25. Probability

Exercise 25.1

1. Question

A coin is tossed 1000 times with the following frequencies:

Head: 455, Tail: 545

Compute the probability for each event.

Answer

Given,

The coin tossed = 1000 times

The total number of trial = 1000

Lets assum,

The event of getting head = E

The event of getting tail = F

Then,

Number of trials in which the E happens = 455

So,

Probability of E = $\frac{number\ of\ event\ head}{total\ no.of\ trials}$

P (E) = $\frac{455}{1000} = 0.455$

Similarly,

The probability of the event getting a tail = $\frac{number\ of\ event\ tails}{total\ no.of\ trials}$

P (F) = $\frac{545}{1000} = 0.545$

Note: we note that P(A)+P(B) = 0.48+0.52

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

2. Question

Two coind 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.

Answer

Given,

Total number of trials = 500 times

Probability (E) = $\frac{number\ of\ trials\ in\ which\ the\ event\ happens}{total\ number\ of\ trials}$

P (getting two heads) = $\frac{95}{500} = 0.19$

P (getting one tail) = $\frac{290}{500} = 0.58$

P (getting no head) = $\frac{115}{500} = 0.23$

3. Question

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

Outcome:	No head	One head	Two head	Three head
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.

Answer

Given,

(i) Probability of 2 heads coming up = $\frac{favourable\ outcome}{total\ outcome}$

$= \frac{36}{100} = 0.36$

(ii) Probability of 3 heads coming up = $\frac{favourable\ outcome}{total\ outcome}$

$= \frac{12}{100} = 0.12$

(iii) Probability of atleast one heads coming up = $\frac{favourable\ outcome}{total\ outcome}$

$= \frac{38+36+12}{100} = \frac{86}{100} = 0.86$

(iv) Probability of getting more heads than tails = $\frac{favourable\ outcome}{total\ outcome}$

$= \frac{36+12}{100} = \frac{48}{100} = 0.48$

(v) Probability of getting more tails than heads coming up = $\frac{favourable\ outcome}{total\ outcome}$

$= \frac{14+38}{100} = \frac{52}{100} = 0.52$

4. Question

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

No. of girls in a family :	0	1	2
No. 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.

Answer

Given,

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

(i) Number of families having no girl = 211

Required probability = $\frac{\text{Number of families having no girl}}{\text{Total number of families}}$

$= \frac{211}{1500} = 0.1406$

(ii) Number of families having one girl = $\frac{\text{Number of families having one girl}}{\text{Total number of families}}$

$= \frac{814}{1500} = 0.5426$

(iii) Number of families having 2 girls = $\frac{\text{Number of families having 2 girls}}{\text{Total number of families}}$

$= \frac{475}{1500} = 0.3166$

(iv) Number of families having at most one girl = $\frac{\text{Number of families having at most one girl}}{\text{Total number of families}}$

$= \frac{1025}{1500} = 0.6833$

(v) Number of families having more girls thanboys= $\frac{number\ of\ families\ having\ more\ girls\ than\ boys}{\text{Total number of families}}$

$= \frac{475}{1500} = 0.3166$

5. Question

In a cricket match, a batsman hits a boundry 6 times out of 30 balls he plays.

Find the probability that on a ball played :

(i) he hits boundry

(ii) he does not hit a boundry.

Answer

Given,

Number of times batsman hits the boundry = 6

Total balls played = 30

Number of times that batsman does not hit the boundry = 30-6 = 24

Probability (number of times he hits a boundry) $= \frac{\text{number of times he hits a boundry}}{\textit{total number of balls played}} = \frac{6}{30} = \frac{1}{5}$

Probability (number of times he does not hits a boundry) $= \frac{\text{number of times he does not hits a boundry}}{\textit{total number of balls played}} = \frac{24}{30} = \frac{4}{5}$

6. Question

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

Unit test :	I	II	III	IV	V
% 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.

