Date: 12/10/2021

Q1. Find the mean deviation about the mean for the following data:
4, 7, 8, 9, 10, 12, 13, 17.

Q2. Find the mean deviation about the mean for the following data:
15, 17, 10, 13, 7, 18, 9, 6, 14, 11

Q3. Find the mean deviation about the mean for the following data:
12, 3, 18, 17, 4, 9, 17, 19, 20, 15, 8, 17, 2, 3, 16, 11, 3, 1, 0, 5

Q4. Find the mean deviation about the mean for the following data:
6, 7, 10, 12, 13, 4, 8, 12

Q5. Find the mean deviation from the mean for the following data.

x_i	5	10	15	20	25
f_i	7	4	6	3	5

Q6. Find the mean deviation from the mean for the following data:

Classes	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequencies	6	8	14	16	4	2

Q7. Find the mean deviation from the mean for the following data:

Class	10–20	20–30	30 –40	40–50	50–60	60–70	70–80
Frequencies	2	3	8	14	8	3	2

Q8. Find the mean deviation from the mean for the following data:

Classes	0 – 100	100 – 200	200 – 300	300 – 400	400 – 500	500 – 600	600 – 700	700 – 800
Frequencies	4	8	9	10	7	5	4	3

Q9. Find the mean deviation from the mean for the following data:
6.5, 5, 5.25, 5.5, 4.75, 4.5, 6.25, 7.75, 8.5

Q10. Find the mean deviation from the mean for the following data:
38, 70, 48, 40, 42, 55, 63, 46, 54, 44

Q11. Find the mean deviation about the mean for following data:

x_i :	10	30	50	70	90
f_i :	4	24	28	16	8

Q12. Find the mean deviation about the mean for following data:

Height in cm	95–105	105–115	115–125	125–135	135–145	145–155
Number of boys	9	13	26	30	12	10

Q13. Find the mean deviation about the mean for the following data:

x_i	3	5	7	9	11	13
f_i	6	8	15	25	8	4

Q14. Find the mean deviation about the mean for the following data:

x_i	2	5	6	8	10	12
f_i	2	8	10	7	8	5

Date: 12/10/2021

S1. Mean $\bar{x} = \dfrac{4+7+8+9+10+12+13+17}{8} = \dfrac{80}{8} = 10$

Table for Calculation of Mean Deviation

x_i	$\lvert x_i - \bar{x} \rvert = \lvert x_i - 10 \rvert$
4	$\lvert 4 - 10 \rvert = 6$
7	$\lvert 7 - 10 \rvert = 3$
8	$\lvert 8 - 10 \rvert = 2$
9	$\lvert 9 - 10 \rvert = 1$
10	$\lvert 10 - 10 \rvert = 0$
12	$\lvert 12 - 10 \rvert = 2$
13	$\lvert 13 - 10 \rvert = 3$
17	$\lvert 17 - 10 \rvert = 7$
$\sum x_i = 80$	$\sum \lvert x_i - \bar{x} \rvert = 24$

$$\text{Mean deviation } (\bar{x}) = \frac{\sum |x_i - \bar{x}|}{n} = \frac{24}{8} = 3.$$

S2. Let the mean of the given data be $\bar{x}$. Then

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{120}{10} = 12 \qquad [\because \; n = 10]$$

The values of $(x_i - \bar{x})$ are: 3, 5, – 2, 1, – 5, 6, – 3, – 6, 2, – 1.

So, the values of $|x_i - \bar{x}|$ are: 3, 5, 2, 1, 5, 6, 3, 6, 2, 1.

$$\therefore \qquad \text{MD } (\bar{x}) = \frac{\sum_{i=1}^{n} |x_i - \bar{x}|}{n} = \frac{34}{10} = 3.4.$$

S3. We have to first find the mean $(\bar{x})$ of the given data

$$\bar{x} = \frac{1}{20}\sum_{i=1}^{20} x_i = \frac{200}{20} = 10$$

The respective absolute values of the deviations from mean, *i.e.*, $|x_i - \bar{x}|$ are

2, 7, 8, 7, 6, 1, 7, 9, 10, 5, 2, 7, 8, 7, 6, 1, 7, 9, 10, 5

Therefore, $$\sum_{i=1}^{20} |x_i - \bar{x}| = 124$$

and $$\text{M.D. } (\bar{x}) = \frac{124}{20} = 6.2 .$$

S4. We proceed step-wise and get the following:

Step 1: Mean of the given data is

$$\bar{x} = \frac{6+7+10+12+13+4+8+12}{8} = \frac{72}{8} = 9$$

Step 2: The deviations of the respective observations form the mean $\bar{x}$, *i.e.*, $x_i - \bar{x}$ are

$6-9,\ 7-9,\ 10-9,\ 12-9,\ 13-9,\ 4-9,\ 8-9,\ 12-9$

or $-3,\ -2,\ 1,\ 3,\ 4,\ -5,\ -1,\ 3$

Step 3: The absolute values of the deviations, *i.e.*, $|x_i - \bar{x}|$ are

$3,\ 2,\ 1,\ 3,\ 4,\ 5,\ 1,\ 3$

Step 4: The required mean deviation about the mean is

$$\text{M.D. } (\bar{x}) = \frac{\sum_{i=1}^{8} |x_i - \bar{x}|}{8}$$

$$= \frac{3+2+1+3+4+5+1+3}{8} = \frac{22}{8} = 2.75 .$$

S5. Calculation of mean deviation about mean.

x_i	f_i	$f_i x_i$	$\lvert x_i - \bar{x} \rvert$	$f_i \lvert x_i - \bar{x} \rvert$
5	7	35	|5 – 14| = 9	63
10	4	40	|10 – 14| = 4	16
15	6	90	|15 – 14| = 1	6
20	3	60	|20 – 14| = 6	18
25	5	125	|25 – 14| = 11	55
Total	**25**	**350**		**158**

$$\text{Mean} = \bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{350}{25} = 14$$

$$\therefore \text{Mean deviation from the mean} = \frac{\sum f_i |x_i - \bar{x}|}{\sum f_i} = \frac{158}{25} = 6.32.$$

S6. **First Method:** We construct the following table:

Classes	x_i	f_i	$f_i\,x_i$	$\lvert x_i - \bar{x}\rvert$	$f_i\lvert x_i - \bar{x}\rvert$
0 – 10	5	6	30	$\lvert 5-27\rvert = 22$	132
10 – 20	15	8	120	$\lvert 15-27\rvert = 12$	96
20 – 30	25	14	350	$\lvert 25-27\rvert = 2$	28
30 – 40	35	16	560	$\lvert 35-27\rvert = 8$	128
40 – 50	45	4	180	$\lvert 45-27\rvert = 18$	72
50 – 60	55	2	110	$\lvert 55-27\rvert = 28$	56
Total		**50**	**1350**		**512**

Therefore $$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1350}{50} = 27$$

Mean deviation from the mean $$= \frac{\sum f_i\lvert x_i - \bar{x}\rvert}{\sum f_i} = \frac{512}{50} = 10.24.$$

Second Method: We could have avoided tedious calculations of computing $\bar{x}$ by following step deviation method. Let the assumed mean of the data be 25.

