Chapter—6

STATISTICS

Mean

Radha enjoys feeding the cattle and giving them water to drink. She fills water for the cattle and also keeps record of the fact that from 8 to 11 in the morning, how many cows drink water. The record she has for the last week is as follows :

Fig. 6.1

Monday -12, Tuesday - 15, Wednesday - 13, Thusday - 11, Friday -13, Saturday - 13, Sunday - 14.

Can you tell how many cows drink water on average everyday ?

Cricket player A in 10 innings had scored 60, 70, 15, 90, 72, 45, 11, 77, 125, 200 runs respectively. Similarly player B made 220, 110, 70, 37, 15 and 07 runs in 06 innings. Can you say which player had a better performance ?

We can easily compare such comparison with the help of average ? We use average in several centexts in our everday life. For example :

1.   The average age of students studying in your class is 14 years.

2.   The average duration of sleep at night for you is 8 hours.

3.   The average rate of our daily newspaper is Rs. 2.50.

4.   The average attendance of students in the class is 45.

5.   This year Raipur received rains below average.

The above examples show that the average age of sudents in the class is 14 years. On the average duration of sleep at night is 8 hours. It is neither the maximum limit nor the minimum limit.

In fact average is attained by dividing the sum of the scores in a given data by the number of scores. This is also known as the mean. This is indicated by M.

$$Therefore\ Average\ or\ mean\ (M) = \frac{sum\ of\ Scores}{No.\ of\ Scores}$$

Now we can easily find the number of cattle that Radha served water to drink.

$$Average = \frac{12+15+13+11+13+12+15}{7} = \frac{91}{7} = 13$$

Therefore on an average 13 cattle drink water that Radha served everyday.

Now you can yourself find out which cricket player had a better performance.

Activity 1

Find out the average age of the members of your family.

Activity 2

Find out the average of the scores obtained by you in all the subjects in your halfyearly exams.

Example 1

In a Fruit shop apples have been kept in five baskets. Containing 46 kg, 21kg, 18kg, 25kg, and 35kg apples. Find out the means.

$$Mean\,(M) = \frac{Sum\ of\ the\ scores}{No.\ of\ scores}$$

$$(M) = \frac{46+21+18+25+35}{5}$$

$$= \frac{145}{5} = 29kg$$

Example 2

Find out the mean of the first 10 natural numbers

Solution :

The first ten natural numbers are :-

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$$Mean\,(M) = \frac{Sum\ of\ the\ scores}{No.\ of\ scores}$$

$$M = \frac{1+2+3+4+5+6+7+8+9+10}{10}$$

$$= \frac{55}{10} = 5.5$$

MODE

The school decided to take 30 students of class VIII for an excursion during the Deepawali vacations. The headmaster instructed the students to select a place. out of Sirpur, Ratanpur, Jagdalpur and Ambikapur. Some students wanted to go to Sirpur while others thought

about Jagdalpur. Since the place could not be decided, the class teacher wrote the names of all the four places on the blackboard and asked the students to raise their hands for each option. He put tally marks in front of each name which was as follows :

Table 6.1

Places to be Visited	Tally Marks	No. of Students
Sirpur	ЦⅢ II	07
Jagdalpur	ЦⅢ ЦⅢ III	13
Ratanpur	ЦⅢ	05
Amtikapur	ЦⅢ	05

After making the table, the class teacher said that the maximum number of student i.e. 13 of the the students want to go to Jagdalpur, so we should proceed towards Jagdapur.

In our daily life, we have many such situations, where selection is made in this manner for example, mostly the size of shirts that people wear are 38 or 40. Therefore we easily get the sizes 38 or 40 in the readymade stores. Generallly shops seldom keep the smaller or bigger sizes beause they are less in demand and the manufacture depends on the maximum demand in the market.

This basis of selection is called the mode.

So, mode is that value in a given data which has been repeated maximum number of times. This is indicated by M_O.

Example 3

In a football Team the sizes of the shoes put on the eleven players are as follows :

6, 4, 5, 6, 7, 7, 6, 5, 6, 7, 8. Find the mode.

Solution :

On writing the given scores in ascending order we get :

4, 5, 5, 6, 6, 6, 6, 7, 7, 7, 8

Clearly, the score 6. appears the maximum number of times (4 times). Therefore the mode of this score would be 6.

