Exercise – 25.1

1. A coin is tossed 1000 times with the following frequencies:
Head: 455, Tail: 545
Compute the probability for each event.
Sol:
It is given that the coin is tossed 1000 times. The total number of trials is 1000.
Let us denote the event of getting head and of getting tail by E and F respectively. Then number of trails in which the E happens = 455

$$\boxed{So,\ probabilites\ of\ \ E = \frac{Number\ of\ \ Event\ head}{Total\ no.of\ \ trails}}$$

$$i.e.,\ p(E) = \frac{455}{1000} = 0 \cdot 455$$

Similarly, the probability of the event getting a

$$\text{Tail } = \frac{Number\ of\ \ Tails}{Total\ \ number\ of\ Trials}$$

$$i.e.,\ p(E) = \frac{545}{1000} = 0 \cdot 545$$

Note: we note that $P(A)+P(B)=0\cdot 48+0\cdot 52$

Therefore, A and B are the only two opposite outcomes.

2. Two coins are tossed simultaneously 500 times with the following frequencies of different outcomes:
Two heads : 95 times
One tail : 290 times
No head : 115 times
Find the probability of occurrence of each of these events.
Sol:

WKT, $\boxed{\text{probabilty}(\text{E}) = \frac{\text{Number of trails which the event happens}}{\text{Total number of Trials}}}$

$$\text{P(getting two heads)} = \frac{95}{500} = 0 \cdot 19$$

$$\text{P(getting one tail)} = \frac{290}{500} = 0 \cdot 58$$

$$\text{P(getting no head)} = \frac{115}{500} = 0 \cdot 23$$

3. Three coins are tossed simultaneously 100 times with the following frequencies of different outcomes:

Outcome:	No head	One head	Two heads	Three heads
Frequency:	14	38	36	12

If the three coins are simultaneously tossed again, compute the probability of:

(i) 2 heads coming up. (ii) 3 heads coming up.

(iii) at least one head coming up. (iv) getting more heads than tails.

(v) getting more tails than heads.

Sol:

Out come	No head	One head	Two heads	Three heads
Frequency	14	38	36	12

(i) Probability of 2 heads coming up $= \dfrac{Favorable\ outcome}{Total\ outcome}$

$$= \frac{36}{100} = 0 \cdot 36$$

(ii) Probability of 3 heads coming up $= \dfrac{Favorable\ outcome}{Total\ outcome}$

$$= \frac{12}{100}$$
$$= 0 \cdot 12$$

(iii) Probability of at least one head coming up $= \dfrac{Favorable\ outcome}{Total\ outcome}$

$$= \frac{38+36+12}{100}$$
$$= \frac{86}{100} = 0 \cdot 86$$

(iv) Probability of getting more than heads and tails $= \dfrac{Favorable\ outcome}{Total\ outcome}$

$$= \frac{36+12}{100} = \frac{48}{100} = 0 \cdot 48$$

(v) Probability of getting more tails than heads

$$= \frac{14+38}{100} = \frac{52}{100} = 0 \cdot 52.$$

4. 1500 families with 2 children were selected randomly and the following data were recorded:

Number of girls in a family:	0	1	2
Number of families:	211	814	475

If a family is chosen at random, compute the probability that it has:

(i) No girl (ii) 1 girl (iii) 2 girls

(iv) at most one girl (v) more girls than boys

Sol:

It is given that

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

(i) No. of families having no girl = 211

Required probability $= \dfrac{No.of\ \ families\ having\ no\ girl}{Total\ number\ of\ \ families}$

$= \dfrac{211}{1500} = 0 \cdot 1406$

(ii) Number of families having 1 girl = 814

Required probability $= \dfrac{No.of\ \ families\ having\ one\ girl}{Total\ number\ of\ \ families}$

$= \dfrac{814}{1500} = \dfrac{407}{750} = 0 \cdot 5426$

(iii) Number of families having 2 girl = 475

Required probability $= \dfrac{No.of\ \ families\ having\ 2\ girl}{Total\ number\ of\ \ families}$

$= \dfrac{475}{1500} = 0 \cdot 3166.$

(iv) Number of families having at the most one girl = 211 + 814 = 1025.

Required probability $= \dfrac{\text{Number of families having atmost one girl}}{Total\ number\ of\ \ families}$

$= \dfrac{1025}{1500} = 0 \cdot 6833$

(v) Probability of families having more girls than boys

$= \dfrac{Number\ of\ \ families\ having\ more\ girls\ than\ Boys}{Total\ number\ of\ \ families}$

$= \dfrac{475}{1500} = 0 \cdot 31$

5. In a cricket match, a batsman hits a boundary 6 times out of 30 balls he plays. Find the probability that on a ball played:

(i) he hits boundary (ii) he does not hit a boundary.

