

CLASS 10 · HOTS · OLYMPIAD PREPARATION · SHORT NOTES

Chapter 13: HOTS: Statistics (Class 10)

Topic-wise short notes with solved examples

Higher order thinking questions on statistics for Class 10: finding a missing frequency from a given mean, the mode and median of grouped data and the relation between the three averages, each with a full solution.

1 Solved HOTS questions

- Formulas for grouped data: mean = $\frac{\sum fx}{\sum f}$ where x is the class mark; mode = $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$; median = $l + \frac{\frac{n}{2} - cf}{f} \times h$; and $3 \text{ median} = \text{mode} + 2 \text{ mean}$ (the empirical relation).

Example 1.1 The mean of the following data is 18. Find the missing frequency p .

Class	11 - 13	13 - 15	15 - 17	17 - 19	19 - 21	21 - 23	23 - 25
Frequency	7	6	9	13	p	5	4

SOLUTION

The class marks are 12, 14, 16, 18, 20, 22, 24. $\sum f = 44 + p$.

$\sum fx = 84 + 84 + 144 + 234 + 20p + 110 + 96 = 752 + 20p$.

The mean is 18, so $752 + 20p = 18(44 + p) = 792 + 18p$, which gives $2p = 40$.

$p = 20$

Example 1.2 Find the mode of the following distribution.

Marks	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Students	5	8	15	9	3

SOLUTION

The modal class is the one with the highest frequency, 20 - 30, so $l = 20$, $h = 10$, $f_1 = 15$, $f_0 = 8$ and $f_2 = 9$.

Mode = $20 + \frac{15 - 8}{30 - 8 - 9} \times 10 = 20 + \frac{70}{13}$.

About 25.38

Example 1.3 The median of the following data is 46. Find the missing frequencies x and y if the total frequency is 230.

Class	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
Frequency	12	30	x	65	y	25	18

SOLUTION

$$12 + 30 + x + 65 + y + 25 + 18 = 230, \text{ so } x + y = 80.$$

The median 46 lies in the class 40 - 50, so $l = 40$, $f = 65$, $h = 10$ and $\frac{n}{2} = 115$. The cumulative frequency before this class is $12 + 30 + x = 42 + x$.

$$46 = 40 + \frac{115 - (42 + x)}{65} \times 10, \text{ so } \frac{73 - x}{65} \times 10 = 6 \text{ and } 73 - x = 39, \text{ giving } x = 34.$$

$$\text{Then } y = 80 - 34 = 46.$$

$$x = 34 \text{ and } y = 46$$

Example 1.4 For a data set the mode is 65 and the mean is 62. Find the median using the empirical relation.

SOLUTION

$$3 \text{ median} = \text{mode} + 2 \text{ mean} = 65 + 124 = 189.$$

$$\text{Median} = 63$$

Example 1.5 The mean of 10 observations is 12. If each observation is multiplied by 3 and then 2 is subtracted, find the new mean.

SOLUTION

Multiplying by 3 gives mean 36, and subtracting 2 gives 34.

$$34$$