and sample space? Give an example of each. 2
- Considering the stem draw the probability tree and write down the sample space. 4
- Find the probability of 4
 - getting at least one head and
 - getting tail in all three tossings for the mentioned experiment.

Solution to the question no. 10

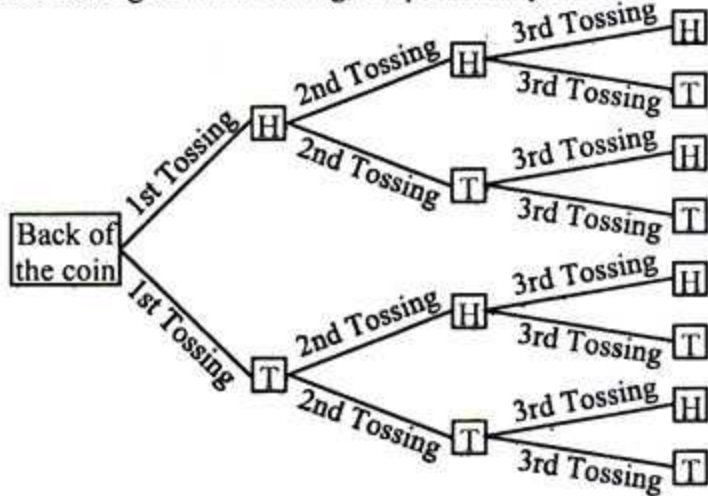
a Equally Likely Events :If the outcomes of a random experiment are such no outcome is more or less likely to happen than any other outcome, than the possible outcomes are called equally likely events.

For example, in the tossing of a coin the occurrence of head or tail are equally likely events

Sample space:The set of all possible outcomes of a random experiment is called the sample space.

If two coins are tossed simultaneously then the sample space is $S = \{HH, HT, TH, TT\}$

b The tossing of three coins gives probability tree :



The sample space is $S = \{HHT, HTH, HTT, HHH, THT, TTH, THT, TTT\}$ (Ans.)

c The sample space is $S = \{HHT, HTH, HTT, HHH, THT, TTH, THT, TTT\}$
Total sample points = 8

(i) The sample points containing at least one head = 7

$\therefore P(\text{at least one Head}) = \frac{7}{8}$ (Ans.)

(ii) The sample points of getting tail in all three tossings = 1

$\therefore P(TTT) = \frac{1}{8}$ (Ans.)

Question ► 11 The tickets number serially from 40 to 60 are mixed thoroughly and a ticket is drawn at random. [R.B.16]

- a. Find the probability of getting a number divisible by 8. 2
- b. Find the probability of getting a number is not a prime and divisible by 6. 4
- c. Find the probability of getting an odd number or a number multiple of 5. 4

Solution to the question no. 11

a Number of natural numbers from 40 to 60 = 21
From 40 to 60, Total numbers divisible by 8 = 3
Probability of ticket to be divisible by 8 is $= \frac{3}{21} = \frac{1}{7}$ (Ans.)

b The numbers which are not prime number and divisible by 6 within 40 to 60 are : 42, 48, 54, 60
So, not prime number and divisible by 6 = 4
 \therefore So, probability of ticket not to be prime number and divisible by 6 is $= \frac{4}{21}$ (Ans.)

c Number of natural numbers from 40 to 60 = 21
And the numbers which are odd or multiple of 5 between 40 and 60 are: 40, 41, 43, 45, 47, 49, 50, 51, 53, 55, 57, 59, 60
So, odd or multiple of 5 = 13

\therefore Probability of ticket to be odd or multiple of 5 is $= \frac{13}{21}$ (Ans.)

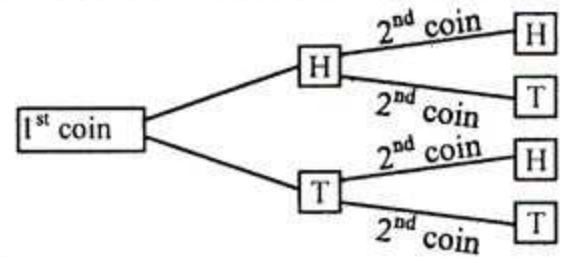
Question ► 12 The last 10 scores of International T-20 innings of Mushfiqur Rahim are given below: —

37, 51, 30, 2, 42, 38, 43, 62, 5, 13 [Dj.B.16]

- a. If an unbiased coin is tossed twice, draw a probability tree. 2
- b. Determine the difference of probability of making either half century or not in any innings. 4
- c. Determine the probability of the scores is an odd number or multiple of 5 in any innings. 4

Solution to the question no. 12

a Probability tree of two tossing of the coin :



b We know,

Probability of any event

$$= \frac{\text{number of favourable outcomes for that event}}{\text{Number of total outcomes}}$$

Runs scored by mushfiqur rahim in last 10 international T-20 is given

\therefore Number of total outcomes = 10

Runs scored fifty or more in international T-20 : 51 & 62

\therefore number of favourable outcomes = 2

\therefore Probability of scoring fifty in any innings

$$= \frac{2}{10} = \frac{1}{5} \text{ (Ans.)}$$

\therefore Probability of not scoring fifty in any innings

$$= 1 - \frac{1}{5} = \frac{4}{5}$$

Difference between probability of scoring and not scoring

$$\text{fifty} = \frac{4}{5} - \frac{1}{5} = \frac{3}{5} \text{ (Ans.)}$$

c Number of total outcomes = 10

Set of odd run = {37, 51, 43, 5, 13}

Set of run to be multiple of 5 = {5, 30}

\therefore Set of favourable outcomes of runs to be odd or multiple of 5 = {37, 51, 43, 5, 13} \cup {5, 30}

$$= \{37, 51, 43, 5, 13, 30\}$$

\therefore Number of sample points of runs to be odd or multiple of 5 = 6

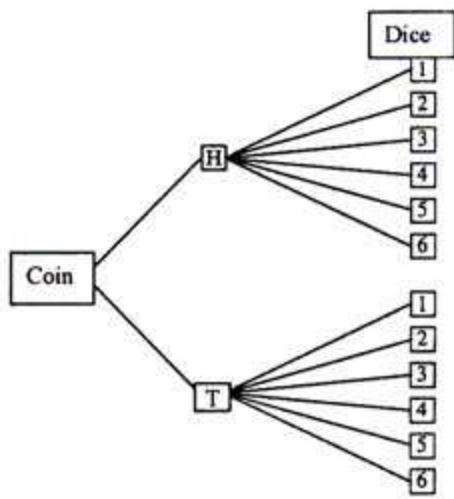
\therefore Probability of run to be odd or multiple of 5 in any innings $= \frac{6}{10} = \frac{3}{5}$ (Ans.)

Question ► 13 An unbiased coin and an unbiased dice are thrown together. [C.B.16]

- a. Draw the probability tree of the event. 2
- b. Find the probability of getting tail on the coin and odd number on the dice from the sample space. 4
- c. Except the dice if only coin is tossed three times, find the probability of getting at least one head from the sample space. 4

Solution to the question no. 13

a Tree diagram of drawing a coin and a dice is shown below:



b According to the probability tree of the events of random experiment of a coin and a dice, together, the sample space is :

$$S = \{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6\}$$

Here total number of possible outcomes = 12

Again number of favorable outcomes of getting the tail in the coin and odd number in dice = 3

∴ The probability of getting tail in the coin and odd number in dice = $\frac{3}{12} = \frac{1}{4}$ (Ans.)

c If only coin is thrown three times, the sample space of events will be as under :

$$\{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$$

∴ The number of possible outcomes = 8

∴ The favorable outcomes of getting at least one head =

$$\{HHH, HHT, HTH, THH, HTT, TTH, THT\} = 7$$

∴ The desired probability of getting at least one head = $\frac{7}{8}$ (Ans.)

Question ► 14 The probability that a person will travel from Chattogram to Dhaka by bus is $\frac{2}{5}$, the probability of that person

will travel from Dhaka to Rajshahi by train is $\frac{5}{8}$ and that he will

travel from Rajshahi to Khulna by plane is $\frac{3}{10}$. [Ctg.B.16]

a. What are the certain events and impossible events? 2

b. Draw the probability tree. 4

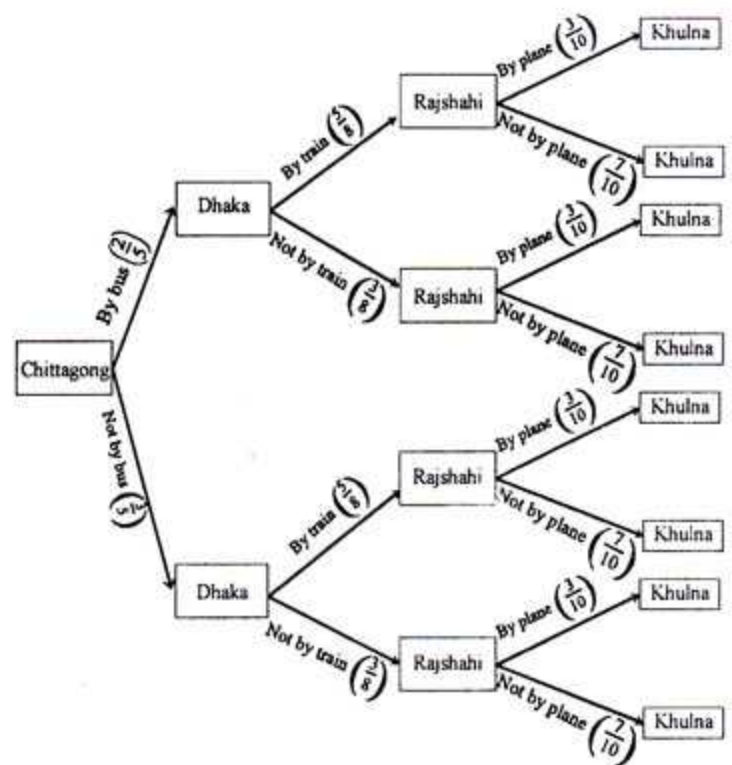
c. Find the probability that the person will travel from Chittagong not by bus, from Dhaka to Rajshahi by train and from Rajshahi to Khulna by plane. Also find the probability that the person will travel from Dhaka to Rajshahi by train and then travel to Khulna not by plane. 4

Solution to the question no. 14

a **Certain event:** An event which is sure to occur is called a certain event. The probability of any certain event is 1. For instance, the probability that the sun will rise tomorrow from the east is 1.

