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Mean deviation (MD)

meaning: Mean deviation is the average differences among the items in a series from the mean itself or median or mode of that series

→ mean deviation is the set of value from the central value is the mean of absolutely deviation of the values from the central

Formula

Individual series

$MD(\bar{x}) = \frac{\Sigma(x-\bar{x})}{n}$ N = NO: of item/ variation/ value

$MD(me) = \frac{\Sigma(x-Me)}{n}$

$MD(z) = \frac{\Sigma(z-\cancel{x})}{n}$

absolute m/s

Discrete series & Continuous series

$MD(\bar{x}) = \frac{\Sigma f(x-\bar{x})}{n}$

$MD = (Me) = \frac{\Sigma f(x-Me)}{n}$

$MD = (z) = \frac{\Sigma f(x-z)}{n}$

Relative measures

Co-Efficient $MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}}$

Co-Efficient $MD(me) = \frac{MD(Me)}{Me}$

Co-Efficient $MD(z) = \frac{MD(z)}{z}$

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1) Find the mean deviation from Mean median & mode from the following

X - 80 90 60 55 30 25 45

in agregating the devition the algebraic negetive signs are not taken into account. it means all the deviation are treated as positive ignoring the negetive Signs.

$\bar{x} = \frac{\Sigma x}{n}$

$= \frac{385}{7}$

$\bar{x} = 55$

Arrey form x	$(x-\bar{x})$	$x - me$	$(x-z)$ 90	
25	30	30	65	
30	25	25	60	
45	10	10	45	
55	0	0	35	
60	5	5	30	
80	25	25	10	
90	35	35	0	
$\Sigma x = 385$	$\Sigma(x-\bar{x}) = 130$	$\Sigma(x - me) = 130$	$\Sigma(x-z) = 245$	

Me is the size of $\left(\frac{n+1}{2}\right)^{th}$ item

Me is the size of $\left(\frac{7+1}{2}\right)^{th}$ item

Me is the size of $(8/2)^{th}$ item

Me is the size of 4^{th} item

$\therefore$ Me is 55

Z = Highest value is 90

(or) Z = 90

$MD(\bar{x}) = \frac{\Sigma(x-\bar{x})}{n} = \frac{130}{7} = 18.57$

Co-Efficient of $MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{18.57}{55} = \boxed{0.3376\%}$

$MD(me) = \frac{\Sigma(x-me)}{n} = \frac{130}{7} = 18.57$

Co-Efficient of $MD(me) = \frac{MD(me)}{me} = \frac{18.57}{55} = \boxed{0.3376\%}$

$MD(z) = \frac{\Sigma(x-z)}{n} = \frac{245}{7} = 35$

Co-Efficient of $MD(z) = \frac{MD(z)}{z} = \frac{35}{90} = \boxed{\text{Co-Efficient } MD(z) = 0.388\%}$

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1) From the following variation find the MD & Co-Efficient of MD from the $\overline{x}$, Me, Z.

x - 68 49 32 21 54 38 59 66 41

2) From the following wages of worker find the mean deviation from the mean, median, & mode and its co-efficient.

wages (x) 59 32 67 43 22 17 64 55 47 20 25

1)

Converted x	$(x-\bar{x})$	x - me	(x - z)
21	26.55	28	47
32	15.55	17	36
38	9.55	11	30
41	6.55	8	27
49	1.45	0	19
54	6.45	5	14
59	11.45	10	9
66	18.45	17	2
68	20.45	19	0
$\Sigma x = 428$	$\Sigma(x-\bar{x}) = 116.45$	$\Sigma(x-me) = 115$	$\Sigma(x-z) = 184$

$\bar{x} = \frac{\Sigma x}{n}$

$\bar{x} = \frac{428}{9}$

$\boxed{\bar{x} = 47.555}$

me is the size of $\left(\frac{n+1}{2}\right)^{th}$ item

Me is the size of $\left(\frac{9+1}{2}\right)^{th}$ item

Me is the size of $\left(\frac{10}{2}\right)^{th}$ item

$\boxed{\text{me is the size } 5^{th} \text{ item}}$

Me is 49

Z = Highest value is 69

$MD(\bar{x}) = \frac{\Sigma(x-\bar{x})}{n} = \frac{116.46}{9} = 12.9383$

Co-efficient of $MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{12.9383}{47.555} = \boxed{0.2721\%}$

$MD(me) = \frac{\Sigma(x-me)}{n} = \frac{115}{9} = 12.7777$

Co-efficient of $MD(me) = \frac{MD(me)}{Me} = \frac{10.4545}{49} = \boxed{0.21335\%}$

