Statistics

Assertion Reason Questions

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).
Choose the correct answer out of the following choices.
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) is true.

1. Assertion (A): The mean deviation about the mean to find a measure of dispersion has certain limitations.
Reason (R): The sum of deviations from the mean is more than the sum of deviations from the median. Therefore, the mean deviation about the mean is not very scientific, where degree of variability is very high.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
Explanation: The sum of the deviations from the mean (minus signs ignored) is more than the sum of the deviations from median. Therefore, the mean deviation about the mean is not very scientific. Thus, in many cases, mean deviation may give unsatisfactory results. Also mean deviation is calculated on the basis of absolute values of the deviations and therefore, cannot be subjected to further algebraic treatment. This implied that we must have some other measure of dispersion. Standard deviation is such a measure of dispersion.

2. Assertion (A): The average marks of boys in a class is 52 and that of girls is 12. The average marks of boy and girls combined is 50. The percentage of boys in the class is 80%.
Reason (R): Mean marks scored by the students of a class is 53 and the mean marks of the boys is 50 and the mean marks of the girls is 55. The percentage of girls in the class is 64%.

Ans. (c) A is true but R is false.
Explanation: Let the number of boys and girls be x and y.

:- 52x+42y= 50(x + y)
= 2x = 8y
= x = 4y
:- Total number of students in the class
=x+y=5y
:- Required percentage of boys

3. Assertion (A): The weights (in kg) of 5 students are as follows
31, 35, 27, 29, 32, 43, 37, 41, 34, 28, 36, 44, 45, 42, 30. If the weight 44 kg is replaced by 46 kg and 27 kg is by 25 kg, then the new median is 35.
Reason (R): The mean deviation from the median of the weights (in kg) 54, 50, 40, 42, 51, 45, 455, 57 is 4.78.

Ans. (b) Both A and R are true but R is not the correct explanation of A.
Explanation: Since, 44 kg is replaced by 46 kg and 27 kg is replaced by 25 kg, then the given series becomes 31, 35, 25, 29, 32, 43, 37, 41, 34, 28, 36, 46, 45, 42, 30. On arranging this series in ascending order, we get 25, 28, 29, 30, 31, 32, 34, 35, 36, 37, 41, 42, 43, 45, 46. Total number of students are 15, therefore the middle term is 8th term whose corresponding value is 35.
On arranging the terms in increasing order of magnitude 40, 42, 45, 47, 50, 51, 54, 55, 57
Number of terms, N = 9

Ans. (c) A is true but R is false.
Explanation: Let the number of boys and girls be x and y.

$$\therefore \quad 52x + 42y = 50(x + y)$$
$$\Rightarrow \quad 2x = 8y$$
$$\Rightarrow \quad x = 4y$$

$\therefore$ Total number of students in the class
$$= x + y = 5y$$

$\therefore$ Required percentage of boys
$$= \frac{4y}{5y} \times 100\%$$
$$= 80\%$$

Let the number of boys be x and number of girls be y.

$\therefore \quad 53(x+y) = 55y + 50x$

$\Rightarrow \quad 3x = 2y$

$\Rightarrow \quad x = \frac{2y}{3}$

$\therefore$ Total number of students

$$= x + y = \frac{2y}{3} + y = \frac{5}{3}y$$

Hence, required percentage

$$= \frac{y}{\frac{5y}{3}} \times 100\%$$

$$= \frac{3}{5} \times 100\% = 60\%$$

4. Assertion (A): The weights (in kg) of 5 students are as follows
31, 35, 27, 29, 32, 43, 37, 41, 34, 28, 36, 44, 45, 42, 30. If the weight 44 kg is replaced by 46 kg and 27 kg is by 25 kg, then the new median is 35.
Reason (R): The mean deviation from the median of the weights (in kg)
54, 50, 40, 42, 51, 45, 455, 57 is 4.78.

Ans. (b) Both A and R are true but R is not the correct explanation of A.
Explanation: Since, 44 kg is replaced by 46 kg and 27 kg is replaced by 25 kg, then the given series becomes 31, 35, 25, 29, 32, 43, 37, 41, 34, 28, 36, 46, 45, 42, 30.
On arranging this series in ascending order, we get 25, 28, 29, 30, 31, 32, 34, 35, 36, 37, 41, 42, 43, 45, 46.
Total number of students are 15, therefore the middle term is 8th term whose corresponding value is 35.
On arranging the terms in increasing order of magnitude 40, 42, 45, 47, 50, 51, 54, 55, 57
Number of terms, N = 9

$\therefore$ Median $= \left(\frac{9+1}{2}\right)^{th}$ term $= 5^{th}$ terms $= 50$ kg

Weight (in kg)	Deviation from Median (d)	$\lvert d \rvert$
40	−10	10
42	−8	8
45	−5	5
47	−3	3
50	0	0
51	1	1
54	4	4
55	5	5
57	7	7
		$\lvert d \rvert = 43$

MD from median $= \frac{43}{9} = 4.78$ kg

5. Assertion (A): The proper measure of dispersion about the mean of a set of observations, i.e. standard deviation, is expressed as the positive square root of the variance.
Reason (R): The units of individual observations x, and the unit of their mean are different,then that of variance. Since, variance involves sum of square of (x-x).

Ans. (a) Both A and R are true and R is the correct explanation of A.
Explanation: In the calculations of variance, we find that the units of individual observations x and the unit of their mean x are different from that of variance, since variance involves the sum of squares of (x,-x).
For this reason, the proper measure of dispersion about the mean of a set of observations is expressed as the positive square root of the variance and is called standard deviation.