Classes	Mid values x_i	$d_i = \frac{x_i - 25}{10}$	Frequencies	$f_i d_i$	$\lvert x_i - \bar{x}\rvert$	$f_i\lvert x_i - \bar{x}\rvert$
0 – 10	5	– 2	6	– 12	22	132
10 – 20	15	– 1	8	– 8	12	96
20 – 30	25	0	14	0	2	28
30 – 40	35	1	16	16	8	128
40 – 50	45	2	4	8	18	72
50 – 60	55	3	2	6	28	56
Total			**50**	**10**		**512**

Mean, $$\bar{x} = \frac{\sum f_i d_i}{\sum f_i} \times \text{class size} = 25 + \frac{10}{50} \times 12 = 25 + 2 = 27$$

Mean deviation from the mean $$= \frac{\sum f_i\lvert x_i - \bar{x}\rvert}{\sum f_i} = \frac{512}{50} = 10.24.$$

S7.

Class	Mid values x_i	$d_i = \frac{x_i - 45}{10}$	f_i	$f_i d_i$	$\lvert x_i - \bar{x} \rvert$	$f_i \lvert x_i - \bar{x} \rvert$
10–20	15	– 3	2	– 6	30	60
20–30	25	– 2	3	– 6	20	60
30–40	35	– 1	8	– 8	10	80
40–50	45	0	14	0	8	0
50–60	55	1	8	8	10	80
60–70	65	2	3	6	20	60
70–80	75	3	2	6	30	60
Total			**40**	**0**		**400**

Therefore $$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i} \times h = 45 + 0 = 45$$

Mean deviation from the mean = $\frac{\sum f_i \lvert x_i - \bar{x} \rvert}{\sum f_i} = \frac{400}{40} = 10$

S8. Assume Mean (a) = 350

Classes	Mid values	$d_i = \frac{x_i - 350}{100}$	Frequencies (f_i)	$f_i d_i$	$\lvert x_i - \bar{x} \rvert$	$f_i \lvert x_i - \bar{x} \rvert$
0–100	50	– 3	4	– 12	308	1232
100–200	150	– 2	8	–16	208	1664
200–300	250	– 1	9	– 9	108	972
300–400	350	0	10	0	8	80
400–500	450	1	7	7	92	644
500–600	550	2	5	10	192	960
600–700	650	3	4	12	292	1168
700–800	750	4	3	12	392	1176
Total			**50**	**4**		**7896**

Here, $$d_i = \frac{x_i - \text{Assumed mean}}{\text{class size}} = \frac{x_i - 350}{100}$$

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i} \times \text{class size}$$

$$\Rightarrow \qquad \bar{x} = 350 + \frac{4}{50} \times 100 = 350 + 8 = 358$$

$$\text{Mean deviation from the mean} = \frac{\sum f_i |x_i - \bar{x}|}{\sum f_i} = \frac{7896}{50} = 157.92$$

S9. Let $\bar{x}$ be the mean of the given data. Then,

$$\bar{x} = \frac{6.5 + 5 + 5.25 + 5.5 + 4.75 + 4.5 + 6.25 + 7.75 + 8.5}{9}$$

$$= \frac{54.00}{9} = 6$$

Calculation of mean deviation

x_i	$x_i - \bar{x}$	$\lvert x_i - \bar{x} \rvert$
6.5	$6.5 - 6 = -0.5$	0.50
5.0	$5 - 6 = -1$	1.00
5.25	$5.25 - 6 = -0.75$	0.75
5.5	$5.5 - 6 = -0.5$	0.50
4.75	$4.75 - 6 = -1.25$	1.25
4.5	$4.5 - 6 = -1.5$	1.50
6.25	$6.25 - 6 = 0.25$	0.25
7.75	$7.75 - 6 = 1.75$	1.75
8.5	$8.5 - 6 = 2.5$	2.50
	Total	**10.00**

$$\text{Hence, Mean deviation from the mean} = \frac{\sum |x_i - \bar{x}|}{n} = \frac{10}{9} = 1.1$$

S10. We proceed with following steps:

Step - I: $$\bar{x} = \frac{38 + 70 + 48 + 40 + 42 + 55 + 63 + 46 + 54 + 44}{10}$$

$$= \frac{500}{10} = 50$$

Step - II: The deviation of the respective observation from the mean $\bar{x}$.

x_i	$x_i - \bar{x}$	$\|x_i - \bar{x}\|$
38	$38 - 50 = -12$	12
70	$70 - 50 = 20$	20
48	$48 - 50 = -2$	2
40	$40 - 50 = -10$	10
42	$42 - 50 = -8$	8
55	$55 - 50 = 5$	5
63	$63 - 50 = 13$	13
46	$46 - 50 = -4$	4
54	$54 - 50 = 4$	4
44	$44 - 50 = -6$	6
	Total 84	

Step - III: $$\sum_{i=1}^{10} |x_i - \bar{x}| = 84$$

Step - IV: Mean deviation from the mean = $\dfrac{\sum_{i=1}^{10} |x_i - \bar{x}|}{10} = \dfrac{84}{10} = 8.4$

S11.

x_i	f_i	$f_i x_i$	$\|x_i - \bar{x}\|$	$f_i \|x_i - \bar{x}\|$
10	4	40	40	160
30	24	720	20	480
50	28	1400	0	0
70	16	1120	20	320
90	8	720	40	320
Total	80	4000		1280

Therefore $$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{4000}{80} = 50$$

Mean deviation from the mean = $\dfrac{\sum f_i |x_i - \bar{x}|}{\sum f_i} = \dfrac{1280}{80} = 16$

S12.

