Question Bank In Mathematics Class IX (Term II)

15 PROBABILITY

A. SUMMATIVE ASSESSMENT

15.1 PROBABILITY — AN EXPERIMENTAL APPROACH

1. The science which measures the degree of uncertainty is called probability.

2. In the experimental approach to probability, we find the probability of the occurrence of an event by actually performing the experiment a number of times and record the happening of an event.

3. The observations of an experiment are called outcomes.

4. A trial is an action which results in one or several outcomes.

5. An event of an experiment is the collection of some outcomes of the experiment.

6. The emperical (or experimental) probability P(E) of an event E is given by :

$$P(E) = \frac{\text{Number of trials in which E has happened}}{\text{Total number of trials}}$$

7. The probability of an event lies between 0 and 1 (0 and 1 inclusive).

8. A die is a well balanced cube with its six faces marked with numbers 1 to 6, one number on one face. Sometimes dots appear in place of numbers.

TEXTBOOK'S EXERCISE 15.1

Q.1. *In a cricket match, a batswoman hits a boundary* 6 *times out of* 30 *balls she plays. Find the probability that she did not hit a boundary.* **[2011 (T-II)]**

Sol. Total number of balls played by the batswoman = 30, Boundaries hit = 6

No. of balls in which she did not hit any boundary = 30 – 6 = 24

$$\therefore \text{P (she did not hit a boundary)} = \frac{\text{No. of balls in which she did not hit any boundary}}{\text{Total number of balls played}} = \frac{24}{30} = \frac{4}{5}$$

Q.2. 1500 *families with* 2 *children were selected randomly, and the following data were recorded. :* **[2011 (T-II)]**

Number of girls in a family	2	1	0
Number of families	475	814	211

Compute the probability of a family, chosen at random, having
(i) 2 *girls* *(ii)* 1 *girl* *(iii) No girl*
Also check whether the sum of these probabilities is 1.

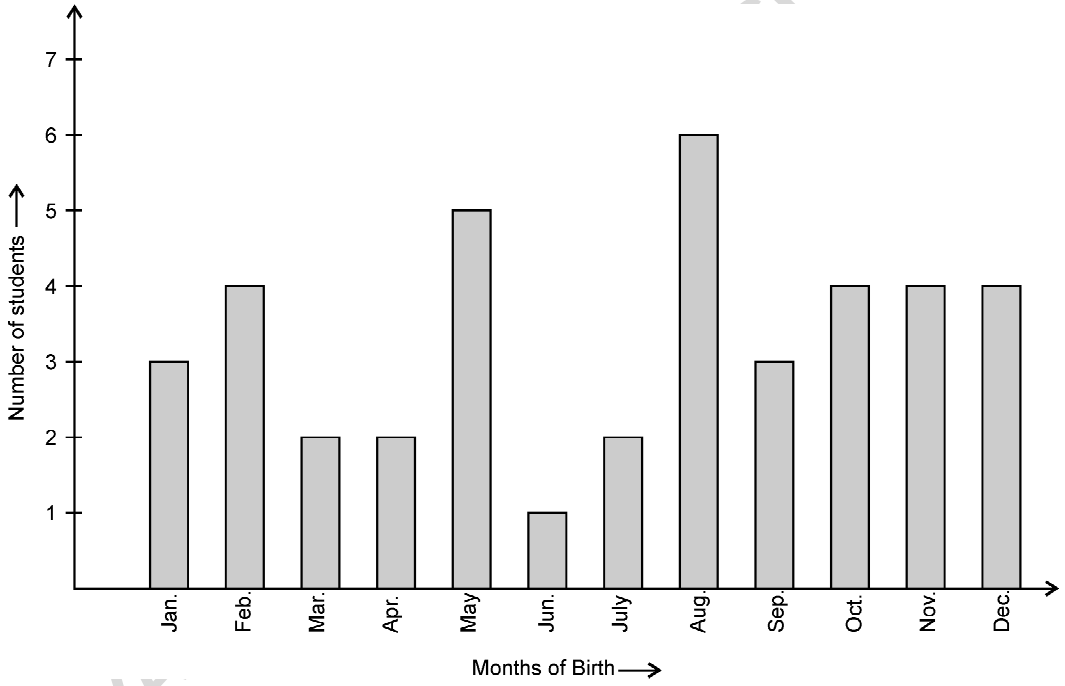
Sol. (i) $\text{P (a family having 2 girls)} = \frac{\text{No. of families having 2 girls}}{\text{Total no. of families}} = \frac{475}{1500} = \frac{19}{60}$

(ii) P (a family having 1 girl) = $\frac{\text{No. of families having 1 girl}}{\text{Total no. of families}} = \frac{814}{1500} = \frac{407}{750}$

(iii) P (a family having no girl) = $\frac{\text{No. of families having no girl}}{\text{Total no. of families}} = \frac{211}{1500}$

