

## EXERCISES ON CHAPTER 5(I)

## Theory

1. What do you understand by Dispersion? Discuss its importance in Statistics and state also how to measure it.
2. Name any three measures of dispersion that you are acquainted with and describe one of those with a suitable illustration.
3. (a) Explain how Dispersion is measured.  
(b) Explain and illustrate Measures of Dispersion.  
(c) Define Range and Quartile Deviation.
4. Why can't we use  $\frac{\sum x}{n}$  as a measure of dispersion? How does Mean Deviation overcome this problem? How does SD overcome this problem?
5. Describe the absolute measures of dispersion. Discuss their relative advantages and disadvantages.
6. (a) What do you mean by Standard Deviation? [C.U. B.Com. 1996]  
(b) Define Mean Deviation. [C.U. B.Com. 1987; B.U. B.Com. 1990]  
(c) Define Standard Deviation. [V.U. B.Com.(H) 2007]
7. Explain the advantages and disadvantages of the different measures of dispersion.
8. Distinguish between absolute and relative measures of dispersion.
9. What are relative measures of variability of observations? Discuss their various uses.
10. Define Coefficient of Variation. What are the special uses of this measure?
11. Define the terms Coefficient of Variation and Coefficient of Mean Deviation.

## Problems (A)

1. Find the Range of the daily wages of 8 persons in (a) and 10 persons in (b) given below:
  - (a) ₹ 9, ₹ 7, ₹ 25, ₹ 18, ₹ 38, ₹ 12, ₹ 30, ₹ 35;
  - (b) ₹ 24, ₹ 18, ₹ 25, ₹ 16, ₹ 20, ₹ 28, ₹ 22, ₹ 17, ₹ 21, ₹ 27.
2. (a) Find the Quartile Deviation of the monthly income of 7 men given below:  
₹ 350, ₹ 840, ₹ 650, ₹ 710, ₹ 980, ₹ 575, ₹ 290.  
(b) Find the *Quartile Deviation* of the following data:  
12, 10, 17, 14, 19, 21, 27, 30, 32, 28, 34. [C.U. B.Com. 2006]
3. Find the Mean Deviation about the Median of the following:
  - (a) (i) 13, 84, 68, 24, 96, 139, 84, 27;  
(ii) 8, 15, 53, 49, 19, 62, 7, 15, 95, 77.
  - (b) 46, 79, 26, 85, 39, 59, 73. [C.U. B.Com. 2005]



- (c) Find the Mean Deviation about the AM of each of the following distributions:  
 (i) 27, 33, 49, 61, 76, 104, 126;  
 (ii) 29, 35, 51, 63, 78, 106, 128;  
 (iii) 31, 35, 29, 63, 55, 72, 37.
- (d) Find the Mean Deviation about the AM and the Median in respect of the following numbers  
 50, 10, 94, 206, 80. [B.U.B.Com. 1990]
- (e) Find the Mean Deviation about median of the following numbers:  
 46, 79, 26, 85, 39, 65, 99, 29, 56. [V.U.B.Com.(H) 2009]
4. (a) For a set of Ungrouped Values the following sums are found:  $N = 15$ ,  $\Sigma x = 480$ ,  $\Sigma x^2 = 15,735$ . Find the Mean and the Standard Deviation. [C.U.B.Com. 2008]
- (b) Calculate the Variance of 1, 5, 6. [C.U.B.Com. 1990]
- (c) The Standard Deviation of a set of 30 items is 9.5. Find the Standard Deviation if every item is decreased by 5. [CA Foun. Nov. 1998]
- (d) The Standard Deviation of a set of 50 items is 8. Find the standard deviation, if each item is multiplied by 2. [CA Foun. May, 1996]
5. (a) Calculate the Standard Deviation from the following series: 20, 85, 120, 60, 40.  
 (b) Find the Standard Deviation for the following distribution:  
 (i) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10;  
 (ii) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11;  
 (iii) 4, 6, 9, 12, 14, 16, 18, 20, 22.
- (c) Prove that the variance of the first  $n$  positive integers is  $\frac{(n^2-1)}{12}$ .
6. (a) Calculate the Mean Deviation of the following distribution:

