K. Kannan, B.E.,
Mobile : 7010157864.
1, Third street, V.O.C.Nagar,
Bodinayakanur.
Email : kannank1956@gmail.com

10th Maths – Chapter 8 STATISTICS AND PROBABILITY

(Book in One Marks & Solutions for Exercises)

Green indicates Thinking Corner, Blue indicates Progress Check

புதுமை படைக்க புரிந்து படி!

STATISTICS

1. Prasanta Chandra Mahalanobis introduced innovative techniques for conducting large-scale sample surveys and calculated acreages and crop yields by using the Method of random sampling.

2. He was awarded the Padma Vibhushan, one of India's highest honours, by the Indian government in 1968 and he is hailed as "Father of Indian Statistics".

3. The Government of India has designated 29th June every year, coinciding with his birth anniversary, as "National Statistics Day".

4. The most common Measures of Central Tendency are
   • Arithmetic Mean • Median • Mode

5. Does the mean, median and mode are same for a given data? Not always. But sometimes they may same like this data : 2, 4, 5, 5, 6, 8

6. What is the difference between the arithmetic mean and average? No difference

7. The mean of n observations is x , if first term is increased by 1 second term is increased by 2 and so on. What will be the new mean?

$$\text{The mean of the increased value alone} = \frac{1+2+3+\ldots+n}{n} = \frac{n(n+1)}{2n} = \frac{n+1}{2}$$

$$\text{The new mean} = x + \frac{n+1}{2}$$

8. The sum of all the observations divided by number of observations is Arithmetic Mean.

9. If the sum of 10 data values is 265 then their mean is 26.5. $\left(\frac{265}{10}\right)$

10. If the sum and mean of a data are 407 and 11 respectively, then the number of observations in the data are 37. $\left(\bar{x} = \frac{S}{n};\ \therefore n = \frac{S}{\bar{x}} = \frac{407}{11} = 37\right)$

11. Measures of Variation (or) Dispersion of a data provide an idea of how observations spread out (or) scattered throughout the data.

12. Different Measures of Dispersion are 1. Range 2. Mean deviation 3. Quartile deviation 4. Standard deviation 5. Variance 6. Coefficient of Variation.

13. The range of first 10 prime numbers is 27.

First 10 prime numbers are : 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

Range (R) = Largest value – Smallest value.= L – S = 29 – 2 = 27.

14. Can variance be negative? Never

Variance is always positive. Since it is the squares of the deviations from the mean.

15. Karl Pearson was the first person to use the word Standard deviation. German mathematician Gauss used the word Mean error.

16. Can the standard deviation be more than the variance? Yes. It can.

(If the Variance is less than one, Standard deviation is more than the Variance.)

(If the Variance is more than one, Standard deviation is less than the Variance.)

17. If the variance is 0.49 then the standard deviation is 0.7

18. For any collection of n values, can you find the value of

(i). $\sum(x_i - \bar{x}) = \sum d_i = 0$

(ii). $(\sum x_i) - \bar{x} = n\bar{x} - \bar{x} = \bar{x}(n-1)$

19. The standard deviation of a data is 2.8, if 5 is added to all the data values then the new standard deviation is 2.8.

⍟⍟ Note : The standard deviation of a given data will not change, if we add or subtract a constant to all the data values. But if we multiply the all data values with a constant, then the existing standard deviation also be multiplied with that constant to get the new standard deviation. ⍟⍟

20. If S is the standard deviation of values p, q, r then standard deviation of p–3, q–3, r–3 is S.

21. Coefficient of variation is a relative measure of Standard deviation.

22. When the standard deviation is divided by the mean we get Coefficient of variation .

23. The coefficient of variation depends upon Standard deviation and Mean.

24. If the mean and standard deviation of a data are 8 and 2 respectively then the coefficient of variation is 25 % . $\left(\frac{2}{8} \times 100\right)$

25. When comparing two data, the data with higher coefficient of variation is inconsistent.

Mere Muck up will put into the Dark Room.

குருட்டு மனப்பாடம் இருட்டறைக்குள் தள்ளிவிடும்.

PROBABILITY

1. An experiment in which a particular outcome cannot be predicted is called Impossible event.

2. The set of all possible outcomes is called a Sample space.

3. If an event E consists of only one outcome then it is called an elementary event.

4. Which of the following values cannot be a probability of an event?

$(a)\ -0.0001 \quad (b)\ 0.5 \quad (c)\ 1.001 \quad (d)\ 1 \quad (e)\ 20\% \quad (f)\ 0.253 \quad (g)\ \frac{1-\sqrt{5}}{2} \quad (h)\ \frac{\sqrt{3}+1}{4}$

a, c, g can not be the values of probability. (Since they are less than zero or more than one. Probability always 0 to 1 only.)

5. What will be the probability that a non leap year will have 53 Saturdays? $\frac{1}{7}$

6. What is the complement event of an impossible event? Certain events

7. 1. P(only A) = P(A) − P(A∩B).

8. $P(\bar{A} \cap B)$ = P(only B) = P(B) − P(A∩B).

9. $A \cap B$ and $\bar{A} \cap B$ are mutually exclusive events.

10. $P(\bar{A} \cap \bar{B}) = P(\overline{A \cup B})$ = 1 − P(A U B).

11. If A and B are mutually exclusive events then $P(A \cap B) = \emptyset$.

12. If $P(A \cap B) = 0.3$, $P(\bar{A} \cap B) = 0.45$ then P(B) = 0.75.

13. $P(A \cup B) + P(A \cap B)$ is P(A) + P(B).

14. $A \cap \bar{A} = \emptyset$; $A \cup \bar{A} = S$

15. If A, B are mutually exclusive events, then P(A U B) = P(A) + P(B)

16. P (Union of mutually exclusive events) = ∑(Probability of events)

ACTIVITIES – 1

Find the standard deviation of the marks obtained by you in all five subjects in the quarterly examination and in the midterm test separately. What do you observe from your results.

S.No.	Test	Tamil	English	Maths	Science	S.S
1	Mid Term	80	81	100	92	97
2	Quarterly	92	88	90	90	90

Mid Term Test : Mean $\bar{x} = \frac{80+81+100+92+97}{5} = \frac{450}{5}$ = 90 (It is an integer)

x_i	$d_i = x_i - \bar{x}$ $= x_i - 90$	d_i^2
80	−10	100
81	−9	81
100	10	100
92	2	4
97	7	49
		334

$$\textit{Standard Deviation } \sigma = \sqrt{\frac{\sum d_i^2}{n}}$$
$$= \sqrt{\frac{334}{5}}$$
$$= \sqrt{66.8}$$
$$= 8.17$$

Quarterly exam : Mean $\bar{x} = \frac{92+88+90+90+90}{5} = \frac{450}{5}$ = 90 (It is an integer)

