

CHAPTER - 15

PROBABILITY

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 = $30 - 6 = 24$

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

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.

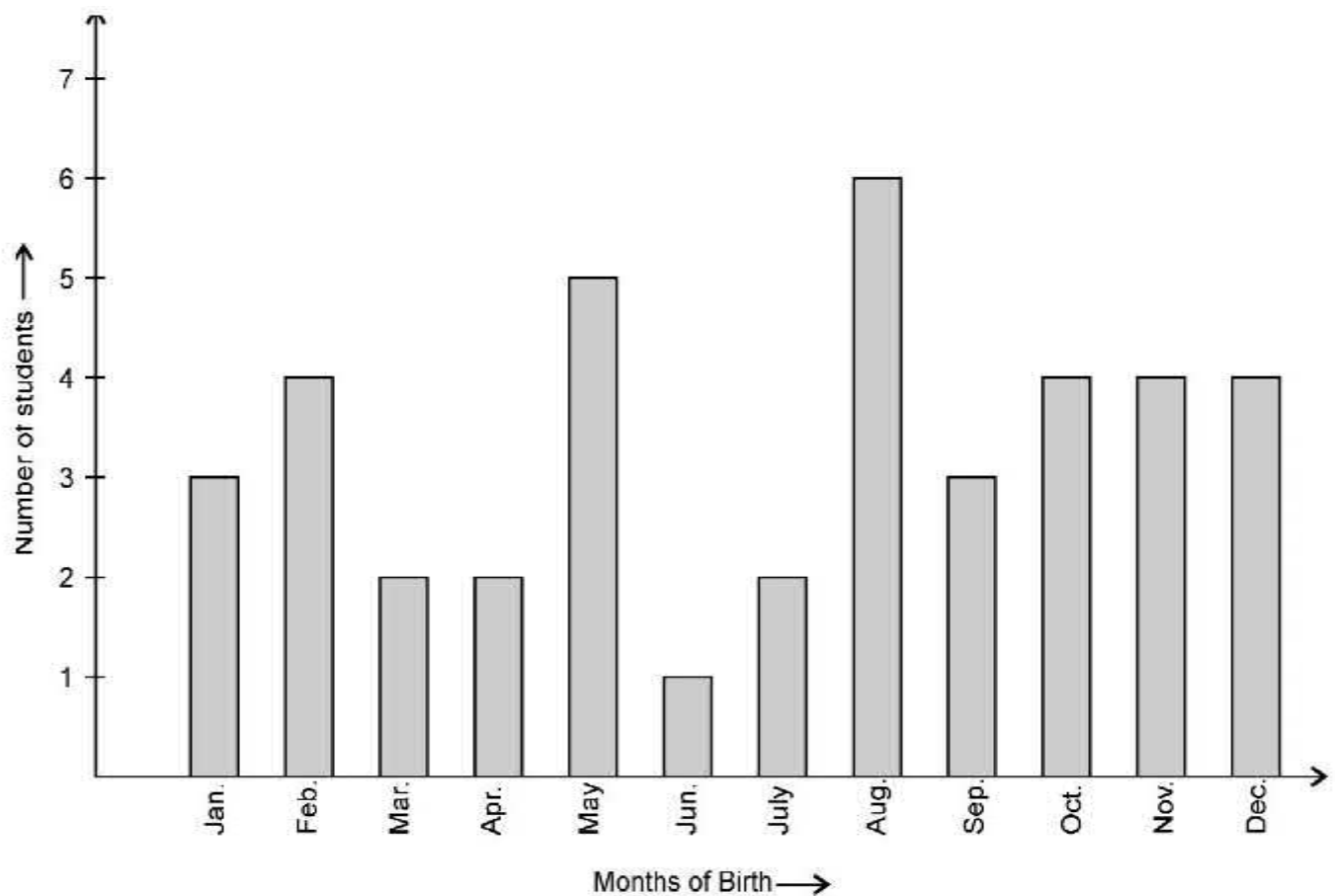
Sol. (i) $P(\text{a family having 2 girls}) = \frac{\text{No. of families having 2 girls}}{\text{Total no. of families}} = \frac{475}{1500} = \frac{19}{60}$

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

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

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

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

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

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

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

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

$$\begin{aligned} P(\text{a student obtained less than 20\%}) &= \frac{\text{No. of students who obtained less than 20\%}}{\text{Total no. of students}} \\ &= \frac{7}{90} \end{aligned}$$

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

$$\begin{aligned} \text{(ii) } P(\text{a student does not like statistics}) &= \frac{\text{No. of students who do not like statistics}}{\text{Total no. of students}} \\ &= \frac{65}{200} = \frac{13}{40} \end{aligned}$$

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

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

Sol. Total no. of bags examined = 11

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

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.

Sol. Total no. of students = 30

$$\begin{aligned} P(\text{a student has blood group AB}) &= \frac{\text{No. of students which have the blood group AB}}{\text{Total no. of students}} \\ &= \frac{3}{30} = \frac{1}{10} \end{aligned}$$