Sum of the probabilities in all three cases = $\frac{19}{60} + \frac{407}{750} + \frac{211}{1500} = \frac{475 + 814 + 211}{1500} = \frac{1500}{1500} = 1$

Q.3. *In a particular section of Class IX,* 40 *students were asked about the months of their birth and the following graph was prepared for the data so obtained. Find the probability that a student of the class was born in August.*



Sol. Total number of students considered = 40

No. of students born in August = 6

$\therefore$ P (a student was born in August) = $\frac{\text{No. of students born in August}}{\text{Total no. of students considered}} = \frac{6}{40} = \frac{3}{20}$

Q.4. *Three coins are tossed simultaneously* 200 *times with the following frequencies of different outcomes :*

Outcome	3 *heads*	2 *heads*	1 *head*	*No head*
Frequency	23	72	77	28

If the three coins are simultaneously tossed again, compute the probability of 2 *heads coming up.* **[2011 (T-II)]**

Sol. Total number of tosses = 200
No. of times 2 heads occur = 72

$\therefore$ P (2 heads coming up) = $\frac{\text{No. of times 2 heads occur}}{\text{Total no. of tosses}} = \frac{72}{200} = \frac{9}{25}$

Q.5. *An organisation selected* 2400 *families at random and surveyed them to determine a relationship between income level and the number of vehicles in a family. The information gathered is listed in the table below :*

Monthly income in (Rs)	***Vehicles per family***			
	0	**1**	**2**	***Above* 2**
Less than 7000	10	160	25	0
7000 – 10000	0	305	27	2
10000 – 13000	1	535	29	1
13000 – 16000	2	469	59	25
16000 or more	1	579	82	88

Suppose a family is chosen. Find the probability that the family chosen is

(i) earning Rs 10000 – 13000 *per month and owning exactly* 2 *vehicles.*

(ii) earning Rs 16000 *or more per month and owning exactly* 1 *vehicle.*

(iii) earning less than Rs 7000 *per month and does not own any vehicle.*

(iv) earning Rs 13000 – 16000 *per month and owning more than* 2 *vehicles.*

(v) owning not more than 1 *vehicle.*

Sol. Total no. of families considered = 2400

(i) P(a family earning Rs 10000 – 13000 per month and owning exactly 2 vehicles)

$= \frac{\text{No. of families earning Rs 10000 – 13000 per month and owning 2 vehicles}}{\text{Total no. of families}} = \frac{29}{2400}$

(ii) P (a family earning Rs 16000 or more per month and owning exactly 1 vehicle)

$= \frac{\text{No. of families earning Rs 16000 or more per month and owning 1 vehicle}}{\text{Total no. of families}} = \frac{579}{2400} = \frac{193}{800}$

(iii) P(a family earning less than Rs 7000 per month and does not own any vehicle)

$= \frac{\text{No. of families earning less than Rs 7000 per month and does not own any vehicle}}{\text{Total no. of families}}$

$= \frac{10}{2400} = \frac{1}{240}$

(iv) P(a family earning Rs 13000 – 16000 per month and owing more than 2 vehicles)

$= \frac{\text{No. of families earning Rs 13000 – 16000 per month and owning more than 2 vehicles}}{\text{Total no. of families}}$

$= \frac{25}{2400} = \frac{1}{96}$

(v) P (a family owning 0 vehicle or 1 vehicle)

= P (a family not owning more than 1 vehicle)

$$= \frac{10+0+1+2+1+160+305+535+469+579}{2400} = \frac{2062}{2400} = \frac{1031}{1200}$$

Q.6. *Following table shows the performance of two sections of students in Mathematics test of* 100 *marks.*

Marks	***Number of students***
0 - 20	7
20 - 30	10
30 - 40	10
40 - 50	20
50 - 60	20
60 - 70	15
70 - above	8
Total	**90**

(i) Find the probability that a student obtained less than 20% *in the mathematics test.*

(ii) Find the probability that a student obtained marks 60 *or above.*

Sol. (i) Total no. of students = 90

$$\text{P (a student obtained less than 20\%)} = \frac{\text{No. of students who obtained less than 20\%}}{\text{Total no. of students}}$$

$$= \frac{7}{90}$$

(ii) P (a student obtained 60 marks or above)

$$= \frac{\text{No. of students who obtained 60 marks or more}}{\text{Total number of students}} = \frac{15+8}{90} = \frac{23}{90}$$

Q.7. *To know the opinion of the students about the subject statistics, a survey of* 200 *students was conducted. The data is recorded in the following table.* **[2010]**

Opinion	***Number of students***
like	135
dislike	65

Find the probability that a student chosen at random

(i) likes statistics, *(ii) does not like it.*

Sol. (i) $\text{P (a student likes statistics)} = \frac{\text{No. of students who like statistics}}{\text{Total no. of students}} = \frac{135}{200} = \frac{27}{40}$

