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QUARTILE DEVIATION (SEMI INTER QUARTILE RANGE)

Quartile Deviation is defined as half the distance between the third and first quartiles.

Quartile Deviation is am absolute measure and it is given by Quartile Deviation $=\frac{Q_3 - Q_1}{2}$ Q₁ and Q₃ are the first quartile and third quartile respectively.

The corresponding relative measure is the Coefficient of Quartile Deviation which is given by

Coefficient of Quartile Deviation =

$${Q_3-Q_1\over Q_3+Q_1}$$



QD IN INDIVIDUAL SERIES

$$Q_1 = \text{size of } \left(\frac{n+1}{4}\right)^{th}$$
 item, when the items are arranged in ascending order.

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$$Q_3 = size of \left(rac{n+1}{4} imes 3
ight)^{th}$$
 item, when the items are arranged in ascending order.

Quartile Deviation $= \frac{Q_3 - Q_1}{2}$ Coefficient of Quartile Deviation $= \frac{Q_3 - Q_1}{Q_3 + Q_1}$ Inter Quartile Range $= Q_3 - Q_1$



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EXAMPLE

Compute Quartile measure of dispersion, Interquartile range, and Coefficient of Quartile Deviation for the following series. 23, 25, 8, 10, 9, 29, 45, 85, 10, 16, 24.

SOLUTION

If values are arranged in the ascending series, 8, 9, 10, 10, 16, 23, 24, 25, 29, 45, 85.; N = 11

$${
m Q}_1={
m size}~{
m of}~\left(rac{11+1}{4}
ight)^{th}$$
 item = size of 3^{rd} item = 10

$$Q_{3} = \text{size of } \left(\frac{11+1}{4} \times 3\right)^{th} \text{ item} = \text{size of } 9^{th} \text{ item} = 29$$

$$Q. D.$$

$$Quartile \text{ Deviation } = \frac{Q_{3} - Q_{1}}{2} = \frac{29 - 10}{2} = 9.5$$

$$INTERQUARTILE \text{ RANGE}$$

$$Inter \text{ Quartile Range} = Q_{3} - Q_{1} = 19$$

$$Coefficient \text{ of } QD = \frac{Q_{3} - Q_{1}}{Q_{3} + Q_{1}} = \frac{29 - 10}{29 + 10} = \frac{19}{39} = 0.49$$

QD IN DISCRETE SERIES

Quartile Deviation
$$= \frac{Q_3 - Q_1}{2}$$
,

$$Q_1 = size \ of \left(rac{N+1}{4}
ight)^{th}$$
 item, $N = \sum f$

$$Q_3 = \text{size of } \left(\frac{3N+1}{4}\right)^{th} \text{ item, } N = \sum f$$



EXAMPLE

Find the QD for the following series

Size	5	8	10	12	19	20	32
Freq.	3	10	15	20	8	7	6





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SOLUTION

Size	Freq	Cum. Freq	
5	3	3	
8	10	13	
10	15	28	
12	20	48	
19	8	56	
20	7	63	
32	6	69	
	$\sum N=69$		

$$Q_{1} = \text{size of } \left(\frac{N+1}{4}\right)^{th} \text{ item}$$

$$= 17.5 \text{ item size} = 10$$

$$Q_{3} = \text{size of } \left(\frac{3N+1}{4}\right)^{th} \text{ item}$$

$$= 52.5 \text{ item size} = 19$$

$$QD = \frac{Q_{3} - Q_{1}}{2} = \frac{19 - 10}{2} = 4.5$$



└ QD IN A CONTINUOUS SERIES

QD IN A CONTINUOUS SERIES Here QD is the the same, i.e. $QD = \frac{Q_3 - Q_1}{2}$ $Q_1 \& Q_3$ are size of $\left(\frac{N}{4}\right)$ th item and size of $\left(\frac{N}{4} \times 3\right)$ th item respectively. They cannot be determined directly and is determined graphically by the interpolation formula which is given by.

$$Q_1 = l_1 + \frac{\left(\frac{N}{4} - cf\right)}{f} \times c \quad \text{and} \quad Q_3 = l_1 + \frac{\left(\frac{3N}{4} - cf\right)}{f} \times c$$

>.

Where

- ${}^{\prime}I_{1}{}^{\prime}$ is the lower limit of the quartile class.
- 'f' is the frequency of the class.
- 'cf' is the cumulative frequency of the preceding class.
- 'c' is the class interval of the quartile class.





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EXAMPLE

Find the quartile deviation for the following frequency distribution.