Classes	Mid values x_i	$d_i = \frac{x_i - 130}{10}$	Frequency (f_i)	$f_i d_i$	$\lvert x_i - \bar{x} \rvert$	$f_i \lvert x_i - \bar{x} \rvert$
95–105	100	– 3	9	– 27	25.8	227.7
105–115	110	– 2	13	– 26	15.3	198.9
115–125	120	– 1	26	– 26	5.3	137.8
125–135	130	0	30	0	4.7	141.0
135–145	140	1	12	12	14.7	176.4
145–155	150	2	10	20	24.7	247.0
Total			**100**	**– 47**		**1128.8**

Let the assumed mean = 130, $d_i = \frac{x_i - 130}{10}$

$$\bar{x} = 130 + \frac{\sum f_i d_i}{\sum f_i} \times 10 = 130 + \frac{-47}{100} \times 10$$

$$= 130 - 4.7 = 125.3$$

Mean deviation from the mean = $\frac{\sum f_i |x_i - \bar{x}|}{\sum f_i} = \frac{1128.8}{100} = 11.288.$

S13. We have

$$N = \sum_{i=1}^{6} f_i = (6 + 8 + 15 + 25 + 8 + 4) = 66$$

$$\bar{x} = \frac{\sum_{i=1}^{6} f_i x_i}{N} = \frac{(6 \times 3) + (8 \times 5) + (15 \times 7) + (25 \times 9) + (8 \times 11) + (4 \times 13)}{66}$$

$$= \frac{528}{66} = 8$$

Now, we prepare the table given below:

x_i	f_i	$\|x_i - \bar{x}\|$	$\sum_{i=1}^{6} f_i \|x_i - \bar{x}\|$
3	6	5	30
5	8	3	24
7	15	1	15
9	25	1	25
11	8	3	24
13	4	5	20
***N* = 66, sum = 138**			

$$\therefore \qquad MD(\bar{x}) = \frac{\sum_{i=1}^{6} f_i |x_i - \bar{x}|}{N} = \frac{138}{66} = \frac{23}{11} = 2.09$$

Hence, mean deviation about the mean = 2.09.

S14. Let us make a Table of the given data and append other columns after calculations.

x_i	f_i	$f_i x_i$	$\|x_i - \bar{x}\|$	$f_i \|x_i - \bar{x}\|$
2	2	4	5.5	11
5	8	40	2.5	20
6	10	60	1.5	15
8	7	56	0.5	3.5
10	8	80	2.5	20
12	5	60	4.5	22.5
	40	300		92

$$N = \sum_{i=1}^{6} f_i = 40, \qquad \sum_{i=1}^{6} f_i x_i = 300, \qquad \sum_{i=1}^{6} f_i |x_i - \bar{x}| = 92$$

Therefore $\qquad \bar{x} = \frac{1}{N}\sum_{i=1}^{6} f_i x_i = \frac{1}{40} \times 300 = 7.5$

and $\qquad \text{M.D. } (\bar{x}) = \frac{1}{N}\sum_{i=1}^{6} f_i |x_i - \bar{x}| = \frac{1}{40} \times 92 = 2.3$

Date: 12/10/2021

Q1. Find the mean deviation about the median for the following data:

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of girls	6	8	14	16	4	2

Q2. Find the mean deviation about the median for the following data:

x_i	5	7	9	10	12	15
f_i	8	6	2	2	2	6

Q3. Find the mean deviation about the median for the following data:
36, 72, 46, 42, 60, 45, 53, 46, 51, 49.

Q4. Find the mean deviation about the median for the following data:
13, 17, 16, 14, 11, 13, 10, 16, 11, 18, 12, 17.

Q5. Find the mean deviation about the median for the following data:
3, 9, 5, 3, 12, 10, 18, 4, 7, 19, 21

Q6. Find the mean deviation about the median for the data given below:
11, 3, 8, 7, 5, 14, 10, 2, 9

Q7. Find the mean deviation from the median for the data.
34, 66, 30, 38, 44, 50, 40, 60, 42, 51

Q8. Calculate the mean deviation about the median for the following data:

Class	16–20	21–25	26–30	31–35	36–40	41–45	46–50	51–55
Frequency	5	6	12	14	26	12	16	9

Q9. Calculate the mean deviation about the median for the following data:

Height (in cm)	95–105	105–115	115–125	125–135	135–145	145–155
Number of boys	9	13	25	30	13	10

Q10. Find the mean deviation about the median for the following data:

x_i	3	5	7	9	11	13
f_i	6	8	15	3	8	4

Q11. Find the mean deviation about the median for the data given below:
45, 36, 50, 60, 53, 46, 51, 48, 72, 42

Q12. Calculate the mean deviation from the median for the following data:

Age (on nearest birth day	17–19.5	20–25.5	26–35.5	36–40.5	41–50.5	51–55.5	56–60.5	61–70.5
No. of persons	5	16	12	26	14	12	6	5

Q13. Find the mean deviation from the median for the following data:

x_i	74	89	42	54	91	94	35
f_i	20	12	2	4	5	3	4

Q14. Calculate the mean deviation from the median of the following data:

Wages per week (in Rs)	10–20	20–30	30–40	40–50	50–60	60–70	70–80
No. of workers	4	6	10	20	10	6	4

Q15. Find the mean deviation from the median for the following data:

x_i	15	21	27	30	35
f_i	3	5	6	7	8

Q16. The scores of a batsman in ten innings are:

48, 80, 58, 44, 52, 65, 73, 56, 64, 54

Find the mean deviation from the median.

Q17. Calculate the mean deviation about median for the following data:

Class	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	6	7	15	16	4	2

Q18. Find the mean deviation about the median for the following data:

x_i	3	6	9	12	13	15	21	22
f_i	3	4	5	2	4	5	4	3

Q19. The following table gives the less than cumulative frequencies of 199 workers, each of age 20 years or more in a factory:

Age below in years	25	30	35	40	45	50	55	60	65	70
Frequency	21	40	90	130	146	166	176	186	195	199

Find mean deviation from the median.

Date: 12/10/2021

S1. Here, $N = 50$. Median Observation = $\frac{N}{2} = \frac{50}{2}$ = 25th, which corresponds to 20 – 30.

Therefore, Median Class is 20 – 30.

$$\text{Median} = l + \frac{h}{f}\left(\frac{N}{2} - C\right) = 20 + \frac{10}{14}(25 - 14)$$

$$= 27.85$$

Table for Calculation of Mean Deviation

Marks	f_i	x_i	$c.f.$	$\|x_i - M\|$	$f_i \|x_i - M\|$
0 – 10	6	5	6	$\|5 - 27.85\| = 22.85$	137.1
10 – 20	8	15	14	$\|15 - 27.85\| = 12.85$	102.8
20 – 30	14	25	28	$\|25 - 27.85\| = 2.85$	39.9
30 – 40	16	35	44	$\|35 - 27.85\| = 7.15$	114.4
40 – 50	4	45	48	$\|45 - 27.85\| = 17.15$	68.6
50 – 60	2	55	50	$\|55 - 27.85\| = 27.15$	54.3
	$\sum f_i = 50$				$\sum f_i \|x_i - M\| = 517.1$

$$\text{Mean deviation (M)} = \frac{\sum f_i |x_i - M|}{\sum f_i} = \frac{517.1}{50} = 10.34.$$

S2. Here, $n = 26$ which is even.

