Mathematics

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(Chapter – 15)(Probability)
(Class – 9)

Exercise 15.1

Question 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.

Answer 1:

Total number of balls = 30
Number of balls having boundary = 6
Therefore, the number of balls not having boundary = 30 – 6 = 24

$$P(\text{She did not hit a boundary}) = \frac{24}{30} = \frac{4}{5} = 0.8$$

Hence, the probability of not hitting a boundary by her is 0.8.

Question 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.

Answer 2:

(i) Total number of families = 1500
Number of families with 2 girls = 475
Therefore,

$$P(2 \text{ girls }) = \frac{475}{1500} = \frac{19}{60}$$

Hence, the probability of family having two girls is $\frac{19}{60}$.

(ii) Number of families with 1 girl = 814
Therefore,

$$P(1 \text{ girl}) = \frac{814}{1500} = \frac{407}{750}$$

Hence, the probability of family having 1 girl is $\frac{407}{750}$.

(iii) Number of families with no girl = 211
Therefore,

$$P(\text{No girl}) = \frac{211}{1500}$$

Hence, the probability of family having no girl is $\frac{211}{1500}$.

Question 3:

Refer to Example 5, Section 14.4, Chapter 14. Find the probability that a student of the class was born in August.

Answer 3:

Example 5, Section 14.4, Chapter 14 is given below:
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:

Total number of students = 40
Number of students born in August = 6
Therefore,

$$P(\text{Student born in August}) = \frac{6}{40} = \frac{3}{20}$$

Hence, the probability that the student born in August is $\frac{3}{20}$.

Question 4:

Three coins are tossed simultaneously 200 times with the following frequencies of different outcomes:

Outcome	3 **Heads**	2 **Heads**	1 **Head**	0 **Head**
Frequency	23	72	77	28

If the three coins are simultaneously tossed again, compute the probability of 2 heads coming up.

Answer 4:

Total number of tosses = 200
Number of getting 2 Heads = 72
Therefore,

$$P(2 \text{ Heads}) = \frac{72}{200} = \frac{9}{25}$$

Hence, the probability of getting 2 Heads is $\frac{9}{25}$.

Question 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 ₹)	**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 ₹10000 – 13000 per month and owning exactly 2 vehicles.
(ii) earning ₹16000 or more per month and owning exactly 1 vehicle.
(iii) earning less than ₹7000 per month and does not own any vehicle.
(iv) earning ₹13000 – 16000 per month and owning more than 2 vehicles.
(v) owning not more than 1 vehicle.

Answer 5:

(i) Total number of families = 2400
Number of families who has earning ₹10000 – 13000 per month and owning exactly 2 vehicles = 29
Therefore,

$$\text{Probability } = \frac{29}{2400}$$

Hence, the probability of families earning ₹10000 – 13000 per month and owning exactly 2 vehicles is $\frac{29}{2400}$.

(ii) Total number of families = 2400
Number of families who has earning ₹16000 or more per month and owning exactly 1 vehicle = 579
Therefore,

$$\text{Probability } = \frac{579}{2400} = \frac{193}{800}$$

Hence, the probability of earning ₹16000 or more per month and owning exactly 1 vehicle is $\frac{579}{2400}$.

(iii) Total number of families = 2400
Number of families who has earning less than ₹7000 per month and does not own any vehicle = 10
Therefore,

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

Hence, the probability of earning less than ₹7000 per month and does not own any vehicle is $\frac{1}{240}$.

(iv) Total number of families = 2400
Number of families who are earning ₹13000 – 16000 per month and owning more than 2 vehicles = 10
Therefore,

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

Hence, the probability of earning ₹13000 – 16000 per month and owning more than 2 vehicles is $\frac{1}{96}$.

(v) Total number of families = 2400
Number of families who are owning not more than 1 vehicle
= 10 + 0 + 1 + 2 + 1 + 160 + 305 + 535 + 469 + 579 = 2062
Therefore,

$$\text{Probability } = \frac{2062}{2400} = \frac{1031}{1200}$$

Hence, the probability of owning not more than 1 vehicle is $\frac{1031}{1200}$.

Question 6:

Refer to Table 14.7, Chapter 14.
(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.

Answer 6:

Table 14.7, Chapter 14:

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

(i) Total number of students = 90
Number of students obtaining less than 20% in the mathematics test 20% = 7
Therefore,

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

Hence, the probability that a student obtained less than 20% in the mathematics test is $\frac{7}{90}$.

(ii) Total number of students = 90
Number of students obtaining marks 60 or above = 15 + 8 = 23
Therefore,

$$\text{Probability } = \frac{23}{90}$$

Hence, the probability that a student obtained marks 60 or above is $\frac{23}{90}$.

Question 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.

Answer 7:

(i) Total number of students = 200
Number of students who like Statistics = 135
Therefore,

$$\text{P(student likes Statistics)} = \frac{135}{200} = \frac{27}{40}$$

Hence, the probability that a student likes Statistics is $\frac{27}{40}$.