(ii) P (a student does not like statistics) $= \frac{\text{No. of students who do not like statistics}}{\text{Total no. of students}}$

$= \frac{65}{200} = \frac{13}{40}$

Q.8. *The distance (in km) of* 40 *engineers from their residence to their place of work were found as follows :*

5	3	10	2	25	11	13	7	12	31
19	10	12	17	18	11	32	17	16	2
7	9	7	8	3	5	12	15	18	3
12	14	2	9	6	15	15	7	6	12

What is the empirical probability that an engineer lives :

(i) less than 7 *km from her place of work?*

(ii) more than or equal to 7 *km from her place of work?*

(iii) within $\frac{1}{2}$ *km from her place of work?*

Sol. Total no. of engineers = 40

Let us arrange the data in ascending order as follows :

2, 2, 3, 3, 3, 5, 5, 6, 6, 7, 7, 7, 7, 8, 9, 9, 10, 10, 11, 11, 12, 12, 12, 12, 12, 13, 14, 15, 15, 15, 16, 17, 17, 18, 18, 19, 20, 25, 31, 32.

(i) P (an engineer lives less than 7 km from her place of work)

$= \frac{\text{No. of engineers who live less than 7 km from their place of work}}{\text{Total no. of engineers}} = \frac{9}{40}$

(ii) P (an engineer lives more than or equal to 7 km from her work place)

$= \frac{\text{No. of engineers who live more than or equal to 7 km from their work place}}{\text{Total no. of engineers}} = \frac{31}{40}$

(iii) P (an engineer lives within $\frac{1}{2}$ km from her place of work)

$= \frac{\text{No. of engineers who live within } \frac{1}{2} \text{ km from their place of work}}{\text{Total no. of engineers}} = \frac{0}{40} = 0$

Questions 9 and 10 are activities, so students should perform these activities on their own.

Q.11. *Eleven bags of wheat flour, each marked* 5 *kg, actually contained the following weights of flour (in kg) :*

4.97 5.05 5.08 5.03 5.00 5.06 5.08 4.98 5.04 5.07 5.00 **[2011 (T-II)]**

Find the probability that any of these bags chosen at random contains moer than 5 *kg of flour.*

Sol. Total no. of bags examined = 11

P (a bag weighing more than 5 kg) $= \frac{\text{No. of bags which weigh more than 5 kg}}{\text{Total no. of bags}} = \frac{7}{11}$

Q.12. *A study was conducted to find out the concentration of sulphur dioxide in the air parts per million (ppm) of a certain city. The data obtained for* 30 *days is as follows :*

0.03	0.08	0.08	0.09	0.04	0.17
0.16	0.05	0.02	0.06	0.18	0.20
0.11	0.08	0.12	0.13	0.22	0.07
0.08	0.01	0.10	0.06	0.09	0.18
0.11	0.07	0.05	0.07	0.01	0.04

Using this table, find the probability of the concentration of sulphur dioxide in the interval 0.12 – 0.16 *on any of these days.*

Sol. Total no. of days = 30

P(concentration of sulphur dioxide in the interval 0.12 – 0.16 in a day)

$$= \frac{\text{No. of days on which the concentration was in the interval } 0.12 - 0.16}{\text{Total no. of days}} = \frac{2}{30} = \frac{1}{15}$$

Q.13. *The blood groups of 30 students of Class VIII are recorded as follows :*

A, B, O, O, AB, O, A, O, B, A, O, B, A, O, O, A, AB, O, A, A, O, O, AB, B, A, O, B, A, B, O

Use this table to determine the probability that a student of this class, selected at random, has blood group AB. **[2010]**

Sol. Total no. of students = 30

$$\text{P (a student has blood group AB)} = \frac{\text{No. of students which have the blood group AB}}{\text{Total no. of students}}$$

$$= \frac{3}{30} = \frac{1}{10}$$

OTHER IMPORTANT QUESTIONS

Q.1. *In an experiment a coin is tossed* 500 *times. If the head turns up* 280 *times, the experimental probability of getting a head is :* **[2010, 2011 (T-II)]**

(*a*) $\frac{14}{25}$ (*b*) $\frac{11}{25}$ (*c*) $\frac{13}{25}$ (*d*) $\frac{19}{25}$

Sol. (*a*) $\text{P}(\text{a head}) = \frac{\text{no. of heads}}{\text{total no. of tosses}} = \frac{280}{500} = \frac{14}{25}$

Q.2. *In a One-Day cricket match, a batsman played* 40 *balls.*
The runs scored were as follows :

Runs scored	No. of balls
0	13
1	15
2	5
3	1
4	4
6	2

The probability that the batsman scored no run is :