Middle observations are $\frac{26}{2}$ and $\frac{26}{2} + 1$, *i.e.*, 13th and 14th observations.

13th observation = 7, 14th observation = 7.

$$\text{Median} = \frac{7+7}{2} = 7$$

Table for Calculation of Mean Deviation

x_i	f_i	$c.f.$	$\lvert x_i - M \rvert = \lvert x_i - 7 \rvert$	$f_i \lvert x_i - 7 \rvert$
5	8	8	$\lvert 5 - 7 \rvert = 2$	16
7	6	14	$\lvert 7 - 7 \rvert = 0$	0
9	2	16	$\lvert 9 - 7 \rvert = 2$	4
10	2	18	$\lvert 10 - 7 \rvert = 3$	6
12	2	20	$\lvert 12 - 7 \rvert = 5$	10
15	6	26	$\lvert 15 - 7 \rvert = 8$	48
	$\sum f_i = 26$			$\sum f_i \lvert x_i - M \rvert = 84$

$$\text{Mean deviation (M)} = \frac{\sum f_i \lvert x_i - M \rvert}{\sum f_i} = \frac{84}{26} = 2.23.$$

S3. Data arranged in ascending order as:

36, 42, 45, 46, 46, 49, 51, 53, 60, 72

$n = 10$, which is even

Middle observations are $\frac{10}{2}$ and $\frac{10}{2} + 1$, *i.e.*, 5^{th} and 6^{th} observations

Now, 5^{th} observation = 46, 6^{th} observation = 49

Hence, $\text{Median} = \frac{46 + 49}{2} = 47.5$

Table for Calculation of Mean Deviation

x_i	$\lvert x_i - M \rvert$
36	$\lvert 36 - 47.5 \rvert = 11.5$
42	$\lvert 42 - 47.5 \rvert = 5.5$
45	$\lvert 45 - 47.5 \rvert = 2.5$
46	$\lvert 46 - 47.5 \rvert = 1.5$
46	$\lvert 46 - 47.5 \rvert = 1.5$
49	$\lvert 49 - 47.5 \rvert = 1.5$
51	$\lvert 51 - 47.5 \rvert = 3.5$
53	$\lvert 53 - 47.5 \rvert = 5.5$
60	$\lvert 60 - 47.51 \rvert = 12.5$
72	$\lvert 72 - 47.51 \rvert = 24.5$
Total	$\sum \lvert x_i - M \rvert = 70.0$

$$\text{Mean deviation } (M) = \frac{\sum \lvert x_i - M \rvert}{n} = \frac{70}{10} = 7.$$

S4. Data arranged in ascendings order as:

10, 11, 11, 12, 13, 13, 14, 16, 16, 17, 17, 18

$n = 12$, which is even

Middle observations are $\frac{12}{2}$ and $\frac{12}{2} + 1$, *i.e.*, 6^{th} and 7^{th} observations

6^{th} observation = 13, 7^{th} observation = 14

Hence, Median = $\frac{13+14}{2} = 13.5$

Table for Calculation of Mean Deviation

x_i	$\lvert x_i - 13.5 \rvert$
10	$\lvert 10 - 13.5 \rvert = 3.5$
11	$\lvert 11 - 13.5 \rvert = 2.5$
11	$\lvert 11 - 13.5 \rvert = 2.5$
12	$\lvert 12 - 13.5 \rvert = 1.5$
13	$\lvert 13 - 13.5 \rvert = 0.5$
13	$\lvert 13 - 13.5 \rvert = 0.5$
14	$\lvert 14 - 13.5 \rvert = 0.5$
16	$\lvert 16 - 13.5 \rvert = 2.5$
16	$\lvert 16 - 13.5 \rvert = 2.5$
17	$\lvert 17 - 13.5 \rvert = 3.5$
17	$\lvert 17 - 13.5 \rvert = 3.5$
18	$\lvert 18 - 13.5 \rvert = 4.5$
Total	$\sum \lvert x_i - M \rvert = 28.0$

$$\text{Mean deviation } (M) = \frac{\sum |x_i - M|}{n} = \frac{28}{12} = 2.33.$$

S5. Here the number of observations is 11 which odd. Arranging the data into ascending order, we have

3, 3, 4, 5, 7, 9, 10, 12, 18, 19, 21

Now, Median = $\left(\frac{11+1}{2}\right)^{th}$ or 6^{th} observation = 9

The absolute values of the respective deviations from the median, *i.e.*, $x_i - M$ are

6, 6, 5, 4, 2, 0, 1, 3, 9, 10, 12

Therefore, $\sum_{i=1}^{11} x_i - M = 58$

and $\text{M.D. } (M) = \frac{1}{11}\sum_{i=1}^{11}|x_i - M| = \frac{1}{11} \times 58 = 5.27$.

S6. Arranging the given data in an ascending order, we get:

2, 3, 8, 7, 8, 9, 10, 11, 14

Here, $n = 9$, which is odd.

$\therefore$ median = $\frac{1}{2}(n+1)^{th}$ observation

$= \frac{1}{2}(9+1)^{th}$ observation = 5^{th} observation = 8

Thus, $M = 8$

The values of $(x_i - M)$ are:

$-6, -5, -3, -1, 0, 1, 2, 3, 6$

$$\therefore \quad \sum_{i=1}^{9} |x_i - M| = (6 + 5 + 3 + 1 + 0 + 1 + 2 + 3 + 6) = 27$$

$$\Rightarrow \quad MD(M) = \frac{\sum_{i=1}^{9} |x_i - M|}{9} = \frac{27}{9} = 3$$

Hence, $MD(M) = 3$.

S7. Arranging the data in ascending order, we have

30, 34, 38, 40, 42, 44, 50, 51, 60, 66

Here, $n = 10$, which is even, so median is the mean of $\left(\frac{n}{2}\right)^{th}$ term and $\left(\frac{n}{2}+1\right)^{th}$ term in the arranged data.

$$\text{So,} \quad \text{Median} = \frac{42+44}{2} = 43$$

Now,

f_i	$x_i - 43$	$\lvert x_i - 43 \rvert$
30	30 – 43 = – 13	13
34	34 – 43 = – 9	9
38	38 – 43 = – 5	5
40	40 – 43 = – 3	3
42	42 – 43 = – 1	1
44	44 – 43 = 1	1
50	50 – 43 = 7	7
51	51 – 43 = 8	8
60	60 – 43 = 17	17
66	66 – 43 = 23	23
	Total	**87**

As such, mean deviation from the median

$$= \frac{\sum |x_i - \text{Median}|}{n} = \frac{\sum |x_i - 43|}{n} = \frac{87}{10} = 8.7$$

S8. Converting the given series into an exclusive series, we prepare the table, given below:

