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:

Number of times the batswoman hits a boundary = 6

Total number of balls played = 30

∴ Number of times that the batswoman does not hit a boundary = 30 − 6 = 24

\[ P(\text{she does not hit a boundary}) = \frac{\text{Number of times when she does not hit boundary}}{\text{Total number of balls played}} \]

\[ = \frac{24}{30} = \frac{4}{5} \]

Question 2:

1500 families with 2 children were selected randomly, and the following data were recorded:

<table>
<thead>
<tr>
<th>Number of girls in a family</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of families</td>
<td>475</td>
<td>814</td>
<td>211</td>
</tr>
</tbody>
</table>

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:

Total number of families = 475 + 814 + 211
= 1500

(i) Number of families having 2 girls = 475

\[
P_1 (a \text{ randomly chosen family has 2 girls}) = \frac{\text{Number of families having 2 girls}}{\text{Total number of families}}
= \frac{475}{1500} = \frac{19}{60}
\]

(ii) Number of families having 1 girl = 814

\[
P_2 (a \text{ randomly chosen family has 1 girl}) = \frac{\text{Number of families having 1 girl}}{\text{Total number of families}}
= \frac{814}{1500} = \frac{407}{750}
\]

(iii) Number of families having no girl = 211

\[
P_3 (a \text{ randomly chosen family has no girl}) = \frac{\text{Number of families having no girl}}{\text{Total number of families}}
= \frac{211}{1500}
\]

\[
\text{Sum of all these probabilities} = \frac{19}{60} + \frac{407}{750} + \frac{211}{1500}
= \frac{475 + 814 + 211}{1500}
= \frac{1500}{1500} = 1
\]

Therefore, the sum of all these probabilities is 1.

Question 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.

Answer:

Number of students born in the month of August = 6
Total number of students = 40

\[
P (\text{Students born in the month of August}) = \frac{\text{Number of students born in August}}{\text{Total number of students}}
\]

\[= \frac{6}{40} = \frac{3}{20}\]

Question 4:

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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>3 heads</th>
<th>2 heads</th>
<th>1 head</th>
<th>No head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>23</td>
<td>72</td>
<td>77</td>
<td>28</td>
</tr>
</tbody>
</table>

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

Answer:
Number of times 2 heads come up = 72
Total number of times the coins were tossed = 200

\[ P(2 \text{ heads will come up}) = \frac{\text{Number of times 2 heads come up}}{\text{Total number of times the coins were tossed}} \]

\[ = \frac{72}{200} = \frac{9}{25} \]

Question 5:

An organization 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:

<table>
<thead>
<tr>
<th>Monthly income (in Rs)</th>
<th>Vehicles per family</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Less than 7000</td>
<td>10</td>
</tr>
<tr>
<td>7000 – 10000</td>
<td>0</td>
</tr>
<tr>
<td>10000 – 13000</td>
<td>1</td>
</tr>
<tr>
<td>13000 – 16000</td>
<td>2</td>
</tr>
<tr>
<td>16000 or more</td>
<td>1</td>
</tr>
</tbody>
</table>

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.
Answer:
Number of total families surveyed = 10 + 160 + 25 + 0 + 0 + 305 + 27 + 2 + 1 +
535 + 29 + 1 + 2 + 469 + 59 + 25 + 1 + 579 + 82 + 88 = 2400
(i) Number of families earning Rs 10000 − 13000 per month and owning exactly 2
vehicles = 29
\[ P = \frac{29}{2400} \]
Hence, required probability,
(ii) Number of families earning Rs 16000 or more per month and owning exactly 1
vehicle = 579
\[ P = \frac{579}{2400} \]
Hence, required probability,
(iii) Number of families earning less than Rs 7000 per month and does not own any
vehicle = 10
\[ P = \frac{10}{2400} = \frac{1}{240} \]
Hence, required probability,
(iv) Number of families earning Rs 13000 − 16000 per month and owning more than 2 vehicles
= 25
\[ P = \frac{25}{2400} = \frac{1}{96} \]
Hence, required probability,
(v) Number of families owning not more than 1 vehicle = 10 + 160 + 0 + 305 + 1 +
535 + 2 + 469 + 1 + 579 = 2062
\[ P = \frac{2062}{2400} = \frac{1031}{1200} \]
Hence, required probability,