Impossible Events : An event which is sure not to occur is called an impossible event. The probability of an impossible event is 0. For instance, the probability that tomorrow the sun will rise in the west or set in the east, is 0.

b Probability tree is shown below:



c From Probability tree,

the probability that the person will travel to Dhaka from Chittagong not by bus, to rajshahi from Dhaka by train and to

Khulna from rajshahi by plane = $\frac{3}{5} \times \frac{5}{8} \times \frac{3}{10}$

$$= \frac{9}{80} \text{ (Ans.)}$$

Again, the probability that the person will travel to rajshahi from Dhaka by train but to Khulna from rajshahi not by

$$\text{plane} = \frac{5}{8} \times \frac{7}{10} = \frac{7}{16} \text{ (Ans.)}$$

Question ► 15 A dice and two coins are thrown together. [S.B.16]

- What is sample space and sample point? 2
- Draw the probability tree and write down the sample space. 4
- What is the probability of getting at least one T of a coin and multiple of 2 and 3 of a dice? 4

Solution to the question no. 15

a **Sample space:** The set of all possible outcomes of a random experiment is called the sample space.

If two coins are tossed simultaneously then the sample space is $S = \{HH, HT, TH, TT\}$

Sample Point : Every element of a sample space is called a sample point. In the preceding example, the sample consists of four sample points.

b See the solution of question no-6(b). Page-211

c Total sample points of sample space = 24

Here, favorable sample points for at least one tail in coin and multiple of 2 and 3 in dice are : 6HT, 6TH, 6TT

Number of sample points Number of = 3

∴ Probability of at least one tail in coin and multiple of 2 and 3

$$\text{in dice} = \frac{3}{24} = \frac{1}{8} \text{ (Ans.)}$$

Question ► 16 The number of students of the sections A, B, C, D, E and F in class nine of a school are 50, 55, 60, 45, 40 and 30 respectively. The students of the sections A, B and C are in science group; D and E are in commerce group and F are in arts group. A student is selected randomly for extempore speech. [J.B.16]

- What are called certain events and impossible events? 2
- Find the probability that the selected student is being from science group. 4
- Find the probability that the selected student is from commerce or arts group. 4

Solution to the question no. 16

a **Certain event:** An event which is sure to occur is called a certain event. The probability of any certain event is 1. For instance, the probability that the sun will rise tomorrow from the east is 1.

Impossible Event: An event which is sure not to occur is called an impossible event. The probability of an impossible event is 0. For instance, the probability that tomorrow the sun will rise in the west or set in the east, is 0.

b Number of total students = $(50 + 55 + 60 + 45 + 40 + 30) = 280$

Number of students from science = $(50 + 55 + 60) = 165$

∴ If one student is chosen randomly, probability of the

student to be in science = $\frac{165}{280} = \frac{33}{56}$ (Ans.)

c From b,

Number of total students = 280

Number of students in humanities = 30

Number of students in commerce = $(45 + 40) = 85$

Probability of the selected student to be in humanities = $\frac{30}{280}$

Again,

Probability of the selected student to be in commerce = $\frac{85}{280}$

∴ Probability of the selected student to be in commerce or

humanities = $\frac{30}{280} + \frac{85}{280}$

$$= \frac{30 + 85}{280}$$

$$= \frac{115}{280}$$

$$= \frac{23}{56} \text{ (Ans.)}$$

Question ► 17 A coin is tossed three times. [B.B.16]

- Define sample space with example. 2
- Draw the probability tree of the probable incident and write down the sample space. 4
- Show that, the sum of the probability of getting three heads and the probability of getting maximum two tails is 1. 4

Solution to the question no. 17

a **Sample Space:** The set of all possible outcomes of a random experiment is called the sample space.

Example: If two coins are tossed simultaneously then the sample space is $S = \{HH, HT, TH, TT\}$

b See the solution of question 21(b), chapter 14, Page-217.

c From 'b' we get, no of sample points = 8

Number of favorable sample points of getting three heads $\{HHH\} = 1$

∴ Probability of getting three heads = $\frac{1}{8}$

Again, number of favorable sample points of getting maximum two tails $\{HHH, HHT, HTH, HTT, THH, THT, TTH\} = 7$

∴ Probability of getting maximum two tails = $\frac{7}{8}$ ∴ Sum of the

probability = $\frac{1}{8} + \frac{7}{8} = \frac{1+7}{8} = \frac{8}{8} = 1$ (Shown)

Question ► 18 According to the report of a rural health centre, the babies in a certain rural area in the period of last five years were born as in the following table:

Nature of baby's weights	Number of babies
Under weight	255
Normal weight	550
Over weight	195

Out of these babies, one baby is selected at random.

[Mymensingh Girls' Cadet College, Mymensingh]

- What do you mean by certain and impossible events? 2
- Find the probability that the baby was born (i) exactly with normal weight (ii) with under weight or over weight. 4
- What is the probability that the baby was born (i) with not less than normal weight (ii) with more than normal weight? 4

Solution to the question no. 18

a See from textbook-chapter-14.

b Total number of baby = $255 + 550 + 195 = 1000$

(i) Babys born with normal weight = 550.

∴ Probability of the baby was born exactly

with normal weight $P(N) = \frac{550}{1000} = \frac{11}{20}$ (Ans.)

(ii) Babys born with under weight = 255

∴ Probability of the baby was born with under weight,

$$P(U) = \frac{255}{1000} = \frac{51}{200}$$

Babys born with over weight = 195

∴ Probability of the baby was born with over weight,

$$P(O) = \frac{195}{1000} = \frac{39}{200}$$

∴ The probability of the baby was born with under or over weight, $P(U \cup O) = P(U) + P(O)$

$$= \frac{51}{200} + \frac{39}{200}$$

$$= \frac{90}{200} = \frac{9}{20} \text{ (Ans.)}$$

c (i) Number of babys with less than normal weight = number of baby's with under weight = 225

∴ Probability of the baby was born with less than

$$\text{normal weight} = \frac{255}{1000} = \frac{51}{200}$$

∴ Probability of the baby was not less

$$\text{than normal weight} = 1 - \frac{51}{200} = \frac{149}{200} \text{ (Ans.)}$$

(ii) Probability of the baby was born with more than normal weight

$$= \text{probability of the baby was born with over weight} = \frac{39}{200}$$

Question ► 19 A bag contains 6 white, 7 red and 9 black balls. One ball is drawn at random from the bag.

[Rajshahi Cadet College, Rajshahi]

- What is the probability of getting the ball to be black? 2
- What is the probability of getting the ball to be white or red? 4
- What is the probability of getting the ball to be white but not red? 4

Solution to the question no. 19

a Total number of balls in the bag = $(6 + 7 + 9) = 22$ and number of black ball = 9

∴ The probability that the ball will be black = $\frac{9}{22}$ (Ans.)

b Number of white balls in the bag = 6

∴ The probability that the ball will be white = $\frac{6}{22} = \frac{3}{11}$

and number of red ball = 7

∴ The probability that the ball will be red = $\frac{7}{22}$

∴ The probability that the ball will be white or red

$$= \frac{3}{11} + \frac{7}{22} = \frac{13}{22} \text{ (Ans.)}$$

c Here,

White ball = 6
Red ,, = 7
Black ,, = 9

∴ Total = 22

Let, Probability of getting a white ball = P(A),
and probability of getting a red ball = P(B)

$$\therefore P(A) = \frac{6}{22}$$

From 'b', we get, probability of getting a ball to be white
or red, $P(A \cup B) = \frac{13}{22}$

Now,

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

$$\text{Or, } \frac{13}{22} = \frac{6}{22} + \frac{7}{22} - P(A \cap B)$$

$$\text{Or, } P(A \cap B) = \frac{6}{22} + \frac{7}{22} - \frac{13}{22}$$

$$\therefore P(A \cap B) = 0$$

So, the incidents are mutually independent.

Now, Probability of getting a ball white but not red

$$= P(A \cap B^c)$$

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

$$= \frac{6}{22} - 0$$

$$= \frac{6}{22} = \frac{3}{11} \text{ (Ans.)}$$

Question ▶ 20 An unbiased coin and a dice is thrown together.

[Joypurhat Girls' Cadet College, Joypurhat]

- What is certain event and impossible event? 2
- Draw a probability tree diagram and write down the sample space of above stem of experiment? 4
- Find the probability of getting head on the coin and even number on the dice. 4

Solution to the question no. 20

a **Certain Events** : An event which is sure to occur is called a certain event. The probability of any certain event is 1.

The probability of getting even or odd in an experiment of throwing dice is 1.

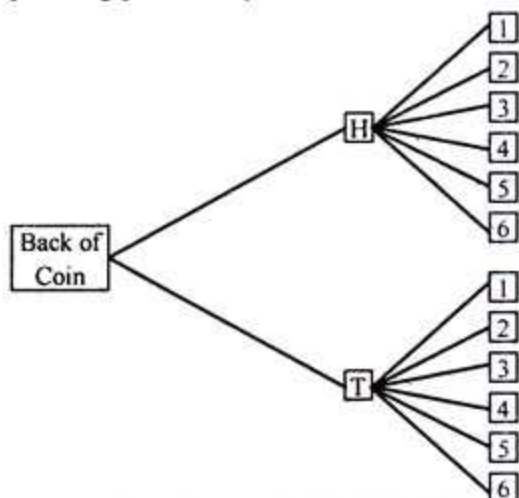
Impossible Events : An event which will not occur is called impossible event. The probability of an impossible event is zero.

The probability of getting 7 in throwing a dice is zero.

b Let consider that, the coin is tossed first. This will result in one of the two possible outcomes: Head, Tail.

In the second, the throwing of the dice will result in one of the six possible outcomes: 1, 2, 3, 4, 5, 6.

The corresponding probability tree is shown below :



The sample space, $S = \{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6\}$ (Ans.)

c Total sample points = 12

Favourable sample points of getting head and even number = 6

$$\therefore \text{Probability of getting head and even number} = \frac{6}{12} = \frac{1}{2} \text{ (Ans.)}$$

Question ▶ 21 20 tickets are numbered serially from 11 to 30. The tickets are mixed thoroughly & one ticket is drawn at random. [Pabna Cadet College, Pabna]

- What do you mean by mutually exclusive events? 2
- Find the probability that the drawn is multiply of 2 & divisible by 3? 4
- Show that, the probability of the drawn that is prime number of multiple of 7 is less then that of odd or divisible by 4? 4

Solution to the question no. 21

a **Mutually exclusive events**: Two or more possible outcomes of a random experiment are called mutually exclusive event if the occurrence of one of those events, precludes the possibility of the other events. In the tossing of a coin, the occurrence of head and tail are two mutually exclusive events. Because head and tail cannot occur together.

b Total number of tickets = 20

The numbers which are multiple of 2 and divisible by 3 are: 12, 18, 24 and 30

∴ Number of favorable sample point = 4

∴ The probability that the drawn is multiple of 2 and divisible by 3 = $\frac{4}{20} = \frac{1}{5} = \frac{4}{20}$ (Ans.)

c The numbers which are prime are:

11, 13, 17, 19, 23, 29

∴ Number of prime numbers = 6

Again, multiples of 7 are : 14, 21, 28

∴ Number of multiples of 7 are = 3

∴ The probability of the drawn to be prime or multiple of 7 is

$$= \frac{9}{20} = \frac{6+3}{20} = \frac{3}{20} + \frac{6}{20}$$

The numbers which are odd:

11, 13, 15, 17, 19, 21, 23, 25, 27, 29

∴ Number of odd numbers = 10

Again, the numbers which are divisible by 4 are : 12, 16, 20, 24, 28

∴ Number of divisible by 4 = 5

∴ The probability of the drawn of odd or divisible by 4

$$= \frac{15}{20} = \frac{10+5}{20} = \frac{5}{20} + \frac{10}{20}$$

$$\text{Here, } \frac{15}{20} > \frac{9}{20}$$

Therefore, probability of the drawn to be prime or multiple of 7 is less than that of odd or divisible by 4. (Shown)

Question ▶ 22 A coin and a dice are thrown together.