(*a*) 0 (*b*) $\frac{1}{13}$ (*c*) $\frac{13}{40}$ (*d*) $\frac{2}{11}$

Sol. (*c*) P (the batsman scored no run) = $\frac{\text{number of times he score no run}}{\text{total number of balls played}} = \frac{13}{40}$

Q.3. *A coin is tossed* 500 *times and head appeared* 300 *times. The sum of the probability of getting a head and the probability of getting a tail is :* **[2011 (T-II)]**

(*a*) $\frac{3}{5}$ (*b*) $\frac{2}{5}$ (*c*) $\frac{1}{5}$ (*d*) 1

Sol. (*d*) $\text{P}(\text{a head}) = \frac{300}{500}$, $\text{P}(\text{a tail}) = \frac{200}{500}$

$\therefore \text{P}(\text{a head}) + \text{P}(\text{a tail}) = \frac{300 + 200}{500} = 1$

Q.4. 12 *packets of salt, each marked* 2 *kg, actually contained the following weights (in kg) of salt :* 1.980, 2.000, 2.025, 1.850, 1.990, 2.040, 1.950, 2.050, 2.060, 1.980, 2.030, 1.970

Out of these packets one packet is chosen at random.

The probability that the chosen packet contains less than 2 *kg of salt is :*

(*a*) $\frac{1}{12}$ (*b*) $\frac{1}{4}$ (*c*) $\frac{1}{3}$ (*d*) $\frac{1}{2}$

Sol. *(d)* No. of packets which contains less than 2 kg of salt is 6.

$\therefore$ P (a packet contains less than 2 kg of salt)

$= \frac{\text{Number of packets which contains less than 2 kg of salt}}{\text{Total number of packets}} = \frac{6}{12} = \frac{1}{2}$

Q.5. *A die is tossed* 200 *times simultaneously, and the frequencies of various outcomes are given below :*

Outcomes	1	2	3	4	5	6
Frequencies	15	40	25	50	65	5

The probability of getting 5 *is* : **[2011 (T-II)]**

(*a*) $\frac{1}{40}$ (*b*) $\frac{13}{40}$ (*c*) $\frac{11}{40}$ (*d*) $\frac{1}{5}$

Sol. (*b*) $\text{P}(5) = \frac{\text{number of times 5 occurs}}{\text{total number of tosses}} = \frac{65}{200} = \frac{13}{40}$

Q.6. *A die is thrown* 225 *times and the results were as follows :*

Outcomes	1	2	3	4	5	6
Frequencies	34	50	16	71	24	30

The probability of getting a prime number is : **[2011 (T-II)]**

(*a*) $\frac{8}{45}$ (*b*) $\frac{2}{5}$ (*c*) $\frac{24}{225}$ (*d*) $\frac{124}{225}$

Sol. (*b*) $\text{P}\left(\text{a prime number}\right) = \dfrac{\text{no. of times a prime number occurs}}{\text{total no. of tosses}} = \dfrac{50 + 16 + 24}{225} = \dfrac{90}{225} = \dfrac{2}{5}$

Q.7. *A machine generated these* 10 *codes :*

{0A1, AAA, ABC, 2B1, 3B7, BB2, 1AC, 111, 222, 333}. **[2010]**

A code is drawn at random to allot an employee. The probability that the code have at least two digits is :

(*a*) $\dfrac{2}{5}$ (*b*) $\dfrac{3}{5}$ (*c*) $\dfrac{4}{5}$ (*d*) *none of these*

Sol. (*b*) The codes generated by the machine having at least 2 digits are : 0A1, 2B1 3B7, 111, 222, 333, i.e., there are 6 such codes.

$\text{P}\left(\text{the code has at least 2 digits}\right) = \dfrac{\text{no. of codes having at least 2 digits}}{\text{total no. of codes}} = \dfrac{6}{10} = \dfrac{3}{5}$

Q.8. *A die is tossed* 270 *times and the results were as follows :*

Outcomes	1	2	3	4	5	6
Frequencies	40	65	60	32	55	18

The probability of getting either 1 or 3 is :

(*a*) $\dfrac{4}{27}$ (*b*) $\dfrac{2}{9}$ (*c*) $\dfrac{1}{25}$ (*d*) $\dfrac{10}{27}$

Sol. (*d*) $\text{P}\left(\text{getting either 1 or 3}\right) = \dfrac{\text{no. of times either 1 or 3 occurs}}{\text{total no. of tosses}} = \dfrac{40 + 60}{270} = \dfrac{10}{27}$

Q.9. *Three coins are thrown simultaneously* 60 *times, with the following frequencies :* 3 *Heads* : 10 *times,* 2 *Heads* : 5 *times,* 1 *Head* : 18 *times, No Head* : 27 *times P (getting* 3 *heads) + P (getting no head) is equal to* : **[Imp.]**

(*a*) 37 (*b*) $\dfrac{37}{60}$ (*c*) $\dfrac{60}{37}$ (*d*) $\dfrac{23}{60}$

Sol. (*b*) $\text{P}\left(\text{getting 3 heads}\right) = \dfrac{10}{60} = \dfrac{1}{6}$

$\text{P}\left(\text{getting no head}\right) = \dfrac{27}{60} = \dfrac{9}{20}$

$\therefore\ \text{P}\left(\text{getting 3 heads}\right) + \text{P}\left(\text{getting no head}\right) = \dfrac{1}{6} + \dfrac{9}{20} = \dfrac{10 + 27}{60} = \dfrac{37}{60}$

Q.10. *Two coins are tossed simultaneously. List all possible outcomes.* **[Imp.]**

Sol. All possible outcomes are : HH, HT, TH, TT.