Class	Frequency f_i	Cumulative frequency c	Midpoint x_i
15.5 – 20.5	5	5	18
20.5 – 25.5	6	11	23
25.5 – 30.5	12	23	28
30.5 – 35.5	14	37	33
35.5 – 40.5	26	63	38
40.5 – 45.5	12	75	43
45.5 – 50.5	16	91	48
50.5 – 55.5	9	100	53
	$N = 100$		

Thus, $N = 100$ and therefore, $\frac{N}{2} = 50$

$\Rightarrow$ median class is 35.5 – 40.5

$\Rightarrow$ $L = 35.5$, $f = 26$, $h = 5$ and $c = 37$

$$\therefore \quad \text{median} = L + \frac{\left(\frac{N}{2} - c\right)}{f} \times h$$

$$= \left\{35.5 + \frac{(50 - 37)}{26} \times 5\right\} = (35.5 + 2.5) = 38$$

Thus, $M = 38$

Now, we prepare the table given below.

f_i	x_i	$\lvert x_i - M \rvert$	$f_i \times \lvert x_i - M \rvert$
5	18	20	100
6	23	15	90
12	28	10	120
14	33	5	70
26	38	0	0
12	43	5	60
16	48	10	160
9	53	15	135
$N = 100$			735

Thus, $\sum f_i \times |x_i - M| = 725$ and $N = 100$

$\therefore$ $$MD\ (M) = \frac{\sum f_i \times |x_i - M|}{N} = \frac{735}{100} = 7.35$$

Hence, the mean deviation about the median is 7.35.

S9. First we find the median.

Class	Frequency f_i	Cumulative frequency c	Midpoint x_i
95 – 105	9	9	100
105 –115	13	22	110
115 – 125	25	47	120
125 – 135	30	77	130
135 – 145	13	90	140
145 – 155	10	100	150
	$N = \sum f_i = 100$		

Thus, $N = 100$ and therefore, $\frac{N}{2} = 50$

$\Rightarrow$ median class is 125 – 135

$\Rightarrow$ $L = 125$, $f = 30$, $h = 10$ and $c = 47$

$\therefore$ $$\text{median} = L + \frac{\left(\frac{N}{2} - c\right)}{f} \times h$$

$$= \left\{125 + \frac{(50 - 47)}{30} \times 10\right\} = (125 + 1) = 126$$

$\therefore$ $M = 126$

Now, we prepare the table given below.

f_i	x_i	$\lvert x_i - M \rvert$	$f_i \times \lvert x_i - M \rvert$
9	100	26	234
13	110	16	208
25	120	6	150
30	130	4	120
13	140	14	182
10	150	24	240
$N = 100$			1135

$\therefore \quad MD(M) = \frac{\sum f_i \times |x_i - M|}{N} = \frac{1134}{100} = 11.34$

Hence, the mean deviation about the median is 11.34

S10. We have

$$N = \sum_{i=1}^{6} f_i = (6 + 8 + 15 + 3 + 8 + 4) = 44$$

$$\bar{x} = \frac{\sum_{i=1}^{6} f_i x_i}{N}$$

$$= \frac{(6 \times 3) + (8 \times 5) + (15 \times 7) + (3 \times 9) + (8 \times 11) + (4 \times 13)}{44}$$

$$= \frac{(18 + 40 + 105 + 27 + 88 + 52)}{44} = \frac{330}{44} = \frac{15}{2} = 7.5$$

x_i	3	5	7	9	11	13
f_i	6	8	15	3	8	4
cf	6	14	29	32	40	44

$N = 44$, which is even.

$\therefore \quad \text{median} = \frac{1}{2} \cdot \left\{\frac{N}{2}\text{th observation} + \left(\frac{N}{2} + 1\right)\text{th observation}\right\}$

$$= \frac{1}{2}\,(22\text{nd observation} + 23\text{rd observation})$$

$$= \frac{1}{2}(7 + 7) = 7$$

Thus, $M = 7$

Now, we have:

$\lvert x_i - M \rvert$	4	2	0	2	4	6
f_i	6	8	15	3	8	4
$f_i \lvert x_i - M \rvert$	24	16	0	6	32	24

$\therefore \quad \sum_{i=1}^{6} f_i = 44 \quad \text{and} \quad \sum_{i=1}^{6} f_i \,|x_i - M|$

$$\therefore \qquad MD(\bar{x}) = \frac{\sum_{i=1}^{6} f_i |x_i - M|}{N} = \frac{102}{44} = 2.32$$

Hence, the mean deviation about the median is 2.32.

S11. Arranging the given data in an ascending order, we get:

36, 42, 45, 46, 48, 50, 51, 53, 60, 72

Here, $n = 10$, which is even

$$\therefore \quad \text{median} = \frac{1}{2}\cdot\left\{\left(\frac{n}{2}\right)^{th} \text{observation} + \left(\frac{n}{2}+1\right)^{th} \text{observation}\right\} = \frac{1}{2}\cdot\left(48 + 50\right) = 49$$

The values of $(x_i - M)$ are:

– 13, – 7, – 4, – 3, – 1, 1, 2, 4, 11, 23

$$\therefore \qquad \sum_{i=1}^{10} |x_i - M| = (13 + 7 + 4 + 3 + 1 + 1 + 2 + 4 + 11 + 23) = 69$$

$$\Rightarrow \qquad MD(M) = \frac{\sum_{i=1}^{10} |x_i - M|}{10} = \frac{69}{10} = 6.9$$

Hence, $MD(M) = 3$

S12. First we make the clean intervals continuous by adding 0.25 to upper limit and subtracting 0.25 from the lower limits of the classes.

Age	Mid Values x_i	Frequency f_i	$C.f.$	$\lvert x_i - 38.63\rvert$	$f_i \lvert x_i - 38.63\rvert$
16.75 – 19.75	18.25	5	5	20.38	101.9
19.75 – 25.75	22.75	16	21	15.88	254.08
25.75 – 35.75	30.75	12	33	7.88	94.56
35.75 – 40.75	38.25	26	59	0.38	9.88
40.75 – 50.75	45.75	14	73	7.12	99.68
50.75 – 55.75	53.25	12	85	14.62	175.44
55.75 – 60.75	58.25	6	91	19.62	117.72
60.75 – 70.75	65.75	5	96	27.12	135.60
	Total	96			988.86

Hence $N = 96, \quad \frac{N}{2} = 48$

The cumulative frequency just greater than 48 is 59. The correspoding class is 35.75 – 40.75. So 35.75 – 40.75 is the median class