[Rangpur Cadet College, Rangpur]

- Write down the sample space for above stem. 2
- Determine the probability of getting head and odd number. 4
- Find the probability of getting at least one head and one even numbers together. 4

Solution to the question no. 22

a Sample space : $\{H1, T1, H2, T2, H3, T3, H4, T4, H5, T5, H6, T6\}$

- b** From 'a'
 Total sample points = 12
 Sample point of getting the head of the coin and an odd number on the dice = H1, H3, H5.
 \therefore Favorable sample points = 3
 \therefore The probability of getting the head of the coin and an odd number on the dice = $\frac{3}{12} = \frac{1}{4}$ (Ans.)

- c** Sample points of getting head and even number's together = H2, H4, H6.
 \therefore Favorable sample points = 3.
 \therefore Probability of getting at least one head and one even number = $\frac{3}{12} = \frac{1}{4}$ (Ans.)

Question ▶ 23 A dice is thrown once and an unbiased coin is tossed together for an experiment. [Cumilla Cadet College, Cumilla]

- a. Define sample with example. 2
 b. What is the probability of getting an even number or a number divisible by 3 from the dice only? 4
 c. Draw the probability tree and find the probability of getting odd numbers from the dice and tail from the coin. 4

Solution to the question no. 23

a **Sample space:** The set of all possible outcomes of a random experiment is called the sample space.

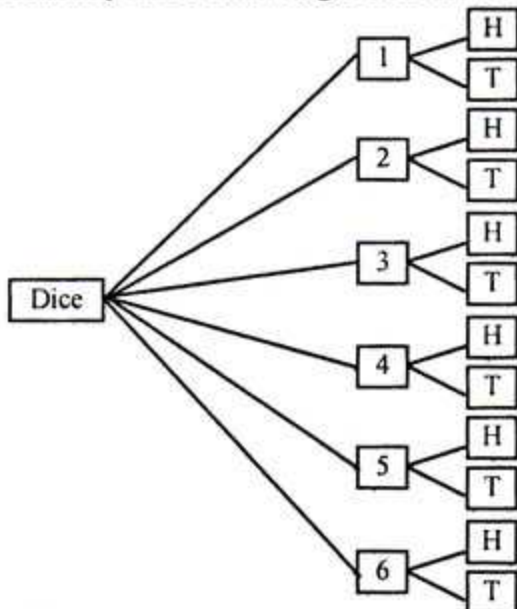
If two coins are tossed simultaneously then the sample space is $S = \{HH, HT, TH, TT\}$

b The possible outcomes of throwing an unbiased dice are : 1, 2, 3, 4, 5, 6

\therefore Number of total possible outcomes = 6
 The possible outcomes to get an even number or a number divisible by 3 are : 2, 3, 4, 6

\therefore The probability of getting an even number or a number divisible by 3 = $\frac{4}{6} = \frac{2}{3}$ (Ans.)

c The probability tree of throwing a dice and a coin is —



\therefore Sample space $S = \{1H, 1T, 2H, 2T, 3H, 3T, 4H, 4T, 5H, 5T, 6H, 6T\}$

\therefore Total sample point = 12
 and favorable events of getting odd numbers from the dice and tail from the coin:
 $\{1T, 3T, 5T\}$
 Favorable sample point = 3
 \therefore Probability of getting odd numbers from the dice and tail on coin = $\frac{3}{12} = \frac{1}{4}$ (Ans.)

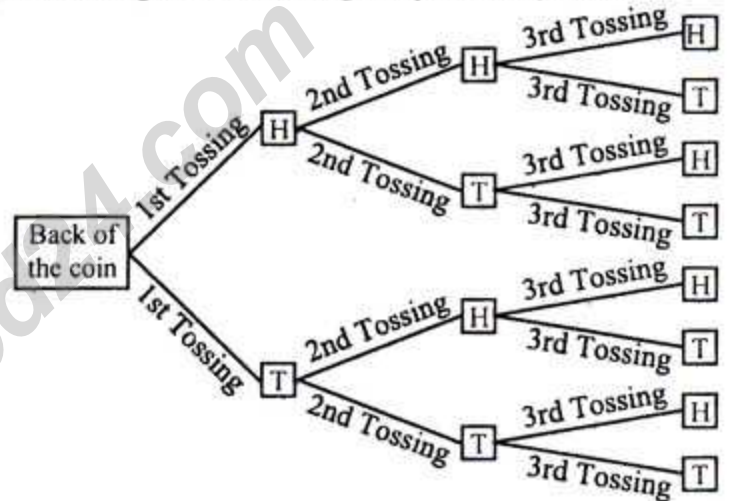
Question ▶ 24 Scenario 1 : An unbiased coin is tossed thrice. [Faujdarhat Cadet College, Chattogram]

- a. What are called event, equally likely event? 2
 b. Form a probability tree of the possible events and write down the sample space. 4
 c. According to scenario— find the probability of each of the following events. i. Getting at least one tail. ii. Getting just one head. 4

Solution to the question no. 24

a See your text book of chapter-14, page-303.

b The tossing of three coins gives probability tree :



The sample space, $S = \{HHT, HTH, HTT, HHH, THT, TTH, THH, TTT\}$ (Ans.)

c (i) The sample points containing at least one tail = 7 and total sample points = 8

$\therefore P(\text{at least one tail}) = \frac{7}{8}$

(ii) The sample points containing just one head = 3

$\therefore P(\text{Just one head}) = \frac{3}{8}$ (Ans.)

Question ▶ 25 An unbiased dice is thrown once and an unbiased coin is tossed twice at a time. [Sylhet Cadet College, Sylhet]

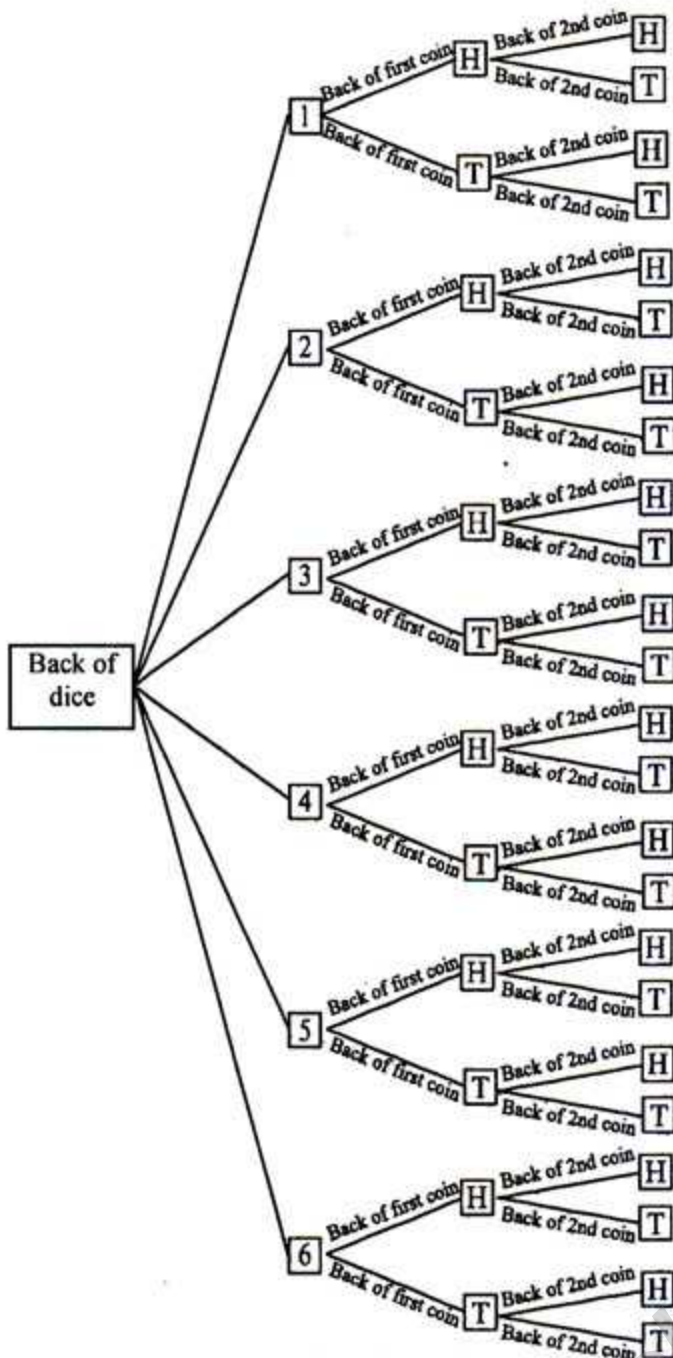
- a. What is the probability of getting odd number on the dice? 2
 b. Draw the probability tree and write down the sample space. 4
 c. What is the probability of getting even number on the dice and same side of the coin? 4

Solution to the question no. 25

a Sample space for throwing a dice, $s = \{1, 2, 3, 4, 5, 6\}$
 Total sample points = 6.
 Favorable sample points of getting odd number = 3

\therefore Probability of getting odd number = $\frac{3}{6} = \frac{1}{2}$ (Ans.)

b Probability tree of throwing a dice and two coins together:



Sample space, $S = \{1HH, 1HT, 1TH, 1TT, 2HH, 2HT, 2TH, 2TT, 3HH, 3HT, 3TH, 3TT, 4HH, 4HT, 4TH, 4TT, 5HH, 5HT, 5TH, 5TT, 6HH, 6HT, 6TH, 6TT\}$ (Ans.)

- c** From 'b',
 total sample points = 24.
 Sample points for getting even number on the dice and same side of the coins :
 2HH, 2TT, 4HH, 4TT, 6HH, 6TT
 \therefore Favorable sample points = 6
 \therefore Probability of getting even number on the dice and same side on the coin = $\frac{6}{24} = \frac{1}{4}$ (Ans.)