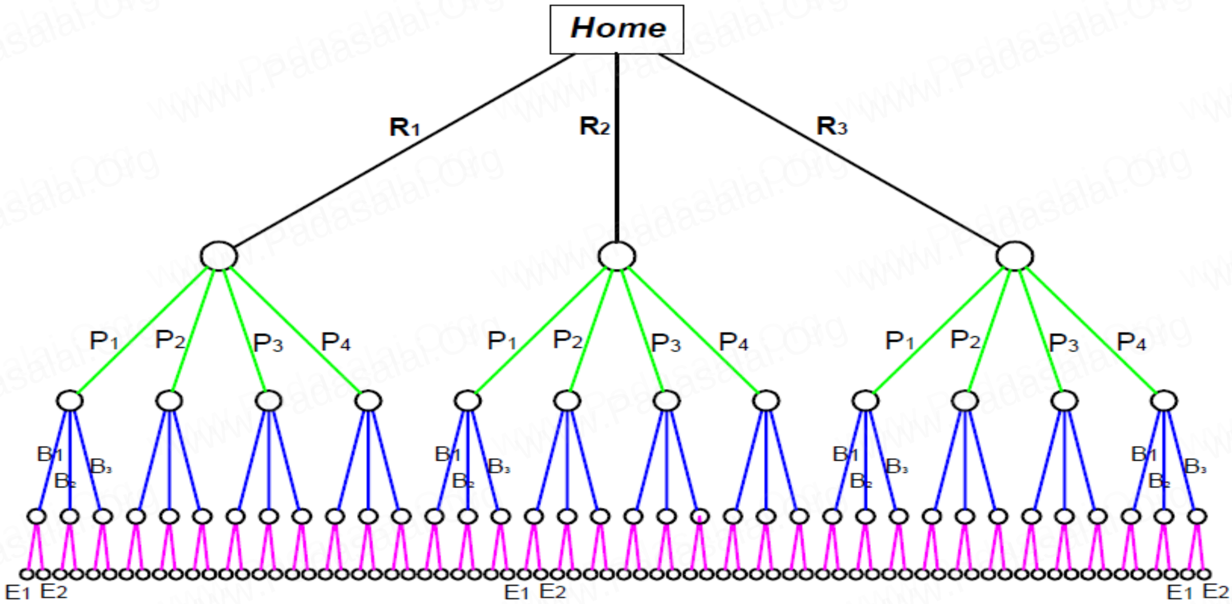
x_i	$d_i = x_i - \bar{x}$ $= x_i - 90$	d_i^2
92	2	4
88	−2	4
90	0	0
90	0	0
90	0	0
		4

$$\textit{Standard Deviation } \sigma = \sqrt{\frac{\sum d_i^2}{n}}$$
$$= \sqrt{\frac{4}{5}}$$
$$= \sqrt{0.8}$$
$$= 0.89$$

Observation : **Eventhough the total and the means are same for both, there are much difference in the Standard deviations. It is because of the marks obtained in the Mid term are scatted towards the central value (Mean) than the Quarterly exam.**

ACTIVITIES – 3

There are three routes R1, R2 and R3 from Madhu's home to her place of work. There are four parking lots P1, P2, P3, P4 and three entrances B1, B2, B3 into the office building. There are two elevators E1 and E2 to her floor. Using the tree diagram explain how many ways can she reach her office?



Number of ways to reach the office = 3(R_1,R_2,R_3) x 4(P_1,P_2,P_3,P_4) x 3(B_1,B_2,B_3) x 2(E_1,E_2)

= 72 Ways

ACTIVITIES – 4

Collect the details and find the probabilities of

(i) selecting a boy from your class. (ii) selecting a girl from your class.

(iii) selecting a student from tenth standard in your school.

(iv) selecting a boy from tenth standard in your school.

(v) selecting a girl from tenth standard in your school.

Solution : Let 10^{th} Std Boys = 32; Girls = 28 ; Total = 60; School Strength = 640

Sample space of 10^{th} Std = 60

Sample space of School = 640

(i) Probability of selecting a boy from 10^{th} Std = $\frac{32}{60}$ = 0.533

(ii) Probability of selecting a girl from 10^{th} Std = $\frac{28}{60}$ = 0.467

(iii) Probability of selecting a student from 10^{th} Std in the school = $\frac{60}{640}$ = 0.094

(iv) Probability of selecting a boy from 10^{th} Std in the school = $\frac{32}{640}$ = 0.05

(v) Probability of selecting a girl from 10^{th} Std in the school = $\frac{28}{640}$ = 0.044

ACTIVITIES – 5

The addition theorem of probability can be written easily using the following way.

P(A U B) = $S_1 - S_2$

P(A U B U C) = $S_1 - S_2 + S_3$

Where S1 ⟶ Sum of probability of events taken one at a time.

S2 ⟶ Sum of probability of events taken two at a time.

S3 ⟶ Sum of probability of events taken three at a time.

$$P(A \cup B) = \underbrace{P(A)+P(B)}_{S_1} - \underbrace{P(A \cap B)}_{S_2}$$

$$P(A \cup B \cup C) = \underbrace{P(A)+P(B)+P(C)}_{S_1} - \underbrace{(P(A\cap B)+P(B\cap C)+P(A\cap C))}_{S_2} + \underbrace{P(A\cap B\cap C)}_{S_3}$$

Find the probability of P(A U B U C U D) using the above way. Can you find a pattern for the number of terms in the formula

Solition :

Let S1 ⟶ Sum of probability of events taken one at a time.

S2 → Sum of probability of events taken two at a time.

S3 → Sum of probability of events taken three at a time.

S4 → Sum of probability of events taken four at a time.

S5 → Sum of probability of events taken five at a time and so on…

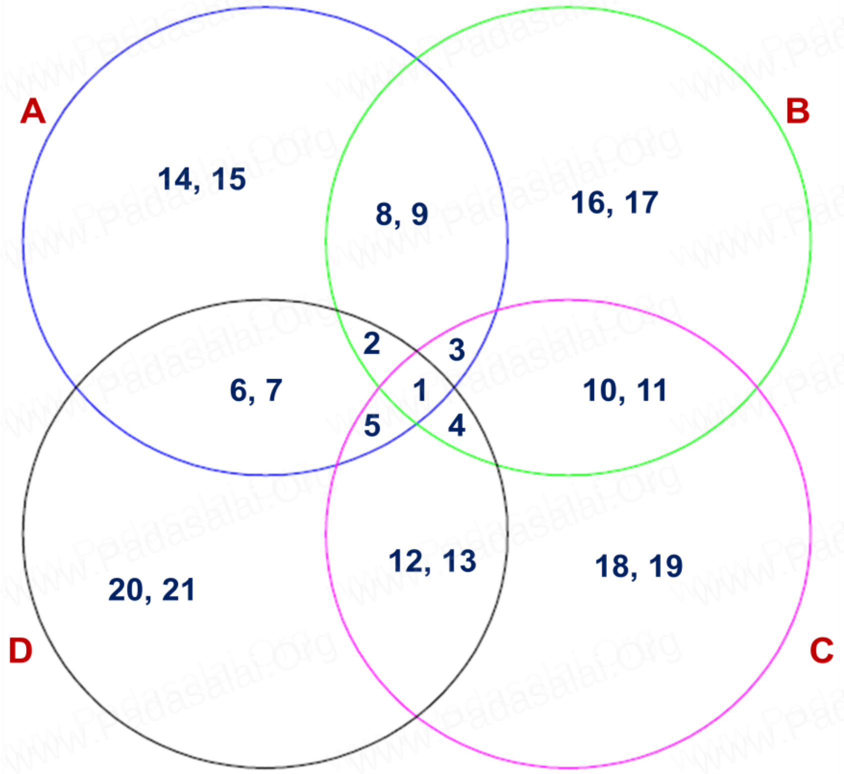
Example for four terms :

Let us take numbers from 1 to 21 and distribute it as shown in the fig. : n(S) = 21

∴ (A U B U C U D) = {1, 2, 3, …,21}; n(A U B U C U D) = 21

P(A U B U C U D) = $\frac{n(A \cup B \cup C \cup D)}{n(S)}$ = $\frac{21}{21}$ = 1 ------------- ①

And let the elements be distributed in A, B, C and D as shown in the Venn Diagram.