Q.11. *Two coins are tossed* 500 *times and the outcomes are recorded as below:*

No. of heads	2	1	0
Frequency	100	250	150

Based on this information, find the probability for at most one head. **[2011 (T-II)]**

Sol. $P\left(\text{at most one head}\right) = \dfrac{\text{no. of times either 1 head or 0 head occurs}}{\text{total no. of trials}}$

$= \dfrac{250 + 150}{500} = \dfrac{400}{500} = \dfrac{4}{5}.$

Q.12. *A student opens his book and notes down the units digit on the right hand page of his book. He repeats the process for 150 times. The outcomes are recorded as below :*

Digit	0	1	2	3	4	5	6	7	8	9
Frequency	7	25	16	30	10	4	11	20	15	12

Based on the above information, find the probability of occurrence of :

(i) 3 *as units digit.*

(ii) 1 *or* 4 *as the units digit.*

(iii) at least 5 *as the units digit.*

Sol. (i) $P\left(3 \text{ as units digit}\right) = \dfrac{\text{no. of times 3 has occurred as units digit}}{\text{total no. of trials}} = \dfrac{30}{150} = \dfrac{1}{5}$

(ii) $P\left(1 \text{ or } 4 \text{ as units digit}\right) = \dfrac{\text{no. of times 1 or 4 has occurred as units digits}}{\text{total no. of trials}}$

$= \dfrac{25 + 10}{150} = \dfrac{35}{150} = \dfrac{7}{30}$

(iii) $P\left(\text{at least 5 as the units digit}\right) = \dfrac{\text{no. of times the units digit has occurred at least 5}}{\text{total no. of trials}}$

$= \dfrac{4 + 11 + 20 + 15 + 12}{150} = \dfrac{62}{150} = \dfrac{31}{75}$

Q.13. *Over the past* 200 *working days, the number of defective parts produced by a machine is given below:*

No. of defective parts	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Days	50	32	22	18	12	12	10	10	10	8	6	6	2	2

Determine the probability that tomorrow's output will have :

(i) no defective part

(ii) not more than 5 *defective parts*

(iii) more than 13 *defective parts?* **[HOTS]**

Sol. (i) P (the output will have no defective part)

$= \dfrac{\text{no. of days on which the output has no defective part}}{\text{total no. of days}} = \dfrac{50}{200} = \dfrac{1}{4}$

(ii) $P\left(\text{the output has not more than 5 defective parts}\right)$

$= \dfrac{\text{no. of days on which the output has not more than 5 defective parts}}{\text{total no. of days}}$

$= \dfrac{50 + 32 + 22 + 18 + 12 + 12}{200} = \dfrac{146}{200} = \dfrac{73}{100}$

$$\text{(iii)} = \frac{\text{P}\left(\text{the output has more than 13 defective parts}\right)}{\text{no. of days on which the output has more than 13 defective parts}} = \frac{0}{200} = 0$$

PRACTICE EXERCISE 15.1A

Choose the correct option (Q.1 – 15) *:*

1 Mark Questions

1. In a cricket match, a batsman hits a boundary 4 times out of 25 balls he plays. The probability that he hits a boundary is : **[2011 (T-II)]**

(*a*) $\frac{4}{25}$ (*b*) $\frac{21}{25}$ (*c*) $\frac{25}{4}$ (*d*) $\frac{25}{21}$

2. A coin is tossed 100 times and head appears 64 times. The probability of getting a tail is :

(*a*) $\frac{18}{25}$ (*b*) $\frac{9}{25}$ (*c*) 0 (*d*) 1

3. Three coins are tossed simultaneously 200 times with following outcomes :

Outcomes	3 heads	2 heads	1 head	No head
Frequency	23	72	77	28

The probability of getting two heads is :

(*a*) $\frac{23}{25}$ (*b*) $\frac{9}{25}$ (*c*) $\frac{18}{25}$ (*d*) $\frac{4}{5}$

4. Following are the ages (in years) of 360 patients, getting medical treatment in a hospital :

Age in years	10-20	20-30	30-40	40-50	50-60	60-70
No. of patients	90	50	60	80	50	30