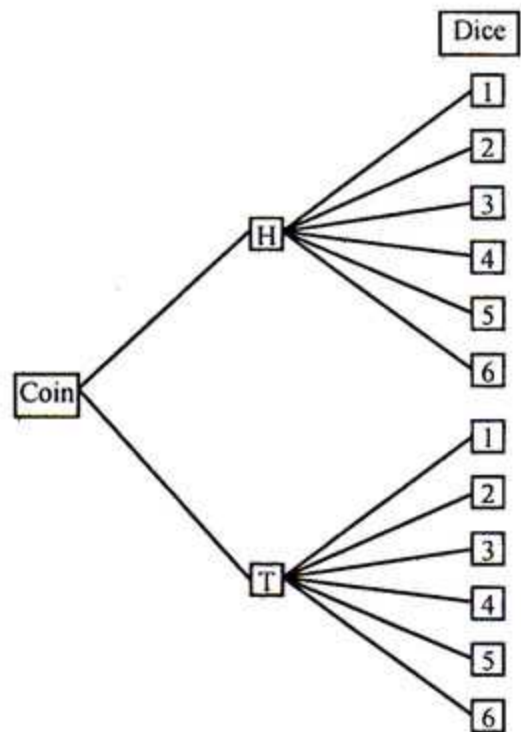
Question 26 Two dice drawing randomly at a time. Also three coins drawing randomly at a time.

[Jhenidah Cadet College, Jhenidah]

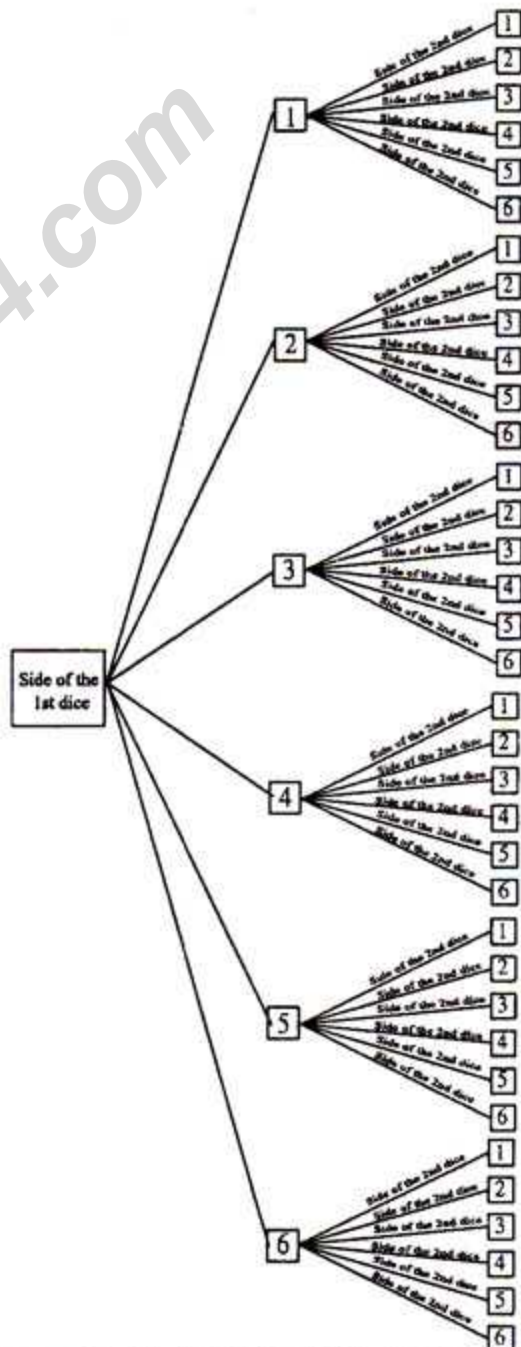
- Draw a probability tree for drawing one dice and one coin. 2
- Find the probability of odd number in both dice, when drawing two dice at a time. 4
- Show that the sum of the probability of three tails and getting at least one head is one. 4

Solution to the question no. 26

a Tree diagram of drawing a coin and a dice is shown below:

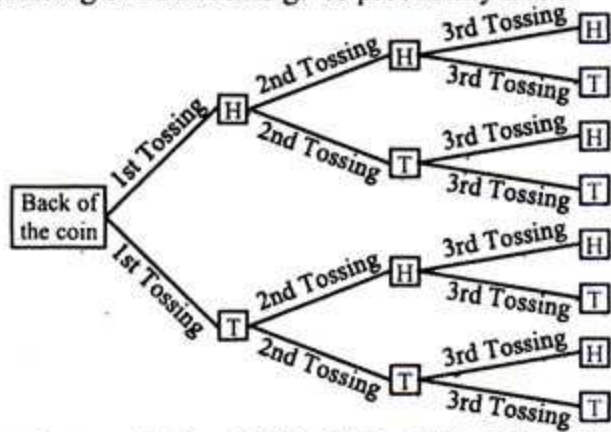


b



Sample Space = $\{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$
 Number of sample space in favor of odd number in both dice = 18
 \therefore Probability of odd number in both dice = $\frac{18}{36} = \frac{1}{2}$ Ans.

c The tossing of three coins gives probability tree :



The sample space is $S = \{HHT, HTH, HTT, HHH, THT, TTH, THH, TTT\}$

\therefore The sum of the probability of three tails and at least one head
 $= \frac{1}{8} + \frac{7}{8} = 1$ (Shown)

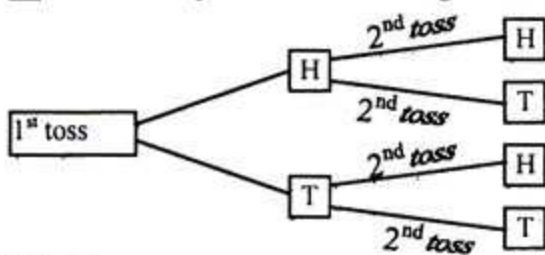
Question 27 A box contains 5 black and 3 green balls. Two balls are drawn at random one after another without replacement.

[Barishal Cadet College, Barishal]

- What is the probability of going Rangpur to Dhaka 'or' Khulna to Barishal by bus. 2
- Find the probability that the balls are in same colors. 4
- If 4 white balls are kept after 2nd- draw and another ball is drawn from the bag then find the probability that is black. 4

Solution to the question no. 27

a Probability tree of two tossing of the coin :



b Given,

Black ball = 5

Green ball = 3

\therefore Total ball = 5 + 3 = 8

If two balls are drawn at random one after another without replacement

= P(two balls are black) + P(two balls are green)

$$= \left(\frac{5}{8} \times \frac{4}{7}\right) + \left(\frac{3}{8} \times \frac{2}{7}\right)$$

$$= \frac{5}{14} + \frac{3}{28}$$

$$= \frac{13}{28} \text{ (Ans.)}$$

c If 4 white balls are kept after 2nd draw then total number of class = (5 + 3) - 2 + 4 = 10

After 2nd drawn, if one ball drawn from the bag then the probability of the ball to be black = P(black, black, black) +

P(Black, Green, Black) +

P(Green, Black, Black) +

P(Green, Green, Black)

$$= \left(\frac{5}{8} \times \frac{4}{7} \times \frac{3}{10}\right) + \left(\frac{5}{8} \times \frac{3}{7} \times \frac{3}{10}\right) +$$

$$+ \left(\frac{3}{8} \times \frac{5}{7} \times \frac{3}{10}\right) + \left(\frac{3}{8} \times \frac{2}{7} \times \frac{3}{10}\right)$$

$$= \frac{3}{28} + \frac{9}{112} + \frac{9}{112} + \frac{9}{280}$$

$$= \frac{3}{10} \text{ (Ans.)}$$

Question 28 The probability that Hasan will travel from Dhaka to Cumilla by bus is $\frac{3}{5}$ and that he will travel from Cumilla to Chattogram by train is $\frac{5}{7}$ and Rakib through of two dice.

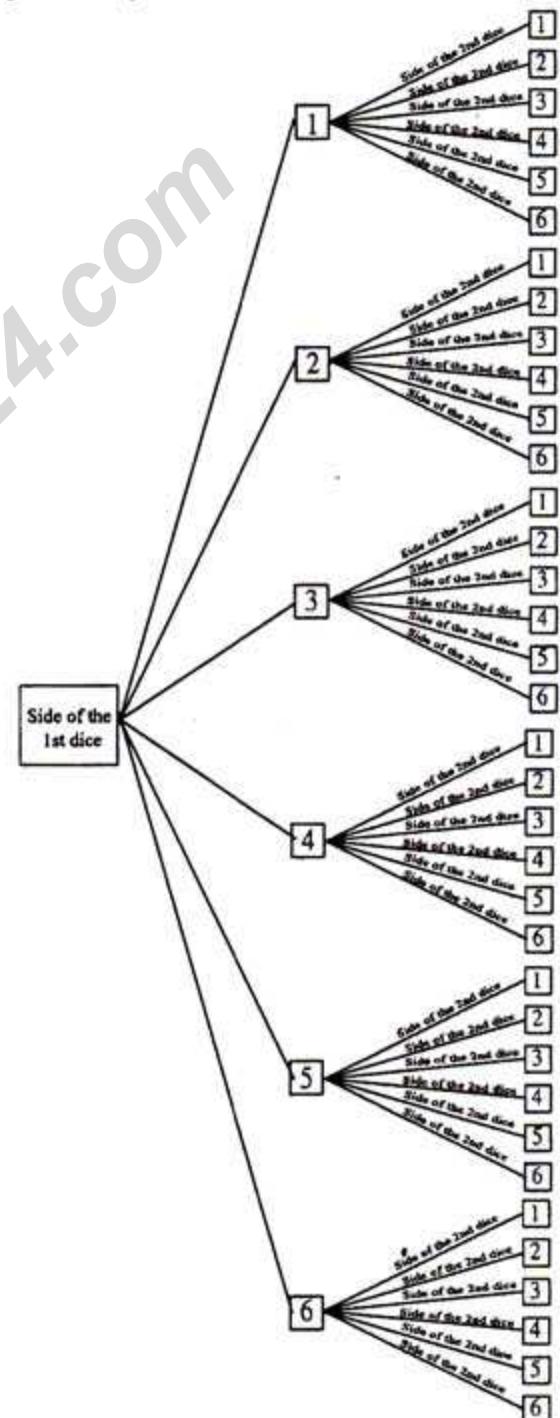
[RAJUK Uttara Model College, Dhaka]

- Define random experiment with example. 2
- Draw a probability tree and write down the sample space by throw dice Rakib. 4
- Use a to determine the probability that Hasan will Dhaka to Cumilla by bus and will subsequently travel to Chattogram not by train. (Use to probability tree) 4

Solution to the question no. 28

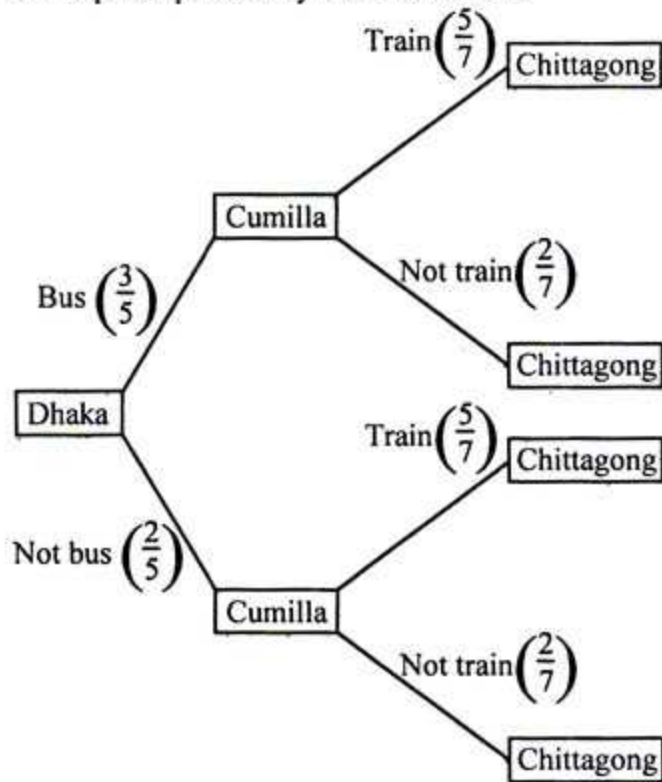
a See your text book.

b The probability tree is as follows :



Sample space = $\{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$

- c The required probability tree is as follow:



∴ Probability of Hasan to visit to Cumilla by bus and to Chattogram not by train.

$$= \frac{3}{5} \times \frac{2}{7}$$

$$= \frac{6}{35} \text{ (Ans.)}$$

- Question ▶ 29** There are same types 5 white, 6 red and 8 black balls in a basket. A ball is chosen randomly.