Answer

Let,

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

The number of times E happens = 3

P(A) $= \frac{3}{5} = 0.6$

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

The number of times F happens = 2

P(B) $= \frac{2}{5} = 0.4$

(iii) G be the event of getting a distinction

The number of times G happens = 1

P(C) $= \frac{1}{5} = 0.2$

7. Question

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

Opinion:	Like	Dislike
No. of students :	135	65

Find the probability that a student chosen at random

(i) likes Mathematics

(ii) does not like it.

Answer

Given,

(i) Probability that a student likes mathematics $= \frac{favourable\ outcome}{total\ number\ of\ outcome}$

$= \frac{135}{200} = 0.675$

(ii) Probability that a student does not like mathematics $= \frac{favourable\ outcome}{total\ number\ of\ outcome}$

$= \frac{65}{200} = 0.325$

8. Question

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

Answer

Given,

Probability of a student of blood group A $= \frac{favourable\ outcome}{total\ outcome}$

$= \frac{9}{30} = 0.3$

Probability of a student of blood group B $= \frac{favourable\ outcome}{total\ outcome}$

$= \frac{6}{30} = 0.2$

Probability of a student of blood group AB $= \frac{favourable\ outcome}{total\ outcome}$

$= \frac{3}{30} = 0.1$

Probability of a student of blood group O $= \frac{favourable\ outcome}{total\ outcome}$

$= \frac{12}{30} = 0.4$

9. Question

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

Given,

Eleven bags of wheat flour, each marked 5 kg, actually contained the different weights of flour

Probability (Bags having more than 5 kg flour) $= \frac{\text{number of Bags having more than 5 kg flour}}{\textit{total number of bags}} = \frac{7}{11}$

10. Question

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

Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
3	4	2	2	5	1	2	6	3	4	4	4

Find the probability that a student was born in August.

Answer

Given,

Probability (students was born in August) $= \frac{\textit{favourable outcome}}{\textit{total outcome}}$

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

11. Question

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 SO_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.

Answer

Given,

The frequency distribution table regarding the concentration of sulphur dioxide in the air in parts per million of a certain city for 30 days

Total number of days = 30

Probability of concentration of SO_2 in the interval 0.12 – 0.16 is

$= \frac{favourable\ outcome}{total\ outcome} = \frac{2}{30} = 0.06$

12. Question

A company 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	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	29	25
16000 or more	1	579	82	88

If a family is chosen find the probability that the family is:

(i) earning Rs. 10,000 – 13,000 per month and owning exactly 2 vehicles.

(ii) earning Rs. 16,000 or more per month and owning exactly 1 vehicles.

(iii) earning less than Rs. 7,000 per month and does not own any vehicles.

(iv) earning Rs. 13,000 – 16,000 per month and owning more than 2 vehicles.

(v) owning not more than 1 vehicle.

(vi)owning at least one vehicle.

Answer

Given,

(i) The probability that the family is earning Rs. 10,000 – 13,000 per month and owning exactly 2 vehicles = $\frac{favourable\ outcome}{total\ outcome} = \frac{29}{2400}$

(ii) The probability that the family earning Rs. 16,000 or more per month and owning exactly 1 vehicles = $\frac{favourable\ outcome}{total\ outcome} = \frac{579}{2400}$

(iii) The probability that the family earning less than Rs. 7,000 per month and does not own any vehicles = $\frac{favourable\ outcome}{total\ outcome} = \frac{10}{2400} = \frac{1}{240}$

(iv) The probability that the family earning Rs. 13,000 – 16,000 per month and owning more than 2 vehicles $= \frac{favourable\ outcome}{total\ outcome} = \frac{25}{2400} = \frac{1}{96}$

(v) The probability that the family owning not more than 1 vehicle =

$\frac{favourable\ outcome}{total\ outcome} = \frac{10+0+1+2+1+160+305+535+469+579}{2400} = \frac{2062}{2400} = \frac{1031}{1200}$

(vi) The probability that the family owning at least one vehicle $= \frac{favourable\ outcome}{total\ outcome}$

$$= \frac{160 + 305 + 535 + 469 + 579 + 254 + 27 + 29 + 29 + 82 + 0 + 2 + 1 + 25 + 86}{2400}$$

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

13. Question

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

Life time (in hrs.)	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.

