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Chapter-15: Probability

Exercise 15.1 (Page 283 of Grade 9 NCERT Textbook)

Q1. 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.

Difficulty Level:
Easy

Known/given:
Total number of balls played and number of times the batswoman hits the boundary.

Unknown:
Probability of the batswoman not hitting a boundary.

Reasoning:

Probability of an event, $P(E) = \frac{\text{Number of instances that event takes place}}{\text{Total number of instances}}$

Solution:
Number of balls played = 30

Number of balls the batswoman hits boundary = 6

Number of balls the batswoman does not hit a boundary = 30 – 6 = 24

$$\text{Probability of the batswoman not hitting a boundary} = \frac{\text{Number of balls the batswoman does not hit the boundary}}{\text{Total number of balls played}} = \frac{24}{30} = \frac{4}{5}$$

Q2. 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.

Difficulty Level:
Easy

Known/given:
Number of families having 2 girl child,1 girl child, no girl child and the total number of families.

Unknown:
Probability of selecting family having 2 girl child,1 girl child, no girl child and whether sum of these probabilities is 1.

Reasoning:
Probability of selecting a family having 2 girls, 1 girl and no girl will be the ratio of the number of girls in the family and the total number of families.

Probability of an event, $P(E) = \dfrac{\text{Number of instances that event takes place}}{\text{Total number of instances}}$

Solution:
Total number of families = 1500
Number of families having 2 girls = 475
Number of families having 1 girl = 814
Number of families having no girl = 211

Probability of family having 2 girls, $P_1 = \dfrac{\text{Family having 2 girls}}{\text{Total number of families}}$

Therefore, $P_1 = \dfrac{475}{1500} = \dfrac{19}{60}$

Probability of family having 1 girl, $P_2 = \dfrac{\text{Family having 1 girl}}{\text{Total number of families}}$

Therefore, $P_2 = \dfrac{814}{1500} = \dfrac{407}{750}$

Probability of family having no girl, $P_3 = \dfrac{\text{Family having no girl}}{\text{Total number of families}}$

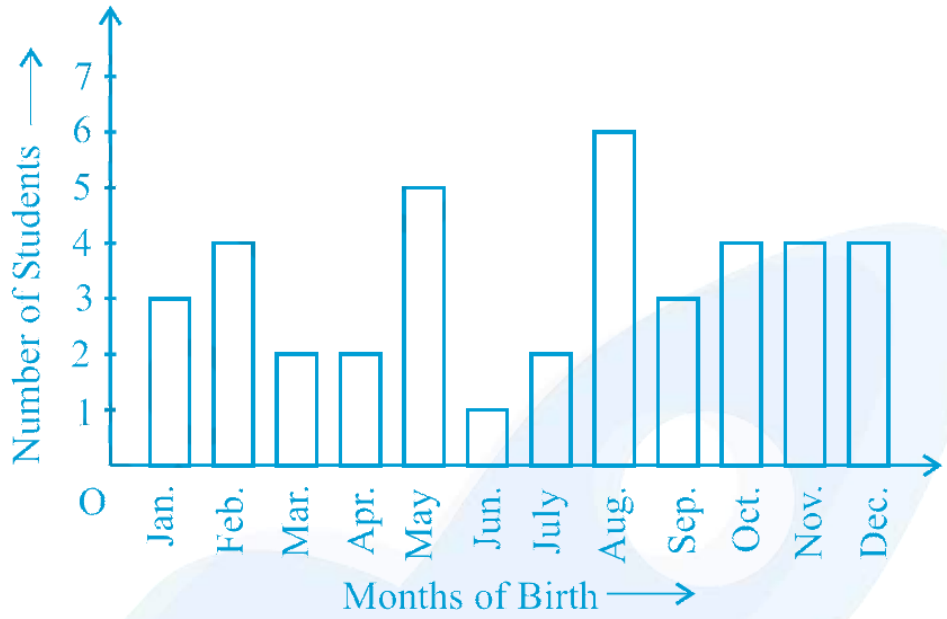
Therefore, $P_3 = \dfrac{211}{1500}$

Sum of all the three probabilities $= P_1 + P_2 + P_3$

$$= \frac{475}{1500} + \frac{814}{1500} + \frac{211}{1500}$$
$$= \frac{475 + 814 + 211}{1500}$$
$$= \frac{1500}{1500}$$
$$= 1$$

Q3. Refer to Example 5, Section 14.4, Chapter 14. Find the probability that a student of the class was born in August.