[Viqarunnisa Noon School & College, Dhaka]

- a. If set B is a favourable out come of any event then show that $0 \leq P(B) \leq 1$ 2
 b. Find the probability of the ball being (i) white (ii) not red. 4
 c. If three balls are picked up one by one without replacing any one of them, then find the probability of all the balls being black. 4

Solution to the question no. 29

- a Let, sample space of the random test be S and B be any event related to that space.

Number of sample points in favor of B = n (B).

∴ according to mathematical definition of probability,

$$P(B) = \frac{n(B)}{n(S)} \dots\dots(i)$$

It is clear that, the number of components of event B ranges from, 0 to n (S)

- i.e. $0 \leq n(B) \leq n(S)$

$$\text{Or, } \frac{0}{n(S)} \leq \frac{n(B)}{n(S)} \leq \frac{n(S)}{n(S)} \text{ [Dividing by } n(S)]$$

$$\text{Or, } 0 \leq P(B) \leq 1 \text{ [from equation (1)]}$$

$$\therefore 0 \leq P(B) \leq 1 \text{ (Shown)}$$

- b Total number of balls = 5 + 6 + 8 = 19

$$\therefore \text{The probability of the ball be white} = \frac{5}{19} \text{ (Ans.)}$$

$$\text{The probability of the ball be red} = \frac{6}{19}$$

$$\therefore \text{The probability of the ball not be red} = 1 - \frac{6}{19} = \frac{13}{19} \text{ (Ans.)}$$

- c If three balls are picked up one by one without replacement, then the probability of all balls being black

$$= \frac{8}{19} \times \frac{7}{18} \times \frac{6}{17}$$

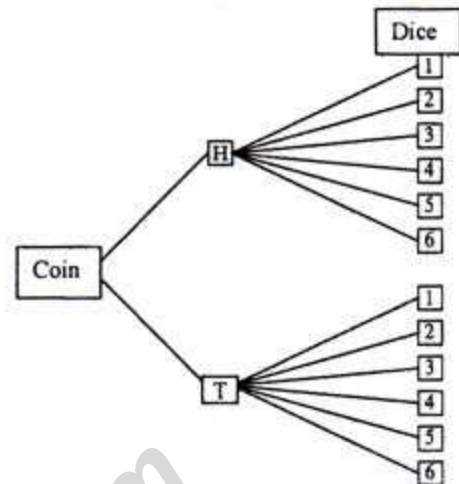
$$= \frac{56}{969} \text{ (Ans.)}$$

- Question ▶ 30** An unbiased coin and an unbiased dice are thrown togetherly. [Dhaka Residential Model School and College, Dhaka]

- a. Draw the probability tree of the event. 2
 b. Find the probability of getting tail on the coin and odd number on the dice from the sample space. 4
 c. Except the dice if only coin is tossed three times, find the probability of getting at least one head from the sample space. 4

Solution to the question no. 30

- a Tree diagram of drawing a coin and a dice is shown below:



- b According to the probability tree of the events of random experiment of a coin and a dice, together the sample space is:

$$S = \{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6\}$$

Here total number of possible outcomes = 12

Again number of favorable outcomes of getting the tail in the coin and odd number in dice = 3

$$\therefore \text{The probability of getting tail in the coin and odd number in dice} = \frac{3}{12} = \frac{1}{4} \text{ (Ans.)}$$

- c If only coin is thrown three times, the sample space of events will be as under:

$$\{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$$

∴ The number of possible outcomes = 8

∴ The favorable outcomes of getting at least one head

$$= \{HHH, HHT, HTH, THH, HTT, TTH, THT\} = 7$$

$$\therefore \text{The desired probability of getting at least one head} = \frac{7}{8} \text{ (Ans.)}$$

- Question ▶ 31** There are 5 apples, 9 oranges and 11 guavas in a box. A fruit is chosen randomly. [Milestone College, Dhaka]

- a. Define random experiments. 2
 b. Find the probability of the fruit being (i) apple and (ii) not orange. 4
 c. If five fruits are picked up one by one without replacing any of them, then find the probability of all the fruits being guava. 4

Solution to the question no. 31

- a **Random experiment:** When all possible outcomes of any experiment are known in advance but the outcomes of any specific trial are unknown then it is called random experiment.

- b Given, apple = 5, orange = 9, guava = 11
 Total fruits = 5 + 9 + 11 = 25

$$\text{Probability of the fruit to be apple} = \frac{5}{25} = \frac{1}{5}$$

$$\text{Probability of the fruit to be orange} = \frac{9}{25}$$

$$\therefore \text{Probability of the fruit not to be orange} = 1 - \frac{9}{25}$$

$$= \frac{16}{25} \text{ (Ans.)}$$

- c The probability of all the fruits being guava, when 5 fruits are picked up one by one without replacing any one of them = $\frac{11}{25} \times \frac{10}{24} \times \frac{9}{23} \times \frac{8}{22} \times \frac{7}{21}$
 $= \frac{1}{115}$ (Ans.)

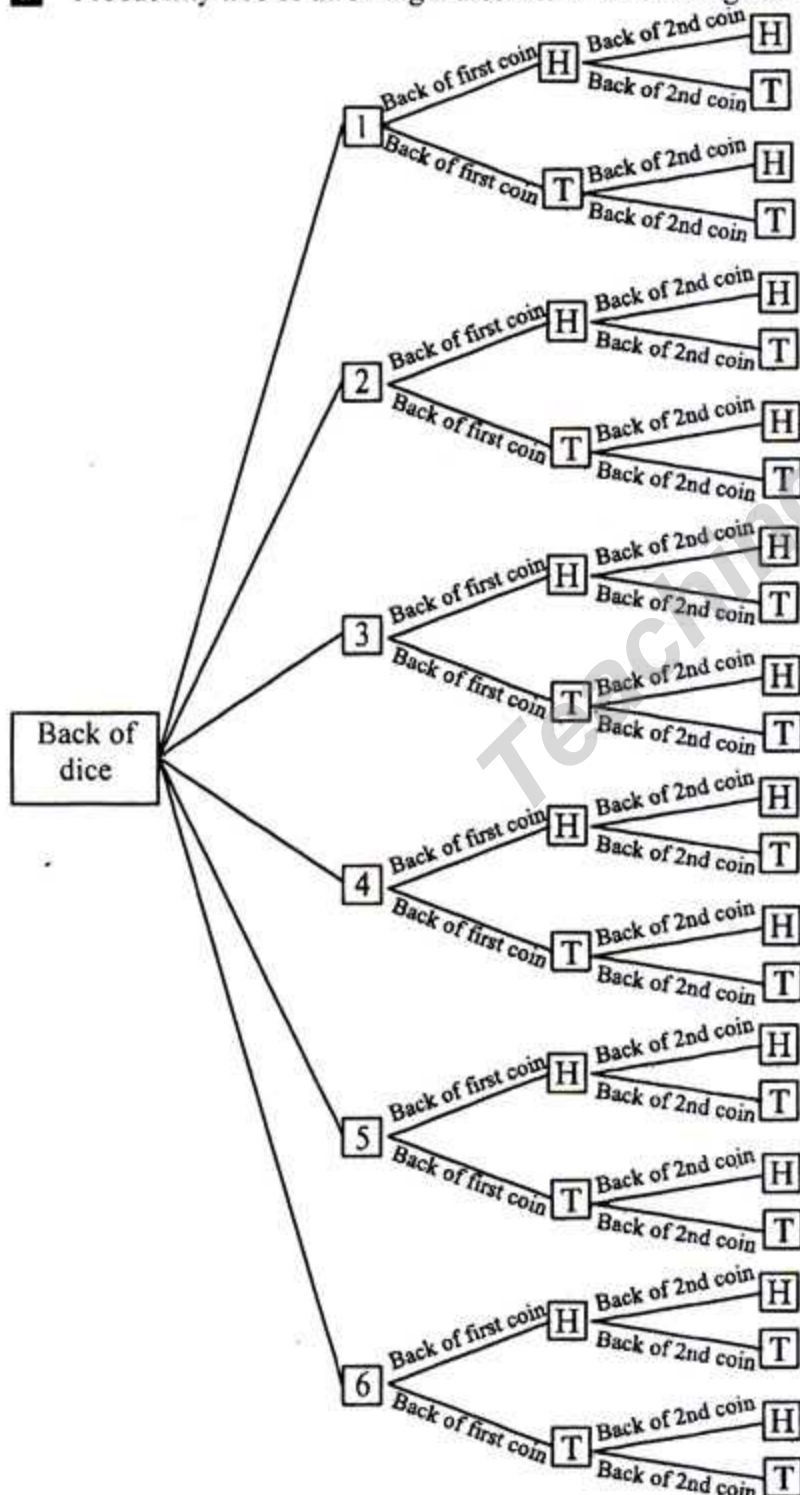
Question ▶ 32 An unbiased dice and two unbiased coins are thrown together. [Saint Joseph Higher Secondary School, Dhaka]

- a. What is random experiment? 2
 b. Draw the probability tree and write the sample space. 4
 c. Find the probability of getting odd number and two tails and (ii) prime number and two heads. 4

Solution to the question no. 32

a Random experiment : When all possible outcomes of any experiment are known in advance but the outcomes of any specific trial are unknown then it is called random experiment.

b Probability tree of throwing a dice and two coins together:



Sample space, $S = \{1HH, 1HT, 1TH, 1TT, 2HH, 2HT, 2TH, 2TT, 3HH, 3HT, 3TH, 3TT, 4HH, 4HT, 4TH, 4TT, 5HH, 5HT, 5TH, 5TT, 6HH, 6HT, 6TH, 6TT\}$ (Ans.)