Value	5	7	9	11	13	Total
Frequency	4	10	22	10	4	50

- (b) Calculate the Mean Deviation about the Arithmetic Mean of the following distribution:

$x$	5	15	25	35	45	55	65
$f$	4	6	10	20	10	6	4

[C.U.B.Com. 1997]

- (c) Calculate the Mean Deviation about AM of the following series:

Marks ( $x$ )	5	10	15	20	Total
No. of Students ( $f$ )	8	2	4	6	20

7. Find out the Standard Deviation from the following table giving the weights of 200 persons:

Weight in kg	50	55	60	65	70	Total
No. of Mean	30	40	65	50	15	200

8. (a) Find t

(b) Find

9. Find the

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8. (a) Find the Mean Deviation about the median from the following distribution:

Class-intervals	2-6	6-10	10-14	14-18
Frequency	6	8	4	2

- (b) Find the mean deviation about mean of the following distribution:

Class-intervals	2-6	6-10	10-14	14-18
Frequency	6	4	8	2

[C.U. B.Com. 2007]

9. Find the Standard Deviation from the following frequency distribution:

(a)

Daily Wages (₹)	20-24	25-29	30-34	35-39
No. of Workers	16	28	14	12

[C.U. B.Com. 1996]

(b)

Weight (lb)	120-124	125-129	130-134	135-139	140-144	145-149
No. of Boys	12	25	28	15	12	8

[B.U. B.Com. 1999]

(c)

Height (cm)	160-163	164-167	168-171	172-175	176-179	180-183	184-187
No. of Students	22	80	98	148	14	43	5

[C.U. B.Com. 1994]

10. A sample of size 15 has mean 3.5 and standard deviation 3.0. Another sample of size 22 has mean 4.7 and standard deviation 4.0. If the two samples are pooled together, find the mean and the standard deviation of the combined sample.

11. Find the coefficient of mean deviation of the series:

- (a) 10, 20, 40, 60, 70, 100;  
 (b) 487, 508, 620, 382, 408, 266, 186, 218.

12. (a) Find the coefficient of variation of the following values:

- (i) 5, 10, 30, 40, 65;  
 (ii) 40, 30, 80, 60, 50, 90, 70.

- (b) Find Mean if CV = 59% and Variance = 4.

[C.U. B.Com. 2001]

- (c) CV = 60% and Variance = 36, find Mean.

[C.U. B.Com. 2002]

[Hints:  $CV = \frac{SD}{Mean} \times 100\%$  or,  $60\% = \frac{\sqrt{Variance}}{Mean} \times 100\% = \frac{\sqrt{36}}{Mean} \times 100\% = \frac{600}{Mean}$  % or,  $\frac{600}{Mean} = 60$  or,  $Mean = \frac{600}{60} = 10$ .]

### Problems (B)

1. (a) From the following array, find out the Mean Deviation: 7, 9, 16, 24, 26, 31 and 39.

- (b) Find the mean deviation about AM of the first ten natural numbers.

2. (a) The Standard Deviation of 1, 2, 3, ..., n is  $\sqrt{14}$ ; find n.

- (b) If CV = 40% and variance = 16, find mean.

[C.U. B.Com. 2002]



3. Find the Standard Deviation of:

- (a) (i) 4, 5, 6, 6, 7, 8;  
 (ii) 1, 5, 3, 8, 2;

(b) 3, 5, 11, 7, 8, 10, 9, 12, 14, 11;

(c) 240.12, 240.13, 240.15, 240.12, 240.17, 240.15, 240.17, 240.16, 240.22, 240.21.