Example 5, Section 14.4, Chapter 14: 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:



Difficulty Level:
Medium

Known/given:
Total number of students in class and number of students born in each month.

Unknown:
Probability of students born in the month of August.

Reasoning:
The probability that student was born in a certain month is given by the ratio of students born in a certain month and the total number of students born.

$$\text{Probability of an event, } P(E) = \frac{\text{Number of instances that event takes place}}{\text{Total number of instances}}$$

Solution:
The total number of students in class = 40
Number of students born in August = 6

$$\text{Probability of students born in August} = \frac{\text{Number of students born in August}}{\text{Total number of students in class}}$$

$$= \frac{6}{40}$$

$$= \frac{3}{20}$$

Q4. 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.

Difficulty Level:
Medium

Known/given:
Total number of tosses and frequencies of different outcomes.

Unknown:
Probability of 2 heads coming up when three coins are tossed simultaneously.

Reasoning:
Probability of 2 heads coming up when three coins are tossed simultaneously is given by the ratio of the number of times a particular outcome occurs and the total number of tosses.

Probability of an event, $P(E) = \dfrac{\text{Number of instances that event takes place}}{\text{Total number of instances}}$

Solution:
Total number of tosses = 200
Number of 2 heads outcomes = 72

$$\text{Probability of 2 heads outcomes} = \frac{\text{Number of 2 heads outcomes}}{\text{Total number of tosses}}$$
$$= \frac{72}{200}$$
$$= \frac{9}{25}$$

Q5. 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.

Difficulty Level:
Medium

Known/given:
Family monthly income and vehicles per family.

Unknown:
Probability of family

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.

Reasoning:
The probability of certain event is given by the ratio of occurrence of a particular event by the total number of events.

$$\text{Probability of having vehicle based on the earnings} = \frac{\text{Number of vehicles per family}}{\text{Total number of families}}$$

Solution:

Total number of families = 2400

Family earning ₹10000 – 13000 per month and owning exactly 2 vehicles = 29

Family earning ₹16000 or more per month and owning exactly 1 vehicle = 579

Family earning less than ₹7000 per month and does not own any vehicle = 10

Family earning ₹13000 – 16000 per month and owning more than 2 vehicles = 25

Family owning not more than 1 vehicle =10+0+1+2+1+160+305+535+469+579 = 2062

(i) Probability of family earning ₹ 10000 – 13000 per month and owning exactly 2 vehicles $= \frac{29}{2400}$

(ii) Probability of family earning ₹ 16000 or more per month and owning exactly 1 vehicle $= \frac{579}{2400}$

(iii) Probability of family earning less than ₹ 7000 per month and does not own any vehicle $= \frac{10}{2400} = \frac{1}{240}$

(iv) Probability of family earning ₹ 13000 – 16000 per month and owning more than 2 vehicles $= \frac{25}{2400} = \frac{1}{96}$

(v) Probability of family owning not more than 1 vehicle $= \frac{2062}{2400} = \frac{1031}{1200}$

Q6. 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.

Table 14.7, Chapter 14, Example 7: 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:

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

Difficulty Level:
Medium

Known/given:
Marks in different range and respective students.

Unknown:
Probability of students obtained
(i) less than 20% in math.
(ii) 60 marks or above.