- c Total sample points = 24
 (i) Favorable sample point to get odd numbers on dice and two tails on coins : 1TT, 3TT, 5TT
 \therefore Favorable sample point = 3
 $\therefore P(\text{odd number and 2T}) = \frac{3}{24}$
 $= \frac{1}{8}$ (Ans.)

- (ii) Favourable sample point to get prime number on dice and two heads on coin's : 2HH, 3HH, 5HH
 \therefore Favorable sample points = 3
 $\therefore P(\text{prime number and 2H}) = \frac{3}{24}$
 $= \frac{1}{8}$ (Ans.)

Question ▶ 33 There are 9 red, 11 white and 7 black balls in a basket. A ball is chosen at random. [BAF Shaheen College, Tejgaon, Dhaka]

- a. What is called sample space and sample point? 2
 b. What is the probability of the ball to be (i) red (ii) not black. 4
 c. If four balls are picked up one-by one without replacing any one of them, then find the probability of the balls being white. 4

Solution to the question no. 33

a **Sample Space** : The set of all possible outcomes of a random experiment is called sample space.

Sample point : Every element of a sample space is called sample point

- b (i) Total number of balls = $(9 + 11 + 7) = 27$
 Number of red balls = 9

\therefore Probability of getting red balls = $\frac{9}{27}$
 $= \frac{1}{3}$ (Ans.)

- (ii) Number of black balls = 7
 Number of balls that are not black = $(27 - 7) = 20$

\therefore Probability of the ball not to be black = $\frac{20}{27}$ (Ans.)

c If the balls are picked successively without replacement then the total number of sample points will decrease by 1 each time.

The probability of getting white balls first time = $\frac{11}{27}$

For the second time the probability = $\frac{10}{26}$

For the 3rd time the probability = $\frac{9}{25}$

For the 4th time probability = $\frac{8}{24}$

\therefore Without replacement pick up four balls one after another the probability of getting white balls = $\frac{11}{27} \times \frac{10}{26} \times \frac{9}{25} \times \frac{8}{24}$
 $= \frac{11}{585}$ (Ans.)

Question ▶ 34 There are 8 red, 10 white and 7 black marbles in a basket. A marble is chosen randomly. [BAF Shaheen College, Kurmitola, Dhaka]

- a. Find all possible outcomes. 2
 b. Find the probability of the marble being (i) Red & (ii) not white. 4
 c. If four marbles are picked up one by one without replacing any one of them then find the probability of all the marbles being white. 4

Solution to the question no. 34

- a** Here,
Number of red marbles 8
Number of white marbles 10
and Number of black marbles 7
 \therefore Number of total marbles = $(8 + 10 + 7) = 25$
- b** (i) Total number of marbles 25.
Number of red marbles 8
 \therefore Probability of getting red marbles = $\frac{8}{25}$ (Ans.)
- (ii) Total number of marbles 25
Number of white marbles 10
 \therefore Number of different colours of white marble = $(25 - 10) = 15$
probability of the marble will not become white
i. e. probability that the marble become different colour of white = $\frac{15}{25} = \frac{3}{5}$ (Ans.)
- c** Without replacing marble pickup more than one each time the number of marbles i. e. total numbers of sample point will be less than one before.
There for the first time,
The probability of getting white marbles = $\frac{10}{25}$
For the second time probability = $\frac{9}{24}$
For the third time probability = $\frac{8}{23}$
and for the fourth time probability = $\frac{7}{22}$
 \therefore Without replacing pick up four marbles one after another the probability of getting white marble
 $= \frac{10}{25} \times \frac{9}{24} \times \frac{8}{23} \times \frac{7}{22}$
 $= \frac{21}{1265}$ (Ans.)

Question ▶ 35 There are 18 red, 20 white and 17 black marbles in a basket. A marble is chosen randomly.

[Bangladesh International School & College, Dhaka]

- a. What do you mean by equally likely events. 2
b. Find the probability of the marbles being (i) red and (ii) not white. 4
c. If five marbles are picked up one by one without replacing any one of them, then find the probability of all the marbles being white. 4

Solution to the question no. 35

- a** See your text book of chapter-14
b To red marbles = $18 + 20 + 17 = 55$
- (i) The Probability of marbles to be red = $\frac{18}{55}$ (Ans.)
- (ii) The Probability of marbles to be white = $\frac{20}{55} = \frac{4}{11}$
 \therefore The probability of marble not to be white = $1 - \frac{4}{11} = \frac{7}{11}$ (Ans.)
- c** If five marbles are picked up successively without replacement, then the probability of all the marble to be white
 $= \frac{20}{55} \times \frac{19}{54} \times \frac{18}{53} \times \frac{17}{52} \times \frac{16}{51}$
 $= \frac{304}{68211}$ (Ans.)

Question ▶ 36 A bag contains 6 white, 7 red and 9 black balls.

[Mirpur Girls' Ideal Laboratory Institute, Dhaka]

- a. What is mutually exclusive events? 2
b. Find the probability of the ball being red and not white. 4
c. If four balls are picked up one by one without replacing any one of them, then find the probability of all the balls being white. 4

Solution to the question no. 36

- a** **Mutually exclusive events:** Two or more possible outcomes of a random experiment are called mutually exclusive event if the occurrence of one of those events, precludes the possibility of the other events. In the tossing of a coin, the occurrence of head and tail are two mutually exclusive events. Because head and tail cannot occur together.
- b** Total number of balls in the bag = $(6 + 7 + 9) = 22$
Number of red balls in the bag = 7
 \therefore The probability that the ball is red = $\frac{7}{22}$ (Ans.)
Number of white balls in the bag = 6
 \therefore The probability of the ball being white = $\frac{6}{22} = \frac{3}{11}$
 \therefore The probability of the ball being not white = $1 - \frac{3}{11} = \frac{8}{11}$ (Ans.)
- c** Without replacing ball if we pickup more than once each time the number of ball i.e total numbers of sample point will be less than one before.
Then, for first time, the probability of getting white balls = $\frac{6}{22}$
For the second time the probability = $\frac{5}{21}$
For the third time the probability = $\frac{4}{20}$
For the fourth time the probability = $\frac{3}{19}$
 \therefore The probability at all four balls being white = $\frac{6}{22} \times \frac{5}{21} \times \frac{4}{20} \times \frac{3}{19} = \frac{3}{1463}$ (Ans.)

Question ▶ 37 The number of examinee answered the different number of questions in an examination are as follows:

Number of answered question	Number of examinee
1	5
2	45
3	150
4	500
5	800
6 or more	500

[Baridhara Scholars' Institution (BSI), Dhaka]

- a. What do you mean by sample space? 2
b. What is the probability that the student answered at most 4 questions? 4
c. Show that, the probability of the student answered at most 5 questions is more than that of at least 6 questions. 4

Solution to the question no. 37

- a** **Sample space:** The set of all possible outcomes of a random experiment is called the sample space.
If two coins are tossed simultaneously then the sample space is $S = \{HH, HT, TH, TT\}$

b Here, total number of examinee
 $= 5 + 45 + 150 + 500 + 800 + 500$
 $= 2000$

Number of examinee that answered at most 4 questions
 $= 5 + 45 + 150 + 500$
 $= 700$

\therefore The probability that the student answered at most 4 questions
 $= \frac{\text{Number of examinee that answered at most 4 questions}}{\text{total number of examinee}}$
 $= \frac{700}{2000} = \frac{7}{20}$ (Ans.)

c Total number of examinee = 2000
 Number of examinee that answered at most 5 questions
 $= 5 + 45 + 150 + 500 + 800$
 $= 1500$

The probability that the student answered at most 5 questions
 $= \frac{\text{Number of examinee that answered at most 5 questions}}{\text{total number of examinee}}$
 $= \frac{1500}{2000} = \frac{3}{4}$

Again, Number of examinee that answered at least 6 questions = 500

\therefore The probability that the student answered at least 6 questions
 $= \frac{\text{Number of examinee that answered at least 6 questions}}{\text{total number of examinee}}$

$= \frac{500}{2000} = \frac{1}{4}$

Since, $\frac{3}{4} > \frac{1}{4}$

So, the probability of the student answered at most 5 questions is more than that of at least 6 questions. (Shown).

Question ▶ 38 In the summer vacation Shihab goes to the grandfather's house of Tarikul at Khulna from Dhaka and then he goes to the uncle's house at Rajshahi. The probability of going to Khulna from Dhaka by bus is $\frac{3}{5}$. The probability of going Rajshahi from Khulna not by train is $\frac{5}{6}$.

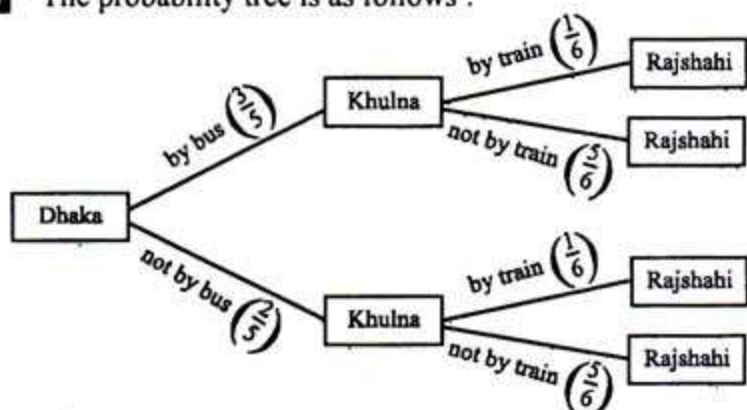
[Chetona Model Academy (CMA), Dhaka]

- Going by bus and not by train is what type of incidents to each other? 2
- Express the given information by probability tree. 4
- What is the probability of Shihab to go to Khulna from Dhaka not by bus and from Khulna to Rajshahi by train? 4

Solution to the question no. 38

a Going by bus and not by train is independent incidents to each other.

b The probability tree is as follows :



c From probability tree, probability of Shihab to go to Khulna from Dhaka not by bus and from Khulna to Rajshahi by train $= \frac{2}{5} \times \frac{1}{6} = \frac{1}{15}$ (Ans.)