$M_O = 6$

Median

Example 4

In a class of 15 students received the following marks in Mathematics out of 100 :-

15, 35, 16, 25, 45, 76, 90, 99, 50, 16, 57, 60, 86, 17, 95. How many students have scored more than 50% marks ? This is not very clear by the marks. Let us arrange the marks in ascending order :

15, 16, 16, 17, 25, 35, 45, 50, 57, 60, 76, 86, 90, 95, 99.

Now, we can see that 07 students have got more than 50% marks. We can also see that 7 students have received less than 50 marks.

Example 5

The number of chapatis that 11 people eat in a day are as follows :

3, 7, 9, 8, 6, 5, 4, 2, 12, 10, 11

Find the mean of these numbers Mary quickly wrote it in her notebook and said that the mean is 7. Can you find out how many people ate more than 7 ? Radha calculated it and said that 5 people ate less than 7 chapatis while Aslam reported that 5 people ate more than 7 chapatis.

In the example (4) 7 students have scored above 50% marks while 7 students have got less than 50% while in example (5) also the number of people who ate less than 7 and more than 7 chapaties are equal i.e. 5.

Therefore, we can say that putting in order, the number 50 (in Example 4) and 5 (in Example 5) are the number that occure in the middle. This number is know as the median.

This means, when the scores are arranged in descending or ascending order, the value that occures in the middle is known as the Median. It is denoted by M_d.

A. Finding the Median when the number of scores N is odd.

When the number of scores in a given data is odd., then first we write them in an ascending order and find the value of the $M_d = \left(\dfrac{N+1}{2}\right)$ to score. This number obtained is the median.

$$\text{Therefore } Median \ M_d = \left(\dfrac{N+1}{2}\right) \text{th item}$$

Example 6

Find the median of the given data :

3, 5, 10, 9, 8, 14, 6, 12, 13, 11, 7

Solution :

On writing the scores in an ascending order :

3, 5, 6, 7, 8, ⑨ 10, 11, 12, 13, 14   (here the total numbers of item is 11 i.e. odd)

$$M_d = \left(\dfrac{N+1}{2}\right) \text{th item value}$$

$$= \dfrac{11+1}{2} \text{ th item} = \text{6th item's value}$$

$$\therefore \quad M_d = 9$$

B. Finding the Median when the number of scores N is even.

When the number of scores in a given data is even, then arranging in ascending or descending order shows two items in the middle position.

In such a state, the mean of these two items are taken to find the median. This means,

$$M_d = \frac{\left[\left(\dfrac{N}{2}\right)^{th} item + \left(\dfrac{N}{2}+1\right)^{th} item\right]}{2}$$

Example 7

Find the median of the given descending numbers :

5, 9, 4, 6, 12, 8

Solution :

On arranging the scores in ascending order, we get :

4, 5, 6, 8, 9, 12

Here N = 6 (even number)

$$\text{Median } M_d = \frac{\left[\left(\dfrac{N}{2}\right)^{th} item + \left(\dfrac{N}{2}+1\right)^{th} item\right]}{2}$$

$$M_d = \frac{\left(\dfrac{6}{2}\right)^{th} item + \left(\dfrac{6}{2}+1\right)^{th} item}{2}$$

$$= \frac{\left(Value\ of\ the\ 3rd\ item + Value\ of\ the\ 4th\ item\right)}{2}$$

$$= \frac{6+8}{2} = \frac{14}{2}$$

$$M_d = 7$$

Exercise 6.1

Q.1 Find the mean : 81, 74, 69, 73, 91, 55, 61.

Q. 2. Find the mean of the even number between 50 and 70.

Q. 3 Find the median : 4, 5, 10, 6, 7, 14, 9, 15.

Q. 4 The weight of 11 students (in kgs) in a class ar e as follows : 25, 27, 29, 32, 30, 28, 26, 31, 35, 41, 34. Find its median.

Q. 5 In a Science quiz competition, one student of class VIII received the following marks :
83, 61, 48, 73, 76, 52, 67, 61, 79.

Find the median of the above marks.