Reasoning:
The probability of certain event is given by the ratio of occurrence of a particular event by the total number of events.

$$\text{Probability of students in range of marks} = \frac{\text{Number of students in range of marks}}{\text{Total number of students}}$$

Solution:
Total number of students = 90
Number of students obtained less than 20% marks = 7
Number of students obtained 60 marks or above = 15+8 = 23

(i) Probability of students obtained less than 20% marks $= \frac{7}{90}$

(ii) Probability students obtained 60 marks or above $= \frac{23}{90}$

Q7. 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.

Difficulty Level:
Medium

Known/given:
Number of students who like statistics and who do not like statistics.

Unknown:
Probability of the number of students
(i) like statistics.
(ii) do not like statistics.

Reasoning:
The probability of certain event is given by the ratio of occurrence of a particular event by the total number of events.

$$\text{Probability of students like/dislike statistics} = \frac{\text{Number of students like/dislike statistics}}{\text{Total number of students}}$$

Solution:
Total number of students = 200
Number of students who like statistics = 135
Number of students who dislike statistics = 65

(i) Probability of students who like statistics $= \frac{135}{200} = \frac{27}{40}$

(ii) Probability students who dislike statistics $= \frac{65}{200} = \frac{13}{40}$

Q8. 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.

Q2, Exercise 14.2: 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

Difficulty Level:
Medium

Known/given:
Number of engineers and distance of their workplace to the residence.

Unknown:
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.

Reasoning:
The probability of certain event is given by the ratio of occurrence of a particular event by the total number of events.

Probability of an event, $P(E) = \frac{\text{Number of instances that event takes place}}{\text{Total number of instances}}$

Solution:
Total number of engineers = 40
Number of engineers who live less than 7 km from their place of work = 9
Number of engineers who live more than or equal to 7 km from their workplace = 31
Number of engineers who live within $\frac{1}{2}$ km from their place of work = 0

(i) Probability of an engineer who lives less than 7 km from their place of work $= \frac{9}{40}$

(ii) Probability of an engineer who lives more than or equal to 7 km from their place of work $= \frac{31}{40}$

(iii) Probability of an engineer who lives within $\frac{1}{2}$ km from their place of work $= \frac{0}{40} = 0$

Q11. 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.

Difficulty Level:
Easy

Known/given:
Number of bags of specific weights.

Unknown:
Probability of any of the bags containing more than 5 kg of flour.

Reasoning:
The probability of certain event is given by the ratio of occurrence of a particular event by the total number of events.

Probability of an event, $P(E) = \frac{\text{Number of instances that event takes place}}{\text{Total number of instances}}$

Solution:

Total number of bags = 11

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

Probability of a bag containing more than 5 kg of flour $= \frac{7}{11}$

Q12. 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.

Q5, Exercise 14.2: 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

Difficulty Level:

Easy

Known/given:

Concentration of Sulphur dioxide for 30 days.

Unknown:

Probability of the concentration of Sulphur dioxide in the interval of 0.12 – 0.16.

Reasoning:

The probability of certain event is given by the ratio of occurrence of a particular event by the total number of events.

Probability of an event, $P(E) = \frac{\text{Number of instances that event takes place}}{\text{Total number of instances}}$

Solution:

Total number of days = 30

Number of days on which concentration was in the interval 0.12 – 0.16 = 2

Probability of the concentration of Sulphur dioxide in the interval 0.12 – 0.16 $= \frac{2}{30} = \frac{1}{15}$

Q13. 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.

Q1, Exercise 14.2: 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.

Difficulty Level:
Easy

Known/given:
Number of students and their blood group.

Unknown:
Probability of students having blood group AB.

Reasoning:
The probability of certain event is given by the ratio of occurrence of a particular event by the total number of events.

Probability of an event, $P(E) = \frac{\text{Number of instances that event takes place}}{\text{Total number of instances}}$

Solution:
Total number of students = 30
Number of students having blood group AB = 3
Probability of students having blood group AB $= \frac{3}{30} = \frac{1}{10}$

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