Chapter 15: Probability

Q.1. Compute the probability of the occurrence of an event if the probability the event not occurring is 0.56.

Solution:

Given,

P(not E) = 0.56

We know that,

P(E) + P(not E) = 1

So, P(E) = 1 – P(not E)

P(E) = 1 – 0.56

Or, P(E) = 0.44

Q.2. In a factory of 364 workers, 91 are married. Find the probability of selecting a worker who is not married.

Solution:

Given,

Total workers (i.e. Sample space) = n(S) = 364

Total married workers = 91

Now, total workers who are not married = n(E) = 364 – 91 = 273

Method 1: So, P(not married) = n(E)/n(S) = 273/364 = 0.75

Method 2: P(married) + P(not married) = 1

Here, P(married) = 91/364 = 0.25

So, 0.25 + P(not married) = 1

P(not married) = 1 – 0.25 = 0.75

Q. 3. From a deck of cards, 10 cards are picked at random and shuffled. The cards are as follows:

6, 5, 3, 9, 7, 6, 4, 2, 8, 2

Find the probability of picking a card having a value of more than 5 and find the probability of picking a card with an even number on it.

Solution:

Total number of cards = 10

Total cards having value more than 5 = 5

i.e. {6, 9, 7, 6, 8}

Total cards having an even number = 6

i.e. {6, 6, 4, 2, 8, 2}

So, the probability of picking a card having a value of more than 5 = 5/10 = 0.5

And, the probability of picking a card with an even number on it = 6/10 = 0.6

Q.4. From a bag of red and blue balls, the probability of picking a red ball is x/2. Find "x" if the probability of picking a blue ball is ⅔.

Solution:

Here, there are only red and blue balls.

P(picking a red ball) + P(picking a blue ball) = 1

x/2 + ⅔ = 1

=> 3x + 4 = 6

=> 3x = 2

Or, x = ⅔

Q.5. Two coins are tossed simultaneously 360 times. The number of times '2 Tails' appeared was three times 'No Tail' appeared and the number of times '1 tail' appeared is double the number of times 'No Tail' appeared. What is the probability of getting 'Two tails'.

Solution:

Given,

Total number of outcomes = Sample space = 360

Now, assume that the number of times 'No Tail' appeared to be "x"

So, the number of times '2 Tails' appeared = 3x (from the question)

Also, the number of times '1 Tail' appeared =2x (from the question)

As the total outcomes = 360,

x + 2x + 3x = 360

=> 6x = 360

Or, x = 60

∴ P(getting two tails) = (3 × 60)/360 = ½

Q.6: 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.

Solution:

Total numbers of families = 1500

(i) Numbers of families having 2 girls = 475

Probability = Numbers of families having 2 girls/Total numbers of families

P = 475/1500

P = 19/60

(ii) Numbers of families having 1 girls = 814
Probability = Numbers of families having 1 /Total numbers of families

P = 814/1500

P = 407/750

(iii)Numbers of families having no girls = 211
Probability = Numbers of families having 0 girls/Total numbers of families
= 211/1500
Sum of the probability = (19/60)+(407/750)+(211/1500)

= (475+814+211)1500 = 1500/1500 = 1

Yes, the sum of these probabilities is 1.

Q.7: A die is thrown 1000 times with the frequencies for the outcomes 1, 2, 3, 4, 5 and 6 as given in the following table :

Outcome	**1**	**2**	**3**	**4**	**5**	**6**
Frequency	**179**	**150**	**157**	**149**	**175**	**190**

Find the probability of getting each outcome.

Solution: Let E_i denote the event of getting the outcome I, where i = 1, 2, 3, 4, 5, 6.

Then

Probability of the outcome 1 = $P(E_1)$

= Frequency of 1/Total number of times the die is thrown

= 179/1000

= 0.179

Similarly,

$P(E_2)$ = 150/1000 = 0.15

$P(E_3)$ = 157/1000 = 0.157

$P(E_4)$ = 149/1000 = 0.149

$P(E_5)$ = 175/1000 = 0.175

and $P(E_6)$ = 190/1000 = 0.19

You can check: $P(E_1) + P(E_2) + P(E_3) + P(E_4) + P(E_5) + P(E_6) = 1$

Q.8: 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 has chosen is

1. **earning ₹10000 – 13000 per month and owning exactly 2 vehicles.**
2. **earning ₹16000 or more per month and owning exactly 1 vehicle.**
3. **earning less than ₹7000 per month and does not own any vehicle.**
4. **earning ₹13000 – 16000 per month and owning more than 2 vehicles.**
5. **owning not more than 1 vehicle.**

Solution:

Total number of families = 2400

(i) Numbers of families earning ₹10000 –13000 per month and owning exactly 2 vehicles = 29

Therefore, the probability that the family earning between ₹10000 – 13000 per month and owning exactly 2 vehicle = 29/2400

(ii) Number of families earning ₹16000 or more per month and owning exactly 1 vehicle = 579

Therefore, the probability that the family earning between ₹16000 or more per month and owning exactly 1 vehicle = 579/2400

(iii) Number of families earning less than ₹7000 per month and does not own any vehicle = 10

Therefore, the probability that the family earning less than ₹7000 per month and does not own any vehicle = 10/2400 = 1/240

(iv) Number of families earning ₹13000-16000 per month and owning more than 2 vehicles = 25

Therefore, the probability that the family earning between ₹13000 – 16000 per month and owning more than 2 vehicles = 25/2400 = 1/96

(v) Number of families owning not more than 1 vehicle = 10+160+0+305+1+535+2+469+1+579 = 2062

Therefore, the probability that the family owns not more than 1 vehicle = 2062/2400 = 1031/1200

Q.9: 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 5.0 0

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

Solution: Total number of bags present = 11
Number of bags containing more than 5 kg of flour = 7

Therefore, the probability that any of the bags chosen at random contains more than 5 kg of flour = 7/11

Q.10: 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.

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 km from her place of work?

Solution:

The distance (in km) of 40 engineers from their residence to their place of work was found as follows:

5 3 10 20 25 11 13 7 12 31 19 10 12 17 18 11 3 2 17 16 2 7 9 7 8 3 5 12 15 18 3 12 14 2 9 6 15 15 7 6 12

Total numbers of engineers = 40

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

The probability that an engineer lives less than 7 km from her place of work =9/40

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

= 40 – 9 = 31

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

= 31/40

(iii) Number of engineers living within km from their place of work = 0

The probability that an engineer lives within km from her place of work = 0/40 = 0

Q.11: Refer to the table below:

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.

Solution: Total number of students = 90

(i) Number of students who obtained less than 20% in the mathematics test = 7

The probability that a student obtained less than 20% in the mathematics test = 7/90

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

The probability that a student obtained marks 60 or above = 23/90