$MD(z) = \frac{\Sigma(x-z)}{n} = \frac{184}{9} = 20.44$

Co-efficient of $MD(z) = \frac{MD(z)}{Z} = \frac{16.7272}{69} = \boxed{0.2906\%}$

9)

Converted x	$(x-\bar{x})$	$(x-Me)$	$(x-z)$
17	29.45	30	63
22	24.45	25	58
25	21.45	22	55
32	14.45	15	48
43	3.45	4	37
47	0.55	0	33
55	8.55	8	25
59	12.55	12	21
64	17.55	17	16
67	20.55	20	13
80	33.55	33	0
$\Sigma x = 511$	$\Sigma(x-\bar{x}) = 186.55$	$\Sigma(x-Me) = 186$	$\Sigma(x-z) = 369$

$\bar{x} = \frac{\Sigma x}{n}$

$\bar{x} = \frac{511}{n}$

$\boxed{\bar{x} = 46.45}$

Me is the size of $\left(\frac{n+1}{2}\right)^{th}$ item

Me is the size of $\left(\frac{11+1}{2}\right)^{th}$ item

Me is the size of $\left(\frac{12}{2}\right)^{th}$ item

$\boxed{\text{Me is the size of } 6^{th} \text{ item}}$

∴ Me is 47

z = Highest value is 80

(or) z = 80.

$MD(\bar{x}) = \frac{\Sigma(x-\bar{x})}{n} = \frac{186.55}{11} = \boxed{16.95}$

Co-efficient of $MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{16.95}{46.45} = \boxed{0.3649\%}$

$MD(Me) = \frac{\Sigma(x-Me)}{n} = \frac{186}{11} = \boxed{16.90}$

Co-efficient of $MD(Me) = \frac{MD(Me)}{Me} = \frac{16.90}{47} = \boxed{0.3595\%}$

$MD(z) = \frac{\Sigma(x-z)}{n} = \frac{369}{11} = \boxed{33.54}$

Co-efficient of $MD(z) = \frac{MD(z)}{z} = \frac{33.54}{80} = \boxed{0.41925\%}$

following are the run scored by batsman in a ~~find the MD~~ Cricket match find the MD and Co. Efficient of mean deviation from Me, $\bar{x}$

Run scored	5	10	15	20	25	30	35	40
No. of matches	16	32	36	44	28	18	12	14

x	f	cf	fx	$x-\bar{x}$	$f(x-\bar{x})$	$(x-md)$	$f(x-me)$
5	16	16	80	15	240	15	240
10	32	48	320	10	320	10	320
15	36	84	540	5	180	5	180
20	44	128	880	0	0	0	0
25	28	166	700	5	140	5	140
30	18	174	540	10	180	10	180
35	12	186	420	15	180	15	180
40	14	200	560	20	280	20	200
	N=200		$\Sigma fx = 4040$		$\Sigma f(x-\bar{x})$ 1520		$\Sigma f(x-me)$ 1520

$\bar{x} = \frac{\Sigma fx}{n}$

$\bar{x} = \frac{4040}{200}$

$\boxed{\bar{x} = 20.2}$ or $\boxed{\bar{x} = 20}$

$MD(\bar{x}) = \frac{\Sigma f(x-\bar{x})}{n} = \frac{1520}{200} = 7.6$

Co. Efficient of $MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{7.6}{20} = \boxed{0.38}$

$MD(Me) = \frac{\Sigma f(x-Me)}{n} = \frac{1520}{200} = 7.6$

Co. Efficient of $MD(Me) = \frac{MD(Me)}{Me} = \frac{7.6}{20} = \boxed{0.38}$

Me is the size of $\left(\frac{n+1}{2}\right)^{th}$ item $\qquad Me = \left(\frac{n}{2}\right)^{th}$ item

Me is the size of $\left(\frac{200+1}{2}\right)^{th}$ item

Me is the size of $\left(\frac{201}{2}\right)^{th}$ item

Me is the size of 100.5^{th} item

Me lies in the cf of 128 $\quad \boxed{\therefore \text{ Me Class is } 20}$

Find the MD

Runs	20	40	60	800	100	120	140	160	180
No. of Batsman	6	19	40	23	65	83	55	20	09.

x	f	cf	fx	$(x-\bar{x})$	$f(x-\bar{x})$	$(x-me)$	$f(x-me)$
20	6	6	120	87	522	100	600
40	19	25	760	67	1273	80	1520
60	40	65	2400	47	1880	60	2400
80	23	80	1840	27	[illegible]	40	920
100	65	153	6500	7	455	20	1300
120	83	236	9960	13	1079	0	0
140	55	291	7700	33	1815	20	1100
160	20	311	3200	53	1060	40	800
180	09	320	1620	73	657	60	540
	N=320		Σfx = 34100		$\Sigma f(x-\bar{x})$ = 9362		$\Sigma(x-me)$ = 9180

$\bar{x} = \frac{\Sigma fx}{n}$

$\bar{x} = \frac{34100}{320}$

$\boxed{\bar{x} = 106.5625}$

$\bar{x} = 107$

Me is the size of $\left(\frac{n+1}{2}\right)^{th}$ item

Me is the size of $\left(\frac{320+1}{2}\right)^{th}$ item

Me is the size of $\left(321/2\right)^{th}$ item

Me is the size of 160.5^{th} item

Me lies in the cf of 236

∴ Me Case is 120.

