

Short Answer Type Questions

Q.1. Find the mean of the 32 numbers, such that if the mean of 10 of them is 15 and the mean of 20 of them is 11. The last two numbers are 10.

Solution: The given mean of 10 numbers = 15

So, Mean of 10 numbers = sum of observations/ no. of observations

$$15 = \text{sum of observations} / 10$$

$$\text{Sum of observations of 10 numbers} = 150$$

Similarly, Mean of 20 numbers = sum of observations/ no. of observations

$$11 = \text{sum of observations} / 20$$

$$\text{Sum of observations of 20 numbers} = 220$$

Hence, Mean of 32 numbers = (sum 10 numbers + sum of 20 numbers + sum of last two numbers)/ no. of observations

$$\text{Mean of 32 numbers} = (150 + 220 + 20) / 32 = 390 / 32 = 12.188$$

Q.2. Find the mean of the first 10 natural numbers.

Solution: The first 10 natural numbers are 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$$\text{Mean} = (1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10) / 10 = 55 / 10 = 5.5$$

Q.3. Find the value of y from the following observations if these are already arranged in ascending order. The Median is 63.

20, 24, 42, y , y + 2, 73, 75, 80, 99

Solution:

As the number of observations made is odd, so the median will be the middle term, i.e. $y + 2$.

Therefore,

$$y + 2 = 63$$

$$y = 63 - 2 = 61$$

Q.4. While checking the value of 20 observations, it was noted that 125 was wrongly noted as 25 while calculating the mean and then the mean was 60.

Find the correct mean.

Solution:

Let y be the sum of observation of 19 ($20 - 1$) numbers leaving 125.

So, $y + 25 = 20 \times 60 = 1200$ {Mean = (sum of observations/ no. of observations)}

As we know,

$$x + 25 = 20 \times 60 = 1200$$

Also

$$x + 125 = 20 \times y = 20y$$

Next, Subtract $125 - 25 = 20y - 1200$

$$20y = 1300$$

$$y = 65$$

Q.5. Find the mode of the following items.

0, 5, 5, 1, 6, 4, 3, 0, 2, 5, 5, 6

Solution: On arranging the items in ascending order, we get:

0, 0, 1, 2, 3, 4, 5, 5, 5, 6, 6

As we can see 5 occurs the maximum number of times.

Therefore, the mode of the given items = 5

Q.6. A student scored the following marks in 6 subjects:

30, 19, 25, 30, 27, 30

Find his modal score.

Solution: If we arrange his marks in ascending order

19, 25, 27, 30, 30, 30

As we can see, 30 occurs a maximum number of times.

Therefore, the modal score of the student = 30

Q.7. The daily minimum steps climbed by a man during a week were as under:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
35	30	27	32	23	28

Find the mean of the steps.

Solution: Number of steps climbed in a week: 35, 30, 27, 32, 23, 28.

So, we get,

Mean = sum of observation (steps) / total no of observations

$$= (35 + 30 + 27 + 32 + 23 + 28) / 6$$

$$= 175/6$$

$$= 29.17$$

Q. 8. If the mean of 4 numbers, 2, 6, 7 and a is 15 and also the mean of other 5 numbers, 6, 18, 1, a, b is 50. What is the value of b?

Solution:

Mean = sum of observations / no. of observations

$$15 = (2 + 6 + 7 + a) / 4$$

$$15 = (15 + a) / 4$$

$$15 \times 4 = 15 + a$$

$$60 - 15 = a$$

$$a = 45$$

Similarly,

Mean = sum of observations / no. of observations

$$50 = (18 + 6 + 1 + a + b) / 5$$

$$50 = (18 + 6 + 1 + 45 + b) / 5$$

$$50 = (70 + b) / 5$$

$$250 = 70 + b$$

$$b = 250 - 70 = 180$$

So, The value of b = 180.

Q.9: If the mean of first n natural numbers is 15, then find n.

Solution:

We know that the sum of first n natural numbers = $n(n + 1)/2$

Mean of the first n natural numbers = Sum of first n natural numbers/n

$$= [n(n + 1)/2] / n$$

$$= (n + 1)/2$$

According to the given,

$$(n + 1)/2 = 15$$

$$n + 1 = 30$$

$$n = 29$$

Q.10: Construct the cumulative frequency distribution of the following distribution :

Class	12.5 – 17.5	17.5 – 22.5	22.5 – 27.5	27.5 – 32.5	32.5 – 37.5
Frequency	2	22	19	14	13

Solution:

The cumulative frequency distribution of the given distribution is given below :

Class	Frequency	Cumulative frequency
12.5 – 17.5	2	2
17.5 – 22.5	22	24
22.5 – 27.5	19	43
27.5 – 32.5	14	57
32.5 – 37.5	13	70

Long Answer Type Questions

Q. 1: Consider the following distribution of daily wages of 50 workers of a factory.

Daily wages (in Rs.)	100-120	120-140	140-160	160-180	180-200
Number of workers	12	14	8	6	10

Find the mean daily wages of the workers of the factory by using an appropriate method.