4. Find out the range of the following data:

Height (inches)	60-62	63-65	66-68	69-71	72-74
No. of Students	8	27	42	18	5

5. (a) Find the Mean Deviation about the AM from the following data:

Daily Wages (₹)	8-11	12-15	16-19	20-23	24-27
No. of Workers	5	11	20	10	4

(b) Calculate the mean deviation from the mean for the following data:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of Students	6	5	8	15	7	6	3

[CA Foun. May 1998]

6. Find the Standard Deviation from the following table:

(a)

x	10	20	30	40	50	60	Total
f	9	18	25	27	14	7	100

[C.U.B.Com. 1991]

(b)

x	62	64	66	68
f	8	13	17	12

[V.U.B.Com.(H) 2007]

[Hints:

x	f	d = x - 65	fd	fd <sup>2</sup>
62	8	-3	-24	72
64	13	-1	-13	13
66	17	1	17	17
68	12	3	36	108
Total	50	—	16	210
	= N		= Σfd	= Σfd <sup>2</sup>

$$SD = \sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2} = \sqrt{\frac{210}{50} - \left(\frac{16}{50}\right)^2}$$

$$= \sqrt{4.2 - (0.32)^2} = \sqrt{4.2 - 0.1024} = \sqrt{4.0976}$$

$$= 2.02]$$

7. (a) Find the Standard Deviation of the following frequency distribution of the daily wages of 500 workers in a factory:

Daily Wages	25	36	45	55	65
No. of Workers	60	130	150	130	30

(b) Find the Standard Deviation from the following table giving the age distribution of 570 members of a Parliament:



Age (Years)	30	40	50	60	70
No. of Members	64	144	164	140	61

[C.U.B.Com. 2000]

8. (a) Find the SD of the following frequency distribution:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of Students	3	13	35	50	15	10	5

[C.U.B.Com. 2007]

(b) Find the Standard Deviation from the following figures:

Marks	No. of Persons	Marks	No. of Persons
0-10	5	40-50	30
10-20	10	50-60	20
20-30	20	60-70	10
30-40	40	70-80	4

(c) Find the AM and SD from the following frequency distribution:

Weekly Wages (₹)	141-150	151-160	161-170	171-180	181-190	191-200	201-210
No. of Workers	5	8	15	25	20	17	10

[N.B.U.B.Com. 1996; Utkal U.B.Com. 2000 Type]

(d) Find the variance of the following frequency distribution:

Marks obtained	20-30	30-40	40-50	50-60	60-70
No. of Students	2	35	46	12	5

[C.U.B.Com. 2008]

9. (a) Find the Standard Deviation from the following frequency distribution:

Heights in inches	No. of Students
Over 60 but not more than 62	35
Over 62 but not more than 64	27
Over 64 but not more than 66	20
Over 66 but not more than 68	13
Over 68 but not more than 70	5
	100

(b) Find the Standard Deviation of the following distribution:

Weight (kg)	45-50	50-55	55-60	60-65	65-70
No. of Persons	10	16	32	28	14

[C.U.B.Com. 1996]



(c) Frequency distribution of marks of 100 students are given below:

Marks	20-29	30-39	40-49	50-59	60-69	70-79	80-89
No. of Students	5	15	18	26	16	14	6

Find the Standard Deviation.

[C.U.B.Com. 2003; H.B.U.B.Com. 1998]

10. Calculate the Variance from the data:

Age (years)	10-19	20-29	30-39	40-49	50-59	60-69
Frequencies	3	61	50	32	20	4

11. Find the Standard Deviation of the following distribution:

Turnover in (₹'000) p.a.	50-100	100-150	150-200	200-250	250-300	300-350	350-400
No. of Firms	5	8	9	12	18	23	17

12. (a) The following table gives the frequency distribution of marks obtained by 150 students in a certain examination:

Marks	No. of Students	Marks	No. of Students
0-10	7	40-50	30
10-20	10	50-60	28
20-30	20	60-70	10
30-40	40	70-80	5

From the above distribution calculate Mean and Standard Deviation and also Coefficient of Variation.

[Agra U.B.Com.]