$MD(\bar{x}) = \frac{\Sigma f(x-\bar{x})}{n} = \frac{9369}{320} = \boxed{29.2660}$

$\text{Co-efficient of } MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{26.7625}{107} = \boxed{0.2501\%}$

$MD(me) = \frac{\Sigma f(x-me)}{n} = \frac{9180}{320} = \boxed{28.6875}$

$\text{Co-efficient of } MD(me) = \frac{MD(Me)}{Me} = \frac{28.6875}{120} = \boxed{0.2390\%}$

Continuous Series

The table below gives the distribution by size

No. of workers	0-50	50-100	100-150	150-200	200-250	250-300	300 & above
No. of Company	13	9	0	7	4	5	2

C-I	f	Mid x	fx	$x-\bar{x}$ (129)	$f(x-\bar{x})$	cf	$x-Me$ (89)	$f(x-Me)$
0-50	13	25	325	104	1352	13	64	832
50-100	9	75	675	54	486	22	14	126
100-150	0	125	0	4	0	22	36	0
150-200	7	175	1225	46	322	29	86	602
200-250	4	225	900	96	384	33	136	544
250-300	5	275	1375	146	730	38	186	930
300 & above	2	325	650	196	392	40	236	472
	N=40		Σfx= 5150		$\Sigma f(x-\bar{x})$= 3666			$\Sigma f(x-Me)$= 3506

$\bar{x} = \frac{\Sigma fx}{N} = \frac{5150}{40}$ $\boxed{\bar{x} = 128.75 \text{ or } 129}$

$MD(\bar{x}) = \frac{\Sigma f(x-\bar{x})}{N} = \frac{3666}{40} = \boxed{91.65}$

Co-efficient of $MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{91.65}{129} = \boxed{0.7104\ \%}$

$MD(Me) = \frac{\Sigma f(x-Me)}{n} = \frac{3506}{40} = \boxed{87.65}$

Co-efficient of $MD(Me) = \frac{MD(Me)}{Me} = \frac{87.65}{89} = \boxed{0.9848\ \%}$

$MD(Z) = \frac{\Sigma f(x-Z)}{n}$

Co-efficient of $MD(Z) = \frac{MD(Z)}{Z}$

Me is the size of $(N/2)^{th}$ item

Me is the size of $(40/2)^{th}$ item

Me is the size of 20^{th} item

Me lies in the cf of 22 ∴ Me class 50-100

$l = 50,\ f = 9,\ m = 13,\ N/2 = 20,\ c = 50$

$Me = L + \frac{N/2 - m}{f} \times c$

$Me = 50 + \frac{20-13}{9} \times 50$

$= 50 + \frac{7}{9} \times 50$

$= 50 + 350/9$

$= 50 + 38.88$

$\boxed{Me = 88.88 \text{ (or) } 89}$

Q1

x	0-5	5-10	10-15	15-20	20-25	25-30
f	15	20	35	30	18	17

x-x̄	f	mid x	fx	$(x-\bar{x})$	$f(x-\bar{x})$	cf	$(x-me)$	$f(x-me)$
0-5	15	2.5	37.5	12.5	187.5	15	12.5	187.5
5-10	20	7.5	150	7.5	150	35	7.5	150
10-15	35	12.5	437.5	2.5	87.5	70	2.5	87.5
15-20	30	17.5	525	2.5	75	100	2.5	75
20-25	18	22.5	405	7.5	135	118	7.5	135
25-30	17	27.5	467.5	12.5	212.5	135	12.5	212.5
	N= 135		Σfx= 2022.5		$\Sigma f(x-\bar{x})$ 847.5			$\Sigma f(x-\bar{x})$ 847.5