Age	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No.	15	30	53	75	100	110	115	125

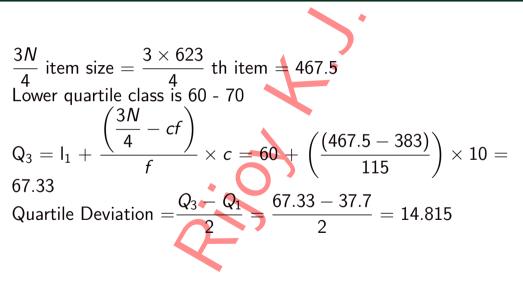
SOLUTION

First you have to form the cumulative frequency distribution and determine Q_1 and Q_3

$$\mathsf{Q}_1 = \mathit{l}_1 + rac{\left(rac{1}{4} - c \mathit{f}
ight)}{\mathit{f}} imes \mathit{c} \hspace{0.5cm} \mathsf{Q}_3 = \mathit{l}_1 + rac{\left(rac{1}{4} - c \mathit{f}
ight)}{\mathit{f}} imes \mathit{c}$$

-QD in a Continuous Series

	-			
Size	f	cf		
0-10	15	15		N 623
10-20	30	45		V_{4} item size $=\frac{623}{4}$ th item $=$
20-30	53	98		155.75
30-40	75	173	$\frac{N}{4}$	Lower quartile class is 30 - 40
40-50	100	273		$\left - \frac{N}{r} - cf \right $
50-60	110	383	($Q_{1} = I_{1} + \frac{\left(\frac{4}{4} - cr\right)}{f} \times c = 30$ $+ \left(\frac{(155.75 - 98)}{75}\right) \times 10 = 37.7$
60-70	115	498	$\frac{3N}{4}$	$\begin{array}{c} \mathbf{Q}_{1} = 1_{1} + f \\ (1 = 1_{2} + 1_{3} + 1_{$
70-80	125	623		$+\left(\frac{(155.75-98)}{-}\right) \times 10 = 37.7$
	$\sum = 623$			





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Mean Deviation is defined as the arithmetic mean of deviations of all the values in a series from their average, counting all such deviations as positive. The average selected may be mean, median or mode.

 $\sum_{i=1}^{n} |d|$

where '| d |' represents deviation from an average without sign. 'n' being number of items.





Mean Deviation is defined as the arithmetic mean of deviations of all the values in a series from their average, counting all such deviations as positive. The average selected may be mean, median or mode.

 \therefore Mean Deviation = $\frac{\sum |d|}{\sum}$

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 \therefore Mean Deviation = $\frac{\sum |d|}{d}$

where '| d |' represents deviation from an average without sign. 'n' being number of items.



Mean deviation is an absolute measure. Its relative value is Coefficient of Mean Deviation. It is equal to the ratio of Mean deviation to Average from which Mean Deviation is computed.

> If Mean is the chosen average, Coefficient of Mean Deviation $= \frac{Mean \ Deviation}{Mean}$



Mean deviation is an absolute measure. Its relative value is Coefficient of Mean Deviation. It is equal to the ratio of Mean deviation to Average from which Mean Deviation is computed.

Mean



└ 1. Mean Deviation in Individual Series

EXAMPLE

Find the mean deviation from mean and its coefficient for the following values 25,63,85,75,62,70,83,28,30,12

SOLUTION

First you have to find out the Mean.

Here the mean is obtained as



Then find out deviations $d \mid$ for each value i.e. 25-53.3 = 28.3



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└ 1. Mean Deviation in Individual Series

EXAMPLE

Find the mean deviation from mean and its coefficient for the following values 25,63,85,75,62,70,83,28,30,12

Solution

First you have to find out the Mean.

Here the mean is obtained as

$$\mathsf{ean} = \frac{25 + 63 + 85 + 75 + 62 + 70 + 83 + 28 + 30 + 12}{10} = 53.3$$

Then find out deviations $d \mid$ for each value i.e. 25-53.3 = 28.3



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└ 1. Mean Deviation in Individual Series

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SOLUTION

First you have to find out the Mean.

Here the mean is obtained as

$$\mathsf{Mean} = \frac{25 + 63 + 85 + 75 + 62 + 70 + 83 + 28 + 30 + 12}{10} = 53.$$

Then find out deviations $d \mid for each value i.e. 25-53.3 = 28.3$



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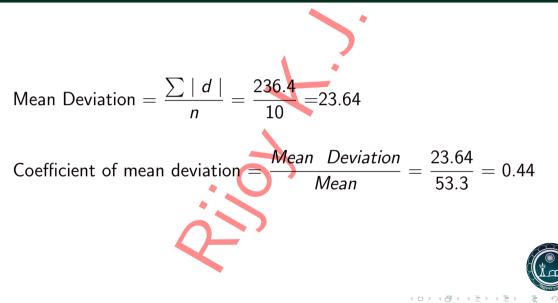
1. Mean Deviation in Individual Series

	<u> </u>
X	d = x - 53.3 without
	sign
25	283
63	9.7
85	31.7
75	21.7
62	8.7
70	16.7
83	29.7
28	25.3
30	23.3
12	41.3
533	236.4



MEAN DEVIATION

└ 1. MEAN DEVIATION IN INDIVIDUAL SERIES



└ 1. Mean Deviation in Individual Series

MEAN DEVIATION FROM MEDIAN

Calculate mean deviation from median and its coefficient for the following values, 5, 25, 28, 33,35, 44, 82, 83, 87, 96, 99

Solution

Median = Size of $\frac{(N+1)}{2}$ th item.= Size of 6th item = 44. Find out the deviation of each value from median. Find the sum of deviation.