$\therefore$ $l = 35.75,\ f = 26,\ h = 5,\ F = 33,\ N = 96$

$$\text{Median} = l + \frac{\frac{N}{2} - F}{f} \times h = 35.75 + \frac{48 - 33}{26} \times 5 = 38.63 \text{ m}$$

$$\therefore \quad \text{Mean deviation from median} = \frac{\sum f_i\,|x_i - 38.63|}{\sum f_i} = \frac{988.86}{96} = 10.3006$$

S13. First we calculate median.

x_i	f_i	c.f.	$\lvert x_i - 74 \rvert$	$f_i \lvert x_i - 74 \rvert$
35	4	4	39	156
42	2	6	32	64
54	4	10	20	80
74	20	30	0	0
89	12	42	15	180
91	5	47	17	85
94	3	50	20	60
Total	**50**			**625**

Since, $N = \sum f_i = 50$ and $\frac{N}{2} = 25$

The cumulative frequency just greater than $\frac{N}{2} = 25$ is 30 and the value of x corresponding to 30 is 47. So the median is 74.

$$\therefore \quad \text{Mean deviation from median} = \frac{\sum f_i\,|x_i - 74|}{\sum f_i} = \frac{625}{50} = 12.5$$

S14. Calculation of Mean Deviation from Median.

Wages Per week (in Rs)	Mid-Values x_i	frequency f_i	Cumulative frequency	$\lvert x_i - 45 \rvert$	$f \lvert x_i - 45 \rvert$
10 – 20	15	4	4	30	120
20 – 30	25	6	10	20	120
30 – 40	35	10	20	10	100
40 – 50	45	20	40	0	0
50 – 60	55	10	50	10	100
60 – 70	65	6	56	20	120
70 – 80	75	4	60	30	120
	Total	$\mathbf{N = \sum f_i = 60}$			$\mathbf{\sum f_i \lvert x_i - 45 \rvert = 680}$

Here, $N = 60$; So, $\frac{N}{2} = 30$

The cumulative frequency just greater than $\frac{N}{2} = 30$ is 40 and the corresponding class is 40 – 50. So, 40 – 50 is the median class.

$\therefore \quad l = 40,\ f = 20,\ h = 10,\ F = 20,\ N = 60$

Now, $$\text{Median} = l + \frac{\frac{N}{2} - F}{f} \times h = 40 + \frac{30 - 20}{20} = 45$$

$$\text{Mean deviation from median} = \frac{680}{60} = 11.33$$

S15. We have to calculate mean deviations about median. So, first we calculate median.

x_i	f_i	**Cumulative frequency**	**| x_i – Median |**	**f_i | x_i – Median |**
15	3	3	15	45
21	5	8	9	45
27	6	14	3	18
30	7	21	0	0
35	8	29	5	40
	Total		**32**	**148**

Since, $n = \sum f_i = 29$ is odd, the median is the $\left(\frac{n+1}{2}\right)^{th}$ observation *i.e.*, $\frac{29+1}{2} = 15^{th}$ observation, which is equal to 30. Thus, median is 30.

Therefore, Mean deviation from the median

$$= \frac{\sum f_i |x_i - 30|}{\sum f_i} = \frac{148}{29} = 5.1$$

S16. Arranging the data in ascending order, we have

44, 48, 52, 54, 56, 58, 64, 65, 73, 80

Here, $n = 10$. So, median is the mean of 5^{th} and 6^{th} terms

$\therefore$ Median $M = \left(\frac{56 + 58}{2}\right) = 57$

Scores (x_i)	Deviations from the median $x_i - M$	Absolute values of deviations $\lvert x_i - M \rvert$
44	44 – 57 = – 13	13
48	48 – 57 = – 9	9
52	52 – 57 = – 5	5
54	54 – 57 = – 3	3
56	56 – 57 = – 1	1
58	58 – 57 = 1	1
64	64 – 57 = 7	7
65	65 – 57 = 8	8
73	73 – 57 = 16	16
80	80 – 57 = 23	23
	Total	**86**

$$\text{Mean deviation} = \frac{\sum |x_i - M|}{n} = \frac{86}{10} = 8.6$$

S17. From the following table from the given data

Class	Cumulative frequency	Frequency	Mid-points	$\lvert x_i - \text{Med.}\rvert$	$f_i \lvert x_i - \text{Med.}\rvert$
	f_i	$(c.f.)$	x_i		
0-10	6	6	5	23	138
10-20	7	13	15	13	91
20-30	15	28	25	3	45
30-40	16	44	35	7	112
40-50	4	48	45	17	68
50-60	2	50	55	27	54
	50				508

The class interval containing $\frac{N^{th}}{2}$ or 25^{th} item is 20-30. Therefore, 20-30 is the median class.

We know that

$$\text{Median} = l + \frac{\frac{N}{2} - C}{f} \times h$$

Here, $l = 20$, $C = 13$, $f = 15$, $h = 10$ and $N = 50$.

Therefore, $$\text{Median} = 20 + \frac{25 - 13}{15} \times 10 = 20 + 8 = 28$$

Thus, Mean deviation about median is given by

$$\text{M.D. }(M) = \frac{1}{N}\sum_{i=1}^{6} f_i\left|x_i - M\right| = \frac{1}{50}\times 508 = 10.16\,.$$

S18. The given observations are already in ascending order. Adding a row corresponding to cumulative frequencies to the given data, we get (see Table)

x_i	3	6	9	12	13	15	21	22
f_i	3	4	5	2	4	5	4	3
$c.f.$	3	7	12	14	18	23	27	30

Now, N = 30 which is even.

Median is the mean of the 15th and 16th observations. Both of these observations lie in the cumulative frequency 18, for which the corresponding observation is 13.

Therefore $$\text{Median } M = \frac{15^{\text{th}}\text{ observation} + 16^{\text{th}}\text{ observation}}{2} = \frac{13+13}{2} = 13$$

Now, absolute values of the deviations from median, *i.e.*, $|x_i - M|$ are shown in the table

$\lvert x_i - M\rvert$	10	7	4	1	0	2	8	9
f_i	3	4	5	2	4	5	4	3
$f_i\lvert x_i - M\rvert$	30	28	20	2	0	10	32	27

We have $$\sum_{i=1}^{8} f_i = 30 \quad\text{and}\quad \sum_{i=1}^{8} f_i\left|x_i - M\right| = 149$$

Therefore, $$\text{M.D. }(M) = \frac{1}{N}\sum_{i=1}^{8} f_i\left|x_i - M\right|$$

$$= \frac{1}{30}\times 149 = 4.97\,.$$

S19. First we make class intervals find frequencies from cumulative frequencies.

