1. Least square lines of regression give best possible estimates, when $\rho(X, Y)$ is equal to

   a. greater than -1

   b. - 1 or 1

   c. 1/ 2

   d. less than 1

2. For a moderately skewed distribution, quartile deviation and the standard deviation are related by

   a. S.D. = 4/3 Q. D.

   b. S.D. =2/3 Q.D.

   c. S.D.=3/2 Q.D.

   d. S.D = 3/4Q. D.

3. If the S.D. of the 1,2,3,4,5,..................10 is σ, then the S.D. of 11,12,13,14,................20 is

   a. $\sigma/10$

   b. 10σ

   c. $\sigma + 10$

   d. σ

4. The mean of 50 observations is 36, if two observations are 30 and 42 are deleted, then the mean of the remaining observations is

a. 48

b. 36

c. 46

d. 38

5. The G.M. of the numbers 4,8,16 is

   a. 28/ 7

   b. 28

   c. 28/ 3

   d. 8

6. Fill in the blanks:

   The mean deviation for n observations $x_1, x_2, ..., x_n$ from their mean $\overline{x}$ is given by
   _____.

7. Fill in the blanks:

   If the variance of a data is 121, then the standard deviation of the data is _____.

8. Check the validity of the following statement. 'If x and y are odd integers, then xy is an odd integer'.

9. Write the component statement of the compound statement and check whether the compound statement is true or false:
   To enter into a public library children need an identity card from the school or a letter from the school authorities.

10. For a group of 200 candidates, the mean and S.D. were found to be 40 and 15 respectively. Later on it was found that the score 43 was misread as 34. Find the correct mean and correct S.D.

11. 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

12. The mean and standard deviation of six observation are 8 and 4 respectively. If each observation is multiplied by 3, find the new mean and new standard deviation of the resulting observations.

13. The mean of 6, 8, 5, 7, a and 4 is 7. Find the mean deviation about median of these observation.

14. A student obtained the mean and standard deviation of 100 observations as 40 and 5.1 respectively. It was later found that one observation was wrongly copied as 50, the correct figure being 40. Find the correct mean and S.D.

15. In a survey of 44 villages of a state, about the use of LPG as a cooking mode, the following information about the families using LPG was obtained.

Number of families	0-10	10-20	20-30	30-40	40-50	50-60
Number of villages	6	8	16	8	4	2

i. Find the mean deviation about median for the following data.
ii. Do you think more awareness was needed for the villagers to use LPG as a mode of cooking?

Solution

1. (b) - 1 or 1

   Explanation: Least square lines of regression give best possible estimates when the lines coincide at that point $\rho = \pm 1$

2. (c) S.D.=3/2 Q.D.

   Explanation: its a standard result

3. (d) σ

   Explanation:

   $$S.D = \sqrt{\frac{n^2-1}{12}}$$

   where n is number of observations

   In case of 1,2,3,......,10 as well as in case of 11,12,13,......,20

   $$S.D = \sqrt{\frac{(10)^2-1}{12}} = \sqrt{99/12} = 2.87$$

4. (b) 36

   Explanation: Mean $= \frac{1}{n}\sum_{i=1}^{n} X_i$
   $\Rightarrow 36 = \frac{1}{50}\sum_{i=1}^{50} X_i$
   $\Rightarrow \sum_{i=1}^{50} X_i = 36 \times 50 = 1800$

   After deleting the observations 30 and 42

   new sum $= 1800 - 30 - 42 = 1728$

   new mean $= 1728/48 = 36$

5. (d) 8

   Explanation: G.M between two numbers a and b is given by,

   $$G.M = \sqrt{ab}$$
   $$= \sqrt{4 \times 16} = \sqrt{64} = 8$$

6. $\frac{1}{n} \sum\limits_{i=1}^{n} |x_i - \overline{x}|$

7. 11

8. Let p and q be the statements given by

   p : x and y are odd integers.

   q : xy is an odd integer.

   Then, the given statement is p then q.

   Now, let p be true,

   $\Rightarrow$ x and y are odd integers.

   $\Rightarrow$ x = 2m + 1 and y = 2n + 1 for some integers m and n.

   $\Rightarrow$ xy = (2m + 1) (2n + 1)

   $\Rightarrow$ xy = 2(mn + m + n) + 1

   Since, xy is an odd integer.

   Hence, q is true.