└ 1. Mean Deviation in Individual Series

MEAN DEVIATION FROM MEDIAN

Calculate mean deviation from median and its coefficient for the following values, 5, 25, 28, 33,35, 44, 82, 83, 87, 96, 99

Solution

Median = Size of
$$\frac{(N+1)}{2}$$
 th item.= Size of 6th item = 44.
Find out the deviation of each value from median. Find the sum of deviation.

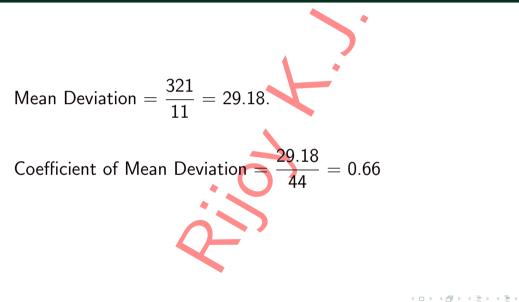
└─1. Mean Deviation in Individual Series

	
X	$ \mathbf{d} =\mathbf{x} - 44$ without
	sign
5	39
25	19
28	16
33	11
35	9
44	0
82	38
83	39
87	43
96	52
99	55
	321



MEAN DEVIATION

└─1. Mean Deviation in Individual Series





MEAN DEVIATION

└─MEAN DEVIATON IN A DISCRETE SERIES

MEAN DEVIATION IN DISCRETE FREQUENCY SERIES

In the case of discrete frequency series, MD is given by,

$$\mathsf{MD} = \frac{\sum f \times \mid d \mid}{N}$$

Where 'f' is the frequency corresponding to the given size, '|x|' and 'N' is the total frequency.



MEAN DEVIATION

└─ Mean Deviaton in a Discrete Series

MEAN DEVIATION IN DISCRETE FREQUENCY SERIES

In the case of discrete frequency series, MD is given by,

$$\mathsf{MD} = \frac{\sum f \times \mid d}{N}$$

Where 'f' is the frequency corresponding to the given size, '|x|' and 'N' is the total frequency.



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STATISTICS └─MEAN DEVIATION └─MEAN DEVIATON IN A DISCRETE SERIES



Calculate the MD for the following series from mean.

Size	0	1	2	3	4	5	6
Frequency	171	82	50	25	13	7	2



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MEAN DEVIATION

└─ Mean Deviaton in a Discrete Series

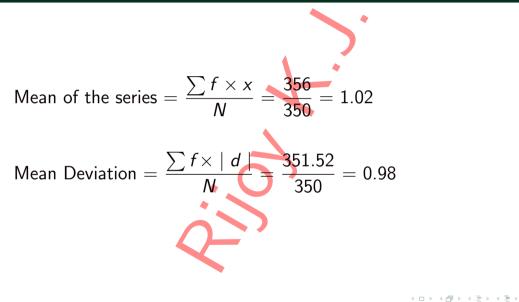
			· · · ·	•
X	f	fx	d	f d
			= x - 1.02	
0	171	0	1.02	174

			= x - 1.02	
0	171	0	1.02	174.42
1	82	82	0.02	1.64
2	50	100	0.98	49.00
3	25	75	1.98	49.5
4	13	52	2.98	38.74
5	7	35	3.98	27.86
6	2	12	4.98	9.96
	350	356		351.12



MEAN DEVIATION

└─MEAN DEVIATON IN A DISCRETE SERIES





MEAN DEVIATION

└ MD IN CONTINUOUS FREQUENCY DISTRIBUTION

MD IN CONTINUOUS FREQUENCY DISTRIBUTION

MD in continuous frequency distribution is given by:

Mean Deviation =
$$\frac{\sum f \times | N|}{N}$$

It is same as discrete frequency series. The only difference is that here the mid value of the class is taken as 'x'.



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MEAN DEVIATION

MD IN CONTINUOUS FREQUENCY DISTRIBUTION

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MD in continuous frequency distribution is given by:

Mean Deviation =
$$\frac{\sum f \times | d}{N}$$

It is same as discrete frequency series. The only difference is that here the mid value of the class is taken as 'x'.



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STATISTICS MEAN DEVIATION MD IN CONTINUOUS FREQUENCY DISTRIBUTION



Calculate the MD from mean for the following frequency distribution.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	4	6	10	20	10	6	4



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MEAN DEVIATION

└─MD IN CONTINUOUS FREQUENCY DISTRIBUTION

60-70

4

60

65

Marks	f	Mid	fx	d	f d
		Х		= x - 35	
0-10	4	5	20	30	120
10-20	6	15	90	20	120
20-30	10	(25)	250	10	100
30-40	20	35	700	0	0
40-50	10	45	450	10	100
50-60	6	55	330	20	120

260

2100

30

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120

680

└ MD IN CONTINUOUS FREQUENCY DISTRIBUTION



SOLUTION

Mean of the series $=\frac{\sum f \times x}{N} = \frac{2100}{60} = 35$ Mean Deviation $=\frac{\sum f \times |d|}{N} = \frac{680}{60} = 11.33$