Solution:

Find the midpoint of the given interval using the formula.

$$\text{Midpoint } (x_i) = (\text{upper limit} + \text{lower limit})/2$$

In this case, the value of mid-point (x_i) is very large, so let us assume the mean value, $A = 150$ and class interval is $h = 20$.

$$\text{So, } u_i = (x_i - A)/h = u_i = (x_i - 150)/20$$

Substitute and find the values as follows:

Daily wages (Class interval)	Number of workers frequency (f_i)	Mid-point (x_i)	$u_i = (x_i - 150)/20$	$f_i u_i$
100-120	12	110	-2	-24
120-140	14	130	-1	-14

140-160	8	150	0	0
160-180	6	170	1	6
180-200	10	190	2	20
Total	Sum $f_i = 50$			Sum $f_i u_i = -12$

So, the formula to find out the mean is:

$$\text{Mean} = \bar{x} = A + h \left(\frac{\sum f_i u_i}{\sum f_i} \right) = 150 + (20 \times -12/50) = 150 - 4.8 = 145.20$$

Therefore, mean daily wage of the workers = Rs. 145.20

Q.2: Thirty women were examined in a hospital by a doctor and the number of heartbeats per minute was recorded and summarised as follows. Find the mean heartbeats per minute for these women, choosing a suitable method.

Number of heart beats per minute	65-68	68-71	71-74	74-77	77-80	80-83	83-86
Number of women	2	4	3	8	7	4	2

Solution:

From the given data, let us assume the mean as $A = 75.5$

$$x_i = (\text{Upper limit} + \text{Lower limit})/2$$

$$\text{Class size (h)} = 3$$

Now, find the u_i and $f_i u_i$ as follows:

Class Interval	Number of women (f_i)	Mid-point (x_i)	$u_i = (x_i - 75.5)/h$	$f_i u_i$
65-68	2	66.5	-3	-6
68-71	4	69.5	-2	-8
71-74	3	72.5	-1	-3
74-77	8	75.5	0	0
77-80	7	78.5	1	7
80-83	4	81.5	2	8
83-86	2	84.5	3	6
	Sum $f_i = 30$			Sum $f_i u_i = 4$

$$\text{Mean} = \bar{x} = A + h \frac{\sum f_i u_i}{\sum f_i}$$

$$= 75.5 + 3 \times (4/30)$$

$$= 75.5 + 4/10$$

$$= 75.5 + 0.4$$

$$= 75.9$$

Therefore, the mean heartbeats per minute for these women is 75.9

Q. 3: The following data gives the distribution of the total monthly household expenditure of 200 families of a village. Find the modal monthly expenditure of the families. Also, find the mean monthly expenditure :

Expenditure	Number of families
1000-1500	24
1500-2000	40
2000-2500	33
2500-3000	28
3000-3500	30
3500-4000	22
4000-4500	16
4500-5000	7

Solution:

From the given data:

Modal class = 1500-2000

$l = 1500$

Frequencies:

$f_m = 40$

$f_l = 24$, $f_{l-1} = 33$ and

$h = 500$

Mode formula:

Substitute the values in the formula, we get;

$$\text{Mode} = 1500 + ((16 \times 500)/23)$$

$$\text{Mode} = 1500 + (8000/23) = 1500 + 347.83$$

Therefore, the modal monthly expenditure of the families = Rupees 1847.83

Calculation for mean:

First find the midpoint using the formula, $x_i = (\text{upper limit} + \text{lower limit})/2$

Let us assume a mean, A be 2750

Class Interval	f_i	x_i	$d_i = x_i - a$	$u_i = d_i/h$	$f_i u_i$
1000-1500	24	1250	-1500	-3	-72
1500-2000	40	1750	-1000	-2	-80
2000-2500	33	2250	-500	-1	-33
2500-3000	28	2750	0	0	0
3000-3500	30	3250	500	1	30
3500-4000	22	3750	1000	2	44
4000-4500	16	4250	1500	3	48

4500-5000	7	4750	2000	4	28
	$f_i = 200$				$\sum f_i u_i = -35$

The formula to calculate the mean,

$$\text{Mean} = \bar{x} = a + \left(\frac{\sum f_i u_i}{\sum f_i} \right) \times h$$