Age Below in yrs	classes	Mid values x_i	Cumulative frequency	Frequency f_i	$\|x_i - 36.19\|$	$f_i \|x_i - 36.19\|$
25	20 – 25	22.5	21	21	13.69	287.49
30	25 – 30	27.5	40	19	8.69	165.11
35	30 – 35	32.5	90	50	3.69	184.50
40	35 – 40	37.5	130	40	1.31	52.4
45	40 – 45	42.5	146	16	6.31	100.96
50	45 – 50	47.5	166	20	11.31	226.20
55	50 – 55	52.5	176	10	16.31	163.10
60	55 – 60	57.5	186	10	21.31	213.10
65	60 – 65	62.5	195	9	26.31	236.79
70	65 – 70	67.5	199	4	31.31	125.21
Total				199		1754.89

Here $N = 199, \frac{N}{2} = 99.5$

The cumulative frequency just greater than 99.5 is 130. The corresponding class is 35 – 40. So, 35 – 40 is the median class.

$\therefore$ $l = 35, f = 40, h = 5, F = 90, N = 199$

$$\text{Median} = l + \frac{\frac{N}{2} - F}{f} \times h = 35 + \frac{99.5 - 90}{40} \times 5 = 36.19$$

$\therefore$ Mean deviation from median $= \frac{\sum f_i |x_i - 36.19|}{\sum f_i} = \frac{1754.89}{199} = 8.819$

Date: 12/10/2021

Q1. Calculate the mean and standard deviation for the following data:

Wages upto (in Rs.)	15	30	45	60	75	90	105	120
No. of Workers	12	30	65	107	157	202	222	230

Q2. Calculate the standard deviation of the following table:

Length of wire (in cm)	No. of wires
72.0 – 73.9	7
74.0 – 75.9	31
76.0 – 77.9	42
78.0 – 79.9	54
80.0 – 81.9	33
82.0 – 83.9	24
84.0 – 85.9	22
86.0 – 87.9	8
88.0 – 89.9	4

Q3. The diameter of circle (in mm) drawn in a design are given below:

Diameter (in mm)	33 – 36	37 – 40	41 – 44	45 – 48	49 – 52
No. of circles	15	17	21	22	25

Calculate the standard deviation and mean diameter of the circles.

Q4. Find the mean, variance and standard deviation for the following data:

Height (*in cms*)	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	110-115
No. of children	3	4	7	7	15	9	6	6	3

Q5.

Classes	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	8	15	16	6

Calculate the mean and variance for following data.

Q6. For a frequency distribution of marks in History of 200 candidates (grouped in intervals 0 – 5, 5 – 10, ...) the mean and standard deviation were found to be 40 and 15. Later it was discovered that the score 43 was misread as 53 in obtaining the frequency distribution. Find the corrected mean and S.D. corresponding to the corrected frequency distribution.

Q7. From the data given below state which group is more variable, *A* or *B*?

Marks	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
Group A	9	17	32	33	40	10	9
Broup B	10	20	30	25	43	15	7

Q8. An analysis of 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	586	648
Mean of monthly wages	Rs. 5253	R. 5253
Variance of the distribution of wages	100	121

(i) Which firm *A* or *B* pays out larger amount as monthly wages?

(ii) Which firm *A* or *B*, shows greater variability in individual wages?

Date: 12/10/2021

S1. We are given the cumulative frequency distribution. So, first we will prepare the frequency distribution as given below:

Class-Interval	Cumulative	Mid-values	frequency	$u_i = \frac{x_i - 67.5}{15}$	$f_i u_i$	$f_i u_i^2$
0 – 15	12	7.5	12	– 4	– 48	192
15 – 30	30	22.5	18	– 3	– 54	162
30 – 45	65	37.5	35	– 2	– 70	140
45 – 60	107	52.5	42	– 1	– 42	42
60 – 75	157	67.5	50	0	0	0
75 – 90	202	82.5	45	1	45	45
90 – 105	222	97.5	20	2	40	80
105 – 120	230	112.5	8	3	24	72
			$\Sigma f_i = 230$		$\Sigma f_i u_i = -105$	$\Sigma f_i u_i^2 = 733$

Here, $a = 67$, $h = 15$, $N = 230$, $\Sigma f_i u_i = -105$ and $\Sigma f_i u_i^2$

$\therefore$

$$\text{Mean} = a + h\left(\frac{1}{N}\Sigma f_i u_i\right) = 67.5 + 15\left(\frac{-105}{230}\right)$$

$$= 67.5 - 6.85 = 60.65$$

And

$$\text{Variance, } \sigma^2 = h^2\left[\frac{1}{N}\Sigma f_i u_i^2 - \left(\frac{1}{N}\Sigma f_i u_i\right)^2\right]$$

$$= 225\left[\frac{733}{230} - \left(-\frac{105}{230}\right)^2\right]$$

$$= 225[3.1870 - 0.2025]$$

$$= 671.51$$

$$\text{Standard deviation} = \sqrt{\text{Variance}} = \sqrt{671.51} = 25.91$$

S2. Let the assumed mean be 80.95.

Length of wires	No. of wires f	Mean Value x	$u = \frac{x_i - 80.95}{2}$	u^2	fu	fu^2
72.0 – 73.9	7	72.95	– 4	16	– 28	112
74.0 – 75.9	31	74.95	– 3	9	– 93	279
76.0 – 77.9	42	76.95	– 2	4	– 84	168
78.0 – 79.9	54	78.95	– 1	1	– 54	54
80.0 – 81.9	33	80.95	0	0	0	0
82.0 – 83.9	24	82.95	+ 1	1	24	24
84.0 – 85.9	22	84.95	+ 2	4	44	88
86.0 – 87.9	8	86.95	+ 3	9	24	72
88.0 – 89.9	4	88.95	+ 4	16	16	64
Total	225				– 151	861

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

$$= \sqrt{\frac{861}{225} - \left(\frac{-151}{225}\right)^2} \times 2$$

$$= \sqrt{3.8267 - 0.4504} \times 2 = \sqrt{3.3765} \times 2$$

$$= 1.8375 \times 2 = 3.675$$

S3. Firstly, the data is to be made continuous by making classes as 32.5 – 36.5, 36.5 – 40.5, 40.5 – 44.5 – 48.5, 48.5 – 52.5

Class-Intervals	Mid values (x_i)	Frequencies (f_i)	$u_i = \frac{x_i - 42.5}{4}$	$f_i u_i$	u_i^2	$f_i u_i^2$
32.5 – 36.5	34.5	15	– 2	– 30	4	60
36.5 – 40.5	38.5	17	– 1	– 17	1	17
40.5 – 44.5	42.5	21	0	0	0	0
44.5 – 48.5	46.5	22	1	22	1	22
48.5 – 52.5	50.5	25	2	50	4	100
		$\Sigma f_i = 100$		$\Sigma f_i u_i = 25$		$\Sigma f_i u_i^2 = 199$