From the Venn diagram,

Taking One at a time,

A = {1, 2, 3, 5, 6, 7, 8, 9, 14, 15} ; n(A) = 10; P(A) = $10/21$

B = {1, 2, 3, 4, 8, 9, 10, 11, 16, 17} ; n(B) = 10; P(B) = $10/21$

C = {1, 3, 4, 5, 10, 11, 12, 13, 18, 19} ; n(C) = 10; P(C) = $10/21$

D = {1, 2, 4, 5, 6, 7, 12, 13, 20, 21} ; n(D) = 10; P(D) = $10/21$

∴P(A)+P(B)+P(C)+P(D) = $S_1 = \frac{40}{21}$

Taking Two at a time,

(A ∩ B) = {1, 2, 3, 8, 9} ; n(A ∩ B) = 5; P(A ∩ B) = $5/21$

(B ∩ C) = {1, 3, 4, 10, 11} ; n(A ∩ B) = 5; P(B ∩ C) = $5/21$

(C ∩ D) = {1, 4, 5, 12, 13} ; n(A ∩ B) = 5; P(C ∩ D) = $5/21$

(D ∩ A) = {1, 2, 5, 6, 7} ; n(A ∩ B) = 5; P(D ∩ A) = $5/21$

(A ∩ C) = {1, 3, 5} ; n(A ∩ C) = 3; P(A ∩ C) = 3/21

(B ∩ D) = {1, 2, 4} ; n(A ∩ C) = 3; P(B ∩ D) = 3/21

∴P(A∩B)+P(B∩C)+P(C∩D)+P(D∩A)+P(A∩C)+P(B∩D) = $S_2 = \frac{26}{21}$

<u>Taking Three at a time</u>,

(A ∩ B ∩ C) = {1, 3} ; n(A ∩ B ∩ C) = 2; P(A ∩ B ∩ C) = 2/21

(B ∩ C ∩ D) = {1, 4} ; n(B ∩ C ∩ D) = 2; P(B ∩ C ∩ D) = 2/21

(C ∩ D ∩ A) = {1, 5} ; n(B ∩ C ∩ D) = 2; P(C ∩ D ∩ A) = 2/21

(D ∩ A ∩ B) = {1, 2} ; n(D ∩ A ∩ B) = 2; P(D ∩ A ∩ B) = 2/21

∴P(A∩B∩C)+ P(B∩C∩D)+ P(C∩D∩A)+ P(D∩A∩B) = $S_3 = \frac{8}{21}$

<u>Taking Four at a time</u>,

(A ∩ B ∩ C ∩ D) = {1} ; n(A ∩ B ∩ C ∩ D) = 1; P(A ∩ B ∩ C ∩ D) = 1/21

∴P(A ∩ B ∩ C ∩ D) = $S_4 = \frac{1}{21}$

P(A U B U C U D) =

$$\underbrace{P(A)+P(B)+P(C)+P(D)}_{S_1} - \underbrace{(P(A\cap B)+P(B\cap C)+P(C\cap D)+P(D\cap A)+P(A\cap C)+P(B\cap D))}_{S_2} +$$

$$\underbrace{(P(A\cap B\cap C)+P(B\cap C\cap D)+P(C\cap D\cap A)+P(D\cap A\cap B))}_{S_3} - \underbrace{P(A\cap B\cap C\cap D)}_{S_4}$$

P(A U B U C U D) = $\frac{40}{21} - \frac{26}{21} + \frac{8}{21} - \frac{1}{21} = \frac{21}{21} = 1$ ------------- ②

Here ① = ②, ∴P(A U B U C U D) = $S_1 - S_2 + S_3 - S_4$

∴The Probability pattern for the number of terms is as follows.

P(A U B) (2 terms) = $S_1 - S_2$

P(A U B U C) (3 terms) = $S_1 - S_2 + S_3$

P(A U B U C U D) (4 terms) = $S_1 - S_2 + S_3 - S_4$

P(A U B U C U D U E) (5 terms) = $S_1 - S_2 + S_3 - S_4 + S_5$

And so on like this…

∴<u>The Probability pattern for the number of terms = Sum of odd terms – Sum of even terms</u>.

எளிதாய் விளங்கும் கல்வியை
இளமையில் விரும்பிக் கற்றிடு
வானமாய் விரிந்த கல்வியை
பாணமாய் விரைந்து கற்றிடு
தானமாய் பெற்ற கல்வியைத்
தரணியில் பலருக் களித்திடு.

Solution to Exercises

Exercise 8.1

1(i). Range = L – S = 125 – 63 = 62; L + S = 125 + 63 = 188

Coeff. of Range = $\frac{L-S}{L+S} = \frac{62}{188}$ = 0.33

(ii). Range = L – S = 61.4 – 13.6 = 47.8; L + S = 61.4 + 13.6 = 75

Coeff. of Range = $\frac{L-S}{L+S} = \frac{47.8}{75}$ = 0.64

2. Range = 36.8; S = 13.4; L = R + S = 36.8 + 13.4 = 50.2

3. Initial range of Income = 400 - 450; Final range of Income = 600 - 650;

Range = 650 – 400 = 250.

4. Total pages to be completed = 60 ; Total number of Students = 8

Pages completed by each = 32, 35, 37, 30, 33, 36, 35, 37

Pages to be completed by each = 28, 25, 23, 30, 27, 24, 25, 23

Mean $\bar{x} = \frac{28+25+23+30+27+24+25+37}{8} = \frac{205}{8}$ = 25.625

Since the mean is not an integer, let us adopt assumed mean method to find SD

Let the assumed mean be 25;

x_i	$d_i = x_i - A = x_i - 25$	d_i^2
28	3	9
25	0	0
23	−2	4
30	5	25
27	2	4
24	−1	1
25	0	0
23	−2	4
	$\sum d_i = 5$	47

Standard Deviation $\sigma = \sqrt{\frac{\sum di^2}{n} - \left(\frac{\sum di}{n}\right)^2}$

$= \sqrt{\frac{47}{8} - \left(\frac{5}{8}\right)^2}$

$= \sqrt{5.875 - (0.625)^2}$

$= \sqrt{5.875 - 0.39}$

$= \sqrt{5.485}$

= 2.34

5. Wages of 9 workers :₹310, ₹290, ₹320, ₹280, ₹300, ₹290, ₹320, ₹310, ₹280.

Mean $\bar{x} = \frac{310+290+320+280+300+290+320+310+280}{9} = \frac{2700}{9}$ = 300. (It is an integer.)

So let us use actual mean with step deviation method with C = 10

x_i	$d_i = (x_i - \bar{x})/10 = (x_i - 300)/10$	d_i^2
310	1	1
290	−1	1
320	2	4
280	−2	4
300	0	0

Standard Deviation $\sigma = C \times \sqrt{\frac{\sum di^2}{n}}$

$= 10 \times \sqrt{\frac{20}{9}}$

$= 10 \times \left(\frac{2}{3}\right) \times \sqrt{5}$

290	−1	1
320	2	4
310	1	1
280	−2	4
		20

σ = 14.91

Variance σ^2 = 14.91 x 14.91 = 222.30

6. Number of strikes in 12 hr = 1+2+3+…+12 = $\frac{n(n+1)}{2} = \frac{12x13}{2}$ = 78 times.

Number of strikes in 24 hr =2(1+2+3+…+12) = 2 x 78 = 156 times.

Standard Deviation of first 'n' natural number = $\sqrt{\frac{n^2-1}{12}}$

Standard Deviation of 12 hr = $\sqrt{\frac{12^2-1}{12}} = \sqrt{\frac{143}{4\times3}} = \frac{1}{2}\times\sqrt{\frac{143}{3}} = \frac{1}{2}\times\sqrt{47.67}$

Standard Deviation of 24 hr = $2\times\frac{1}{2}\times\sqrt{47.67} = \sqrt{47.67}$ = = 6.9

7. Standard Deviation of first 'n' natural number = $\sqrt{\frac{n^2-1}{12}}$

Standard Deviation of first 21 natural number = $\sqrt{\frac{21^2-1}{12}} = \sqrt{\frac{440}{12}} = \sqrt{\frac{110}{3}}$

= $\sqrt{36.67}$ = 6.05

8. The standard deviation of a data = 4.5

Each value of the data is decreased (subtracted) by 5

The standard deviation of a data will not change for addition or subtraction of a constant in each data.