(b) Find the Standard Deviation of the following distribution:

Weight (pounds)	120-124	125-129	130-134	135-139	140-144	145-149
No. of Students	12	25	28	15	12	8

[C.U.B.Com. 1997]

13. (a) Find the Coefficient of Variation of the following data:

Marks	0-10	10-20	20-30	30-40	40-50
No. of Students	4	10	16	12	8

(b) Find the Coefficient of Variation for the following distribution:

Weight in gm	Frequency	Weight in gm	Frequency
110-119	5	150-159	16
120-129	7	160-169	10
130-139	12	170-179	7
140-149	20	180-189	3



14. From the following data determine in which firm A or B, there is greater variability in individual wages:

	Firm A	Firm B
Average Monthly Wages	₹ 52.50	₹ 47.50
Variance of Distribution of Wages	₹ 100.00	₹ 121.00

15. An analysis of the monthly wages paid to workers in two firms A and B, belonging to the same industry, gives the following results:

	Firm A	Firm B
No. of Wage Earners	500	650
Average Monthly Wages	₹ 50	₹ 45
Standard Deviation of the Distribution of Wages	₹ ( $\sqrt{90}$ )	₹ ( $\sqrt{120}$ )

Answer to the following questions with proper justifications:

- Which firm, A or B, gives a pay out of larger amount as monthly wages?
  - In which firm, A or B, is greater variability in individual wages?
  - What are the measures of: (i) average monthly wages and (ii) standard deviation in the distribution of individual wages of all workers in the two firms taken together?
16. The scores of two batsmen, A and B, in ten innings during a certain season, are as under:

A	32	28	47	63	71	39	10	60	96	14
B	19	31	48	53	67	90	10	62	40	80

Find which of the batsmen is more consistent in scoring.

[C.U.B.Com. 2006]

17. The mean and SD of income of 50 men are ₹ 3200 and ₹ 525 respectively. The same for 40 women are ₹ 2850 and ₹ 460 respectively. Find the SD of income for the combined group. [C.U.B.Com. 2001]

[Hints: Mean ( $\bar{x}$ ) of the combined group is

$$\bar{x} = \frac{n_1 \bar{x}_1 + n_2 \bar{x}_2}{n_1 + n_2} = \frac{50 \times 3200 + 40 \times 2850}{50 + 40} = \frac{274000}{90} = 3044.40.$$

$$d_1 = \bar{x}_1 - \bar{x} = 3200 - 3044.40 = 155.60 \text{ and } d_2 = \bar{x}_2 - \bar{x} = 2850 - 3044.40 = -194.4.$$

$$\text{Now, } \sigma^2 = \frac{n_1 (\sigma_1^2 + d_1^2) + n_2 (\sigma_2^2 + d_2^2)}{n_1 + n_2} = \frac{50 \{ (525)^2 + (155.6)^2 \} + 40 \{ (460)^2 + (-194.4)^2 \}}{50 + 40}, \text{ etc.}]$$

### ANSWERS

#### A

- ₹ 31;
  - ₹ 12.
- ₹ 245;
- (i) 33.88 (approx.);  
(ii) 27.2;
  - 8.
  - 18;
- (i) 29.14;  
(ii)  $29\frac{1}{7}$ ;  
(iii) 14.86;
  - 49.6; 48.

1. Find the range of the following distributions:

(a)

Value	5	10	25	35	50
Frequency	3	8	14	10	5

(b)

Marks	1-10	11-20	21-30	31-40	41-50
No. of Students	8	12	20	10	6

2. Find the Quartile Deviation of the following distributions:

(a)

Heights (inches)	60	62	64	66	68	70	72
No. of Students	4	10	18	26	20	12	5

(b)

Weights (kg)	40-45	45-50	50-55	55-60	60-65	65-70
No. of Men	10	22	28	20	12	8



3. (a) Find out the Arithmetic Mean and Standard Deviation from the following data:

Variable	Frequency	Variable	Frequency
5-10	2	20-25	54
10-15	9	25-30	11
15-20	29	30-35	6

- (b) Calculate the SD ( $\sigma$ ) of the following frequency distribution:  
Wages in a sample of factory workers in Kolkata, 1980.