Q. 6 Find the mode of the given data:

7, 5, 99, 3, 1, 9, 7, 5, 3

1, 1, 9, 7, 7, 5, 5, 5, 3, 1

5, 3, 5, 1, 5, 7, 7, 9, 9, 1

Q. 7 Find the mode of the given distribution :

5, 3, 2, 2, 4, 5, 3, 3, 4, 3, 5, 3.

Q. 8 Find the mean of the first five odd natural numbers.

Q. 9 The mean of the number 8, 5, x, 6, 10, 5 is 7. Find the value of x.

Pie Chart
Activity 1

The area of forest in 5 districts of a state A, B, C, D, E have been represented in a circular digram as in fig. 6.2.

If it is considerd that the district where the area under forest is the maximum gets the maxiuman rainfall then can you say :

1. Which district gets the maximum rainfall ?
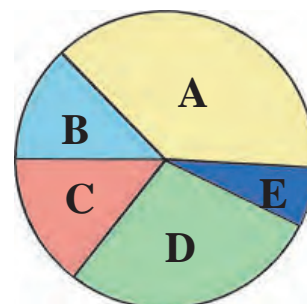
2. Which district gets the minimum rainfall ?

Fig. 6.2

Activity 2

In an Asseimbly election 4 candidates A, B, C & D faced the election. The votes received by them have been represented in the circular diagram.

Look at the diagram and answer.

1.   Which candidate got the maximum number of votes ?

2.   Which candidate got the least votes ?
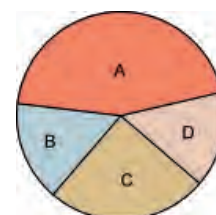
How did you conclude this ?

Fig. 6.3

You know that the sum of angles subtended at the centr e of a circle is 360^0 the area of votes obtained by candidate A subtends the largest angle at the centre. Similarly, the area of votes obtained by candidate D subtends the smallest angle at the centre. Hence, the conclusions you arrive at.

Example 8

The following are the number of students studying in classes 6 to 10 of a school in Jashpur. Show the following data in a diagramatic representation as a pi-chart.

Class	6	7	8	9	10
No. of Students	216	180	150	110	64

Solution :

To make a pi-chart we first add the number of students in all the classes and find out the value of angle subtended at the centre by the number of student in each class. Thus:

$= 216 + 180 + 150 + 110 + 64 = 720$

Hence, for 720 students the angle subtended at the centre of the circle is 360^0.

$\therefore$ For 1 student the angle subtended at the centre would be $\dfrac{360^0}{720}$

$\therefore$ For 216 students the angle subtended at the centre $= \dfrac{360}{720} \times 216$

$\therefore$ The angle subtended for students of class VI $= \dfrac{360}{720} \times 216 = 108^0$

The angle subtended for students of class VII $= \dfrac{360}{720} \times 180 = 90^0$

The angle subtended for students of Class VIII $= \dfrac{360}{720} \times 150 = 75^0$

The angle subtended for students of class IX $= \dfrac{360}{720} \times 110 = 55^0$

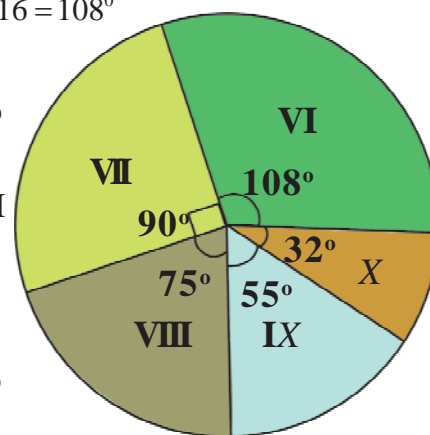The angle subtended for students of class X $= \dfrac{360}{720} \times 64 = 32^0$

Fig. 6.4

Now when you know the measurement of angles you can take a circle of any radius and depict these measuremets by segtments of r adius for each class as shown in the diagram.

Example 9

The percentage of interest of 100 students, in class VIII in different games are as follows:

Name of the Game	Interest in the Game (%)	Angle at the centre
Cricket	65	$\dfrac{65}{100} \times 360^0 = 234^0$
Football	15	$\dfrac{15}{100} \times 360^0 = 54^0$
Hockey	10	$\dfrac{10}{100} \times 360^0 = 36^0$
Handball	03	$\dfrac{3}{100} \times 360^0 = 11^0$ (Approx)
Volleyball	07	$\dfrac{7}{100} \times 360^0 = 25^0$ (Approx)
Total No. of Student	100	Total angle the centre $= 360^0$

Graphic representation

In the above examples the data have been represented in a circle.