∴The standard deviation of the new data after decrease is also = 4.5

9. The standard deviation of a data = 3.6

Each value of the data is divided by 3

For mulplication or divition of a constant in each data, the existing standard deviation of the data will also be multiplied or divided by that constant to get the new SD.

∴The standard deviation of the new data = 3.6/3 = 1.2

Problems 10 to 13 are grouped datas Standard Deviation. (Let us solve 12)

10. Hints : For any grouped use assumed mean method. For easy calculation use the middle midvalue as assumed mean.

Do it with assumed mean as 55 or 60 and C as 5 ; (Do as in Example : 8.13)

11. Hints : Here the mid values are 5,15,25,35,45,55,65.

Do it with assumed mean as 35 and C as 10; (Do as in Example : 8.13)

13. Hints : Here the mid values are 9,10,11,12,13.

Do it with assumed mean as 11; (Do as in Example : 8.12)

12. The given frequencies are 21-24, 25-28, 29-32, 33-36, 37-40, 41-44

It's not a continuous frequency one. So let us change it as a continuous.

The continuous frequency = 20.5-24.5, 24.5- 28.5, 28.5-32.5,32.5-36.5,36.5-40.5, 40.5-44.5

The Midvalue = 22.5, 26.5, 30.5, 34.5, 38.5, 42.5;

Being decimal and for easy calculation let us deduct 2.5 in each midvalue

The New Midvalue = 20, 24, 28, 32, 36, 40; Let the assumed mean A = 28 and C = 4

Diameters	Midvalue – 2.5	fi	$d_i = x_i - A = x_i - 28$	$d_i = (x_i - A)/4$	$f_i d_i$	$f_i d_i^2$
20.5-24.5	20	15	−8	−2	−30	60
24.5-28.5	24	18	−4	−1	−18	18
28.5-32.5	28	20	0	0	0	0
32.5-36.5	32	16	4	1	4	16
36.5-40.5	36	8	8	2	16	32
40.5-44.5	40	7	12	3	21	63
		N=84	$\sum d_i = 5$		$\sum f_i d_i = 5$	$\sum f_i d_i^2 = 189$

Standard Deviation $\sigma = C \times \sqrt{\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2}$

$= 4 \times \sqrt{\frac{189}{84} - \left(\frac{5}{84}\right)^2}$

$= 4 \times \sqrt{2.25 - 0.00}$ $\quad [\because \left(\frac{5}{84}\right)^2 = 0.06^2 = 0$ for two decimal places]

= 4 x 1.5 = 6.0

14. Candidates = 100; Mean = 60; SD = 15

Incorrect datas = 40, 27 ; Correct data = 45, 72

Correct total value = 100x60 – (40 + 27) + (45 + 72) = 6050;

Correct mean = 6050/100 = 60.5

Let us first find incorrect $\sum x_i^2$ Using direct method of SD

$$\sqrt{\frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2} = \sigma$$

$$\frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2 = \sigma^2$$

$$\frac{\sum x_i^2}{100} - (60)^2 = 15^2$$

$$\frac{\sum x_i^2}{100} = 225 + 3600 = 3825$$

$$\sum x_i^2 = 3825 \times 100 = 382500$$

Corrected $\sum x_i^2 = 382500 - (40^2 + 27^2) + (45^2 + 72^2) = 387380$

Corrected SD = $\sqrt{\frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2} = \sqrt{\frac{387380}{100} - (60.5)^2}$

$= \sqrt{3873.80 - 3660.25}$

$= \sqrt{213.55}$ = 14.61

15. Mean ($\bar{x}$) = 8; Variance (σ^2) = 16; Number of datas = 7; Five datas are : 2, 4, 10, 12, 14

Let the remaining two datas be x, y

$$\frac{Sum\ of\ the\ datas}{Number\ of\ datas} = \bar{x}$$

$$\frac{2+4+10+12+14+x+y}{7} = 8$$

42 + x + y = 56; x + y = 14; y = 14 – x ------------- (1)

$\sigma^2 = \left(\frac{1}{n}\right)\sum(x_i - \bar{x})^2 = 16$

$\sum(x_i - 8)^2 = 16 \times 7 = 112$

$(2-8)^2 + (4-8)^2 + (10-8)^2 + (12-8)^2 + (14-8)^2 + (x-8)^2 + (y-8)^2 = 112$

$(-6)^2 + (-4)^2 + (2)^2 + (4)^2 + (6)^2 + (x-8)^2 + (6-x)^2 = 112$ [From (1) y = 14 – x]

$36 + 16 + 4 + 16 + 36 + x^2 - 16x + 64 + x^2 - 12x + 36 = 112$

$2x^2 - 28x + 208 - 112 = 0$; $x^2 - 14x + 48 = 0$; $(x-10)(x-4) = 0$

Solving x = 6 or 8; ∴ y = 8 or 6

The two datas are : 6, 8

Exercise 8.2

1. Standard Deviation σ = 6.5; Mean $\bar{x}$ = 12.5 ; C.V = ?

C.V = $\frac{\sigma}{\bar{x}} \times 100 = \frac{6.5}{12.5} \times 100$ = 52 %

2. Standard Deviation σ = 1.2; C.V = 25.6; Mean $\bar{x}$ = ?

C.V = $\frac{\sigma}{\bar{x}} \times 100$

Mean $\bar{x} = \frac{\sigma}{C.V} \times 100 = \frac{6.5}{25.6} \times 100$ = 4.6875 or 4.69

3. Mean $\bar{x}$ = 15; C.V = 48; Standard Deviation σ = ?

C.V = $\frac{\sigma}{\bar{x}} \times 100$

Standard Deviation $\sigma = \frac{C.V \times \bar{x}}{100} = \frac{48 \times 15}{100}$ = 7.2

4. n = 5; $\bar{x}$ = 6 , $\sum x^2$ = 765; C.V = ?

Standard Deviation $\sigma = \sqrt{\frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2} = \sqrt{\frac{765}{5} - (6)^2}$

$= \sqrt{153 - 36} = \sqrt{117}$ = 10.82

C.V = $\frac{\sigma}{\bar{x}} \times 100 = \frac{10.82}{6} \times 100$ = 180.33 %

5. Given datas : 24, 26, 33, 37, 29, 31; Number of datas = 6

$$Mean\ (\bar{x}) = \frac{24+26+33+37+29+31}{6} = 30$$

x_i	$d_i = x_i - \bar{x} = x_i - 30$	d_i^2
24	−6	36
26	−4	16
33	3	9
37	7	49
29	−1	1
31	1	1
		112

$$Standard\ Deviation\ \sigma = \sqrt{\frac{\sum d_i^2}{n}}$$

$$= \sqrt{\frac{112}{6}} = \sqrt{18.67} = 4.32$$

$$C.V = \frac{\sigma}{\bar{x}} \times 100 = \frac{4.32}{30} \times 100$$

= 14.4 %

6. Time taken (in min.) by 8 students : 38, 40, 47, 44, 46, 43, 49, 53.

$$Mean\ (\bar{x}) = \frac{38+40+47+44+46+43+49+53}{8} = 45$$

x_i	$d_i = x_i - \bar{x} = x_i - 45$	d_i^2
38	−7	49
40	−5	25
47	2	4
44	−1	1
46	1	1
43	−2	4
49	4	16
53	8	64
		165

$$Standard\ Deviation\ \sigma = \sqrt{\frac{\sum d_i^2}{n}}$$

$$= \sqrt{\frac{165}{8}} = \sqrt{20.625} = 4.54$$

$$C.V = \frac{\sigma}{\bar{x}} \times 100 = \frac{4.54}{45} \times 100$$

= 10.09 %

7. Sathya's total in 5 subjects = 460; Her SD = 4.6; Her mean($\bar{x}$) = $\frac{460}{5}$ = 92

Sathya's C.V = C.V = $\frac{\sigma}{\bar{x}} \times 100$ = $\frac{4.6}{92} \times 100$ = 5 ------------- ①

Vidhya's total in 5 subjects = 480; Her SD = 2.4; Her mean($\bar{x}$) = $\frac{480}{5}$ = 96

Vidhya's C.V = $\frac{2.4}{96} \times 100$ = 2.5 ------------- ②

Comparing ① and ② Vidhya is more consistent than Sathya.