One of the patients is selected at random. The probability that his age is 30 years or more but less than 40 years is :

(*a*) $\frac{1}{6}$ (*b*) $\frac{2}{9}$ (*c*) 0 (*d*) 1

5. Marks obtained by 80 students of a class in a test of maximum marks 100 are given below :

Marks	0-15	15-30	30-45	45-60	60-75	75 and above
No. of students	6	13	17	24	16	4

A student of the class is selected at random. The probability that he gets less than 45% marks is : **[2011 (T-II)]**

(*a*) $\frac{1}{6}$ (*b*) $\frac{3}{40}$ (*c*) $\frac{9}{20}$ (*d*) $\frac{37}{40}$

6. 80 bulbs are selected at random from a lot and their life time (in hrs) is recorded in the form of a frequency table given below :

Life time (in hours)	300	500	700	900	1100
Frequency	10	12	23	25	10

One bulb is selected at random from the lot. The probability that its life is 1150 hours, is :

(*a*) $\frac{1}{80}$ (*b*) $\frac{7}{16}$ (*c*) 0 (*d*) 1 **[Imp.]**

7. In a medical examination of students of a class, the following blood groups are recorded :

Blood group	A	AB	B	O
Number of students	10	13	12	5

A student is selected at random from the class. The probability that he/she has blood group B, is :

(*a*) $\frac{1}{4}$ (*b*) $\frac{13}{40}$ (*c*) $\frac{3}{10}$ (*d*) $\frac{1}{8}$

8. Games played by 200 students of a school are recorded as below :

Games	Cricket	Football	Tennis	Badminton
No. of students	115	35	16	34

A student is chosen at random. The probability that he plays neither cricket nor football is :

(*a*) $\frac{23}{40}$ (*b*) $\frac{7}{40}$ (*c*) $\frac{3}{4}$ (*d*) $\frac{1}{4}$ **[Imp.]**

9. Marks obtained by 50 students in a class test of 100 marks are given below :

Marks	0-25	25-50	50-75	75-100
No. of students	4	12	18	16

The probability that a student obtains less than 50% marks is :

(*a*) $\frac{2}{25}$ (*b*) $\frac{6}{25}$ (*c*) $\frac{8}{25}$ (*d*) $\frac{9}{25}$

10. A coin is tossed 100 times with the following frequencies :

Head : 64, Tail : 36

The ratio of probabilities for each event is :

(*a*) 16 : 9 (*b*) 9 : 16 (*c*) 1 : 1 (*d*) 3 : 4

11. A coin is tossed 50 times and head appears 18 times. If we toss the coin randomly, the probability of getting neither a head nor a tail is : **[2011 (T-II)]**

(*a*) $\frac{9}{25}$ (*b*) $\frac{16}{25}$ (*c*) 0 (*d*) 1

12. In a cricket match, a batsman hits a boundary 6 times out of 36 balls he plays. The probability that he did not hit a boundary is: **[2011 (T-II)]**

(*a*) $\frac{1}{6}$ (*b*) $\frac{5}{6}$ (*c*) $\frac{6}{5}$ (*d*) 1

13. The salaries of 150 employees in an office are given below :

Salary (in Rs.)	3000-6000	6000-9000	9000-12000	12000-15000	15000 or above
No. of employees	52	35	29	26	8

An employee is selected at random. The probability that his salary is Rs 6000 or more but less than Rs 12000 is :

(*a*) $\frac{7}{30}$ (*b*) $\frac{32}{75}$ (*c*) $\frac{29}{150}$ (*d*) $\frac{58}{75}$

14. The following table shows the blood groups of 60 students of a class:

Blood Groups	A	B	O	AB
No. of Students	16	12	23	9

One student of the class is chosen at random.

What is the probability that the chosen student has either blood group A or B? **[V. Imp.]**

(*a*) $\frac{1}{5}$ (*b*) $\frac{1}{30}$ (*c*) $\frac{7}{15}$ (*d*) $\frac{17}{30}$

15. Two coins are tossed 1000 times and the outcomes are recorded as below : **[2011(T-II)]**

Number of heads	2	1	0
Frequency	200	550	250

Based on this information, the probability for at most one head is :

(*a*) $\frac{1}{5}$ (*b*) $\frac{1}{4}$ (*c*) $\frac{4}{5}$ (*d*) $\frac{3}{4}$

2 Marks Questions

16. Can the experimental probability of an event be greater than 1? If not, why? **[Imp.]**

17. Can the experimental probability of an event be zero? If not, why?

18. As the number of tosses increases, the ratio of the number of heads to the total number of tosses will be $\frac{1}{2}$. Is it correct? if not, write the correct one. **[Imp.]**

19. In a sample study of 420 people, it was found that 240 people were government employees. If a person is selected at random, find the probability that the person is not a government employee?

