Measures of Dispersion

Digital Assignment 1

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(20BDS0405)

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Statistics for Engineers
(MAT 2001)

VIT
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A1+A2

SCHOOL OF ADVANCED SCIENCES

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Digital Assignment-1

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1. From the following identity the more stable data

X	74	75	78	72	78	77	79	81	79	76	72	71
y	87	84	80	88	89	85	86	82	82	79	86	80

2. The scores of two batsman A and B in a series of 10 matches are as follows

Scores of A	37	43	28	62	59	20	83	48	52	47
Scores of B	35	52	77	38	26	58	63	31	40	46

Identify the better player and the more consistent player.

3. The following table gives the monthly wages of workers in a factory.

Wages	125-175	175-225	225-275	275-325	325-375	375-425	425-475	475-525	525-575	Total
No.of workers	2	22	19	14	3	4	6	1	1	72

Compute (i) standard deviation (ii)quartile deviation (iii)coefficient of variation

4. Find the (i)Mean (ii)Mean deviation about Mean (ii)Range (iii)Standard deviation (iv)Coefficient of variation for the following marks of 10 students

20 , 22, 27, 30, 40, 48, 45, 32 ,31, 35

5.Compute (i)Mean deviation about mean (ii)Mean deviation about median for the following data

Class	3-4.9	5-6.9	7-8.9	9-10.9	11-12.9	13-14.9	15-16.9
Frequency	5	8	30	82	45	24	6

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1). From the following, identify the more stable data.

X	74	75	78	72	78	77	79	81	79	76	72	71	, N=12
Y	87	84	80	88	89	85	86	82	82	79	86	80	

Sol:

X	Y	X^2	Y^2
74	87	5476	7569
75	84	5625	7056
78	80	6084	6400
72	88	5184	7744
78	89	6084	7921
77	85	5929	7225
79	86	6241	7396
81	82	6561	6724
79	82	6241	6724
76	79	5776	6241
72	86	5184	7396
71	80	5041	6400
$\Sigma X = 912$	$\Sigma Y = 1008$	$\Sigma X^2 = 69426$	$\Sigma Y^2 = 84796$

For X_1

$$\text{Mean}(\bar{X}_1) = \frac{\Sigma X}{N} = \frac{912}{12} = 76$$

$$\text{Standard deviation}(\sigma_1) = \sqrt{\frac{\Sigma X^2}{N} - \left(\frac{\Sigma X}{N}\right)^2}$$

$$= \sqrt{\frac{69426}{12} - 76^2}$$

$$= 3.08$$

$$C.V_1 = \frac{\sigma_1}{\bar{X}_1} \times 100\%$$

$$= 4.05\%$$

For Y,

$$\text{Mean}(\bar{Y}_2) = \frac{\Sigma Y}{N} = \frac{1008}{12} = 84$$

$$\text{Standard deviation}(\sigma_2) = \sqrt{\frac{\Sigma Y^2}{N} - \left(\frac{\Sigma Y}{N}\right)^2}$$

$$= \sqrt{\frac{84796}{12} - 84^2}$$

$$= 3.21$$

$$CV_2 = \frac{\sigma_2}{\bar{Y}} \times 100\%$$

$$= \frac{3.21}{84} \times 100\%$$

$$= 3.83\%$$

Conclusion:- B is better player (The average score of B is higher).

B is more consistent player (C.V. of B is less than that of A).

2). The scores of two batsman A and B in a series of 10 matches are as follows:-

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Scores of A	37	43	28	62	59	20	83	48	52	47
Scores of B	35	52	77	38	26	58	63	31	40	46

Identify the better player and more consistent player.

SOF A	B	A^2	B^2
37	35	1369	1225
43	52	1849	2704
28	77	784	5929
62	38	3844	1444
59	26	3481	676
20	58	400	3364
83	63	6889	3969
48	31	2304	969
52	40	2704	1600
47	46	2209	2116
$\Sigma A = 479$	$\Sigma B = 466$	$\Sigma A^2 = 25833$	$\Sigma B^2 = 23988$

$$\bar{X}_A = \frac{\Sigma A}{N} = \frac{479}{10} = 47.9$$

$$\bar{X}_B = \frac{\Sigma B}{N} = \frac{466}{10} = 46.6$$

Standard deviation of A is:-

$$\sigma_A = \sqrt{\frac{\Sigma A^2}{N} - \left(\frac{\Sigma A}{N}\right)^2}$$

$$= \sqrt{\frac{25833}{10} - 47.9^2}$$

$$= 16.997$$

Coefficient of Variation of A is:-

$$CV_A = \frac{\sigma_A}{\bar{X}_A} \times 100\%$$

$$= \frac{16.997}{47.9} \times 100\%$$

$$= 35.48\%$$

Standard deviation of B is:-

$$\sigma_B = \sqrt{\frac{\Sigma B^2}{N} - \left(\frac{\Sigma B}{N}\right)^2}$$

$$= \sqrt{\frac{23988}{10} - 46.6^2}$$

$$= 15.07$$

Coefficient of Variation of B is:-

$$CV_B = \frac{\sigma_B}{\bar{X}_B} \times 100\%$$

$$= 32.35\%$$

In above calculation $\bar{X}_A > \bar{X}_B$ and $CV_A > CV_B$.

So, A is the better player due to higher average runs. But B is more consistent player due to lesser coefficient of variation.

3). The following table gives the monthly wages of workers in a factory.

Total => 72.