$\bar{x} = \frac{\Sigma fx}{n}$

$\bar{x} = \frac{2022.5}{135}$

$\boxed{\bar{x} = 14.98}$ or $\bar{x} = \boxed{15}$

Me is the size of $(n/2)^{th}$ item

Me is the size of $(135/2)^{th}$ item

Me is the size of 67.5^{th} item

Me lies in the cf of 70

∴ Me class is 10-15

$L=10, M=35, f=35, c=5$

$Me = L + \frac{n/2 - M}{f} \times c$

$Me = 10 + \frac{67.5 - 35}{35} \times 5$

$Me = 10 + \frac{32.5}{35} \times 5$

$Me = 10 + \frac{162.5}{35}$

$Me = 10 + 4.64$

$\boxed{Me = 14.64 \text{ or } 15}$

$MD(\bar{x}) = \frac{\Sigma f(x-\bar{x})}{n} = \frac{847.5}{135} = \boxed{6.28}$

Co-efficient of $MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{6.28}{15} = \boxed{0.4186\%}$

$MD(me) = \frac{\Sigma f(x-me)}{n} = \frac{847.5}{135} = \boxed{6.28}$

Co-efficient of $MD(me) = \frac{MD(me)}{me} = \frac{6.28}{15} = \boxed{0.4186\%}$

Scanned with CamScanner

3) Calculate MD

C-I	10-20	20-30	30-40	40-50	50-60	60-70	70-80
f	4	6	10	30	10	6	4

C-I	f	mid x	fx	$(x-\bar{x})$ 45	$f(x-\bar{x})$	cf	(x-me)	f(x-me)
10-20	4	15	60	30	120	4	30	120
20-30	6	25	150	20	120	10	20	120
30-40	10	35	350	10	100	20	10	100
40-50	30	45	1350	0	0	50	0	0
50-60	10	55	550	10	100	60	10	100
60-70	6	65	390	20	60	66	20	60
70-80	4	75	300	30	120	70	30	120
	N=70		Σfx= 3150		$\Sigma f(x-\bar{x})$ 620			Σf(x-me) 620

$\bar{x} = \frac{\Sigma fx}{n}$

$\bar{x} = \frac{3150}{70}$

$\boxed{\bar{x} = 45}$

Me is the size of $(N/2)^{th}$ item

Me is the size of $(70/2)^{th}$ item

Me is the size of 35^{th} item

Me lies in the cf of 50^{th} item

∴ Me class is 40-50

l = 40, m = 20, f = 30, c = 10

$m = L + \frac{N/2 - m}{f} \times c$

$me = 40 + \frac{35-20}{30} \times 10$

$Me = 40 + \frac{15}{30} \times 10$

$Me = 40 + \frac{150}{30}$

$me = 40 + 5$

$\boxed{me = 45}$

$MD(\bar{x}) = \frac{\Sigma f(x-\bar{x})}{n} = \frac{620}{70} = 8.857$

$\text{Co-efficient of } MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{8.857}{45} = \boxed{0.1968\%}$

$MD(me) = \frac{\Sigma f(x-me)}{n} = \frac{620}{70} = 8.857$

$\text{Co-efficient of } MD(me) = \frac{MD(me)}{me} = \frac{8.857}{45} = \boxed{0.1968\%}$

4) Cal^n of MD from ~~median~~ & Median

Variable	more than 5	10	15	20	25	30	35	40
No. of item	25	23	21	14	10	7	4	2

Converted C-I	Corrected f	cf	m/d x	fx	$(x-\bar{x})$ 24	$f(x-\bar{x})$	$(x-m_e)$ 22	$f(x-m_e)$
5-10	2	2	7.5	15	16.5	33	14.5	29
10-15	2	4	12.5	25	11.5	23	9.5	19
15-20	7	11	17.5	122.5	6.5	46.5	4.5	31.5
20-25	4	15	22.5	90	1.5	6	0.5	2
25-30	3	18	27.5	82.5	3.5	10.5	5.5	16.5
30-35	3	21	32.5	97.5	8.5	25.5	10.5	31.5
35-40	2	23	37.5	75	13.5	27	15.5	31
40-45	2	25	42.5	85	18.5	37	20.5	41
	N=25			Σfx = 592.5		$\Sigma f(x-\bar{x})$ = 207.5		201.5

$\bar{x} = \frac{\Sigma fx}{n}$

$= \frac{592.5}{25} = \boxed{23.7 \text{ or } 24}$ approx

$MD(\bar{x}) = \frac{\Sigma f(x-\bar{x})}{n} = \frac{207.5}{25} = \boxed{8.30}$

Co-efficient $MD(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{8.30}{24} = \boxed{0.3458\%}$