   Thus, p is true $\Rightarrow$ q is true.

   Hence, 'if p then q' is a true statement. Thus the given statement is valid statement.

9. The component statements of the compound statement.

   p: To get into a public library children need an identity card.

   q: To get into a public library children need a letter from the school authorities.

   We know that if p and q are true then p or q must also be true.

   Hence, the compound statement is true.

10. We have, n = 200, $\overline{X} = 40, \sigma = 15$.

    $\therefore \quad \overline{X} = \frac{1}{n} \Sigma x_i \Rightarrow \Sigma x_i = n\overline{X} = 200 \times 40 = 8000$.

    Now, Correct Σx_i = Incorrect $\sum x_i$ - (Sum of incorrect values) + (Sum of correct values) = 8000 - 34 + 43 = 8009.

    $\therefore \quad$ Correct mean $= \frac{\text{Correct } \Sigma x_i}{n} = \frac{8009}{200} = 40.045$

    and, $\sigma = 15$

    $\Rightarrow \quad 15^2$ = Incorrect Variance

    $\Rightarrow \quad 15^2 = \frac{1}{200} \left(\Sigma x_i^2 \right) - \left(\frac{1}{200} \Sigma x_i \right)^2$

    $\Rightarrow \quad 225 = \frac{1}{200} \left(\Sigma x_i^2 \right) - \left(\frac{8000}{200} \right)^2$

$$\Rightarrow \quad 225 = \frac{1}{200}\left(\Sigma x_i^2\right) - 1600$$

$$\Rightarrow \quad \Sigma x_i^2 = 200 \times 1825 = 365000$$

$$\Rightarrow \quad \text{Incorrect } \Sigma x_i^2 = 365000$$

$\therefore \quad$ Correct $\Sigma x_i^2 = \left(\text{Incorrect } \Sigma x_i^2\right)$ - (Sum of squares of incorrect values) + (Sum of squares of correct values)

$$\Rightarrow \quad \text{Correct } \Sigma x_i^2 = 365000 - (34)^2 + (43)^2 = 365693$$

So, Correct S.D., $\sigma = \sqrt{\frac{1}{n}\text{ Correct }\Sigma x_i^2 - \left(\frac{1}{n}\text{ Correct }\Sigma x_i\right)^2}$

$$= \sqrt{\frac{365693}{200} - \left(\frac{8009}{200}\right)^2}$$

$$= \sqrt{1828.465 - 1603.602} = 14.995$$

11. We make the table from the given data.

Class	f_i	cf	Mid-point(x_i)	$|x_i - M|$	$f_i|x_i - M|$
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

Here, $\frac{N}{2} = \frac{50}{2} = 25$

Here, 25th item lies in the class 20-30. Therefore, 20-30 is the median class.

Here, l = 20, cf = 13, f = 15, b = 10 and N = 50

$\because$ Median, M $= l + \dfrac{\frac{N}{2}-cf}{f} \times b$

$\Rightarrow$ M = 20 + $\dfrac{25-13}{15} \times 10 = 20 + 8 = 28$

Thus, mean deviation about median is given by

MD (M) = $\dfrac{1}{N} \sum\limits_{i=1}^{6} f_i \left|x_i - M\right|$ = $\dfrac{1}{50} \times 508 = 10.16$

Hence, mean deviation about median is 10.16.

12. Let $x_1, x_2, x_3, x_4, x_5, x_6$ be six observations, then

$$\frac{x_1+x_2+x_3+x_4+x_5+x_6}{6} = 8$$

$$\Rightarrow x_1 + x_2 + x_3 + x_4 + x_5 + x_6 = 48$$

Now if each observation is multiplied by 3 then

New mean $= \frac{3x_1+3x_2+3x_3+3x_4+3x_5+3x_6}{6}$

$= \frac{3(x_1+x_2+x_3+x_4+x_5+x_6)}{6} = \frac{1}{2} \times 48 = 24$

Also $\frac{1}{6}\left(x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_5^2 + x_6^2\right) - (8)^2 = 16$

$\Rightarrow x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_5^2 + x_6^2 = 480$

If each observation multiplied by 3 then

New variance $= \frac{1}{6}\left(9x_1^2 + 9x_2^2 + 9x_3^2 + 9x_4^2 + 9x_5^2 + 9x_6^2\right) - (24)^2$

$= \frac{9}{6} \times 480 - 576 = 720 - 576 = 144$

$\therefore$ New S.D. $= \sqrt{144} = 12$

13. Here, n = 6

By the given condition, $\frac{6+8+5+7+a+4}{6} = 7$

$\Rightarrow 30 + a = 6 \times 7 \Rightarrow a = 42 - 30 = 12$

Now, arranged the observations, in ascending order, i.e., 4, 5, 6, 7, 8, 12.