Wages	125-175	175-225	225-275	275-325	325-375	375-425	425-475	475-525	525-575
No. of workers	2	22	19	14	3	4	6	1	1

Wages	No. of workers (f)	Mid Value (x)	cf	fx	x^2	fx^2
125-175	2	150	2	300	22500	45000
175-225	22	200	24	4400	40000	880000
225-275	19	250	43	4750	62500	1187500
275-325	14	300	57	4200	90000	1260000
325-375	3	350	60	1050	122500	367506
375-425	4	400	64	1600	160000	640000
425-475	6	450	70	2700	202500	1215000
475-525	1	500	71	500	250000	250000
525-575	1	550	72	550	302500	302500
	N=72			$\sum fx = 20000$		$\sum fx^2 = 6147500$

$$\text{Mean}(\bar{x}) = \frac{\sum fx}{\sum f} = \frac{20000}{72} = 278.147$$

$$\text{Standard deviation}(\sigma) = \sqrt{\frac{\sum fx^2}{N} - \left(\frac{\sum fx}{N}\right)^2}$$

$$= \sqrt{\frac{6147500}{72} - \left(\frac{20000}{72}\right)^2}$$

$$= 88.54$$

$$\text{Coefficient of variation} = \frac{\sigma}{\bar{x}} \times 100\%$$

$$= \frac{90.67}{278.47} \times 100\%$$

$$= 31.75\%$$

Find the (i) Mean (ii) Mean Deviation about Mean (iii) Range (iv) Standard deviation, (v) Coefficient of Variation for following 10 students' marks.

4). 20, 22, 27, 30, 40, 48, 49, 32, 31, 35.

Sol:- Arranged data:-

x	20	22	27	30	31	32	35	40	45	48	$\Sigma x = 330$
x^2	400	484	729	900	961	1024	1225	1600	2025	2304	$\Sigma x^2 = 11652$
$\lvert x-\bar{x}\rvert$	13	11	6	3	2	1	2	7	12	15	$\Sigma \lvert x-\bar{x}\rvert = 72$

Here,

$$\text{Mean}(\bar{x}) = \frac{\Sigma x}{N} = \frac{330}{10} = 33$$

$$\text{Mean Deviation about Mean} = \text{M.D.} = \frac{\Sigma |x-\bar{x}|}{N} = \frac{72}{10} = 7.2$$

$$\text{Range} = \text{Highest Value} - \text{Lowest Value}$$
$$= 48 - 20$$
$$= 28$$

$$\text{Standard deviation} = \sqrt{\frac{\Sigma x^2}{N} - \left(\frac{\Sigma x}{N}\right)^2}$$

$$\text{or, } \sigma = \sqrt{\frac{11652}{10} - \left(\frac{330}{10}\right)^2}$$

$$\text{or, } \sigma = 8.73$$

$$\text{Coefficient of variation} = \frac{\sigma}{\bar{x}} \times 100\%$$

$$= \frac{8.73}{33} \times 100\%$$

$$= 26.45\%$$

$\therefore \bar{x} = 33$, MD about $\bar{x} = 7.2$

Range $= 28$

$\sigma = 8.73$

C.V. $= 26.45\%$

5). Compute · (I) Mean Deviation about Mean (II) Mean Deviation about median for the following data:-

Class	3-4.9	5-6.9	7-8.9	9-10.9	11-12.9	13-14.9	15-16.9
frequency	5	8	30	82	45	24	6

Sol: After readjusting the class intervals, we get following table:-

Class Interval	(f) frequency	c.f	Mid Value(x)	fx	$\lvert x-\bar{x}\rvert$	$\lvert x-Md\rvert$	$f\lvert x-\bar{x}\rvert$	$f\lvert x-Md\rvert$
2.95-4.95	5	5	3.95	19.75	6.5	6.39	32.5	31.95
4.95-6.95	8	13	5.95	47.6	4.5	4.39	36	35.12
6.95-8.95	30	43	7.95	238.5	2.5	2.39	75	71.7
8.95-10.95	82	125	9.95	815.9	0.5	0.39	41	31.98
10.95-12.95	45	170	11.95	537.75	1.5	1.61	67.5	72.45
12.95-14.95	24	194	13.95	334.8	3.5	3.61	84	86.64
14.95-16.95	6	200	15.95	95.7	5.5	5.61	33	33.66
	$\Sigma f = N = 200$			$\Sigma fx = 2090$			$\Sigma f\lvert x-\bar{x}\rvert = 366$	$\Sigma f\lvert x-Md\rvert = 363.5$

Mean:

$$\bar{x} = \frac{\Sigma fx}{N} = \frac{2090}{200} = 10.45$$

For Median (Q_2):

$\frac{N}{2} = 100$, Corresponding higher cf = 125. Hence, cf class is (8.95-10.95)

$l = 8.95$, $h = 2$, $f = 82$, $\frac{N}{2} = 100$, $cf = 43$.

$$Q_2 = l + \frac{h}{f}\left(\frac{N}{2} - cf\right)$$

$$= 8.95 + \frac{2}{82}(100-43)$$

$$= 10.34$$

Now,

Mean Deviation about mean is:-

$$MD_{\bar{x}} = \frac{\Sigma f\lvert x-\bar{x}\rvert}{\Sigma f} = \frac{366}{200} = 1.83$$

Mean Deviation about median is:-

$$MD_{Md} = \frac{\Sigma f\lvert x-Md\rvert}{\Sigma f} = \frac{363.5}{200} = 1.8175$$