8. Mathematic's mean = 56; It's SD = 12

Science's mean = 65; It's SD = 14

Social Science's mean = 60; It's SD = 10

Mathematic's C.V = C.V = $\frac{\sigma}{\bar{x}} \times 100$ = $\frac{12}{56} \times 100$ = 21.43 ------------- ①

Science's C.V = $\frac{14}{65} \times 100$ = 21.54 ------------- ②

Social Science's C.V = $\frac{10}{60} \times 100$ = 16.67 ------------- ③

Comparing ①, ② and ③

Science shows the highest variation.

Social Science shows the lowest variation.

9. Temperature of city A (in degree Celsius) : 18, 20, 22, 24, 26

Temperature of city B (in degree Celsius) : 11, 14, 15, 17, 18

$$Mean\ of\ A = \frac{18+20+22+24+26}{5} = 22\ ;\ Mean\ of\ B = \frac{11+14+15+17+18}{5} = 15$$

To find SD for city A

x_i	$d_i = x_i - \bar{x} = x_i - 22$	d_i^2
18	−4	16
20	−2	4
22	0	0
24	2	4
26	4	16
		40

To find SD for city B

x_i	$d_i = x_i - \bar{x} = x_i - 15$	d_i^2
11	−4	16
14	−1	1
15	0	0
17	2	4
18	3	9
		30

SD of A (σ) = $\sqrt{\frac{\sum d_i^2}{n}} = \sqrt{\frac{40}{5}} = \sqrt{8} = 2\sqrt{2}$ = 2.828

SD of B (σ) = $\sqrt{\frac{\sum d_i^2}{n}} = \sqrt{\frac{30}{5}} = \sqrt{6}$ = 2.45

C.V of A = $\frac{\sigma}{\bar{x}} \times 100 = \frac{2.828}{22} \times 100$ = 12.85 ------------- (1)

C.V of B = $\frac{2.45}{15} \times 100$ = 16.33 ------------- (2)

Comparing (1) and (2) City A is more consistent.

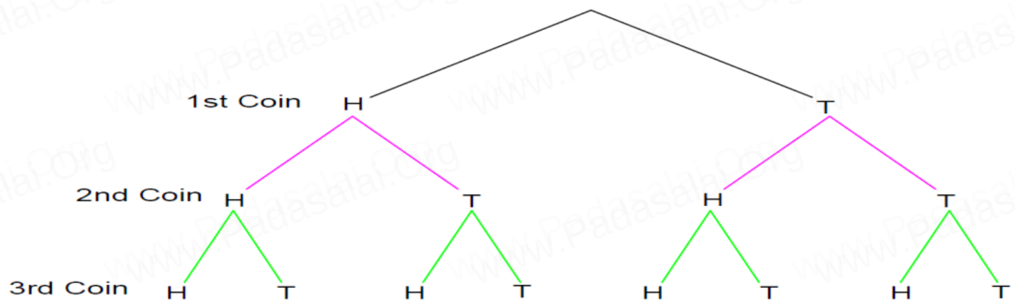
Hints to find SD

1. For ungrouped data first find the mean. If the mean is an integer ,use actual mean method. If the mean is in decimal, use assumed mean method.

2. For grouped data, use assumed mean method to find SD.

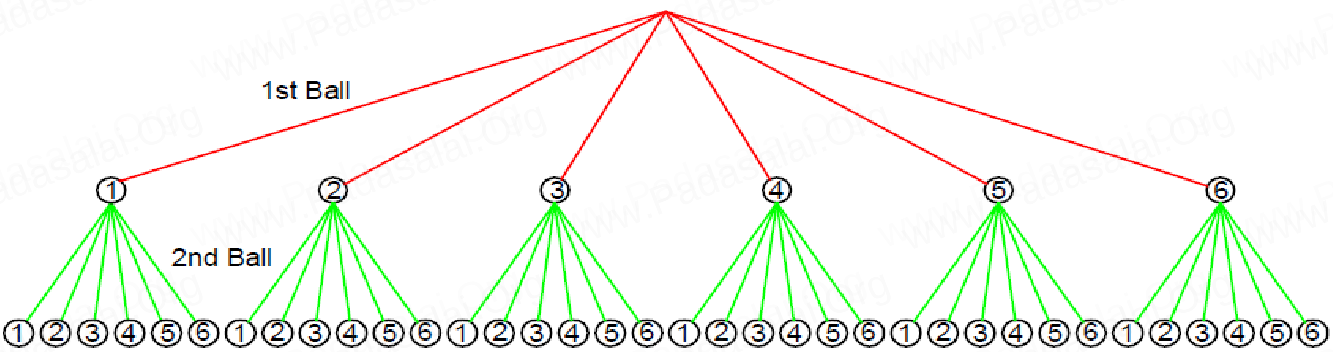
Exercise 8.3

1. Tossing 3 Coins



Sample space : {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}

2. Selecting two balls from a bag containing 6 balls numbered 1 to 6



Sample space = {(1,1), (1,2), (1,3), (1,4), (1,5), (1,6),
(2,1), (2,2), (2,3), (2,4), (2,5), (2,6),
(3,1), (3,2), (3,3), (3,4), (3,5), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)}

3. $P(A) : P(\bar{A}) = 17 : 15$; $n(S) = 640$;

$15P(A) = 17P(\bar{A})$

$15[1 - P(\bar{A})] = 17P(\bar{A})$ [$\because P(A) + P(\bar{A}) = 1$]

$15 - 15P(\bar{A}) = 17P(\bar{A})$

$32P(\bar{A}) = 15$;

(i) $P(\bar{A}) = \frac{15}{32}$;

$\therefore P(A) = 1 - P(\bar{A}) = 1 - \frac{15}{32} = \frac{17}{32}$

(ii) $P(A) = \frac{n(A)}{n(S)} = \frac{17}{32}$

$\therefore n(A) = \frac{17}{32} \times n(S) = \frac{17}{32} x\, 640 = 340$

4. A coin is tossed thrice, S = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT} ; n(S) = 8

Let A be the event of getting two consecutive tails

A = {HTT, TTH, TTT}; n(A) = 3

$P(A) = \frac{n(A)}{n(S)} = \frac{3}{8}$

5. Number of cards = 1000; n(S) = 1000

Let A be the event of getting perfect square number above 500

A = {529, 576, 625, 676, 729, 784, 841, 900, 961};

(i). Chance of getting 1st prize winner n(A) = 9

$P(A) = \frac{n(A)}{n(S)} = \frac{9}{1000}$

(ii). After getting 1st prize, now n(S) = 1000 – 1 = 999

Let B be the event of getting perfect square number above 500

For getting 2nd prize, n(B) = 9 – 1 = 8

P(B) = $\frac{n(B)}{n(S)} = \frac{8}{999}$

6. (i) Blue balls = 12; Red falls = x; n(S) = x+12

Let A be the event of getting red balls

n(A) = x; P(A) = $\frac{n(A)}{n(S)} = \frac{x}{x+12}$ ------------- ①

(ii) After adding 8 Red falls, now n(S) = 12+x+8 = x+20

Now B be the event of getting red balls

n(B) = x+8; P(B) = $\frac{n(B)}{n(S)} = \frac{x+8}{x+20}$ ------------- ②

As per condition, ② = 2 x ①

$\frac{x+8}{x+20} = 2 \times \frac{x}{x+12}$

$(x+8) \times (x+12) = 2x \times (x+20)$

$x^2 + 20x + 96 = 2x^2 + 40x$

$x^2 + 20x - 96 = 0$

$(x + 24)(x - 4) = 0$

x = – 24 or 4; Since negative value is impossible, x = 4; P(A) = $\frac{4}{16} = \frac{1}{4}$