Me is the size of $(N/2)^{th}$ item

Me is the size of $(25/2)^{th}$ item

Me is the size of 12.5^{th} item

Me lies in the cf of 15

$\therefore$ Me class is 20-25

$l = 20,\ f = 4,\ m = 11,\ c = 5,\ N/2 = 12.5$

$Me = l + \frac{N/2 - m}{f} \times c$

$= 20 + \frac{12.5 - 11}{4} \times 5$

$= 20 + \frac{1.5}{4} \times 5$

$= 20 + \frac{7.5}{4}$

$= 20 + 1.875$

$\boxed{Me = 21.875 \text{ or } 22 \text{ Approx}}$

$MD(Me) = \frac{\sum f(x - Me)}{n} = \frac{201.5}{25} = \boxed{8.06}$

Co-efficient $MD(Me) = \frac{MD(Me)}{Me} = \frac{8.06}{22} = \boxed{0.3663 \%}$

5) Cal. MD from median

Variable	More than 10	20	30	40	50	60	70	80
f	50	45	43	28	20	14	8	4

44

Converted c-I	Converted f	cf	Mid x	(x-Me)	f(x-Me)
10-20	50-45 = 5	5	15	29	145
20-30	45-43 = 2	7	25	19	38
30-40	43-28 = 15	22	35	9	135
40-50	28-20 = 8	30	45	1	8
50-60	20-14 = 6	36	55	11	66
60-70	14-8 = 6	42	65	21	126
70-80	8-4 = 4	46	75	31	124
80-90	4-0 = 4	50	85	41	164
	N = 50				f(x-Me) = 806

Me is the size of $(n/2)^{th}$ item

Me is the size of $(50/2)^{th}$ item

Me is the size of 25^{th} item

~~Me is the s~~

Me lies in the cf of 30

∴ Me class is 40-50

$l = 40$, $f = 8$, $c = 10$, $m = 22$

$Me = L + \frac{n/2 - m}{f} \times c$

$= 40 + \frac{25 - 22}{8} \times 10$

$= 40 + 3/8 \times 10$

$= 40 + 30/8$

$= 40 + 3.75$

$\boxed{Me = 43.75 \text{ or } 44 \text{ Approx}}$

$MD(Me) = \frac{\sum f(x - Me)}{n} = \frac{806}{50} = \boxed{16.12}$

Co-efficient $MD(Me) = \frac{MD(Me)}{Me} = \frac{16.12}{44} = \boxed{0.3663 \%}$

Standard deviation (SD)

Meaning: Standard deviation is the square root of the sum of the squares of the deviation divided by their numbers.
It is a second moment of a dispersion.
Since the sum of the squares of the deviations from the mean is minimum, the deviation are taken from only from mean (but not from median and mode)
It is proposed by prof. karl pearson in 1893. it is denoted by "σ" (sigma)

Formulas Direct method

Individual series	Discrete series and Continuous series
$\sigma = \sqrt{\frac{\Sigma d^2}{n}}$	$\sigma = \sqrt{\frac{\Sigma fd^2}{n}}$
$\sigma = \sqrt{\frac{\Sigma (x-\bar{x})^2}{n}}$	

absolute

Shortcut method

Some times the mean values will be a fractional figure. then we should take the deviation from the assumed mean.
the direct method formula will be having some adjustement

Individual series
$\sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2}$

Discrete series & Continuous Series
$\sigma = \sqrt{\frac{\Sigma fd^2}{n} - \left(\frac{\Sigma fd}{n}\right)^2}$

Step deviation method

the deviation are further divided by the common factor in case of assumed mean. this deliberate error is compensated by multiplying the entire formula by the same factor

Individual series | Discrete series & Continuous series

$\sigma = \sqrt{\frac{\Sigma fd'^2}{n} - \left(\frac{\Sigma fd'}{n}\right)^2} \times c$ | $\sigma = \sqrt{\frac{\Sigma fd'^2}{n} - \left(\frac{\Sigma fd'}{n}\right)^2} \times c$

(EP) Co-efficient of variation (CV) meaning

Formula

$CV = \frac{\sigma}{\bar{x}} \times 100$ result expressed in %

Problems

deviation are taken from actual mean

1) 10 Students BCom Class have obtained following marks in Kannada out of 100. Cal^n SD of marks obtained

38.5

SI	marks	$d = x - \bar{x}$	d^2
1	5	-33.5	1122.25
2	10	-28.5	812.25
3	20	-18.5	342.25
4	25	-13.5	182.25
5	40	1.5	2.25
6	42	3.5	12.5
7	45	6.5	42.25
8	48	9.5	90.25
9	70	31.5	992.25
10	80	41.5	1722.25
	$\Sigma x = 385$	$\Sigma d = 0$	$\Sigma d^2 = 5320.50$

