Mathematics

(Chapter – 15) (Statistics)
(Class – IX)

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.*

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. :*

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

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

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

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

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.*
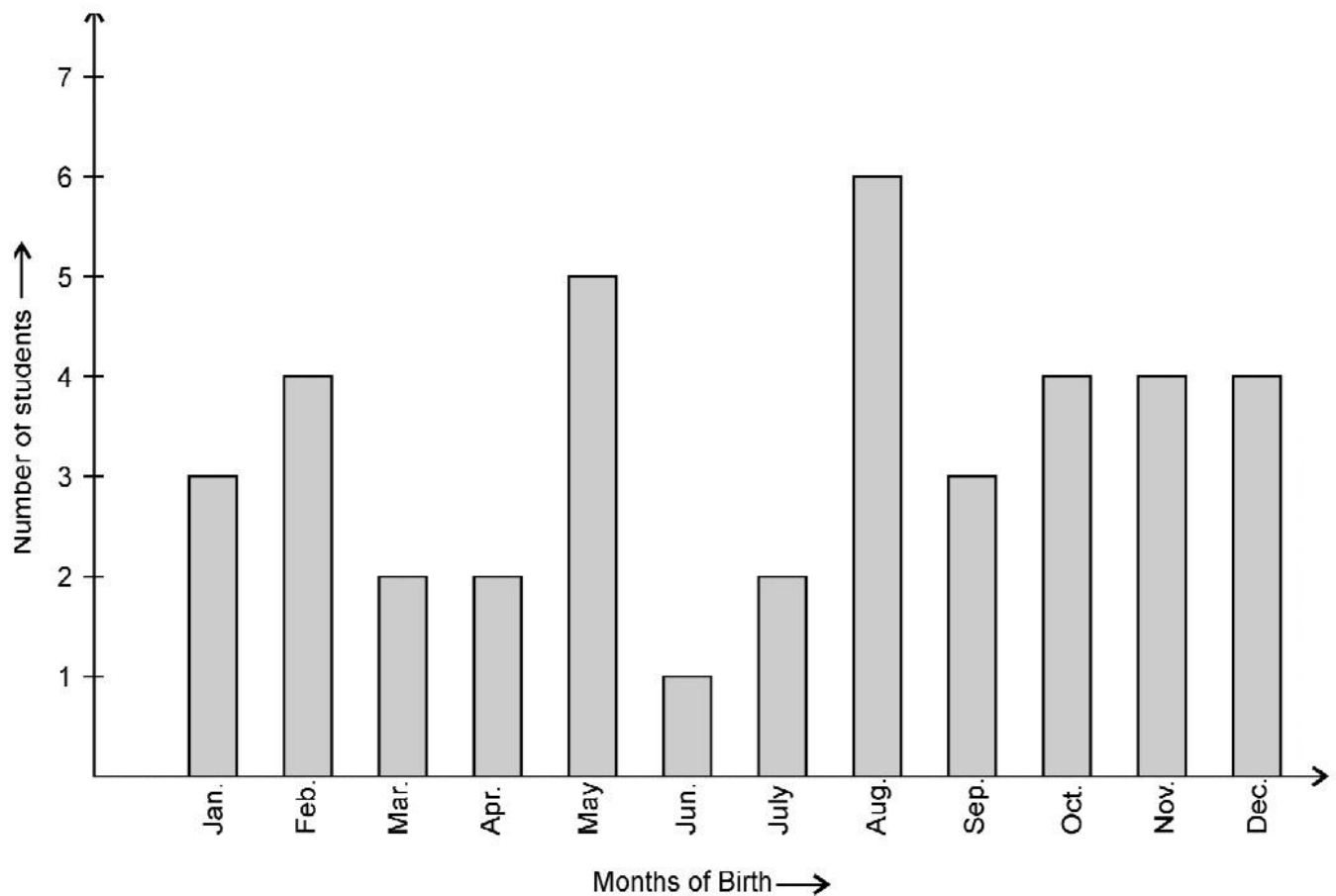
Sol. Total number of students considered = 40

No. of students born in August = 6

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

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.

Sol. Total number of tosses = 200

No. of times 2 heads occur = 72

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

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 | Vehicles per family | | | |
in (Rs)	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)

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

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

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

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

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

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

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

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

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

(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.*

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) $= \dfrac{\text{No. of students who do not like statistics}}{\text{Total no. of students}}$

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

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 $\dfrac{1}{2}$ 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)

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

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

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

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

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

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

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) $= \dfrac{\text{No. of bags which weigh more than 5 kg}}{\text{Total no. of bags}} = \dfrac{7}{11}$

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.

Sol. Total no. of students = 30

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

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