7. Two unbiased dice are rolled once.

Then Sample space = {(1,1), (1,2), (1,3), (1,4), (1,5), (1,6),
(2,1), (2,2), (2,3), (2,4), (2,5), (2,6),
(3,1), (3,2), (3,3), (3,4), (3,5), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6)
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)}

n(S) = 36

(i). Let A be the event of getting a doublet

A = {(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)} ; n(A) = 6 ;

P(A) = $\frac{n(A)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

(ii). Let B be the event of getting a product as a prime number

B = {(1,2), (1,3), (1,5), (2,1), (3,1), (5,1)} ; n(A) = 6

P(B) = $\frac{n(B)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

(iii). Let C be the event of getting a Sum as a prime number

C = {(1,1), (1,2), (1,4), (1,6), (2,1), (2,3), (2,5), (3,2), (3,4), (4,1), (4,3), (5,2), (5,6), (6,1), (6,5)} ; n(C) = 15

P(C) = $\frac{n(C)}{n(S)} = \frac{15}{36} = \frac{5}{12}$

(iv). Let D be the event of getting the sum as 1

D = { } ; n(A) = 0

P(D) = $\frac{n(D)}{n(S)} = \frac{0}{36} = 0$

8. If threee coins are tossed together,

Then it's sample space : {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}; n(S) = 8

(i) All heads ; A = {HHH}; n(A) = 1; P(A) = $\frac{n(A)}{n(S)} = \frac{1}{8}$

(ii) Atleast one tail ; B = {HHT, HTH, HTT, THH, THT, TTH, TTT}; n(B) = 7

P(B) = $\frac{n(B)}{n(S)} = \frac{7}{8}$

(iii) Atmost one head; C = { HTT, THT, TTH, TTT }; n(C) 4; P(C) = $\frac{n(C)}{n(S)} = \frac{4}{8} = \frac{1}{2}$

(iv) Atmost two tails; D = { HHH, HHT, HTH, HTT, THH, THT, TTH}; n(D) = 7

P(D) = $\frac{n(D)}{n(S)} = \frac{7}{8}$

9. Two dice are numbered as : 1,2,3,4,5,6 and 1,1,2,2,3,3

Then it's Sample space = {(1,1), (1,1), (1,2), (1,2), (1,3), (1,3),
(2,1), (2,1), (2,2), (2,2), (2,3), (2,3),
(3,1), (3,1), (3,2), (3,2), (3,3), (3,3),
(4,1), (4,1), (4,2), (4,2), (4,3), (4,3),
(5,1), (5,1), (5,2), (5,2), (5,3), (5,3),
(6,1), (6,1), (6,2), (6,2), (6,3), (6,3)}

n(S) = 36

(i) Let A_1 be the event of getting a sum of 2.

A_1 = {(1,1), (1,1)}; n(A_1) = 2; P(A_1) = $\frac{n(A1)}{n(S)} = \frac{2}{36} = \frac{1}{18}$

(ii) Let A_2 be the event of getting a sum of 3.

A_2 = {(1,2), (1,2), (2,1), (2,1)}; n(A_2) = 4; P(A_2) = $\frac{n(A2)}{n(S)} = \frac{4}{36} = \frac{1}{9}$

(iii) Let A_3 be the event of getting a sum of 4.

A_3 = {(1,3), (1,3), (2,2), (2,2), (3,1), 3,1)}; n(A_3) = 6; P(A_3) = $\frac{n(A3)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

(iv) Let A_4 be the event of getting a sum of 5.

A_4 = {(2,3), (2,3), (3,2), (3,2), (4,1), (4,1) }; n(A_4) = 6; P(A_4) = $\frac{n(A4)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

(v) Let A_5 be the event of getting a sum of 6.

A_5 = {(3,3), (3,3), (4,2), (4,2), (5,1), (5,1)}; n(A_5) = 6; P(A_5) = $\frac{n(A5)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

(vi) Let A_6 be the event of getting a sum of 7.

A_6 = {(4,3), (4,3), (5,2), (5,2), (6,1), (6,1)}; n(A_6) = 6; P(A_2) = $\frac{n(A6)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

(vii) Let A_7 be the event of getting a sum of 8.

A_7 = {(5,3), (5,3), (6,2), (6,2)}; n(A_7) = 4; P(A_2) = $\frac{n(A7)}{n(S)} = \frac{4}{36} = \frac{1}{9}$

(viii) Let A_8 be the event of getting a sum of 9.

A_8 = {(6,3), (6,3)}; n(A_2) = 2; P(A_8) = $\frac{n(A8)}{n(S)} = \frac{2}{36} = \frac{1}{18}$

10. Bag contains : 5 red balls, 6 white balls, 7 green balls, 8 black balls.

It's sample space : n(S) = 5+6+7+8 = 26

(i) Probability white

Let A be the event of getting a white ball.

n(A) = 6; P(A) = $\frac{n(A)}{n(S)}$ = $\frac{6}{26}$ = $\frac{3}{13}$

(ii) Probability black or red

Let B be the event of getting a black or red ball.

n(B) = 8+5 = 13; P(B) = $\frac{n(B)}{n(S)} = \frac{13}{26} = \frac{1}{2}$

(iii) Probability of not white

From (i), Probability white P(A) = $\frac{3}{13}$

Probability not white is P($\bar{A}$) = 1 – P(A) = $1 - \frac{3}{13} = \frac{10}{13}$

(iv) Probability of neither white nor black

Let C be the event of getting either white nor black

n(C) = 8+6 = 14; P(C) = $\frac{n(C)}{n(S)} = \frac{14}{26} = \frac{7}{13}$

Probability neither white nor black is P($\bar{C}$) = 1 – P(C) = $1 - \frac{7}{13} = \frac{6}{13}$

11. Non-defective bulbs = 20 ; Let the defective bulbs (A) = x ; n(S) = 20 + x

Probability of getting a defective bulb = $\frac{n(A)}{n(S)}$ = $\frac{x}{20+x} = \frac{3}{8}$

8x = 3x + 60;

5x = 60; ∴x = $\frac{60}{5}$ = 12 ; Defective bulbs = 12

12.

Cards removed in Diamonds (Red in colour)	King	Queen	
Cards removed in Hearts (Red in colour)		Queen	Jack
Cards removed in Spades (Black in colour)	King		Jack
Total cards removed	2 King	2 Queen	2 Jack

The remaining cards : n(S) = 52 – 6 = 46

(i) Probability of a clavor : (No cards removed in clavor)

Let A be the event of getting a clavor card.

n(A) = 13 ; P(A) = $\frac{n(A)}{n(S)} = \frac{13}{46}$

(ii) Probability of a queen of red card :

Let B be the event of getting a queen of red card.

∵Both red cards of queen have been removed from deck of cards

n(B) = 0 ; P(B) = $\frac{n(B)}{n(S)} = 0$

(iii). <u>Probability of a king of black card</u>

Let C be the event of getting a king of black card.

