

Statistics for IIT JEE covers important concepts such as measures of Dispersion, calculation of mean, median, mode of grouped and ungrouped data, calculation of standard deviation, variance and mean deviation for grouped and ungrouped data. In this article, aspirants can practice previous year's questions on Statistics asked in IIT JEE exams. We have included all the important questions and a detailed solution for each question.

Question 1: The mean of n items is \bar{x} . If the first term is increased by 1, second by 2 and so on, then what is the new mean?

Solution:

Let x_1, x_2, \dots, x_n be n items.

Then, $\bar{x} = [1 / n] \sum x_i$

Let $y_1 = x_1 + 1, y_2 = x_2 + 2, y_3 = x_3 + 3, \dots, y_n = x_n + n$

Then the mean of the new series is $[1 / n] \sum y_i = [1 / n] \sum_{i=1}^n (x_i + i)$

$$= [1 / n] \sum_{i=1}^n x_i + 1/n (1 + 2 + 3 + \dots + n)$$

$$= \bar{x} + [1 / n] * [n (n + 1) / 2]$$

$$= \bar{x} + (n+1)/2.$$

Question 2: The average of n numbers x_1, x_2, \dots, x_n is M . If x_n is replaced by x' , then what is the new average?

Solution:

$$M = \frac{x_1 + x_2 + \dots + x_n}{n}$$

$$nM = x_1 + x_2 + \dots + x_{n-1} + x_n$$

$$nM - x_n = x_1 + x_2 + \dots + x_{n-1}$$

$$[nM - x_n + x'] / n = [x_1 + x_2 + \dots + x_{n-1} + x'] / n$$

$$\text{New average} = [nM - x_n + x'] / n$$

Question 3: Mean of 100 observations is 45. It was later found that two observations 19 and 31 were incorrectly recorded as 91 and 13. The correct mean is _____.

Solution:

Sum of 100 items = $45 \times 100 = 4500$

Sum of items added = $19 + 31 = 50$

Sum of items replaced = $91 + 13 = 104$

New sum = $4500 - 104 + 50 = 4446$

New mean = $4446 / 100 = 44.46$

Question 4: The following data gives the distribution of the height of students.

Height (in cm)	160	150	152	152	161	154	155
Name of students	12	8	4	4	3	3	7

What is the median of the distribution?

Solution:

Arranging the data in ascending order of magnitude, we obtain

Height (in cm)	150	152	154	155	156	160	161
Number of students	8	4	3	7	3	12	4
Cumulative frequency	8	12	15	22	25	37	41

Here, the total number of items is 41 i.e., an odd number.

Hence, the median is $[(41 + 1) / 2]^{\text{th}}$ i.e., 21st item.

From the cumulative frequency table, we find that median i.e., 21st item is 155.

(All items from 16 to 22nd are equal, each 155).

Question 5: The mean and S.D. of the marks of 200 candidates were found to be 40 and 15 respectively. Later, it was discovered that a score of 40 was wrongly read as 50. The correct mean and S.D. respectively are _____.

Solution:

$$\text{Corrected } \Sigma x = 40 \times 200 - 50 + 40 = 7990$$

$$\text{Corrected } \bar{x} = 7990 / 200 = 39.95$$

$$\text{Incorrect } \Sigma x^2 = n [\sigma^2 + (\bar{x})^2] = 200 [15^2 + 40^2] = 365000$$

$$\text{Correct } \Sigma x^2 = 365000 - 2500 + 1600 = 364100$$

$$\text{Corrected } \sigma = \sqrt{\frac{364100}{200} - (39.95)^2}$$

$$= \sqrt{(1820.5 - 1596)}$$

$$= \sqrt{224.5}$$

$$= 14.98$$

Question 6: Let r be the range and $S^2 = 1/(n-1)$ be the S.D. of a set of observations x_1, x_2, \dots, x_n , then what is the condition for S ?

Solution:

$$r = \max |x_i - x_j|; i \neq j \text{ and } S^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$$

$$\text{Now, } (x_i - \bar{x})^2 = (x_i - [x_1 + x_2 + \dots + x_n] / n)^2$$

$$= [1 / n^2] [(x_i - x_1) + (x_i - x_2) + \dots + (x_i - x_i - 1) + (x_i - x_i + 1) + \dots + (x_i - x_n)]$$

$$\leq [1 / n^2] [(n-1)r]^2,$$

$$[\because |x_i - x_j| \leq r]$$

$$\leq r^2$$

$$\Rightarrow \sum_{i=1}^n (x_i - \bar{x})^2 \leq nr^2$$

$$\Rightarrow \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2 \leq [nr^2 / (n-1)]$$

$$\text{or } S^2 \leq \frac{nr^2}{n-1}$$

$$S \leq \frac{\sqrt{nr}}{n-1}$$

Question 7: If a variable takes the discrete values $\alpha - 4, \alpha - 7/2, \alpha - 5/2, \alpha - 3, \alpha - 2, \alpha + 1/2, \alpha - 1/2, \alpha + 5$ ($\alpha > 0$), then the median is _____.