$\bar{x} = \frac{\Sigma x}{n} = \frac{385}{10}$

$\boxed{\bar{x} = 38.5}$

$\sigma = \sqrt{\frac{\Sigma d^2}{n}}$

$\sigma = \sqrt{\frac{5320.50}{10}}$

$\sigma = \sqrt{532.05}$

$\boxed{\sigma = 23.06}$

$CV = \frac{\sigma}{\bar{X}} \times 100$

$CV = \frac{23.06}{38.5} \times 100$

$\boxed{CV = 59.896\%}$

$\frac{-149}{54}$

deviation are taken from assumed mean

Shortcut method

SI	Marks	d=X-A	d^2
1	5	-43	1849
2	10	-38	1444
3	20	-28	784
4	25	-23	529
5	40	-8	64
6	42	-6	36
7	45	-3	9
8	$\boxed{48}$ A	0	0
9	70	+22	484
10	80	32	1024
	Σx=385	Σd = -95	Σd^2 = 6223

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

$\sigma = \sqrt{\frac{6223}{10} - \left(\frac{-95}{10}\right)^2}$

$\sigma = \sqrt{622.3 - (-9.5)^2}$

$= \sqrt{622.3 - 90.25}$

$= \sqrt{532.05}$

$\boxed{\sigma = 23.06}$

$CV = \frac{\sigma}{\bar{X}} \times 100$

$= \frac{23.06}{38.5} \times 100$

$\boxed{CV = 59.896\%}$

Q) Following are the run scored by two batsman name Yuvaraj & Kohli in 10 innings. Find who is better scorer and who is more consistent.

	Yuvaraj	Kohli	$d = x - A\bar{x}$	d^2	$d = x - A$	d^2
1	101	97	63.5	4032.25	56	3136
2	22	12	-15.5	240.25	-23	529
3	0	40	-37.5	1406.25	-45	2025
4	36	96	-1.5	2.25	-9	81
5	82	13	44.5	1980.25	37	1369
6	$\boxed{45}$	8	7.5	56.25	0	0
7	7	85	-30.5	930.25	-38	1444
8	3	8	-34.5	1190.25	-42	1764
9	65	56	27.5	756.25	20	400
10	14	16	-23.5	552.25	-31	961
	$\Sigma x = 375$		$\Sigma d = 0$	$\Sigma d^2 = 11146.5$	$\Sigma d = -75$	$\Sigma d^2 = 11709$

$\bar{x} = \frac{\Sigma x}{n}$

$\bar{x} = \frac{375}{10}$

$\boxed{\bar{x} = 37.5}$

DM

$\sigma = \sqrt{\frac{\Sigma d^2}{n}}$ $\quad CV = \frac{\sigma}{\bar{x}} \times 100$

$\sigma = \sqrt{\frac{11146.5}{10}}$ $\quad = \frac{33.38}{37.5} \times 100$

$\sigma = \sqrt{1114.65}$ $\quad \boxed{CV = 89.013\%}$

$\boxed{\sigma = 33.38}$

Short Cut Method

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

$\sigma = \sqrt{\frac{11709}{10} - \left(\frac{-75}{10}\right)^2}$

$\sigma = \sqrt{1170.9 - (-7.5)^2}$

$\sigma = \sqrt{1170.9 - 56.25}$

$\sigma = \sqrt{1114.65}$

$\boxed{\sigma = 33.38}$

$CV = \frac{\sigma}{\bar{x}} \times 100$

$= \frac{33.38}{37.5} \times 100$

43.1

S.No	Kohli	$d=x-\bar{x}$	d^2	$d=x-A$	d^2
1	97	53.9	2905.21	12	144
2	12	-31.1	967.21	-73	6329
3	40	3.1	9.61	-45	2025
4	96	-52.9	2798.41	11	121
5	13	-30.1	906.01	-72	5184
6	8	-35.1	1232.01	-77	5929
7	$\boxed{85}$	41.9	1755.61	0	0
8	8	-35.1	1232.01	-77	5929
9	56	12.9	166.41	-29	841
10	16	-27.1	734.41	-69	4761
	$\Sigma x = 431$	$\Sigma d = 0$	$\Sigma d^2 = 12706.9$	$\Sigma d = -419$	$\Sigma d^2 = 30263$

$\bar{x} = \frac{\Sigma x}{n}$

$\bar{x} = \frac{431}{10}$

$\boxed{\bar{x} = 43.1}$

Direct method

$\sigma = \sqrt{\frac{\Sigma d^2}{n}}$ $CV = \frac{\sigma}{\bar{x}} \times 100$

$\sigma = \sqrt{\frac{12706.9}{10}}$ $= \frac{35.64}{43.1} \times 100$

$\boxed{CV = 82.69\%}$

$\sigma = \sqrt{1270.69}$

$\boxed{\sigma = 35.64}$

Shortcut Method

$\boxed{\sigma = 35.64}$

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

$CV = \frac{\sigma}{\bar{x}} \times 100$

$\sigma = \sqrt{\frac{30263}{10} - \left(-\frac{419}{10}\right)^2}$

$CV = \frac{35.64}{43.1} \times 100$

$\sigma = \sqrt{3026.3 - (-41.9)^2}$

$\boxed{CV = 82.69\%}$

$\sigma = \sqrt{3026.3 - 1755.61}$

$\sigma = \sqrt{1270.69}$

Kohli is a best planner and more Consi-sting player than yuvarg his average is more & variation is less

Scanned with CamScan

Q) The following tables is the age distribution of boys & girls in a High School find which of the two groups is more variable in age.