Out of two black kings, one has been removed spades.

n(C) = 1 ; P(C) = $\frac{n(C)}{n(S)} = \frac{1}{46}$

13. Total area of rectangular region = 4 x 3 = 12 ; n(S) = 12

Prize winning area of circular region = 3.14 x 1^2 = 3.14 ,

n(A) = 3.14; P(A) = $\frac{n(A)}{n(S)} = \frac{3.14}{12} = \frac{314}{1200} = \frac{157}{600}$

14. Both Priya and Amudhan are visiting the shop from Monday to Saturday.

It is as like as rolling of two dice of 1 to 6

∴ Their's Sample space = {(Mo,Mo), (Mo,Tu), (Mo,We), (Mo,Th), (Mo,Fr), (Mo,Sa),
(Tu,Mo), (Tu,Tu), (Tu,We), (Tu,Th), (Tu,Fr), (Tu,Sa),
(We,Mo), (We,Tu), (We,We), (We,Th), (We,Fr), (We,Sa),
(Th,Mo), (Th,Tu), (Th,We), (Th,Th), (Th,Fr), (Th,Sa),
(Fr,Mo), (Fr,Tu), (Fr,We), (Fr,Th), (Fr,Fr), (Fr,Sa),
(Sa,Mo), (Sa,Tu), (Sa,We), (Sa,Th), (Sa,Fr), (Sa,Sa)}

n(S) = 36

(i) <u>Probability of visiting on the same day</u>

Let A be the event of visiting on the same day.

A = {(Mo,Mo), (Tu,Tu), (We,We), (Th,Th), (Fr,Fr), (Sa,Sa)}

n(A) = 6 ; P(A) = $\frac{n(A)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

(ii) <u>Probability of visiting on different days</u>

Let B be the event of visiting on different days.

Except the days as per (i), the all other days are different days

n(B) = 36 – 6 = 30 ; P(B) = $\frac{n(B)}{n(S)} = \frac{30}{36} = \frac{5}{6}$

(iii) <u>Probability of visiting on consecutive days</u>

Let C be the event of visiting on consecutive days.

C = {(Mo,Tu), (Tu,We), (We,Th), (Th,Fr), (Fr,Sa)}

n(C) = 5 ; P(C) = $\frac{n(C)}{n(S)} = \frac{5}{36}$

15. The game consists of tossing a coin 3 times.

∴It's sample space = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}; n(S) = 8

(i) To get double entry fee : She should throw 3 heads

Let A be the event of getting 3 heads.

A = {HHH}

n(A) = 1 ; P(A) = $\frac{n(A)}{n(S)} = \frac{1}{8}$

(ii) To get just her entry fee : She should throw one or two heads

Let B be the event of getting one or two heads.

B = {HHT, HTH, HTT,THH, THT, TTH}

n(B) = 6 ; P(B) = $\frac{n(B)}{n(S)} = \frac{6}{8} = \frac{3}{4}$

(iii) To loose the entry fee : Excluding both (i) and (ii)

Let C be the event of getting except both (i) and (ii).

P(C) = 1 – 〔P(A) + P(B)〕 = 1 – $\left(\frac{1}{8} + \frac{6}{8}\right) = \frac{1}{8}$

Exercise 8.4

1. P(A) = 2/3; P(B) = 2/5; P(A U B) = 1/3; P(A ∩ B) = ?

P(A U B) = P(A) + P(B) – P(A ∩ B)

P(A ∩ B) = (P(A) + P(B)) – P(A U B)

= $\frac{2}{3} + \frac{2}{5} - \frac{1}{3}$ = $\frac{11}{15}$

2. P(A) = 0.42; P(B) = 0.48; P(A ∩ B) = 0.16

(i). P(not A) = P($\bar{A}$) = 1 – P(A) = 1 – 0.42 = 0.58

(ii). P(not B) = P($\bar{B}$) = 1 – P(B) = 1 – 0.48 = 0.52

(iii). P(A or B) = P(A U B)

= P(A) + P(B) – P(A ∩ B)

= 0.42 + 0.48 – 0.16 = 0.74

3. P(not A) = 0.45; P(A U B) = 0.65; P(B) = ?

P(not A) = P($\bar{A}$) = 0.45

P(A) = 1 – P($\bar{A}$) = 1 – 0.45 = 0.55

Being mutually exclusive events : P(A) + P(B) = P(A U B)

P(B) = P(A U B) – P(A) = 0.65 – 0.55 = 0.1

4. P(A U B) = 0.6; P(A ∩ B) = 0.2; P($\bar{A}$) + P($\bar{B}$) = ?

P(A) + P(B) – P(A ∩ B) = P(A U B)

P(A) + P(B) = P(A U B) + P(A ∩ B) = 0.6 + 0.2 = 0.8

P($\bar{A}$) + P($\bar{B}$) = 1 – P(A) + 1 – P(B)

= 2 – (P(A) + P(B))

= 2 – 0.8

= 1.2

5. P(A) = 0.5; P(B) = 0.3; A and B are mutually exclusive events

P(A U B) = P(A) + P(B) (For mutually exclusive events)

P(A U B) = 0.5 + 0.3 = 0.8

Probability that neither A nor B = P($\overline{A \cup B}$)

P($\overline{A \cup B}$) = 1 – P(A U B) = 1 – 0.8 = 0.2

6. Two dice are rolled once. It's Sample space = {(1,1), (1,2), (1,3), (1,4), (1,5), (1,6),
(2,1), (2,2), (2,3), (2,4), (2,5), (2,6),
(3,1), (3,2), (3,3), (3,4), (3,5), (3,6),

(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)}

n(S) = 36

Let A be the event of getting an even number first

A = {(2,1), (2,2), (2,3), (2,4), (2,5), (2,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)}

n(A) = 18; P(A) = $\frac{n(A)}{n(S)} = \frac{18}{36}$

Let B be the event of getting a face sum of 8

B = {(2,6), (3,5), (4,4), (5,3), (6,2)}

n(B) = 5; P(B) = $\frac{n(B)}{n(S)} = \frac{5}{36}$

A ∩ B = {(2,6), (4,4), (6,2)}

n(A ∩ B) = 5; P(A ∩ B) = $\frac{n(A\cap B)}{n(S)} = \frac{3}{36}$

Probability of getting an either A or B = P(A ∪ B)

P(A ∪ B) = P(A) + P(B) – P(A ∩ B)

$= \frac{18}{36} + \frac{5}{36} - \frac{3}{36} = \frac{20}{36} = \frac{5}{9}$

7. For a deck of cards : n(S) = 52

Let A be the event of getting a red king

A = {King(diamods), King(hearts)}

n(A) = 2; P(A) = $\frac{n(A)}{n(S)} = \frac{2}{52}$

Let B be the event of getting a black queen

A = {Queen(clavor), Queen(spade)}

n(B) = 2; P(B) = $\frac{n(B)}{n(S)} = \frac{2}{52}$

The above two events are mutually exclusive events

P(A ∪ B) = P(A) + P(B)

$= \frac{2}{52} + \frac{2}{52} = \frac{4}{52} = \frac{1}{13}$

8. The cards in the box = {3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37}

n(S) = 18

Let A be the event of getting a card which is multiples of 7

A = {7, 21, 35}

n(A) = 3; P(A) = $\frac{n(A)}{n(S)} = \frac{3}{18}$

Let B be the event of getting a card which is a prime number

B = {3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37}

n(B) = 11; P(B) = $\frac{n(B)}{n(S)} = \frac{11}{18}$

A ∩ B = {7}

n(A ∩ B) = 1; P(A ∩ B) = $\frac{n(A \cap B)}{n(S)} = \frac{1}{18}$

<u>Probability that the drawn card have either A or B</u> = P(A U B)

P(A U B) = P(A) + P(B) – P(A ∩ B)

$= \frac{3}{18} + \frac{11}{18} - \frac{1}{18} = \frac{13}{18}$

9. Sample space tossing 3 coins = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}

<u>Let A be the event of getting atmost 2 tails</u>

A = {HHH, HHT, HTH, HTT, THH, THT, TTH}

n(A) = 7; P(A) = $\frac{n(A)}{n(S)} = \frac{7}{8}$

<u>Let B be the event of getting atleast 2 heads</u>

B = {HHH, HHT, HTH, THH }

n(B) = 4; P(B) = $\frac{n(B)}{n(S)} = \frac{4}{8}$

A ∩ B = {HHH, HHT, HTH, THH }

n(A ∩ B) = 4; P(A ∩ B) = $\frac{n(A \cap B)}{n(S)} = \frac{4}{8}$

Probability of getting either A or B = P(A U B)