$\therefore$ Median, M $= \dfrac{\left(\frac{6}{2}\right) \text{th term} + \left(\frac{6}{2}+1\right) \text{th term}}{2} = \dfrac{3\text{rd} + 4\text{th observations}}{2}$

$= \frac{6+7}{2} = \frac{13}{2} = 6.5$

We make the table from the given data.

x_i	x_i - M	$|x_i$ - M$|$
4	-2.5	2.5
5	-1.5	1.5
6	-0.5	0.5
7	0.5	0.5
8	1.5	1.5
12	5.5	5.5
Total		$\sum|x_i$ - M$|$ = 12

Here, n = 6 and $\sum |x_i - M| = 12$

$\therefore$ Mean deviation about median = $\frac{\sum |x_i - M|}{n}$ = $\frac{12}{6}$ = 2

14. We have, n = 100, $\bar{x}$ = 40 and σ = 5.1

$\therefore \bar{x} = \frac{1}{n} \Sigma x_i$

$\Rightarrow \Sigma x_i = n\bar{x}$ = 100 $\times$ 40 = 4000

$\therefore$ Incorrect Σx_i = 4000

and,

σ = 5.1

$\Rightarrow \sigma^2$ = 26.01

$\Rightarrow \frac{1}{n} \Sigma x_i^2$ - (mean)^2 = 26.01

$\Rightarrow \frac{1}{100} \Sigma x_i^2$ - 1600 = 26.01

$\Rightarrow \Sigma x_i^2$ = 1626.01 $\times$ 100

$\therefore$ Incorrect Σx_i^2 = 162601

To correct the $\sum x_i$, we need to subtract the incorrect observation 50 and add correct observation is 40.

We have, incorrect Σx_i = 4000

$\therefore$ Correct Σx_i = 4000 - 50 + 40 = 3990

and,

Similarly, to obtain correct $\sum x_i^2$ we need to subtract 50^2 and add 40^2 to incorrect one.

Incorrect Σx_i^2 = 162601

$\therefore$ Correct Σx_i^2 = 162601 - 50^2 + 40^2 = 161701

Now, Correct mean = $\frac{3990}{100}$ = 39.90

Correct variance = $\frac{1}{100}$ (Correct Σx_i^2) - (Correct mean)^2

$\Rightarrow$ Correct variance = $\frac{161701}{100} - \left(\frac{3990}{100} \right)^2$

$\Rightarrow$ Correct variance = $\frac{161701 \times 100 - (3990)^2}{(100)^2}$

$\Rightarrow$ Correct variance = $\frac{16170100 - 15920100}{10000} = 25$

∴ Correct standard deviation = $\sqrt{25}$ = 5

15. i.

Number of families	Mid value (x_i)	Number of villages (f_i)	cf	$\lvert x_i - M \rvert$	$f_i \lvert x_i - M \rvert$
$0 - 10$	5	6	6	20	120
$10 - 20$	15	8	14	10	80
$20 - 30$	25	16	30	0	0
$30 - 40$	35	8	38	10	80
$40 - 50$	45	4	42	20	80
$50 - 60$	55	2	44	30	60
		44			420

Here, $N = 44$

Now, $\frac{N}{2} = \frac{44}{2} = 22$, which, lies in the cumulative frequency of 30, therefore median class is 20-30.

∴ $l = 20, f = 16, cf = 14$ and $h = 10$

∴ Median (M) = $l + \dfrac{\frac{N}{2} - cf}{f} \times b$

$= 20 + \dfrac{22 - 14}{16} \times 10$

$= 20 + \dfrac{8}{16} \times 10 = 20 + 5 = 25$

∴ Mean deviation about median = $\dfrac{\sum\limits_{i=1}^{6} f_i \lvert x_i - M \rvert}{\sum f_i}$ = $\dfrac{420}{44} = 9.55$

ii. There is a need for awareness among villagers for using LPG as a mode of cooking. Because it will help in keeping the environment clean and will also help in saving of forests.