Sol:

Number of times batsman hits a boundary = 6

Total number of balls played = 30.

$\therefore$ Number of times that batsman does not hit a boundary $= 30 - 6 = 24.$

(i) Probability (he hits a boundary) $= \frac{No \cdot of \ \ times \ he \ hits \, boundary}{Total \ \ No \cdot of \ balls \ \ played}$

$= \frac{6}{30} = \frac{1}{5}$

(ii) P (he does not hits a boundary) $= \frac{No \cdot of \ \ times \ he \ hits \, boundary}{Total \ \ No \cdot of \ balls \ \ played}$

$= \frac{24}{30} = \frac{4}{5}$

6. The percentage of marks obtained by a student in monthly unit tests are given below:

Unit test:	I	II	III	IV	V
Percentage of marks obtained:	69	71	73	68	76

Find the probability that the student gets: (i) more than 70% marks (ii) less than 70% marks (iii) a distinction.

Sol:

(i) Let E be the event of getting more than 70% marks

The number of times E happens is 3

$\therefore P(A) = \frac{3}{5} = 0 \cdot 5$

(ii) Let F be the event of getting less than 70% marks

The number of times B happens is 2

$\therefore P(B) = \frac{2}{5} = 0 \cdot 4$

(iii) Let G be the event of getting a distinction

The number of G happens is 1.

$\therefore P(C) = \frac{1}{5} = 0 \cdot 2.$

7. To know the opinion of the students about Mathematics, a survey of 200 students was conducted. The data is recorded in the following table:

Opinion:	Like	Dislike
Number of students:	135	65

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

Sol:

Opinion	Like	Dislike
No. of students	135	65

(i) Probability that a student likes mathematics

$$= \frac{Favorable\ outcome}{Total\ outcome} = \frac{135}{200}$$

$$= \frac{135}{200} = 0 \cdot 675$$

(ii) Probability that a student does not like mathematics

$$= \frac{Favorable\ outcome}{Total\ outcome} = \frac{65}{200} = 0 \cdot 325$$

8. The blood groups of 30 students of class IX 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,
A student is selected at random from the class from blood donation. Find the probability that the blood group of the student chosen is:
(i) A (ii) B (iii) AB (iv) O

Sol:

Blood group	A	B	0	AB	Total
No. of students	9	6	12	3	30

(i) Probability of a student of blood group $A = \frac{Favorable\ outcome}{Total\ outcome}$

$$= \frac{9}{30} = 0 \cdot 3$$

(ii) Probability of a student of blood group $B = \frac{Favorable\ outcome}{Total\ outcome}$

$$= \frac{6}{30} = 0 \cdot 2.$$

(iii) The probability of a student of blood group

$$AB = \frac{Favorable\ outcome}{Total\ outcome} = \frac{3}{30}$$

$$= 0 \cdot 1$$

(iv) The probability of a student of blood group

$$0 = \frac{Favorable\ outcome}{Total\ outcome} = \frac{12}{30} = 0 \cdot 4.$$

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, 5.00
Find the probability that any of these bags chosen at random contains more than 5 kg of flour.

Sol:
It is given that
Eleven bags of wheat flour, each marked 5kg, actually contained the following weights
$4\cdot 97, 5\cdot 05, 5\cdot 08, 5\cdot 03, 5\cdot 00, 5\cdot 06, 5\cdot 08, 4\cdot 98, 5\cdot 04, 5\cdot 07, 5\cdot 00$
Probability (Bag having more than 5kg of flour)

$$= \frac{No\cdot of\ \ bags\ \ having\ \ more\ \ than\ \ 5kg}{Total\ \ no\cdot oof\ \ bags}$$

$$= \frac{7}{11}.$$

10. Following table shows the birth month of 40 students of class IX.

Jan	Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec
3	4	2	2	5	1	2	5	3	4	4	4

Find the probability that a student was born in August.
Sol:
The birth month of 40 students of class 1X

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
3	4	2	2	5	1	2	6	3	4	4	4

Probability (Students was born in August) $= \frac{Favorable\ \ outcome}{Total\ \ outcome}$

$$= \frac{6}{40} = \frac{3}{20}.$$

11. Given below is the frequency distribution table regarding the concentration of sulphur dioxide in the air in parts per million of a certain city for 30 days.