P(A U B) = P(A) + P(B) – P(A ∩ B)

$= \frac{7}{8} + \frac{4}{8} - \frac{4}{8} = \frac{7}{8}$

10. Probability getting an electrification contract P(A) = $\frac{3}{5}$

robability not getting a plumbing contract P($\bar{B}$) = $\frac{5}{8}$

∴Probability getting a plumbing contract P(B) = 1 – P($\bar{B}$)

$= 1 - \frac{5}{8} = \frac{3}{8}$

The probability of getting atleast one contract = P(A U B) = $\frac{5}{7}$

The probability that he will get both A and B = P(A ∩ B)

P(A U B) = P(A) + P(B) – P(A ∩ B)

P(A ∩ B) = P(A) + P(B) – P(A U B)

P(A ∩ B) = $\frac{3}{5} + \frac{5}{8} - \frac{5}{7} = \frac{168+105-200}{280} = \frac{73}{280}$ (LCM of 5,8,7 is 280)

11. Population of town = 8000 ; n(S) = 8000

People above 50 yrs = 1300 ; n(A) = 1300; P(A) = $\frac{1300}{8000} = \frac{13}{80}$

Female population = 3000; n(B) = 3000; P(B) = $\frac{3000}{8000} = \frac{30}{80}$

Female above 50 yrs = 30 % of 3000 ; n(A ∩ B) = 900; P(A ∩ B) = $\frac{900}{8000} = \frac{9}{80}$

Probability of selecting a female or over 50 years = P(A U B)

P(A U B) = P(A) + P(B) – P(A ∩ B)

P(A U B) = $\frac{13}{80} + \frac{30}{80} - \frac{9}{80} = \frac{34}{80} = \frac{17}{40}$

12. Sample space tossing 3 coins = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}

Let A be the event of getting exactly 2 heads

A = {HHT, HTH, THH}

n(A) = 3; P(A) = $\frac{n(A)}{n(S)} = \frac{3}{8}$

Let B be the event of getting atleast 1 tail

B = { HHT, HTH, HTT, THH, THT, TTH, TTT}

n(B) = 7; P(B) = $\frac{n(B)}{n(S)} = \frac{7}{8}$

Let C be the event of getting cosecutive 2 heads

C = {HHH, HHT, THH}

n(C) = 3; P(C) = $\frac{n(C)}{n(S)} = \frac{3}{8}$

A ∩ B = {HHT, HTH, THH}; n(A ∩ B) = 3; P(A ∩ B) = $\frac{3}{8}$

B ∩ C = {HHT, THH}; n(B ∩ C) = 2; P(B ∩ C) = $\frac{2}{8}$

C ∩ A = {HHT, THH}; n(C ∩ A) = 2; P(C ∩ A) = $\frac{2}{8}$

A ∩ B ∩ C = {HHT, THH}; n(A ∩ B ∩ C) = 2; P(A ∩ B ∩ C) = $\frac{2}{8}$

(i). Probability of selecting one at a time S_1 = P(A) + P(B) + P(C)

$= \frac{3}{8} + \frac{7}{8} + \frac{3}{8} = \frac{13}{8}$

(ii). Probability of selecting two at a time S_2 = P(A ∩ B) + P(B ∩ C) + P(C ∩ A)

$= \frac{3}{8} + \frac{2}{8} + \frac{2}{8} = \frac{7}{8}$

(iii). Probability of selecting three at a time S_3 = P(A ∩ B ∩ C) = $\frac{2}{8}$

Probability of above three ie P(A U B U C) = S

S = $S_1 - S_2 + S_3$

$= \frac{13}{8} - \frac{7}{8} + \frac{2}{8} = \frac{8}{8} = \mathbf{1}$

13. A, B, C are any three events ; P(B) = 2P(A); P(C) = 3P(A)

P(A) + P(B) + P(C) = P(A) + 2P(A) + 3P(A) = 6P(A)

P(A ∩ B) = $\frac{1}{6}$; P(B ∩ C) = $\frac{1}{4}$; P(C ∩ A) = $\frac{1}{8}$; P(A ∩ B ∩ C) = $\frac{1}{15}$

P(A U B U C) = $\frac{9}{10}$

P(A U B U C) = P(A) + P(B) + P(C) – P(A ∩ B) – P(B ∩ C) – P(C ∩ A) + P(A ∩ B ∩ C)

$\frac{9}{10}$= 6P(A) – P(A ∩ B) – P(B ∩ C) – P(C ∩ A) + P(A ∩ B ∩ C)

$\frac{9}{10} = 6P(A) - \frac{1}{6} - \frac{1}{4} - \frac{1}{8} + \frac{1}{15}$

6P(A) = $\frac{9}{10} + \frac{1}{6} + \frac{1}{4} + \frac{1}{8} - \frac{1}{15} = \frac{108+20+30+15-8}{120}$

6P(A) = $\frac{165}{120}$

P(A) = $\frac{165}{120 \times 6} = \frac{11}{48}$

P(B) = 2 P(A) = $2 \times \frac{11}{48} = \frac{11}{24}$

P(C) = 3 P(A) = $3 \times \frac{11}{48} = \frac{11}{16}$

14. Class strength = 35; Boys : Girls = 4 : 3

Number of boys = $35 \times \left(\frac{4}{7}\right)$ = 20

Number of girls = 15

Let A be the event of selecting a boy with prime roll number

A = {2, 3, 5, 7, 11, 13, 17, 19}

n(A) = 8; P(A) = $\frac{n(A)}{n(S)} = \frac{8}{35}$

Let B be the event of selecting a girl with composite roll number

B = {21, 22, 24, 25, 26, 27, 28, 30, 32, 33, 34, 35}

n(B) = 12; P(B) = $\frac{n(B)}{n(S)} = \frac{12}{35}$

Let C be the event of selecting an even roll number

C = {2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34}

n(C) = 12; P(C) = $\frac{n(C)}{n(S)} = \frac{17}{35}$

A ∩ B = ∅; n(A ∩ B) = 0; P(A ∩ B) = 0

B ∩ C = {22, 24, 26, 28, 30, 32, 34}; n(B ∩ C) = 7; P(B ∩ C) = $\frac{7}{35}$

C ∩ A = {2}; n(C ∩ A) = 1; P(C ∩ A) = $\frac{1}{35}$

A ∩ B ∩ C = ∅; n(A ∩ B ∩ C) = 0; P(A ∩ B ∩ C) = 0

(i). Probability of selecting one at a time S_1 = P(A) + P(B) + P(C)

$= \frac{8}{35} + \frac{12}{35} + \frac{17}{35} = \frac{37}{35}$

(ii). Probability of selecting two at a time S_2 = P(A ∩ B) + P(B ∩ C) + P(C ∩ A)

$= 0 + \frac{7}{35} + \frac{1}{35} = \frac{8}{35}$

(iii). Probability of selecting three at a time S_3 = P(A ∩ B ∩ C) = 0

Probability of above three ie P(A U B U C) = S

S = $S_1 - S_2 + S_3$

$= \frac{37}{35} - \frac{8}{35} + 0 = \frac{29}{35}$

Important note:

1. For any chapter don't muck up the book back one mark answer.
2. Dry to know how the answer has come. It will help you in many ways.
3. Students can raise your doubts through mail or whatsapp and I try to give solution as much as I can.

Wish you all the Best.

K. Kannan, B.E, Bodinayakanur, Mobile : 7010157864.

Email : kannank1956@gmail.com. Errors if any, Pl. notify to the mail.