Answer

Given,

(i) Probability that the life time of the selected bulb is less than 400 $= \frac{favourable\ outcome}{total\ outcome} = \frac{14}{400} = \frac{7}{200}$

(ii) Probability that the life time of the selected bulb is between 300 – 800 hours $= \frac{favourable\ outcome}{total\ outcome} = \frac{14+56+60+86+74}{400} = \frac{290}{400} = \frac{29}{40}$

(iii) Probability that the life time of the selected bulb is at least 700 hours $= \frac{favourable\ outcome}{total\ outcome} = \frac{74+62+48}{400} = \frac{184}{400} = \frac{23}{50}$

14. Question

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 atr 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.

Answer

Given,

Total number of workers = 30

(i) Probability that his wages are less than rs 150 = $\frac{favourable\ outcome}{total\ outcome} = \frac{3+4}{30} = \frac{7}{30}$

(ii) Probability that his wages are at least rs 210 = $\frac{favourable\ outcome}{total\ outcome} = \frac{3+4}{30} = \frac{7}{30}$

(iii) Probability that his wages are more than or equals to rs 150 but less than rs 200 = $\frac{favourable\ outcome}{total\ outcome} = \frac{5+6+5}{30} = \frac{16}{30} = \frac{8}{15}$

An Elementary Event is any single outcome or element of a sample space.

1. Question

Define a trial.

Answer

Any particular performance of a random experiment is called a trial.

By Experiment or Trial in the subject of probability, we mean a Random experiment unless otherwise specified.

Each trial results in one or more outcomes.

2. Question

Define an elementary event.

Answer

In probability theory, an elementary event (also called an atomic event or simple event) is an event which contains only a single outcome in the sample space.

Using set theory terminology, an elementary event is a singleton.

3. Question

Define an event.

Answer

When we say "Events" we mean one (or more) outcomes or results of an experiment.

4. Question

Define probability of an event.

Answer

The probability of an event E is defined as the number of outcomes favorable to E divided by the total number of equally likely outcomes in the sample space S of the experiment.

5. Question

A bag contains 4 white balls and some red balls. If the probability of drawing a white ball from the bag is $\frac{2}{5}$, find the number of red balls in the bag.

Answer

let the number of red ball be x.

total number of red balls = 4+x.

probability of drawing a white ball is = $\frac{2}{5}$

$\therefore \frac{4}{4+x} = \frac{2}{5}$

2(4+x) = 4×5

4+x = 2×5 = 10

X = 10-4 = 6

X = 6

Thus the number of red balls are 6.

6. Question

A die is thrown 100 times. If the probability of getting an even number is $\frac{2}{5}$. How many times an odd number is obtained?

Answer

Possible outcomes of a dice = {1, 2, 3, 4, 5, 6}

of the given six possible outcomes,

{1, 3, 5} are 3 odd number and {2, 4, 6} are 3 even so,

here, there is an equal possibility of coming an odd number and even number in every throw.

Given the probability of getting an even number = $\frac{2}{5}$

∴The probability of getting an odd number = 1 – Probability of getting an even number

$= 1 - \frac{2}{5} = \frac{3}{5}$

Given the dice is thrown 100 times

∴ Number of times an odd number obtained = $\frac{3}{5} \times 100 = 3 \times 20 = 60\ times$

7. Question

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

Outcome	3 heads	2 heads	1 head	No head
Frequency	23	72	77	28

Find the probability of getting at most two heads.

Answer

Probability of getting at most two heads = $\frac{favourable\ outcome}{total\ outcome} = \frac{72+77+28}{200} = \frac{177}{200}$

8. Question

what is the probability of getting at least two heads?

Answer

Probability of getting at least 2 heads $= \frac{favourable\ outcome}{total\ outcome} = \frac{72+23}{200} = \frac{95}{200} = \frac{19}{40}$

CCE - Formative Assessment

1. Question

The probability of an impossible event is

A. 1

B. 0

C. less than 0

D. greater than 1

Answer

The event is known ahead of time to be not possible, therefore by definition in mathematics, the probability is defined to be 0 which means it can never happen.