(ii) Total number of students = 200
Number of students who dislike Statistics = 65
Therefore,

$$\text{P(students dislike Statistics)} = \frac{65}{200} = \frac{13}{40}$$

Hence, the probability that a student dislike is $\frac{13}{40}$.

Question 8:

Refer to Q.2, Exercise 14.2. 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?

Answer 8:

Q.2, Exercise 14.2 is given below:
The distance (in km) of 40 engineers from their residence to their place of work were found as follows:

5	3	10	20	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

Arranging the data in ascending order:

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) Total number of engineers = 200
Number of engineers who lives less than 7 km from her place of work = 9
Therefore,

$$\text{P(an engineer lives less than 7 km from her place of work)} = \frac{9}{40}$$

Hence, the probability that an engineer lives less than 7 km from her place of work is $\frac{9}{40}$.

(ii) Total number of engineers = 200
Number of engineers who lives more than or equal to 7 km from her place of work = 31
Therefore,

$$\text{P(an engineer lives more than or equal to 7 km from her place of work)} = \frac{31}{40}$$

Hence, the probability that an engineer lives more than or equal to 7 km from her place of work is $\frac{31}{40}$.

(iii) Total number of engineers = 200
Number of engineers who lives within $\frac{1}{2}$ km from her place of work = 0
Therefore,

$$\text{P}\left(\text{an engineer lives within } \frac{1}{2} \text{ km from her place of work}\right) = \frac{0}{40} = 0$$

Hence, the probability that an engineer lives within $\frac{1}{2}$ km from her place of work is 0.

Question 9:

Activity: Note the frequency of two-wheelers, three-wheelers and four-wheelers going past during a time interval, in front of your school gate. Find the probability that any one vehicle out of the total vehicles you have observed is a two-wheeler.

Answer 9:

The frequency table of the two-wheelers, three-wheelers and four-wheelers going past during 2:30 pm to 3:30 pm in front of our school is given below:

Vehicle	Two-wheelers	Three-wheelers	Four-wheelers	**Total**
Frequency	12	7	9	**28**

Total number of vehicles = 28 and number of two-wheelers = 12
Therefore,

$$\text{P(two} - \text{wheelers)} = \frac{12}{28} = \frac{3}{7}$$

Hence, the probability of two-wheelers is $\frac{3}{7}$.

Question 10:

Activity: Ask all the students in your class to write a 3-digit number. Choose any student from the room at random. What is the probability that the number written by her/him is divisible by 3? Remember that a number is divisible by 3, if the sum of its digits is divisible by 3.

Answer 10:

Given 3-digit numbers = 100, 101, 102 ...999 and total number of 3-digit numbers = 999 – 99 = 900
Numbers divisible by 3 = 102, 105, 108 ...999. So, the number of numbers divisible by 3 = 300
Therefore,

$$\text{P(number divisible by 3)} = \frac{300}{900} = \frac{1}{3}$$

Hence, the probability that the number written by her/him is divisible by 3 is $\frac{1}{3}$.

Question 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.

Answer 11:

Arranging the data in ascending order: 4.97, 4.98, 5.00, 5.00, 5.03, 5.04, 5.05, 5.06, 5.07, 5.08, 5.08

Total number of flour bags = 11 and number of bags containing more than 5 kg of flour = 7

Therefore,

$$\text{P(a bag contains more than 5 kg of flour)} = \frac{7}{11}$$

Hence, the probability that any of these bags chosen at random contains more than 5 kg of flour is $\frac{7}{11}$.

Question 12:

In Q.5, Exercise 14.2, you were asked to prepare a frequency distribution table, regarding the concentration of sulphur dioxide in the air in parts per million of a certain city for 30 days. Using this table, find the probability of the concentration of sulphur dioxide in the interval 0.12 - 0.16 on any of these days.

Answer 12:

Q.5 of Exercise 14.2 is given below:

A study was conducted to find out the concentration of sulphur dioxide in the air in 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

The grouped frequency distribution table for this data is as follows:

Sulphur dioxide in parts per million (ppm)	Number of days (Frequency)
0.00 – 0.04	4
0.04 – 0.08	9
0.08 – 0.12	9
0.12 – 0.16	2
0.16 – 0.20	4
0.20 – 0.24	2
Total	**30**

$$\text{P(Concentration of sulphur dioxide in the interval } 0.12 - 0.16) = \frac{2}{30} = \frac{1}{15}$$

Hence, the probability of the concentration of sulphur dioxide in the interval 0.12 - 0.16 on any of day is $\frac{1}{15}$.

Question 13:

In Q.1, Exercise 14.2, you were asked to prepare a frequency distribution table regarding the blood groups of 30 students of a class. Use this table to determine the probability that a student of this class, selected at random, has blood group AB.

Answer 13:

The frequency table of Q.1 of Exercise 14.2 is given below:

Blood groups	A	B	AB	O	**Total**
Frequency	9	6	3	12	**30**

$$\text{P(a student selected at random, has blood group AB)} = \frac{3}{30} = \frac{1}{10}$$

Hence, the probability that a student of this class, selected at random, has blood group AB is $\frac{1}{10}$.