20. A dice is tossed 100 times and the outcomes are recorded as below : **[2011 (T-II)]**

Outcome	1	Even number less than 6	Odd no. greater than 1	6
Frequency	20	35	30	15

Find the probability of getting

(a) the number 6 (b) even number less than 6

21. Following table shows the marks obtained by 30 students in a class test : **[2011 (T-II)]**

Marks obtained	70	58	60	52	65	75	68
Number of Students	3	5	4	7	6	2	3

Find the probability that a student secures

(a) 60 marks (b) less than 60 marks

22. A survey of 100 students is done regarding the likes and dislikes about the subject mathematics. The data are given below : **[2011 (T-II)]**

Views	Number of students
Likes	80
Dislikes	20

Find the probability that student chosen randomly

(a) like mathematics (b) does not like mathematics

3 Marks Questions

23. Two dice are thrown simultaneously 200 times. Each time the sum of numbers appearing on their top is noted and recorded as below:

Sum	2	3	4	5	6	7	8	9	10	11	12
Frequency	18	10	26	16	25	29	15	4	24	20	13

If the dice are thrown once more, what is the probability of getting a sum :

(i) 3 ? (ii) more than 10 ? (iii) less than or equal to 5 ? **[Imp.]**

24. The ages (in years) of workers of a factory are as follows :

Age (in years)	10-19	20-29	30-39	40-49	50-59	60 and above
No. of workers	5	40	26	15	8	6

If a worker is selected at random, find the probability that the person is :

(i) 30 years or more (ii) below 50 years

(iii) having age from 10-19 years

25. The percentage of marks obtained by a student in monthly unit test are given below :

Unit test	I	II	III	IV	V
% of marks obtained	70	72	65	68	85

Find the probability that the student gets :

(i) more than 70% marks

(ii) less than 70% marks

(iii) more than 90% marks.

26. Bulbs are packed in cartons, each containing 40 bulbs. Seven hundered cartons were examined for defective bulbs and the results are given in the following table :

No. of defective bulbs	0	1	2	3	4	5	6	more than 6
Frequency	400	180	48	41	18	8	3	2

One carton was selected at random, what is the probability that it has :

(i) no defective bulbs ? (ii) defective bulbs from 2 to 6 ? (iii) defective bulbs less than 4 ?

27. In a One Day International, a batsman played 40 balls. The runs scored are as follows :

Runs scored	0	1	2	3	4	6
No. of balls	13	15	5	1	4	2

Find the probability that the batsman will score :

(i) 6 runs ? (ii) a four or a six run ? (iii) 0 or 4 or 6 runs ? **[V. Imp.]**

28. The records of a weather station shows that out of the 250 consecutive days, its weather forecast were correct 175 times. **[2011 (T-II)]**

(i) What is the probability that on a given day it was correct?

(ii) What is the probability that it was not correct on a given day?

29. Marks obtained by students of class IX in Mathematics are given in the table : **[2011 (T-II)]**

Marks	0-20	20-40	40-60	60-80	80-100
Number of students	8	12	30	30	10

(i) Find the probability that a student gets less than 40% in a test.

(ii) Find the probability that a student gets more than 80%.

30. A bag contains tickets which are numbered from 1 to 100. Find the probability that a ticket number picked up at random **[2011 (T-II)]**

(i) is a multiple of 7 (ii) is not a multiple of 7

31. Two coins are tossed simultaneously. Find the probability of getting **[2011 (T-II)]**

(i) atleast one head (ii) both heads.

32. If a person is selected at random, find the probability that the person is : **[2011 (T-II)]**

(i) under 40 years of age (ii) having age from 30 years to 39 years

B. FORMATIVE ASSESSMENT

Group Activity - 1

Objective : To find experimental probability when a die is tossed different number of times by different persons.

Materials Required : Dice, geometry box, etc.

Procedure :

1. Divide the class into groups of 2 or 3 students. Let a student in each group throw a die 30 times. Another student in each group should note down the number of times the numbers 1, 2, 3, 4, 5, 6 come up.

   Following table can be used to record the observations.

Table 1

No. of times a die is thrown	No. of times these numbers turn up					
30	1	2	3	4	5	6
	4	6	5	8	5	2

2. Now throw the die 60 times and record the number of times the numbers 1, 2, 3, 4, 5, 6 come up.

Table 2

No. of times a die is thrown	No. of times these numbers turn up					
60	1	2	3	4	5	6
	10	8	14	12	10	6

3. Again throw the die 90 times and record the observations.

Table 3

No. of times a die is thrown	No. of times these numbers turn up					
90	1	2	3	4	5	6
	14	12	18	20	15	11

4. Repeat the above steps by throwing the die 120, 150, ... times and record your observations.

Observations :