2. Question

The probability of a certain event is

A. 0

B. 1

C. greater than 1

D. less than 0

Answer

If there is a chance that an event will happen, then, its probability is between zero and 1.

3. Question

The probability of an event of a trials is

A. 1

B. 0

C. less than 1

D. more than 1

Answer

The probability of an event of a trials is less than 1.

4. Question

Which of the following cannot be the probability of an event?

A. $\frac{1}{3}$

B. $\frac{3}{5}$

C. $\frac{5}{3}$

D. 1

Answer

The most the probability of an event occurring can be is 1which means the event has a 100% probability of happening. But 5/3 is greater than 1 so it can’t be the probability of an event.

5. Question

Two coins are tossed simultaneously. The probability of getting atmost one head is

A. $\frac{1}{4}$

B. $\frac{3}{4}$

C. $\frac{1}{2}$

D. $\frac{1}{4}$

Answer

When two coins are tossed simultaneously then the possible outcomes obtained are {HH, HT, TH, and TT}.

Here H denotes head and T denotes tail.

Therefore, a total of 4 outcomes obtained on tossing two coins simultaneously.

The favourable outcome of getting at most one head are HT, TH, and TT.

So, the probability of getting at most one head is 3/4

6. Question

A coin is tossed 1000 times, if the probability of getting a tail is 3/8, how many times head is obtained?

A. 525

B. 375

C. 625

D. 725

Answer

Possible outcomes of a coin = HT

So here,

there is an equal possibilty of coming of Head and Tail in every toss.

Now it is given that probability of getting a tail = 38

The probability of getting a head = 1 - probability of getting a tail = $1-\frac{3}{8}=\frac{5}{8}$

The coin is tossed 1000 times.

Hence number of times a head obtained = $\frac{5}{8}\times1000$ = 625 times

7. Question

A dice is rolled 600 times and the occurrence of the outcomes 1, 2, 3, 4, 5 and 6 are given below :

Outcome	1	2	3	4	5	6
Frequency	200	30	120	100	50	100

The probability of getting a prime number is

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $\frac{49}{60}$

D. $\frac{39}{125}$

Answer

Total trials = 600

No. Of getting prime number = 30+120+50 = 200

Let E be the event of getting a prime number so,

P(E) = $\frac{200}{600} = \frac{2}{6} = \frac{1}{3}$

8. Question

The percentage of attendance of different classes in a year in a school is given below :

Class:	X	IX	VIII	VII	VI	V
Attendance:	30	62	85	92	76	55

What is the probability that the class attendance is more than 75%?

A. $\frac{1}{6}$

B. $\frac{1}{3}$

C. $\frac{5}{6}$

D. $\frac{1}{2}$

Answer

Total classes = 6

No. Of class that have more than 75% attendance = 3

Let E be the event of more than 75% attendance

P(E) = $\frac{3}{6} = \frac{1}{2}$

9. Question

A bag is contains 50 coins and each coin is marked from 51 to 100. One coin is picked at random. The probability that the number on the coin is not a prime number, is

A. $\frac{1}{5}$

B. $\frac{3}{5}$

C. $\frac{2}{5}$

D. $\frac{4}{5}$

Answer

Total number of coins = 50

∴ Total number of outcomes = 50

prime numbers are = 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

P(prime numbers) = $\frac{10}{50} = \frac{1}{5}$

∴ P(not prime numbers) = $1 - \frac{1}{5} = \frac{4}{5}$

10. Question

In a football match, Ronaldo makes 4 goals from 10 penanlty kicks. The probability of converting a penalty kick into a goal by Ronaldo, is

A. $\frac{1}{4}$

B. $\frac{1}{6}$

C. $\frac{1}{3}$

D. $\frac{2}{5}$

Answer

Total penalty kicks = 10

Total goals = 4

Let E be the event of converting a penalty kick into a goal = $\frac{4}{10} = \frac{2}{5}$