Conc. of S0$_2$	0.00-0.04	0.04-0.08	0.08-0.12	0.12-0.16	0.16-0.20	0.20-0.24
No. of days	4	8	9	2	4	3

Find the probability of concentration of sulphur dioxide in the interval 0.12-0.16 on any of these days.
Sol:
Given that
The frequency distribution table regarding the concentration of sulphurdioxide in the air in parts per million of a certain city for 30 days is as follows

Conc of SO_2	$0\cdot 00-0\cdot 04$	$0\cdot 04-0\cdot 88$	$0\cdot 88-0\cdot 12$	$0\cdot 12-0\cdot 16$	$0\cdot 16-0\cdot 20$	$0\cdot 20-0\cdot 24$
No. of days	4	8	9	2	4	2

Total number of days = 30.
Probability of concentration of SO_2 in the internal $0\cdot 12-0\cdot 16$ is

$$= \frac{Favourable\ \ outcome}{Total\ \ outcome} = \frac{2}{30} = 0\cdot 06.$$

12. Companies selected 2400 families at random and survey them to determine a relationship between income level and the number of vehicles in a home. The information gathered is listed in the table below:

Monthly income (in Rs)	Vehicles per family			
	0	1	2	Above2
Less than 7000	10	160	25	0
7000-10000	0	305	27	2
10000-13000	1	535	29	1
13000-16000	2	469	29	25
16000 or more	1	579	82	88

If a family is chosen, find the probability that the family 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 vehicle.

(v) owning not more than 1 vehicle

(vi) owning at least one vehicle.

Sol:

(i) The probability that the family is earning Rs 10000-13000 per month and owning exactly 2 vehicles

$$= \frac{Favorable\ outcomes}{Total\ outcome} = \frac{29}{2400}$$

(ii) The probability that the family is earning Rs 16000 or more per month and owning exactly one vehicle $= \frac{Favorable\ outcomes}{Total\ outcome} = \frac{579}{2400}$

(iii) The probability that the family is earning less than Rs 7,000 per month and does not own any vehicle $= \frac{Favorable\ outcomes}{Total\ outcome}$

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

(iv) The probability that thee family is earning Rs 13,000 – 16,000 per month and owning more than 2 vehicle $= \frac{Favorable\ outcomes}{Total\ outcome} = \frac{25}{2400} = \frac{1}{96}$

(v) The probability that the family is owning not more Than 1 vehicle

$$= \frac{Favorable\ outcomes}{Total\ outcome} = \frac{10+0+1+2+1+160+305+535+469+579}{2400}$$

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

(vi) The probability that the family is owning at-least one vehicle

$$= \frac{Favorable\ outcomes}{Total\ outcome}$$

$$= \frac{160+305+535+469+579+25+27+29+29+82+0+2+1+25+88}{2400}$$

$$= \frac{2356}{2400} = \frac{589}{600}$$

13. The following table gives the life time of 400 neon lamps:

Life time (in hours)	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
No. of lamps	14	56	60	86	74	62	48

A bulb is selected at random. Find the probability that the life time of the selected bulb is:

(i) less than 400

(ii) between 300 to 800 hours

(iii) at least 700 hours.

Sol:

Life time	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
(in hours)	14	56	60	86	74	62	48

(i) The probability that the life time of the selected bulb is less than 400

$$= \frac{Favorable\ outcomes}{Total\ outcome}$$

$$= \frac{14}{400} = \frac{7}{200}$$

(ii) The probability that the life time of the selected bulb is between 300 – 800 hours

$$= \frac{Favorable\ outcomes}{Total\ outcome}$$

$$= \frac{14+56+60+86+74}{400}$$

$$= \frac{290}{400} = \frac{29}{40}$$

(iii) The probability that the life time of the selected bulb is at least 700 hours

$$= \frac{Favorable\ outcomes}{Total\ outcome} = \frac{74+62+48}{400} = \frac{184}{400} = \frac{23}{50}$$

14. Given below is the frequency distribution of wages (in Rs) of 30 workers in a certain factory:

Wages (in Rs) 110-130 130-150 150-170 170-190 190-210 210-230 230-250

No. of workers 3 4 5 6 5 4 3

A worker is selected at random. Find the probability that his wages are:

(i) less than Rs 150

(ii) at least Rs 210

(iii) more than or equal to 150 but less than Rs 210.

Sol:

Wages (in Rs)	110-130	130-150	150-170	170-190	190-210	210-230	230-250
No. of workers	3	4	5	6	5	4	3

Total no. of workers = 30.

(i) The probability that his wages are less than Rs 150 $= \frac{Favorable\ outcomes}{Total\ outcome}$

$= \frac{3+4}{30} = \frac{7}{30}$

(ii) The probability that his wages are at least Rs 210 $= \frac{Favorable\ outcomes}{Total\ outcome}$

$= \frac{4+3}{30} = \frac{7}{30}.$

The probability that his wages are more than or equal to 150 but less than Rs 200 $= \frac{Favorable\ outcomes}{Total\ outcome} = \frac{5+6+5}{30} = \frac{16}{30} = \frac{8}{15}$