Question ▶ 39 A bag contains 10 red (R), 5 black (B), 8 white (W) and 6 yellow (Y) marbles. A marble is chosen at random from bag. [Rajshahi Cantonment Public School & College, Rajshahi]

- What is random experiment? 2
- What is the probability that the marble will be yellow or black. 4
- Show that the probability that the marble will be red or white or white or black is equal to the probability that the marble will not be yellow. 4

Solution to the question no. 39

a **Random experiment:** When all possible outcomes of any experiment are known in advance but the outcomes of any specific trail are unknown then it is called random experiment.

b Given, there are 10 red, 5 black, 8 white and 6 yellow marbles.
 Total marbles = 10 + 5 + 4 + 6 = 25

\therefore The probability of a marble to be black = $\frac{5}{25} = \frac{1}{5}$

\therefore The probability of a marble to be yellow = $\frac{6}{25}$

So the probability of a marble to be black or yellow

$= \frac{6}{25} + \frac{1}{5} = \frac{6+5}{25} = \frac{11}{25}$ (Ans.)

c The probability of a marble to be red = $\frac{10}{25}$

The probability of a marble to be white = $\frac{4}{25}$

The probability of a marble to be black = $\frac{5}{25}$

\therefore The probability of a marble to be red or white or black

$= \frac{10}{25} + \frac{4}{25} + \frac{5}{25} = \frac{19}{25}$

From 'b' we get,

The probability of a marble to be yellow = $\frac{6}{25}$

\therefore The probability of a marble not to be yellow = $1 - \frac{6}{25}$

$= \frac{19}{25}$

So, the probability that the marble to be red white or black is equal to the probability that the marble not to be yellow. (Shown)

Question ▶ 40 A bag contains 10 red, 5 back, 8 white and 6 yellow marbles. A marble is chosen at random from the bag. [Millennium Scholastic School & College, Bogura]

- What is random experiment? 2
- What is the probability that the marble will be yellow or black? 4
- Show that, the probability that the marble will be red or white or black is equal to the probability that the marble will not be yellow. 4

Solution to the question no. 40

a **Random experiment:** When all possible outcomes of any experiment are known in advance but the outcomes of any specific trail are unknown then it is called random experiment.

b Given, there are 10 red, 5 black, 8 white and 6 yellow marbles.
 Total marbles = 10 + 5 + 4 + 6 = 25.

\therefore The probability of a marble to be black = $\frac{5}{25} = \frac{1}{5}$

∴ The probability of a marble to be yellow = $\frac{6}{25}$

So the probability of a marble to be black or yellow

$$= \frac{6}{25} + \frac{1}{5} = \frac{6+5}{25} = \frac{11}{25} \text{ (Ans.)}$$

c The probability of a marble to be red = $\frac{10}{25}$

The probability of a marble to be white = $\frac{4}{25}$

The probability of a marble to be black = $\frac{5}{25}$

∴ The probability of a marble to be red or white or black

$$= \frac{10}{25} + \frac{4}{25} + \frac{5}{25} = \frac{19}{25}$$

From 'b' we get,

The probability of a marble to be yellow = $\frac{6}{25}$

$$\begin{aligned} \therefore \text{The probability of a marble not to be yellow} &= 1 - \frac{6}{25} \\ &= \frac{19}{25} \end{aligned}$$

So, the probability that the marble to be red white or black is equal to the probability that the marble not to be yellow. (Shown)

Question ▶ 41 A coin is tossed four times by Shoishab.

[Dinajpur Laboratory School & College, Dinajpur]

- What is the probability of getting an odd number or a number divisible by 2 in single throw of a dice? 2
- Draw the probability tree and write down the sample space. 4
- What is the probability contains at least two heads and one tail? 4

Solution to the question no. 41

a The sample space of drawing a dice = {1, 2, 3, 4, 5, 6}

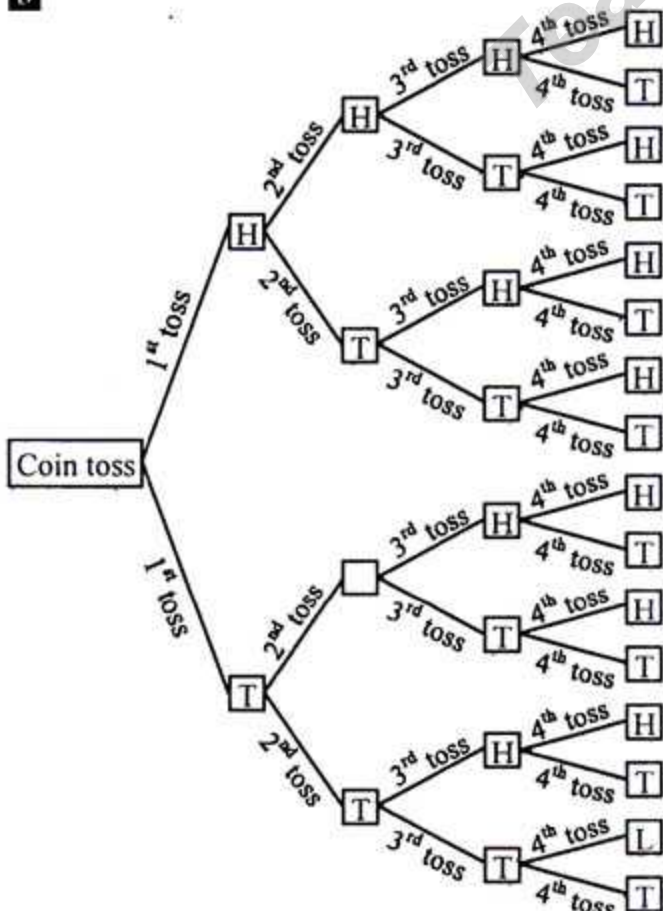
∴ Total sample points = 6

Again, probable sample points of getting an odd number or a number divisible by 2 in a single throw of a dice = 1, 2, 3, 4, 5, 6

∴ Favorable sample point = 6

∴ Probability of getting an odd number or a number divisible by 2 = $\frac{6}{6} = 1$ (Ans.)

b



∴ Sample space, $S = \{HHHH, HHHT, HHTH, HHTT, HTHH, HTHT, HTTH, HTTT, THHH, THHT, THTH, THTT, TTHH, TTHT, TTTH, TTTT\}$

c From 'b' we get,

Total number of sample points = 16

Favorable events contains at least 2 heads and one tail:

HHHT, HHTH, HHTT, HTHH, HTHT, HTTH, THHH, THHT, THTH, THTT, TTHH

∴ Favorable sample point = 10

∴ Probability of getting at least 2 heads and one tail = $\frac{10}{16}$

$$= \frac{5}{8} \text{ (Ans.)}$$

Question ▶ 42 There are 20 students in class X of Karimpur school. One student will get full free scholarship. In a lottery system if the roll of one student is chosen randomly.

[Cantonment Public School & College, Saidpur]

- Find the probability that the roll of the student will be prime number. 2
- Find the probability that the roll of the student will be divisible by 3 or 5. 4
- Find the probability that the roll of the student will be divisible by 4 or 6. 4

Solution to the question no. 42

a Prime numbers in between 1 and 20 are 2, 3, 5, 7, 11, 13, 17, 19

Number of prime numbers is = 8

Total number in = 20

∴ The probability of the roll of the student will be prime is

$$= \frac{8}{20} = \frac{2}{5} \text{ (Ans.)}$$

b The numbers which are divisible by 3 or 5

are : 3, 5, 6, 9, 10, 12, 15, 18, 20

Number of rolls which are divisible by 3 or 5 is = 9

∴ Probability of the roll will be divisible by 3 or 5 is = $\frac{9}{20}$ (Ans.)

c The numbers which are divisible by 4 and 6 are : 12

1 roll is divisible by 4 and 6.

∴ Probability of the roll will be divisible by 4 and 6 is = $\frac{1}{20}$ (Ans.)

Question ▶ 43 There are 6 green, 10 blue and 5 black balls in a basket. A ball is chosen randomly.

[Mainamati International School and College, Cumilla]

- Find all possible outcomes. 2
- Find the probability of the ball being (a) Green and (b) not blue. 4
- If four balls are picked up one by one without replacing any one of them, then find the probability of all the balls being white. 4

Solution to the question no. 43

a Number of green balls 6

Number blue balls 10

Number black balls 5

∴ Total number of possible outcomes = 6 + 10 + 5 = 21 (Ans.)

b Total number of balls = 10 + 5 + 6 = 21

Number of green balls = 6

∴ The probability of

being green = $\frac{\text{number of Green balls}}{\text{total number of balls}}$

$$= \frac{6}{21} = \frac{2}{7} \text{ (Ans.)}$$

Number of blue balls = 10

∴ The probability of being blue = $\frac{\text{number of blue balls}}{\text{total number of balls}}$
 $= \frac{10}{21}$

∴ Probability of being not blue = 1 - probability of being blue
 $= 1 - \frac{10}{21} = \frac{11}{21}$ (Ans.)

c There are no white balls in the basket. So, if we picked any number of balls we will not be able to find any white ball. So, probability of being all four balls white is 0. (Ans.)

Question 44 Tipu and Roni collected some mangoes from the mango grove and kept in a bag. Till now they have collected 9 Fajli, 7 Langra, 13 Amropali and 11 Fajvough. Suddenly Tipu took out a mango from the bag and ate it. After that Roni also put his hand into the bag took a mango out.

(Cantonment English School & College, Chattogram)

- a. What do you mean by event and sample space? 2
- b. What is the probability of the mango eaten by Tipu to be Amropali or Langra? 4
- c. What is the probability of the mango took by Roni not to be Fajli? 4

Solution to the question no. 44

a **Event** : An outcome or a combination of outcomes of an experiment is called an event.

Example : Getting 3 after throwing a dice is an event.

Sample Space : The set of all possible outcomes of a random experiment is called the sample space.

Example : The tossing of a coin has two possible outcomes.

b Total number of mango is = (9 + 7 + 13 + 11) = 40
 Number of Amropali = 13

∴ Probability of the mango eaten by Tipu will be Amropali = $\frac{13}{40}$

Number of Langra = 7

∴ Probability of the mango eaten by Tipu will be langra = $\frac{7}{40}$

∴ Probability of the mango eaten by Tipu will be Amropali or

$$\begin{aligned} \text{Langra} &= \frac{13}{40} + \frac{7}{40} \\ &= \frac{13+7}{40} \\ &= \frac{20}{40} \\ &= \frac{1}{2} \text{ (Ans.)} \end{aligned}$$

c After eaten a mango by Tipu the total number of mango is = 39.

Number of Fajli = 9

∴ Probability of the mango took by Roni is to be Fajli
 $= \frac{9}{39}$
 $= \frac{3}{13}$

∴ Probability of the mango took by Roni is not to be Fajli
 $= 1 - \frac{3}{13}$
 $= \frac{13-3}{13}$
 $= \frac{10}{13}$ (Ans.)

Question 45 A coin is thrown 3 times.

(Bangladesh Mahila Somitee Girls' High School & College, Chattogram)

- a. Show that, the value of probability of an event lies between 0 and 1. 2
- b. Determine the probability of getting three heads and at least one tail drawing the probability tree of the possible events of the stem. 4
- c. Show that, if the coin is thrown n-times the event will support 2^n . 4

Solution to the question no. 45

a Let, sample space of the random test be S and A be any event related to that space.

Number of sample points in favor of A = n(A).