Age (in yrs) –	13	14	15	16	17
No. of Students B –	12	15	15	5	3
G –	13	10	12	2	1

Deviation taken from assum.

(x) Age	f	fx	d = x - A	d^2	fd	fd^2
13	12	156	-2	4	-24	48
14	15	210	-1	1	-15	15
15 A	15	225	0	0	0	0
16	5	80	1	1	5	25
17	3	51	2	4	6	12
	N = 50	Σfx = 722			Σfd = -28	Σfd^2 = 80

$\overline{X} = \frac{\Sigma fx}{n}$

$\overline{X} = \frac{722}{50} = \boxed{14.44}$

x (Age)	f	fx	d = x - A	d^2	fd	fd^2
13	13	169	-2	-4	-26	52
14	10	140	-1	-1	-10	10
→A 15	12	180	0	0	0	0
16	2	32	1	1	2	2
17	1	17	2	4	2	4
	N : 38	Σfx 538			Σfd -32	Σfd^2 68

$\overline{X} = \frac{\Sigma fx}{n}$

$\overline{X} = \frac{538}{38} = \boxed{14.16}$

Boys | Girls

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

$$\sigma = \sqrt{\frac{80}{50} - \left(\frac{-28}{50}\right)^2}$$

$$\sigma = \sqrt{1.60 - 0.3136}$$

$$\sigma = \sqrt{1.2864}$$

$$\boxed{\sigma = 1.134}$$

$$CV = \frac{\sigma}{\bar{x}} \times 100$$

$$CV = \frac{1.134}{14.44} \times 100$$

$$\boxed{CV = 7.853\%}$$

Girls:

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

$$\sigma = \sqrt{\frac{68}{38} - \left(\frac{-32}{38}\right)^2}$$

$$\sigma = \sqrt{1.78 - 0.709}$$

$$\sigma = \sqrt{1.071}$$

$$\boxed{\sigma = 1.034}$$

$$CV = \frac{\sigma}{\bar{x}} \times 100$$

$$CV = \frac{7.034}{14.15} \times 100$$

$$\boxed{CV = 7.307\%}$$

10) A tire dealers received Sample of tires from two suppliers x & y. he had the samples tested for length of life with the following reasons

length of life (in once)	4 - 8	8 - 12	12 - 16	16 - 20
Supplier x	10	16	30	4
y	2	42	12	4

1. Which of the two makes as a higher average life ?
2. If prices are same, which tire would you prefer and y?

c-I	f	mid x	fx	d=x-A	d^2	fd	fd^2
4-8	10	6	50	-8	64	-80	640
8-12	16	10	160	-4	16	-64	256
12-16	30	14	420	0	0	0	0
16-20	4	18	72	4	16	16	64
	N=60		Σfx 702			Σfd -128	Σfd^2 960

$\bar{x} = \frac{\Sigma fx}{n} = \frac{702}{60} = 11.7$

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

$\sigma = \sqrt{\frac{960}{60} - \left(\frac{-128}{60}\right)^2}$

$\sigma = \sqrt{16 - (-2.133)^2}$

$\sigma = \sqrt{11.4503}$

$\boxed{\sigma = 3.3838}$

$Cv = \frac{\sigma}{\bar{x}} \times 100$

$Cv = \frac{3.3838}{11.7} \times 100$

$Cv = \frac{338.38}{11.7}$

$\boxed{Cv = 28.92}$

c-I	f	mid x	fx	d=x-A	d^2	fd	fd^2
4-8	2	6	12	-10	100	-20	200
8-12	42	16	672	0	0	0	0
12-16	12	14	168	-2	4	-24	48
16-20	4	18	72	2	4	8	16
	N=60		Σfx= 924			Σfd= -36	Σfd^2 264

$\bar{x} = \frac{\Sigma fx}{n} = \frac{924}{60} = \boxed{15.4}$

$$\sigma = \sqrt{\frac{\Sigma fd^2}{n} - \left(\frac{\Sigma fd}{n}\right)^2} \qquad CV = \frac{\sigma}{\bar{x}} \times 100$$

$$\sigma = \sqrt{\frac{264}{60} - \left(\frac{-36}{60}\right)^2} \qquad CV = \frac{6.6060}{16.4} \times 100$$

$$\sigma = \sqrt{44 - (-0.6)^2} \qquad CV = \frac{660.6}{16.4}$$

$$\sigma = \sqrt{44 - 0.36} \qquad \boxed{CV = 42.896}$$

$$\sigma = \sqrt{43.64}$$

$$\boxed{\sigma = 6.6060}$$

y Supplier makes has a higher average type?
If the prices are same. 'y' suppliers type would I prefers (Because y's suppliers Avg & CV is more)