Weekly Wages (₹)	30-34.99	35-39.99	40-44.99	45-49.99	50-54.99	55-59.99	60-64.99	65-69.99
No. of Employees	3	9	15	27	18	12	9	7

- (c) Calculate the Mean Deviation about the Arithmetic Mean of the following distribution:

$x$	10	11	12	13	14
$f$	1	2	4	2	1

[C.U. B.Com. 1995]

- (d) Define SD. Find the Standard Deviation from the following frequency distribution:

Earned Profit (₹ '000)	50-100	100-150	150-200	200-250	250-300	300-350	350-400
No. of Company	3	8	9	12	18	23	17

[V.U. B.Com. 1997]

4. (a) Two samples of sizes 40 and 50 respectively have the same mean 53, but different standard deviations 19 and 8 respectively. Find the standard deviation of the combined sample of size 90.

- (b) The mean and variance of a group of 250 items was 15.6 and 13.44 respectively. If the mean and standard deviation of 100 of these items are 15 and 3 respectively, find the mean and standard deviation of the remaining 150 items.

[C.U. B.Com. 2004]

[Hints:  $N = 250$ ,  $\bar{x} = 15.6$ ,  $\sigma^2 = 13.44$ ;  $n_1 = 100$ ,  $\bar{x}_1 = 15$ ,  $\sigma_1 = 3$ ,  $\bar{x}_2 = ?$ ,  $\sigma_2 = ?$ ,  $n_2 = 250 - 100 = 150$ ; ( $N = n_1 + n_2$ ).

Now  $\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2} \Rightarrow 15.6 = \frac{100 \times 15 + 150 \times \bar{x}_2}{100 + 150} \Rightarrow 150\bar{x}_2 = 15.6 \times 250 - 1500 = 2400 \Rightarrow \bar{x}_2 = 16$ .

$d_1 = \bar{x}_1 - \bar{x} = 15 - 15.6 = -0.6$ ,  $d_2 = \bar{x}_2 - \bar{x} = 16 - 15.6 = 0.4$ .

Now find  $\sigma_2$  from  $\sigma^2 = \frac{n_1(\sigma_1^2 + d_1^2) + n_2(\sigma_2^2 + d_2^2)}{n_1 + n_2}$ .

5. (a) Calculate the appropriate measure of dispersion from the following data:

Wages in ₹ per Week	No. of Wage Earners
Less than 35	14
35-37	62
38-40	99
41-43	18
Over 43	7



- (b) Find the Mean Deviation from the Mean for the following data:

Class-interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	8	12	10	8	3	2	7

[CA Foun. Nov. 1996]

6. (a) The mean and the standard deviation of a sample of size 10 were found to be 9.5 and 2.5 respectively. Later on an additional observation became available. This was 15.0 and was included in the original sample. Find the mean and the standard deviation of the 11 observations.

[Hints: For the additional observation,  $\bar{x}_2 = \frac{15}{1} = 15$  and  $\sigma_2 = \sqrt{\frac{(15-15)^2}{1}} = 0, n_2 = 1.$ ]

- (b) For a group containing 100 observations, the arithmetic mean and standard deviation are 8 and  $\sqrt{10.5}$ , respectively. For 50 observations selected from these 100 observations the mean and the standard deviations are 10 and 2 respectively. Find the arithmetic mean and the standard deviation of the other half.
- (c) The first of two samples has 100 items with mean 15 and standard deviation 3. If the whole group has 250 items with mean 15.6 and standard deviation  $\sqrt{13.44}$ , find the standard deviation of the second group.
7. (a) A student obtained the mean and SD of 100 observations as 40 and 5.1 respectively. It was later found that he had wrongly copied one observation as 50, the correct figure being 40. Calculate the correct mean and correct SD
- (b) The mean and SD of 20 items is found to be 10 and 2 respectively. At the time of checking it was found that one item 8 was incorrect. Calculate the mean and SD if (i) the wrong item is omitted, and (ii) it is replaced by 12.
- (c) The mean and the standard deviation of a characteristic of 100 items were found to be 60 and 10 respectively. At the time of calculations, two items were wrongly taken as 5 and 45 instead of 30 and 20. Calculate the corrected mean and corrected standard deviation.