When the data is represented by segments of radius in a circle, it is known as the pi-chart (Circular diagram or pi-graph).

Activity 3

Make a pi-chart of the scores obtained by you in different subjects in class VII.

Fig.6.5

Example 10

A farmer represented the crops grown in his farm last year in a pi-chart. If the total production of crops in 720 quintals, find the quantity of each crop produced.

The total producton of crops = 720 qunitals.

$$\therefore \quad 360^0 = 720 \text{ qunitals}$$

$$\therefore \quad 1^0 = \frac{1}{360^0} \times 720 \text{ quintals}$$

$$\therefore \quad 135^0 = \frac{135^0}{360^0} \times 720 \text{ quintals}$$

Fig. 6.6

Production of Wheat $= \frac{720}{360^0} \times 135^0 = 270 \text{ quintals}$

Production of Rice $= \frac{720}{360^0} \times 90^0 = 180 \text{ quintals}$

Production of Urad $= \frac{720}{360^0} \times 45^0 = 90 \text{ quintals}$

Production of Moong $= \frac{720}{360^0} \times 40^0 = 80 \text{ quintals}$

Production of Mustard $= \frac{720}{360^0} \times 50^0 = 100 \text{ quintals}$

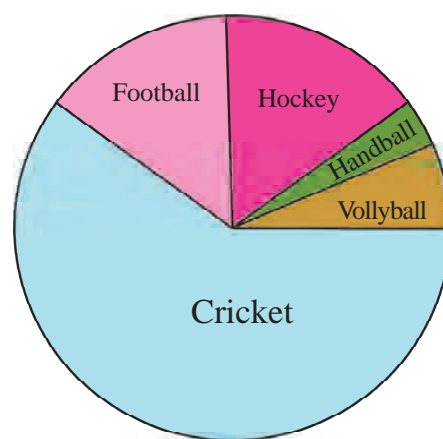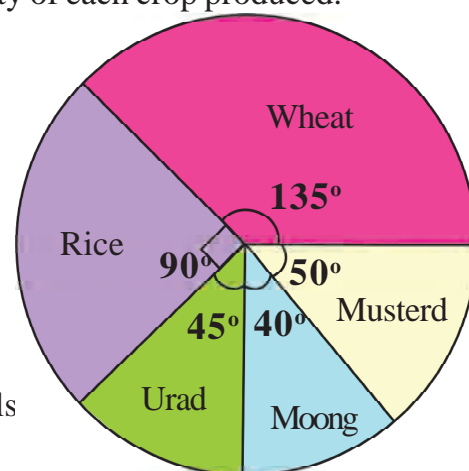## Excercise 6.2

Q.1 The marks obtained by Geeta in the monthly test exams in mathematies for 6 months are as follows:

Months	July	August	September	October	Nov.	Dec.
Marks obtained (Out of 100)	40	45	65	35	55	60

Construct a pi-chart with the help of the above data.

Q. 2 The monthy income of a family Rs. 12,000=00. The expenditure of the family in the month is as follows. Make a pi-chart of the given data.

S.No.	Item	Expenditure in Rs.
01.	House rent	1500=00
02.	Food	6000=00
03.	Education	2200=00
04.	Entertainment	800=00
05.	Health	1500=00

Probability

Today as the school was going to be over, it started raining very heavily. The students were worried how to go home in such heavy rains. Just then meena said to Anu, there was no possibility of such rain in the month of October. Anu said, no, we cannot say that there was no possibility of rains but there was less possibility. The possibility of rains is always stonger in July. Even otherwise, the possiblity of rains in October or April is always very less.

