

MATHEMATICS • CLASS 10

CHAPTER 13

Statistics

CHAPTER NOTES



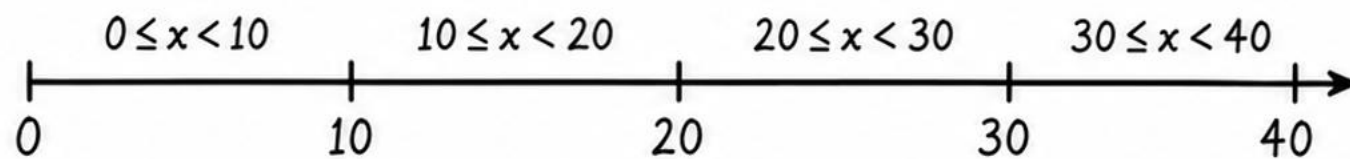
GROUPED DATA AND CLASS MARKS

- Raw data: Data collected as individual observations in their original form.
- Grouped frequency distribution: The data is arranged into non-overlapping class intervals with their corresponding frequencies.
- Class interval: The range between the lower class limit and the upper class limit.
- Lower and upper class limits: The two endpoints of a class interval.
- Class size: The width of a class interval.
 $h = \text{upper limit} - \text{lower limit}.$
- Frequency f_i : The number of observations in the i^{th} class.
- Total frequency n : The sum of all frequencies.
 $n = \sum f_i$
- Class mark x_i : The midpoint of a class interval.

$$x_i = \frac{(\text{lower limit} + \text{upper limit})}{2}$$

Class interval	Frequency f_i	Class-mark calculation	Class mark x_i
0-10	3	$\frac{0+10}{2}$	5
10-20	5	$\frac{10+20}{2}$	15
20-30	4	$\frac{20+30}{2}$	25
30-40	8	$\frac{30+40}{2}$	35

$$n = 3 + 5 + 4 + 8 = 20$$



For grouped mean, each class is represented by its class mark.

MEAN BY THE DIRECT METHOD

- Grouped arithmetic mean is the weighted average of class marks x_i with frequencies f_i .

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

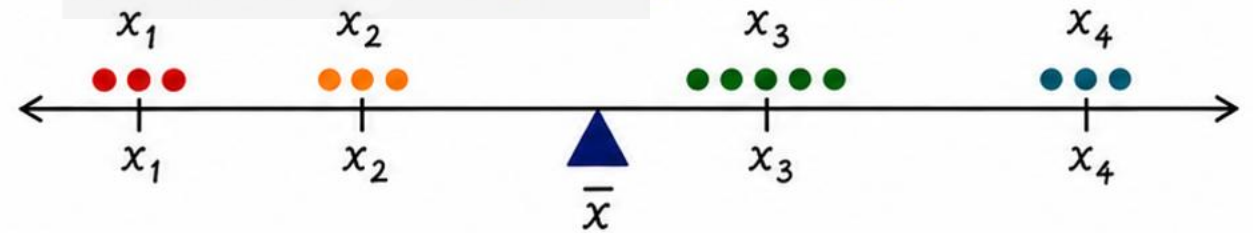
x_i = class mark, f_i = frequency, $\bar{x}$ = mean.

DIRECT METHOD - FOUR SIMPLE STEPS

- Find every class mark x_i .
- Calculate $f_i x_i$ for each class.
- Add to get $\sum f_i$ and $\sum f_i x_i$.
- Divide: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$.

Class interval	f_i	x_i	$f_i x_i$
$l_1 - u_1$	f_1	x_1	$f_1 x_1$
$l_2 - u_2$	f_2	x_2	$f_2 x_2$
$l_3 - u_3$	f_3	x_3	$f_3 x_3$
$l_4 - u_4$	f_4	x_4	$f_4 x_4$
Total	$\sum f_i$	-	$\sum f_i x_i$

Visual explanation: The mean $\bar{x}$ is the balance point of all observations (classes) weighted by their frequencies.



The grouped mean is usually approximate because all observations in a class are represented by its class mark.

The direct method is convenient when the numbers are small and easy.

DIRECT-METHOD MEAN

EXAMPLE - Mean of Grouped Data

- When data is given in groups (class intervals) with their frequencies, we can find the mean using the direct method with the formula

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

- Here, f_i = frequency of the i -th class and x_i = class mark (midpoint) of the i -th class.

→ Calculation of Mean (Direct Method):

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{470}{20} = 23.5$$

$$\bar{x} = 23.5$$

Mean of the grouped data
= 23.5

Class Interval	Frequency f_i	Class Mark x_i (Midpoint)	Product $f_i x_i$
0 - 10	3	5	15
10 - 20	5	15	75
20 - 30	4	25	100
30 - 40	8	35	280
Total	$\sum f_i = 20$		$\sum f_i x_i = 470$

→ Interpretation: The mean 23.5 means that 23.5 is the average value represented by this grouped distribution. It is the single value that balances all the observations in the data.

ASSUMED-MEAN METHOD

EXAMPLE - Same Data, Shorter Numbers

Choose assumed mean $a=25$; $d_i = x_i - a$.

x_i	f_i	$d_i = x_i - 25$	$f_i d_i$
5	3	-20	-60
15	5	-10	-50
25	4	0	0
35	8	10	80

$$\Sigma f_i = 20$$

$$\Sigma f_i d_i = -30$$

Formula: $\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$.

Substitute: $\bar{x} = 25 + \left(\frac{-30}{20}\right) = 25 - 1.5 = 23.5$.

A convenient assumed mean shortens the arithmetic but does not change the answer.

$$\bar{x} = 23.5$$



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