[CA Foun. June 1993]

8. In a distribution of 200 boys, where 0-5, 5-10, etc. are groups, mean and standard deviations are 40 and 15 respectively. On checking it was found that the marks obtained by one student was wrongly entered as 53 in place of 43. Find the correct mean and standard deviation.

9. The following table gives the heights of students in a class. Find out the Quartile Deviation:

Heights in inches	50-53	53-56	56-59	59-62	62-65	65-68
No. of Students	2	7	24	7	13	3

10. Prices of a particular commodity in five years in two cities are given below:

Prices in City A	Prices in City B
20	10
22	20
19	18
23	12
26	15



Find from the above data the city which had more stable prices.

11. (a) From the following data calculate Mean and Standard Deviation:

Age Group	No. of Employees
Below 20	20
20-25	26
25-30	44
30-35	60
35-40	101
40-45	109
45-50	84
50-55	56
55 and above	10

What inference will you draw from the above?

- (b) Find the SD of the following distribution:

Weights (kg)	50-52	52-54	54-56	56-58	58-60
No. of Students	17	35	28	15	5

[Hints: See worked-out Ex. 11.]

[C.U. B.Com. 2005]

12. Calculate Quartile Deviation and Standard Deviation from the following data:

Expenditure on Food	No. of Families of Factory Employees
55.5-57.5	2
57.5-59.5	4
59.5-61.5	9
61.5-63.5	30
63.5-65.5	23
65.5-67.5	20
67.5-69.5	9
69.5-71.5	2
71.5-73.5	1

13. Find the Coefficient of Variation of the marks of Business Mathematics and Statistics obtained by the students of a college:

Marks Obtained	20-30	30-40	40-50	50-60	60-70
No. of Students	2	35	46	12	5

[C.U. B.Com. 1994]

14. From the data given below, state which series is more consistent:

Variable	Series A	Series B
10-20	10	18
20-30	18	22
30-40	32	40
40-50	40	32
50-60	22	18
60-70	18	10

15. A purchasing agent obtained samples of incandescent lamps from two suppliers. He had the samples tested in his own laboratory for length of life with the following results:

Length of Life (in hours)	Samples from	
	Co. A	Co. B
700 and under 900	10	3
900 and under 1100	16	42
1100 and under 1300	26	12
1300 and under 1500	8	3

Which company's lamps are more uniform?

16. The number of workers employed, the mean wage (in ₹) p.m. and the standard deviation (in ₹) in each section of a factory are given below. Calculate the mean wage and standard deviation of all workers taken together:

Section	No. of Workers Employed	Mean Wage (in ₹)	Standard Deviation (in ₹)
A	50	113	6
B	60	120	7
C	90	115	8

17. Find the missing information from the following:

	Group I	Group II	Group III	Combined
No.	50	?	90	200
Standard Deviation	6	7	?	7.746
Mean	113	?	115	116

[Hints:  $50 + n_2 + 90 = 200$  or,  $n_2 = 60$ ;  $116 = \bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2 + n_3\bar{x}_3}{n_1 + n_2 + n_3} = \frac{50 \times 113 + 60 \times \bar{x}_2 + 90 \times 115}{200}$ , etc.]

1. (a) 45;  
(b) 50.
2. (a) 2 inches  
(b) 5.17 kg.
3. (a) 21.15, 4  
(b) ₹ 8.76;  
(c) 0.8;  
(d) ₹ 88.48
4. (a) 14;  
(b) Mean :