∴ According to mathematical definition of probability,

$$P(A) = \frac{n(A)}{n(S)} \dots\dots(i)$$

It is clear that, the number of components of event A ranges from, 0 to n(S)

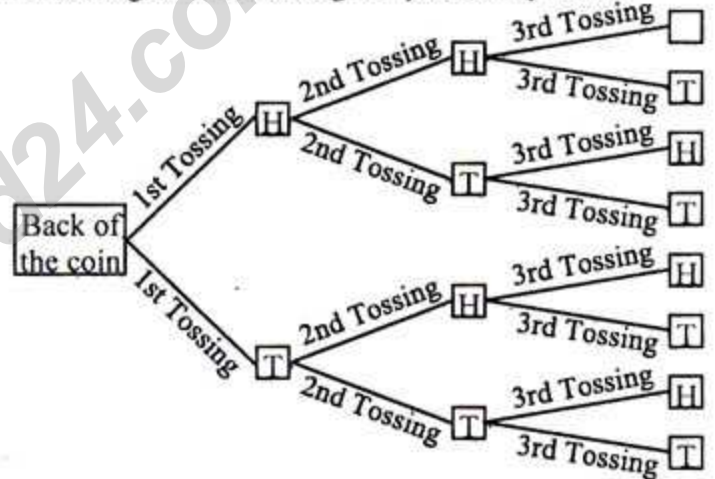
i.e. $0 \leq n(A) \leq n(S)$

Or, $\frac{0}{n(S)} \leq \frac{n(A)}{n(S)} \leq \frac{n(S)}{n(S)}$; [Dividing by n(S)]

Or, $0 \leq P(A) \leq 1$; [from equation (1)]

∴ $0 \leq P(A) \leq 1$ (Shown)

b The tossing of three coins gives probability tree :



Let, event A = 3 heads = {HHH}

∴ Number of sample points infavor of A = 1, and total number of sample points is = 8

∴ $P(A) = \frac{1}{8}$ (Ans.)

Again, let event B = at least one T occurs

= {HHT, HTH, HTT, THH, THT, TTH, TTT}

∴ Number of sample points infavor of B = 7 and total number of sample points = 8

∴ $P(B) = \frac{7}{8}$ (Ans.)

c Since a coin has only two sides, all possible outcomes of one tossing of a coin is 2

Again, all possible outcomes of two tossing of a coin is 4
 Similarly,

all possible outcomes of 1 tossing a coin = 2

" " " " " " 2 tossing = 4 = 2 × 2 = 2²

" " " " " " 3 " = 8 = 2 × 2 × 2 = 2³

" " " " " " 4 " = 16 = 2 × 2 × 2 × 2 = 2⁴

.....
 All possible outcomes of n tossing a coin = 2ⁿ

∴ For n times tossing of the coin, the sample space will consist of 2ⁿ points. (Shown)

Question ▶ 46 A bag contains 6 black balls, 3 purple and 7 green balls. A ball is taken at random.

[Navy Anchorage School and College, Chattogram]

- How many way to select a ball at random? 2
- What is the probability of getting the ball purple or black? 4
- What is the probability of getting the ball black but not green? 4

Solution to the question no. 46

a There are 6 black, 3 purple and 7 green balls. Now one ball from three different colors can be selected in 3 different ways.

b Total number of balls in the bag = 6 + 3 + 7 = 16

Number of purple balls in the bag = 3

∴ The probability that ball will be purple = $\frac{3}{16}$

Number of black ball in the bag = 6

∴ The probability that the ball will be black = $\frac{6}{16} = \frac{3}{8}$

So the probability of getting the ball purple or black = $\frac{3}{16} + \frac{6}{16}$
 $= \frac{9}{16}$ (Ans.)

c The probability of getting the ball black but not green, that means the probability of the ball being black.

So, from 'b' probability of getting the ball black = $\frac{3}{8}$ (Ans.)

Question ▶ 47 In a school, the number of students of section A, B, C, D, E and F of class X are 60, 55, 45, 50, 46, and 44 respectively. The students of sections A, B, C are in Science group, D and E are in Commerce group and F are in Arts group. A student is selected randomly as a presenter of a program.

[SCHOLARSHOME, Sylhet]

- What is random experiment? 2
- Find the probability that the selected student is being from Science group. 4
- Find the probability that the selected student is not from Commerce group. 4

Solution to the question no. 47

a **Random Experiment** : When all the outcomes of an experiment is known but it can't be said for which definite attempt, which outcome will be obtained, such experiment is called random experiment.

b Number of total students = (60 + 55 + 45 + 50 + 46 + 44)
 = 300

Number of students from science = (60 + 55 + 45)
 = 160

∴ Probability of the chosen student is being from science group = $\frac{160}{300}$
 $= \frac{8}{15}$ (Ans.)

c Total number of students = 300
 number of students from commerce group = (50 + 46)
 = 96

∴ Probability of the chosen student is being from commerce group = $\frac{96}{300} = \frac{8}{25}$

∴ Probability of the chosen student is not being from commerce group = $1 - \frac{8}{25}$
 $= \frac{17}{25}$ (Ans.)

Question ▶ 48 In a pond 13 Rui, 7 Mrigel and 10 Katal were released and caught them randomly.

[Jalalabad Cantonment Public School & College, Sylhet]

- Define impossible event with an example. 2
- What is the probability that the fish will be Katal? 4
- If the first fish is Katal and then if another fish is caught at random then what is the probability that the second fish will be Katal or a Mrigel? 4

Solution to the question no. 48

a See your text book of chapter- 14, page- 305.

b Total number of fish in a pond = 13 + 7 + 10
 = 30

Number of Katal fish = 10

∴ your probability that the fish will be katal = $\frac{10}{30}$
 $= \frac{1}{3}$ (Ans.)

c Total Number of Katal or Mrigel = 10 + 7 = 17
 If the fish is Katal and then another fish is caught at randomly, the probability that, the second fish will be Katal or Mrigel = $\frac{1}{3} \times \frac{16}{29} = \frac{16}{87}$ (Ans.)

Question ▶ 49 A coin is thrown thrice.

[The Sylhet Khajanchibari International School & College, Sylhet]

- Find the sum of probability of getting an head and tail if it thrown once. 2
- Draw the probability tree and write down sample space. 4
- Find the probability of getting - 4
 - three head, ii) at least one tail.

Solution to the question no. 49

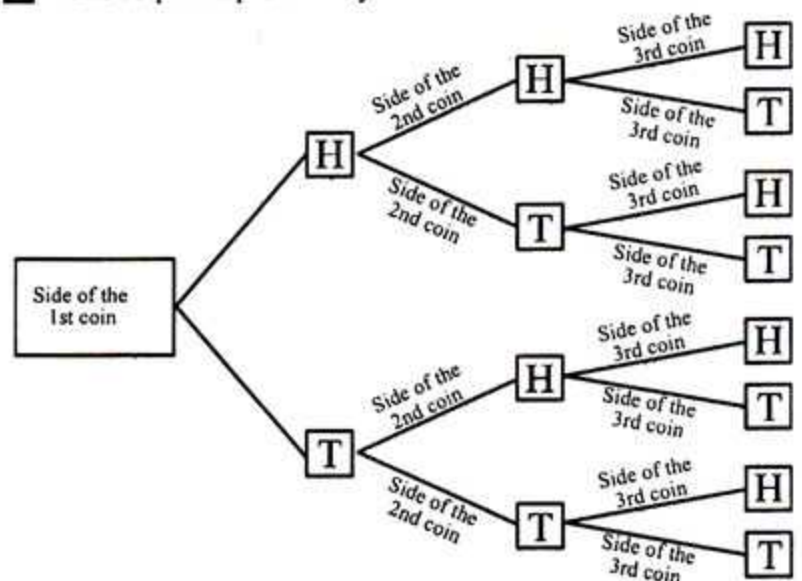
a If the coin is thrown once, then sample space, S = {H, T}

Probability of getting head = $\frac{1}{2}$

Probability of getting tail = $\frac{1}{2}$

∴ Sum of probability of getting head tail = $\frac{1}{2} + \frac{1}{2} = 1$ (Ans.)

b The required probability tree is:-



Probable outcomes are: HHH, HHT, HTH, HTT, THH, THT, TTH, TTT

∴ Sample space, S = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}

& total number of sample points = 8

- c** Let, event $A = 3 \text{ heads} = \{HHH\}$
 \therefore Number of sample points in favor of $A = 1$, and total number of sample points is $= 8$
 $\therefore P(A) = \frac{1}{8}$ (Ans.)
- Again, let, event $B = \text{at least one T occurs}$
 $= \{HHT, HTH, HTT, THH, THT, TTH, TTT\}$
 \therefore Number of sample points in favor of $B = 7$ and total number of sample points $= 8$
 $\therefore P(B) = \frac{7}{8}$ (Ans.)

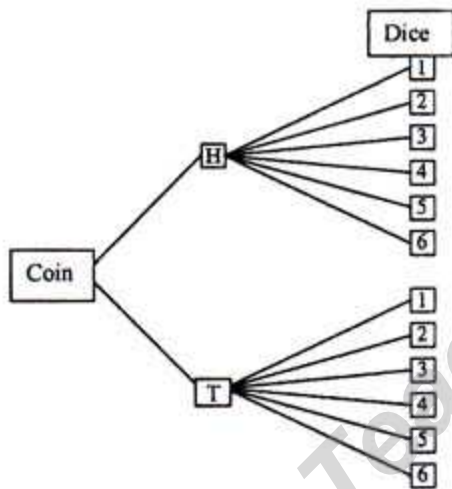
Question ▶ 50 Two dices are tossed once. A ticket is drawn from the 1 to 32 numbered for the first prize.

[Secondary & Higher Secondary Education Board, Jashore]

- Draw the probability tree from the throw of a coin and a dice. 2
- Find the probability where the number of first dice is less than the second dice. 4
- Find the probability of getting the ticket number is multiple of 2 and 3. 4

Solution to the question no. 50

- a** Tree diagram of drawing a coin and a dice is shown below:



- b** Sample space $= \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$

Let, $A = \text{outcome of getting the number of 1st dice less than the second dice.}$

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

Number of possible outcomes for $A = 15$
 and total number of sample point $= 36$

$$\therefore P(A) = \frac{15}{36}$$
 (Ans.)

- c** Here,
 total number of tickets $= 32$
 The numbers which are multiple of 2 and 3
 $= 6, 12, 18, 24, 30$
 Number of multiples of 2 and 3 $= 5$
 \therefore Probability of getting the ticket number is multiple of 2 and 3 $= \frac{5}{32}$ (Ans.)

Question ▶ 51 An unbiased dice and an unbiased coin are thrown and tossed once.

[Jashore English School and College (JESC), Jashore]

- Form a probability tree by using given information. 2
- Write down the sample spaces. 4
- What is the probability of getting 5 on the dice and head on the coin? 4

Solution to the question no. 51

- See, example-08, chapter-14, of your text book. Page-309
- See, example-08, chapter-14, of your text book. Page-309
- See, example-08, chapter-14, of your text book. Page-309