In our daily life, probability is used in many situations. For example, who will win among the teams participating in a game is never known but the better team has a greater possibility of winning. Some situations are given below, write whether the possibility of their happening is more or less :

1. The possibility of suffering from polio after being vaccinated.

2. The possibility of lung cancar due to smoking.

3. The possibility of rains in a place where there are more trees.

4. The possibility of meeting with an accident when one is driving slow.

5. The possibility of seeing snakes in the rainy season.

All the above possibility can be understood with simple assumption on the basis of available data, for example, data indicate that the possibility of polio attacks are more prominent when the individual has not been vaccinated, similarly generally the possibility of accident is always more when people drive very fast. Let us try to presume possibilities.

Activity 4

Take two boxes and write A & B on them. Take 25 pieces of paper of equal size. Write 'x' on 10 picees of paper and 'y' on 15 of them. Now fold all the pieces in the same manner and keep in two separate heaps. Take 5 pieces from the heap of papers marked 'x' and 5 pieces from the heap of papers marked 'y' & put them into one box and then put 5 pieces from the 'x' marked ones and 10 pieces from the papers marked 'y' in another box.

Shake the boxes to mix the pieces of papers well after you have put them in the boxes. Now askone of your friends to close the eyes and take out one piece of paper from each box let him note down whether he has got a piece of paper marked x or y, fold it back as it was and put them in the box again. Now shake the box again to mix the papers all over

well and ask your other friends also to repeat the activity. Then comptete the table given below.

S.No.	Name	Letter on the piece of paper fox A	Letter on the piece of paper from box B
1.			
2.			
3.			
4.			
		Total no. of x from box A= Total no. of y from box A=	Total no. of x from box B = Total no. of x from box B =

Now look at the table and say :

from which box the probability of getting letter 'x' would be more and why ?

While showing the problem, Suresh said, "Therefore 15 pieces of paper in box B out of which 'x' is written on 5 pieces and y on 10 pieces. Since y is written on more pieces of paper, therefore the probability of getting letter y is more.

Rani asked, is the probability of getting letter 'x' and 'y' from box 'A' would be equal? Think about rani's question and write its answer in your notebooks with proper reason.

Activity 5

In the pricture there are boxes with black (B) and white (W) balls. If we are asked to take out of one ball from the boxes without seeing, then answer the questions given below -
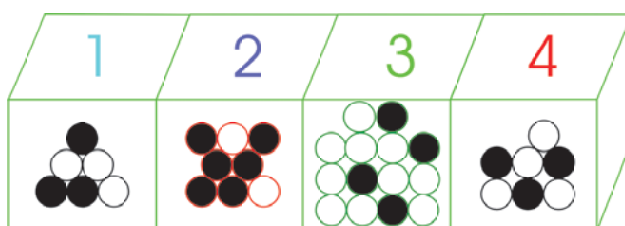

Fig. 6.7

1. From which box is the possibility of getting a white ball maximum.?

2. From which box is the possibility of getting a black ball maximum ?

With the help of the table made by Rani, Suresh drew the following conclusions :

1. The total number of balls in box 1 is 6 out of which 3 balls are white and 03 are black, therefore the pobability of getting both the colours are equal.

2. The total no of balls in box 2 is 8, of which 02 are white balls and 6 balls are black, hence the probability of getting black balls is greater.

3. In box 3, the total no. of balls is 14 out of which 10 balls are white and 04 balls are black, therefore the probability of getting white balls is more.

4. In box 4 out of total 7 balls, 04 balls are white and 03 balls are black, therefore the probability of getting white balls is greater.

The answer that Suresh has thought is right, but he is not able to understand that when box 3 has 10 white balls out of total 14 balls and box no 4 has 04 white balls out of total 07 balls, then from which box is the probability of getting a white ball is more ?

Mary suggested, How it would be, if we consider in the form of a fraction.

$$10 \text{ out of } 14 = \frac{10}{14}$$

$$\text{and } 4 \text{ out of } 7 = \frac{4}{7}$$

On comparing the two fractions, we will have -

$$\frac{10}{14} = \frac{10}{14} \text{ and } \frac{7}{4} = \frac{4 \times 2}{7 \times 2} = \frac{8}{14} \text{ (equalising demonstrations)}$$

Therefore out of $\frac{10}{14}$ and $\frac{8}{14}$, $\frac{10}{14}$ is greater. Hence out of 14 balls, the probability of getting white balls would be more when 10 balls are drawn out as compared to drawing out 04 white balls out of 07 balls.