Solution:

Arrange the data as $\alpha - 7/2, \alpha - 3, \alpha - 5/2, \alpha - 2, \alpha - 1/2, \alpha + 1/2, \alpha - 4, \alpha + 5$

Median = $[1/2] [\text{value of 4}^{\text{th}} \text{ item} + \text{value of 5}^{\text{th}} \text{ item}]$

Median = $[(\alpha - 2) + (\alpha - 1/2)] / 2$

= $[2\alpha - 5/2] / 2$

= $\alpha - 5/4$

Question 8: The median of a set of 9 distinct observations is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set is _____.

Solution:

Since $n = 9$, then median term = $([9 + 1] / 2)^{\text{th}} = 5^{\text{th}}$ term.

Now, the last four observations have increased by 2.

The median is 5th observation, which is remaining unchanged.

There will be no change in the median.

Question 9: Runs scored by a batsman in 10 innings are: 38, 70, 48, 34, 42, 55, 63, 46, 54, 44 the mean deviation is _____.

Solution:

Arranging the given data in ascending order, we have 34, 38, 42, 44, 46, 48, 54, 55, 63, 70, Median, $M = [46 + 48] / [2] = 47$

(Here, $n = 10$, median is the mean of 5th and 6th items)

$$\begin{aligned}\text{Mean deviation} &= \frac{\sum |x_i - M|}{n} = \frac{\sum |x_i - 47|}{10} \\ &= \frac{13 + 9 + 5 + 3 + 1 + 1 + 7 + 8 + 16 + 23}{10}\end{aligned}$$

$$= 8.6$$

Question 10: Computer the median from the following table.

Marks obtained	No. of students
0-10	2
10-20	18
20-30	30
30-40	45
40-50	35
50-60	20
60-70	6
70-80	3

Solution:

Marks obtained	No. of students	Cumulative frequency
0-10	2	2
10-20	18	20
20-30	30	50
30-40	45	95
40-50	35	130
50-60	20	150
60-70	6	156
70-80	3	159

$N = \Sigma f = 159$ (Odd number)

Median is $[1 / 2] (n + 1) = [1 / 2] [(159 + 1)] = 80^{\text{th}}$ value, which lies in the class [30 - 40] (see the row of cumulative frequency 95, which contains 80).

Hence the median class is [30 - 40].

We have l = Lower limit of median class = 30

f = frequency of median class = 45

C = Total of all frequencies preceding median class = 50

i = width of class interval of median class = 10

Required median = $l + ([N / 2 - C] / f) * i$

= $30 + ([159 / 2 - 50] / 45) \times 10$

$$= 3 + 295 / 45$$

$$= 36.55$$

Question 11: The number of observations in a group is 40. If the average of the first 10 is 4.5 and that of the remaining 30 is 3.5, then the average of the whole group is _____.

Solution:

$$[x_1 + x_2 + \dots + x_{10}] / [10] = 4.5$$

$$[x_1 + x_2 + \dots + x_{10}] = 45 \text{ and } [x_{11} + x_{12} + \dots + x_{40}] / [30] = 3.5$$

$$x_{11} + x_{12} + \dots + x_{40} = 105$$

$$x_1 + x_2 + \dots + x_{40} = 150$$

$$[x_1 + x_2 + \dots + x_{40}] / [40] = 150 / 40 = 15 / 4.$$

Question 12: A school has four sections of chemistry in class XII having 40, 35, 45 and 42 students. The mean marks obtained in chemistry tests are 50, 60, 55 and 45 respectively for the four sections, the overall average of marks per student is _____.

Solution:

$$\text{Total number of students} = 40 + 35 + 45 + 42 = 162$$

$$\text{Total marks obtained} = (40 \times 50) + (35 \times 60) + (45 \times 55) + (42 \times 45) = 8465$$

$$\text{Overall average of marks per student} = 8465 / 162 = 52.25.$$

Question 13: The mean weight per student in a group of seven students is 55 kg. If the individual weights of 6 students are 52, 58, 55, 53, 56 and 54; then the weight of the seventh student is _____.

Solution:

$$\text{Total weight of 7 students is} = 55 \times 7 = 385 \text{ kg}$$

$$\text{Sum of weight of 6 students} = 52 + 58 + 55 + 53 + 56 + 54 = 328 \text{ kg}$$

$$\text{Weight of seventh student} = 385 - 328 = 57 \text{ kg}.$$

Question 14: In a class of 100 students there are 70 boys whose average marks in a subject are 75. If the average marks of the complete class are 72, then what are the average marks of the girls?

Solution:

Let the average marks of the girls students be x , then $72 = [70 \times 75 + 30x] / 100$

i.e., $[7200 - 5250] / [30] = x$

$x = 65$.

Question 15: The average weight of students in a class of 35 students is 40 kg. If the weight of the teacher is included, the average rises by 12kg; the weight of the teacher is _____.

Solution:

Let the weight of the teacher is w kg, then

$$40 + [1 / 2] = [35 \times 40 + w] / [35 + 1]$$

$$36 \times 40 + 36 \times 12 = 35 \times 40 + w$$

$$w = 58$$

Weight of the teacher = 58kg.