1. **For table 1 :**

$$\frac{\text{No. of times 1 turned up}}{\text{Total no. of times the die is thrown}} = \frac{4}{30} = \frac{2}{15}$$

$$\frac{\text{No. of times 2 turned up}}{\text{Total no. of times the die is thrown}} = \frac{6}{30} = \frac{1}{5}$$

$$\frac{\text{No. of times 3 turned up}}{\text{Total no. of times the die is thrown}} = \frac{5}{30} = \frac{1}{6}$$

$$\frac{\text{No. of times 4 turned up}}{\text{Total no. of times the die is thrown}} = \frac{8}{30} = \frac{4}{15}$$

$$\frac{\text{No. of times 5 turned up}}{\text{Total no. of times the die is thrown}} = \frac{5}{30} = \frac{1}{6}$$

$$\frac{\text{No. of times 6 turned up}}{\text{Total no. of times the die is thrown}} = \frac{2}{30} = \frac{1}{15}$$

2. **For table 2 :**

$$\frac{\text{No. of times 1 turned up}}{\text{Total no. of times the die is thrown}} = \frac{10}{60} = \frac{1}{6}$$

$$\frac{\text{No. of times 2 turned up}}{\text{Total no. of times the die is thrown}} = \frac{8}{60} = \frac{2}{15}$$

$$\frac{\text{No. of times 3 turned up}}{\text{Total no. of times the die is thrown}} = \frac{14}{60} = \frac{7}{30}$$

$$\frac{\text{No. of times 4 turned up}}{\text{Total no. of times the die is thrown}} = \frac{12}{60} = \frac{3}{15}$$

$$\frac{\text{No. of times 5 turned up}}{\text{Total no. of times the die is thrown}} = \frac{10}{60} = \frac{1}{6}$$

$$\frac{\text{No. of times 6 turned up}}{\text{Total no. of times the die is thrown}} = \frac{6}{60} = \frac{1}{10}$$

3. Similarly, calculate the fractions as done above for other tables.
4. You will observe that as the number of throws of the die increases, the value of each fraction calculated for Table 1, Table 2, ... comes closer and closer to $\frac{1}{6}$.

Conclusions :

1. The thoretical probability of getting 1, or 2 or 3 or 4 or 5 or 6 is $\frac{1}{6}$. Clearly, this is not true in case of experimental probability.
2. As the number of throws of the die increases, then the experimental probability of getting 1 or 2 or 3 or 4 or 5 or 6 comes closer and closer to $\frac{1}{6}$.

Note : The above data is for your comprehension. The students must do the Activity and collect the data.

Group Activity - 2

This is an experiment to find out if you can see into the future. You need to work in pairs and you need one coin. One of you is the tosser and recorder and the other is the guesser.

1. The guesser predicts whether the coin will land head up or tail up. The tosser then tosses the coin.

When this experiment is repeated 100 times, about how many times do you expect the guesser to predict the actual outcome.

2. Now perform the experiment described at least 100 times and record each result as right or wrong as appropriate.

Use an observation sheet in the form of a tally chart.

3. Compare what you expected to happen with what did happen, using appropriate diagrams as illustrations. Comment on the likelihood of the guesser being able to predict which way the coin will land.

4. State how could you make your results more reliable.

5. Suggest other experiments that you could perform to test whether someone can see into the future.

ANSWERS

Practice Exercise 15.1A

1. (*a*) **2.** (*b*) **3.** (*b*) **4.** (*a*) **5.** (*c*) **6.** (*c*) **7.** (*c*) **8.** (*d*) **9.** (*c*) **10.** (*a*)

11. (*c*) **12.** (*b*) **13.** (*b*) **14.** (*c*) **15.** (*c*) **16.** No **17.** yes **18.** No **19.** $\frac{3}{7}$

20. (a) 0.15 (b) 0.35 **21.** (a) $\frac{2}{15}$ (b) $\frac{4}{15}$ **22.** (a) $\frac{4}{15}$ (b) $\frac{1}{5}$

23. (*i*) $\frac{1}{20}$ (ii) $\frac{33}{200}$ (iii) $\frac{7}{20}$ **24.** (*i*) $\frac{11}{20}$ (ii) $\frac{43}{50}$ (iii) $\frac{1}{20}$

25. (*i*) $\frac{2}{5}$ (ii) $\frac{2}{5}$ (iii) 0 **26.** (i) $\frac{4}{7}$ (ii) $\frac{59}{350}$ (iii) $\frac{669}{700}$

27. (*i*) $\frac{1}{20}$ (ii) $\frac{3}{20}$ (iii) $\frac{19}{40}$ **28.** (i) $\frac{7}{10}$ (ii) $\frac{3}{10}$ **29.** (i) $\frac{2}{9}$ (ii) $\frac{1}{9}$

30. (i) $\frac{7}{50}$ (ii) $\frac{43}{50}$ **31.** (i) $\frac{3}{4}$ (ii) $\frac{1}{4}$ **32.** (i) $\frac{13}{40}$ (ii) $\frac{27}{200}$