Substitute the values in the given formula

$$= 2750 + (-35/200) \times 500$$

$$= 2750 - 87.50$$

$$= 2662.50$$

So, the mean monthly expenditure of the families = Rupees 2662.50

Q. 4: A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarised it in the table given below. Find the mode of the data:

Number of cars	Frequency
0-10	7
10-20	14
20-30	13
30-40	12

40-50	20
50-60	11
60-70	15
70-80	8

Solution:

From the given data:

Modal class = 40 – 50, l = 40,

class width (h) = 10, $f_m = 20$, $f_1 = 12$ and $f_2 = 11$

Substitute the values

Mode = $40 + (80/17) = 40 + 4.7 = 44.7$

Thus, the mode of the given data is 44.7 cars

Q. 5: An aircraft has 120 passenger seats. The number of seats occupied during 100 flights are given in the following table :

Number of seats	100-104	104-108	108-112	112-116	116-200
Frequency	15	20	32	18	15

Determine the mean number of seats occupied over the flights.

Solution:

Class Interval	Class Marks (xi)	Frequency (fi)	Deviation (di = xi - a)	fidi
100 – 104	102	15	– 8	– 120
104 – 108	106	20	– 4	– 80
108 – 112	110	32	0	0
112 – 116	114	18	4	72
116 – 120	118	15	8	120
		$N = \sum fi = 100$		$\sum fidi = -8$

∴ Assumed mean, $a = 110$

Class width, $h = 4$

And total observations, $N = 100$

$$= 110 + (-8/100)$$

$$= 110 - 0.08$$

$$= 109.92$$

But we know that the seats cannot be in decimal.

Therefore, the number of seats = 109 (approx).

Q. 6: A survey regarding the heights (in cm) of 51 girls of Class X of a school was conducted and the following data were obtained:

Height (in cm)	Number of girls
Less than 140	4
Less than 145	11
Less than 150	29
Less than 155	40
Less than 160	46
Less than 165	51

Find the median height.

Solution:

To calculate the median height, we need to find the class intervals and their corresponding frequencies.

The given distribution is of the less than type, 140, 145, 150, ..., 165 gives the upper limits of the corresponding class intervals.

So, the classes should be below 140, 140 – 145, 145 – 150, ..., 160 – 165.

Observe that from the given distribution, we find that there are 4 girls with height less than 140, i.e., the frequency of class interval below 140 is 4.

Now, there are 11 girls with heights less than 145 and 4 girls with heights less than 140. Therefore, the number of girls with height in the interval of 140 – 145 is $11 - 4 = 7$.

Similarly, the frequency of 145 – 150 is $29 - 11 = 18$, for 150 – 155, it is $40 - 29 = 11$, and so on. So, our frequency distribution table with the given cumulative frequencies becomes:

Class intervals	Frequency	Cumulative frequency
Below 140	4	4
140-145	7	11
145-150	18	29
150-155	11	40
155-160	6	46
160-165	5	51

Now $n = 51$. So, $n/2 = 51/2 = 25.5$

This observation lies in class 145 – 150.

Then, l (the lower limit) = 145,

cf (the cumulative frequency of the class preceding 145 – 150) = 11,

f (the frequency of the median class 145 – 150) = 18,

h (the class size) = 5.

Using the formula,

we have Median

$$= 145 + 72.5/18 = 149.03.$$

So, the median height of the girls is 149.03 cm.

This means that the height of about 50% of the girls is less than this height, and 50% are taller than this height.

Q. 7: The lengths of 40 leaves of a plant are measured correct to the nearest millimetre, and the data obtained is represented in the following table :

Length(in mm)	Number of leaves
118-126	3
127-135	5
136-144	9
145-153	12
154-162	5
163-171	4
172-180	2

Find the median length of leaves.

(**Hint:** The data needs to be converted to continuous classes for finding the median since the formula assumes continuous classes. The classes then change to 117.5 – 126.5, 126.5 – 135.5, . . . , 171.5 – 180.5.)

Solution:

Since the data are not continuous reduce 0.5 in the lower limit and add 0.5 in the upper limit.

Class Interval (CI)	Frequency	Cumulative frequency
117.5-126.5	3	3
126.5-135.5	5	8
135.5-144.5	9	17
144.5-153.5	12	29
153.5-162.5	5	34
162.5-171.5	4	38
171.5-180.5	2	40

From the above tab

$$n = 40 \text{ and } n/2 = 20$$

$$\text{Median class} = 144.5-153.5$$

then, $I = 144.5$,

$cf = 17$, $f = 12$ & $h = 9$

$$= 144.5 + (9/4)$$

$$= 146.75 \text{ mm}$$

Therefore, the median length of the leaves = 146.75 mm.

