Statistics

Assertion & Reason Type Questions

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A)

b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A)

c. Assertion (A) is true but Reason (R) is false

d. Assertion (A) is false but Reason (R) is true

Q1. Assertion (A): If $\Sigma f_i = 20$, $\Sigma f_i x_i = 3h + 20$ and mean of the distribution is 4, then the value of h is 20.

Reason (R): If there are X_1, X_2, ..., X, observations where corresponding frequencies are f_1, f_2, ...fn then mean is determined by the formula,

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

Answer : (a) **Assertion (A):** Given, $\Sigma f_i = 20$, $\Sigma f_i x_i = 3h + 20$ and mean of data is x = 4

Then
$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$\Rightarrow \quad 4 = \frac{3\lambda + 20}{20}$$

$$\Rightarrow \quad 3\lambda + 20 = 80$$

$$\Rightarrow \quad 3\lambda = 60 \Rightarrow \lambda = 20.$$

So, Assertion (A) is true.

Reason (R): It is true to say that in frequency distribution, the mean is determined by $\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$

Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

Q2. Assertion (A): The mode of the following frequency distribution is 52.25 kg.

Weight (in kg)	Frequency
40-45	20
45-50	30
50-55	35
55-60	20
60-65	10

Reason (R): A modal class is a class which has highest frequency.

Answer : (d) **Assertion (A):** In the frequency distribution, the highest frequency is 35, which lies in the class interval 50-55.

So, modal class is 50-55.

Here, $l = 50$, $f_m = 35$, $f_p = 30$ and $f_s = 20$, $h = 5$

$$\because \qquad \text{Mode} = l + \left(\frac{f_m - f_p}{2f_m - f_p - f_s}\right) \times h$$

$$= 50 + \left(\frac{35 - 30}{2 \times 35 - 30 - 20}\right) \times 5$$

$$= 50 + \frac{25}{70 - 50} = 50 + \frac{25}{20}$$

$$= 50 + 1.25 = 51.25 \text{ kg.}$$

So, Assertion (A) is false.

Reason (R): It is a true statement.

Hence, Assertion (A) is false but Reason is true.

Q3. Assertion (A): The median of the frequency distribution is 68.75.

Marks obtained (Class Interval)	Number of students (Frequency)	Cumulative frequency
30-40	5	5
40-50	10	15
50-60	3	18
60-70	8	26
70-80	14	40
80-90	10	50

Reason (R): The cumulative frequency of median is just next to the median class.

Answer : (c) **Assertion (A):** Given, the sum of frequencies is N = 50.

$\therefore \quad \dfrac{N}{2} = \dfrac{50}{2} = 25$, which lies in the cumulative

frequency 26.

So, median class is 60-70.

Here, $l = 60$, $f = 8$, $cf = 18$ and $h = 10$

$\because \quad$ Median $= l + \dfrac{\dfrac{N}{2} - cf}{f} \times h$

$= 60 + \dfrac{25 - 18}{8} \times 10$

$= 60 + \dfrac{70}{8} = 60 + 8.75 = 68.75$

So, Assertion (A) is true.

Reason (R): Given Reason (R) is false, because cumulative frequency is just before the median class. Hence, Assertion (A) is true and Reason (R) is false.

Q4. Assertion (A): The following table gives the marks scored by students in an examination:

Marks	Number of students
0-5	3
5-10	7
10-15	15
15-20	24
20-25	16
25-30	8

The succeeding frequency of modal class is 16.

Reason (R): The sum of frequency of modal class and its preceding frequency is 40.

Answer : (c) **Assertion (A):** In a given table, the highest frequency is 24, whose modal class is 15-20. The succeeding frequency of modal class is 16. So, Assertion (A) is true.

Reason (R): In the given table, frequency of modal class is 24 and preceding frequency is 15.

:- The sum of modal class frequency and preceding frequency is 24 +15, i.e., 39.

So, Reason (R) is false.

Hence, Assertion (A) is true but Reason (R) is false.

Q5. Assertion (A): If the median and mode of a frequency distribution are 150 and 154 respectively, then its mean is 148.

Reason (R): The relation between mean, mode and median is:

Mode = 3 (Median) - 2 (Mean)

Answer : (a) Assertion (A): Given that,

median = 150 and mode = 154

By using empirical relation,

$$mode = 3 \text{ (median)} - 2 \text{ (mean)}$$

$$\Rightarrow \qquad 154 = 3 \times 150 - 2 \text{ (mean)}$$

$$\Rightarrow \qquad 2 \text{ (Mean)} = 450 - 154$$

$$\Rightarrow \qquad \text{Mean} = \frac{296}{2} = 148.$$

So, Assertion (A) is true.

Reason (R): It is true to say that the relation between mean, mode and median is

Mode = 3 (Median) - 2 (Mean)

Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

Mean of first 10 prime numbers

$$= \frac{\text{Sum of all the observations}}{\text{Total number of observations}}$$

$$= \frac{2+3+5+7+11+13+17+19+23+29}{10}$$

$$= \frac{129}{10} = 12.9$$

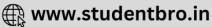**Q.6. Assertion (A):** The arithmetic mean of the following given frequency distribution table is 13.81.

x	4	7	10	13	16	19
f	7	10	15	20	25	30

Reason (R): $\overline{x} = \dfrac{\sum f_i x_i}{\sum f_i}$

Answer : (a) Both assertion and reason are true, reason is the correct explanation of the assertion.

Q.7. Assertion (A): If the number of runs scored by 11 players of a cricket team of India are 5, 19, 42, 11, 50, 30, 21, 0, 52, 36, 27 then median is 30.

Reason (R): Median $= \left(\frac{n+1}{2}\right)^{th}$ value, if n is odd.

Answer : (d) Arranging the terms in ascending order, 0, 5, 11, 19, 21, 27, 30, 36, 42, 50, 52

$$\text{Median value} = \left(\frac{11+1}{2}\right)^{th}$$

$$= 6^{th} \text{ value} = 27$$

Q.8. Assertion (A): If the value of mode and mean is 60 and 66 respectively, then the value of median is 64.

Reason (R): Median = (mode + 2 mean)

Answer : (c)

$$\text{Median} = \frac{1}{3}(\text{mod}\,e + 2\,\text{mean})$$

$$= \frac{1}{3}(60 + 2 \times 66) = 64$$