Taking a decision by tossing a coin

You might have seen that in the beginning of a cricket match, the captains of the two teams decide to ball or bat on the basis of the toss when it is in favour of the team.

Can you think of some examples where you can take decision by tossing a cion ?

Activity 6

Let us perform an activity and see if we can do so - Take a coin and toss it with all your Friends one by one, and observe whether it shows head or tail as it falls on the ground every time. Note the occurances in the given table.

Table 6.5

S.No.	Name of the Student	What did you get ? Head or tail
1.		
2.		
3.		
4.		

Look at the table and say :-

1. Do head & tail appear one after another.

2. Is the number of heads and tails nearly equal ?

3. Which is more probable when a coin is tossed head or tail ?

You must have noticed that a coin has two sides -

A head and a tail. These out of two sides the probability of occurance of head is 1 out 2 or ½. Similarly out of 2 sides, the probability of occurance of tail is 1 out of 2 or ½.

In a box, if there are 3 balls of red, yellow and white colours respectively and we take out any one ball while closing our eyes, then the probability of the ball being red would be $\frac{1}{3}$ because out 3 one ball is red. Similarly, the probability of the ball being yellow would be $\frac{1}{3}$, when only one ball out of 3 is yellow and the probability of the ball being white would also be $\frac{1}{3}$. So, be now you must have understood that probability can also be measured.

Thus, the possibility of occurance of an event is measured as probability.

Let us know more about probability with a few more examples :

Example 11

If you are asked to take out a spade out of a pack of cards then what will be the probability of getting a spade card ?

Solution :

Since the pack of cards has 52 cards, out of which 13 are spades.

Hence, the probability of finding a spade is 13 out of 52 i.e. $\frac{13}{52} = \frac{1}{4}$.

Example 12

Find out the probability of getting the number 3, a dice head when it is tossed once.

Solution :

A dice has 6 faces which includes dots 1, 2, 3, 4, 5 and 6.

Therefore, the probability of digit 3 appearing on the head = 1 out of $6 = \frac{1}{6}$.

(Since only one face out of the six faces on the dice has three dots on it.)

Example 13

In a bag there are three white, five red and eight black balls. What is the probability of taking out a red ball out of it ?

Solution :

Total no. of balls in the bag = 3 white + 5 red + 8 black = 16 balls.

The probability of taking out a red ball out of the 16 balls would be 5 out of 16 because

the bag contains 5 red balls. Therefore, The probability of one red ball = $\dfrac{5}{16}$

Example 14

One is asked to draw out one card out of a pack of cards. Find out the probability of that card being a King.

Solution :

Total no. of cards in the pack = 52.

The no of King cards in the pack = 04.

When we draw out of the pack any one out of the 4 Kings cards one would come out.

Therefore, the probability of getting a King cards.

$= 4$ out of 52

$= \dfrac{4}{52} = \dfrac{1}{13}$

Excercise 6.3

Q.1 What will be the probability of drawing a card of diamond from a pack of cards ?

Q. 2 A bag has 6 white, 11 red & 7 blue balls. Find out the probability of drawing a white ball out of that bag ?

Q. 3 A horse race competition has five competitors. Find out their possibility of winning the race.

Q. 4 In a basket there are 10 apples, 8 pomegranates (Anar) and 12 guavas. What will be the probability of taking out apples from the basket ?

Q. 5 Find out the probability of appearance of an even number when a coin is tossed .

Q. 6 On tossing a coin, what will be the possibabilty of appearance of head and the appearance of tail for that coin?

WE HAVE LEARNT

1. Average (Mean) is one unique number, that represents a group of scores or data.

2. $Average = \dfrac{The\ sum\ of\ all\ scores}{Total\ no.\ of\ scores}$

3. While finding out the median the scores are arranged in ascending order.

4. The medan is the number in the middle of the scores arranged in ascending order.

5. (a) $M_d = \left(\dfrac{N+1}{2}\right)^{th}$ item (when N is an odd No.)

    (b) $M_d = \dfrac{\left[\left(\dfrac{N}{2}\right)^{th} item + \left(\dfrac{N}{2}+1\right)^{th} item\right]}{2}$ (when N is an even No.)

6. The mode is the number that has the highest frequency in the scores.

7. Probability is the possibility of occurance of any event.