Here, we have taken $u_i = \frac{x_i - a}{h} = \frac{x_i - 42.5}{4}$

where, assumed mean is 42.5 and $h = 4$

Now, $\text{Mean} = \bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h = 42.5 + 4 \times \frac{25}{100}$

$= 42.5 + 1 = 43.5$

Variance, $\sigma^2 = h^2\left[\frac{1}{N}\sum f_i u_i^2 - \left(\frac{1}{N}\sum f_i u_i\right)^2\right]$

$= 4^2\left[\frac{1}{100} \times 199 - \left(\frac{1}{100} \times 25\right)^2\right] = 4^2\left[1.99 - \frac{1}{16}\right]$

$= 1.99 \times 16 - 1 = 31.84 - 1$

$= 30.84$

Standard deviation = $\sqrt{\text{Variance}}$

$\Rightarrow$ Standard deviation = $\sqrt{30.84} = 5.55$

S4. Let, $\text{Mean } \bar{x} = A + \frac{\sum f_i d_i}{N} \times h$

$= 92.5 + \frac{6}{60} \times 5 = 92.5 + \frac{1}{2} = 93$

$\text{Variance} = h^2\left[\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2\right] = (5)^2\left[\frac{254}{60} - \left(\frac{6}{60}\right)^2\right]$

$= 25\,[4.2333 - .01] = 25 \times 4.2233 = 105.5825$

Standard deviation = $\sqrt{105.5825} = 10.27$

Calculation for Mean and Variance

Height (in cms)	f_i	x_i	$d_i = \frac{x_i - A}{h}$	$f_i d_i$	$f_i d_i^2$
70 – 75	3	72.5	– 4	– 12	48
75 – 80	4	77.5	– 3	– 12	36
80 – 85	7	82.5	– 2	– 14	28
85 – 90	7	87.5	– 1	– 7	7
90 – 95	15	92.5 = A	0	0	0
95 – 100	9	97.5	1	9	9
100 – 105	6	102.5	2	12	24
105 – 110	6	107.5	3	18	54
110 – 115	3	117.5	4	12	48
Total	$\sum f_i = 60$			$\sum f_i d_i = 6$	$\sum f_i d_i^2 = 254$

S5. Let $\text{Mean} = A + \frac{\sum f_i d_i}{\sum f_i} \times h = 25 + \frac{10}{50} \times 10 = 25 + 2 = 27$

Calculation for Mean and Variance

Classes	f_i	x_i	$d_i = \frac{x_i - A}{h}$	$f_i d_i$	$f_i d_i^2$
0 – 10	5	5	– 2	– 10	20
10 – 20	8	15	– 1	– 8	8
20 – 30	15	25	0	0	0
30 – 40	16	35	1	16	16
40 - 50	6	45	2	12	24
	$\sum f_i = 50$			$\sum f_i d_i = 10$	$\sum f_i d_i^2 = 68$

$$\text{Variance} = \sigma^2 = h^2\left[\frac{\sum f_i d_i^2}{\sum f_i} - \left(\frac{\sum f_i d_i}{\sum f_i}\right)^2\right]$$

$$= (10)^2\left[\frac{68}{50} - \left(\frac{10}{50}\right)^2\right] = 100\,[1.36 - 0.4]$$

$$= 100 \times 1.32 = 132.$$

Hence, Mean $\bar{x} = 27$, Variance = 132.

S6. We have

Number of candidates = 200, Incorrect mean ($\bar{x}$) = 40, Incorrect S.D. = 15

Incorrect score = 53, correct score = 43

Now, $\bar{x} = \frac{\sum x_i}{n} \Rightarrow 40 = \frac{\sum x_i}{200}$

$\Rightarrow$ Incorrect $\sum x_i = 8000 \Rightarrow$ Correct $\sum x_i = 8000 - 53 + 43 = 7990$

$\Rightarrow$ Correct Mean, $\bar{x} = \frac{7990}{200} = 39.95$

Now, $\text{S.D.} = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}} = \sqrt{\frac{\sum x_i^2}{n} - (\bar{x})^2}$

$\Rightarrow$ $15 = \sqrt{\frac{\sum x_i^2}{200} - (40)^2}$

$\Rightarrow$ Incorrect $\sum x_i^2 = (225 + 1600)200 = 365000$

$\Rightarrow$ Correct $\sum x_i^2 = 365000 - (53)^2 + (43)^2 = 364040$

$\therefore$ Correct S.D. $= \sqrt{\frac{364040}{200} - (39.95)^2} = \sqrt{224.1975} = 14.975$

S7. **For Group *A*:**

Calculation for Mean and Variance

Marks	f_i	x_i	$d_i = \frac{x_i - A}{h}$	$f_i d_i$	$f_i d_i^2$
10 – 20	9	15	– 3	– 27	81
20 – 30	17	25	– 2	– 34	68
30 – 40	32	35	– 1	– 32	32
40 – 50	33	45 = *A*	0	0	0
50 – 60	40	55	1	40	40
60 – 70	10	65	2	20	40
70 – 80	9	75	3	27	81
	$N = \sum f_i = 150$			$\sum f_i d_i = -6$	$\sum f_i d_i^2 = 342$

$$\text{Variance (For } A) = h^2\left[\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2\right] = (10)^2\left[\frac{342}{150} - \left(\frac{-6}{150}\right)^2\right]$$

$$= 100\,[2.28 - 0.0016] = 100 \times 2.2784 = 227.84.$$

For Group *B*:

Calculation for Mean and Variance

Marks	f_i	x_i	$d_i = \frac{x_i - A}{h}$	$f_i d_i$	$f_i d_i^2$
10 – 20	10	15	– 3	– 30	90
20 – 30	20	25	– 2	– 40	80
30 – 40	30	35	– 1	– 30	30
40 – 50	25	45 = *A*	0	0	0
50 – 60	43	55	1	43	43
60 – 70	15	65	2	30	60
70 – 80	7	75	3	21	63
	$N = 150$			$\sum f_i d_i = -6$	$\sum f_i d_i^2 = 366$

$$\text{Variance (For } B) = h^2\left[\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2\right] = (10)^2\left[\frac{366}{150} - \left(\frac{-6}{150}\right)^2\right]$$

$$= 100\,[2.44 - 0.0016] = 100\,[2.4384] - 243.84.$$

Since, variance for Group B is more than that for *A*, therefore *B* is more variable than *A*.

S8. (i) Mean of monthly wages for firm *A* and firm *B* are same *i.e.*, Rs. 5253.

Since, the wage earners of firm *B* are more than that of *A*, hence firm *B* pays out larger amount as monthly wages.

(ii) Variance for firm A = 100

and Variance for firm B = 121

Since, variance for firm B is greater than that of A, therefore firm B shows greater variability than that of A.