Length of life	Mid x	d = x - A	d^2	Supplier X f	fd	fd^2	Supplier Y f	fd	fd^2
4 - 8	6	-4	16	10	-40	160	2	-8	32
8 - 12	10	0	0	16	0	0	42	0	0
12 - 16	14	4	16	30	120	480	12	48	192
16 - 20	18	8	64	4	32	256	4	32	256
				N: 60	Σfd = 112	Σfd^2 = 896	N = 60	Σfd 72	Σfd^2 = 480

$$\bar{x} = A + \frac{\Sigma fd}{n} = 10 + \frac{112}{60} = \bar{x} = 10 + 1.866 = \boxed{\bar{x} = 11.866}$$

$$\sigma = \sqrt{\frac{\Sigma fd^2}{n} - \left(\frac{\Sigma fd}{n}\right)^2} \qquad CV = \frac{\sigma}{\bar{x}} \times 100$$

$$\sigma = \sqrt{\frac{896}{60} - \left(\frac{112}{60}\right)^2} \qquad CV = \frac{3.383}{11.866} \times 100$$

$$\sigma = \sqrt{14.93 - 3.484} \qquad \boxed{CV = 28.510}$$

$$\sigma = \sqrt{11.446}$$

$$\boxed{\sigma = 3.383}$$

Supplier y

$\bar{X} = A + \frac{\Sigma fd}{n} = 10 + \frac{72}{60}$ $10 + 1.20$ $\boxed{\bar{x} = 11.20}$

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

$CV = \frac{\sigma}{\bar{x}} \times 100$

$\sigma = \sqrt{\frac{480}{60} - \left(\frac{72}{60}\right)^2}$

$CV = \frac{2.56}{11.20} \times 100$

$\sigma = \sqrt{8 - 1.44}$

$\boxed{CV = 22.85}$

$\sigma = \sqrt{6.56}$

$\boxed{\sigma = 2.56}$

1) Type 'x' tyre has higher avg life ($\bar{x} = 11.86$)
2) Type y tyre are prefer ∴ variation less than Type 'x' type

11) your given below the daily wages paid to workers in two factory's R & S find
1. which factory pays higher average wages
2. In which factory or wages more variable ~~daily wages~~

Daily wages(₹)	50-60	60-70	70-80	80-90	90-100
No. of workers R	15	30	45	20	10
S	20	35	50	10	5

C-I	Mid x	d = x - A	d^2	Supplier R f	fd	fd^2	Supplier S f	fd	fd^2
50-60	55	-20	-400	15	-300	6000	20	-400	8000
60-70	65	-10	-100	30	-300	3000	35	-350	3500
70-80	$\boxed{75}$	0	0	45	0	0	50	0	0
80-90	85	+10	+100	20	200	2000	10	+100	1000
90-100	95	+20	+400	10	200	4000	5	100	2000
				N = 120	Σfd = 2000	Σfd^2 = 15000	N = 120	Σfd = -560	Σfd^2 = 14500

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R

$\bar{x} = A + \frac{\Sigma fd}{n}$

$= 75 + \frac{-200}{120}$

$= 75 + (-1.66)$

$\boxed{\bar{x} = 73.34}$

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

$\sigma = \sqrt{\frac{15000}{120} - \left(\frac{-200}{-120}\right)^2}$

$\sigma = \sqrt{125 - 2.77}$

$\sigma \sqrt{122.23}$

$\boxed{\sigma = 11.05}$

$CV = \frac{\sigma}{\bar{x}} \times 100$

$CV = \frac{11.05}{73.34} \times 100$

$\boxed{CV = 15.06}$

S

$\bar{x} = A + \frac{\Sigma fd}{n}$

$= 75 + \frac{-550}{120}$

$= 75 + (-4.58)$

$\boxed{\bar{x} = 70.42}$

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

$\sigma = \sqrt{\frac{14500}{120} - \left(-\frac{550}{120}\right)^2}$

$\sigma = \sqrt{120.83 - 21.006}$

$\sigma = \sqrt{99.824}$

$\boxed{\sigma = 9.99}$

$CV = \frac{\sigma}{\bar{x}} \times 100$

$= \frac{9.99}{70.42} \times 100$

$\boxed{CV = 14.186}$