Q. 8: If the median of a distribution given below is 28.5 then, find the value of x & y .

Class Interval	Frequency
0-10	5
10-20	x
20-30	20
30-40	15
40-50	y
50-60	5
Total	60

Solution:

From the given data,

$$n = 60$$

Median of the given data = 28.5

$$\text{Where, } n/2 = 30$$

Median class is 20 – 30 with a cumulative frequency = 25 + x

Lower limit of median class = 20,

$$Cf = 5 + x,$$

$$f = 20 \text{ & } h = 10$$

Substitute the values

$$28.5 = 20 + 10(30 - 5 - x)/20$$

$$8.5 = (25 - x)/2$$

$$17 = 25 - x$$

Therefore, $x = 8$

Now, from cumulative frequency, we can identify the value of $x + y$ as follows:

Since,

$$60 = 5 + 20 + 15 + 5 + x + y$$

Now, substitute the value of x , to find y

$$60 = 5 + 20 + 15 + 5 + 8 + y$$

$$y = 60 - 53$$

$$y = 7$$

Therefore, the value of $x = 8$ and $y = 7$

Q. 9: The annual profits earned by 30 shops of a shopping complex in a locality give rise to the following distribution :

Profit (Rs in lakhs)	Number of shops (frequency)
More than or equal to 5	30
More than or equal to 10	28
More than or equal to 15	16
More than or equal to 20	14
More than or equal to 25	10
More than or equal to 30	7
More than or equal to 35	3

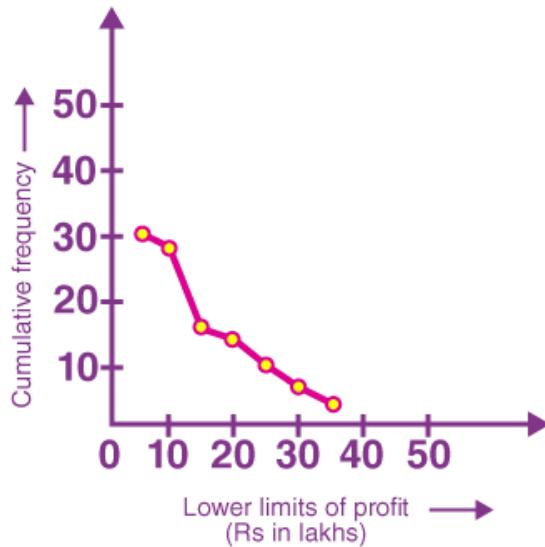
Draw both Ogives for the above data. Hence obtain the median profit.

Solution :

We first draw the coordinate axes, with lower limits of the profit along the horizontal axis, and the cumulative frequency along the vertical axes.

Then, we plot the points $(5, 30)$, $(10, 28)$, $(15, 16)$, $(20, 14)$, $(25, 10)$, $(30, 7)$ and $(35, 3)$. We

join these points with a smooth curve to get the 'more than' ogive, as shown in the below figure.



Now, let us obtain the classes, their frequencies and the cumulative frequency from the given table.

Classes	Number of shops	Cumulative frequency
5-10	2	2
10-15	12	14
15-20	2	16

20-25	4	20
25-30	3	23
30-35	4	27
35-40	3	30

Using these values, we plot the points $(10, 2)$, $(15, 14)$, $(20, 16)$, $(25, 20)$, $(30, 23)$, $(35, 27)$, $(40, 30)$ on the same axes as in the above figure, to get the 'less than' ogive, as shown below.



The abscissa of their point of intersection is nearly 17.5, which is the median. This can also be verified by using the formula.

Hence, the median profit (in lakhs) is Rs. 17.5.

Q. 10: The following tables give the production yield per hectare of wheat of 100 farms of a village.

Production Yield	50-55	55-60	60-65	65-70	70-75	75-80
Number of farms	2	8	12	24	38	16

Change the distribution to a more than type distribution and draw its ogive.

Solution:

Converting the given distribution to a more than type distribution, we get

Production Yield (kg/ha)	Number of farms
More than or equal to 50	100
More than or equal to 55	$100-2 = 98$
More than or equal to 60	$98-8 = 90$
More than or equal to 65	$90-12 = 78$
More than or equal to 70	$78-24 = 54$
More than or equal to 75	$54-38 = 16$

From the table obtained draw the ogive by plotting the corresponding points

where the upper limits in x-axis and the frequencies obtained in the y-axis are $(50, 100), (55, 98), (60, 90), (65, 78), (70, 54)$ and $(75, 16)$ on this graph paper.

The graph obtained is known as more than type ogive curve.