Question 6:
A teacher wanted to analyse the performance of two sections of students in a mathematics test of 100 marks. Looking at their performances, she found that a few students got under 20 marks and a few got 70 marks or above. So she decided to
group them into intervals of varying sizes as follows: 0 – 20, 20 – 30... 60 – 70, 70 – 100. Then she formed the following table:

<table>
<thead>
<tr>
<th>Marks</th>
<th>Number of student</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 20</td>
<td>7</td>
</tr>
<tr>
<td>20 – 30</td>
<td>10</td>
</tr>
<tr>
<td>30 – 40</td>
<td>10</td>
</tr>
<tr>
<td>40 – 50</td>
<td>20</td>
</tr>
<tr>
<td>50 – 60</td>
<td>20</td>
</tr>
<tr>
<td>60 – 70</td>
<td>15</td>
</tr>
<tr>
<td>70 – above</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
</tr>
</tbody>
</table>

(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:

Total number of students = 90

(i) Number of students getting less than 20 % marks in the test = 7

\[ P = \frac{7}{90} \]

Hence, required probability,

(ii) Number of students obtaining marks 60 or above = 15 + 8 = 23

\[ P = \frac{23}{90} \]

Hence, required probability,
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.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>like</td>
<td>135</td>
</tr>
<tr>
<td>dislike</td>
<td>65</td>
</tr>
</tbody>
</table>

Find the probability that a student chosen at random (i) likes statistics, (ii) does not like it

Answer:

(i) Number of students liking statistics = 135
\[
P(\text{students liking statistics}) = \frac{135}{200} = \frac{27}{40}
\]

(ii) Number of students who do not like statistics = 65
\[
P(\text{students not liking statistics}) = \frac{65}{200} = \frac{13}{40}
\]

Question 8:

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  17  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?

Answer:

(i) Total number of engineers = 40
Number of engineers living less than 7 km from their place of work = 9

Hence, required probability that an engineer lives less than 7 km from her place of work,

$$p = \frac{9}{40}$$

(ii) Number of engineers living more than or equal to 7 km from their place of work =

$$40 - 9 = 31$$

Hence, required probability that an engineer lives more than or equal to 7 km from her place of work,

$$p = \frac{31}{40}$$

(iii) Number of engineers living within $\frac{1}{2}$ km from her place of work = 0

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

$$p = 0$$

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:

Number of total bags = 11

Number of bags containing more than 5 kg of flour = 7

Hence, required probability,

\[ P = \frac{7}{11} \]

Question 12:

<table>
<thead>
<tr>
<th>Concentration of SO₂ (in ppm)</th>
<th>Number of days (frequency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 – 0.04</td>
<td>4</td>
</tr>
<tr>
<td>0.04 – 0.08</td>
<td>9</td>
</tr>
<tr>
<td>0.08 – 0.12</td>
<td>9</td>
</tr>
<tr>
<td>0.12 – 0.16</td>
<td>2</td>
</tr>
<tr>
<td>0.16 – 0.20</td>
<td>4</td>
</tr>
<tr>
<td>0.20 – 0.24</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

The above frequency distribution table represents 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:

Number days for which the concentration of sulphur dioxide was in the interval of
0.12 − 0.16 = 2

Total number of days = 30

Hence, required probability,

\[ P = \frac{2}{30} = \frac{1}{15} \]

Question 13:

<table>
<thead>
<tr>
<th>Blood group</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
</tr>
<tr>
<td>AB</td>
<td>3</td>
</tr>
<tr>
<td>O</td>
<td>12</td>
</tr>
</tbody>
</table>
The above frequency distribution table represents 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:

Number of students having blood group AB = 3

Total number of students = 30

\[ P = \frac{3}{30} = \frac{1}{10} \]

Hence, required probability,