MODE

- When mean and median are available

Relation between $\overline{X}$, M and Z

In a Moderately Asymmetric Series ; **$Z = 3M - 2\overline{X}$**

Example 1. Mean = 16 and Median = 18. Calculate the Mode.

Solution

Mean = 16 ; Median = 18 Mode = ?

$$Z = 3M - 2\overline{X} = 3 \times 18 - 2 \times 16 = 54 - 32 = 22$$

Example 2. If $\overline{X}$ = 61 and Z = 63.2 find M.

Solution

As $Z = 3M - 2\overline{X}$ $\therefore$ $63.2 = 3M - 2 \times 61$

or $3M = 63.2 + 122 = 185.2 \Rightarrow$ $M = \frac{185.2}{3} = \mathbf{61.73}$ (approx.)

Calculation of Mode:

- **Individual Series:**

  The terms are arranged in any order. Ascending or Descending. If each term of the series is occurring once, then there is no mode, otherwise the value that occurs Maximum Times is known as Mode. Mode is often denoted by Z.

Method to Calculate Mode:

(1) Arrange the terms in ascending or descending order (Preferably Ascending)

(2) Note the term occurring maximum times if it is or is a unique one.

(3) This term is Mode. (Z).

(Note:-If all terms occur once or some terms occur equal number of times, we can’t find Z by this method)

Example 1. Find Mode from the following data.

12	14	16	18	26	16	20	16	11	12	16	15	20	24

Solution

Arranging above data in ascending order

11	12	12	14	15	16	16	16	16	18	20	20	24	26

Here we get 16 four times, 12 and 20 two times each and other terms once only. Thus **Z = 16.**

Discrete Series:

Here the mode is known by Inspection Method only. Here that variable is the^ Mode where the frequency is highest.; But this method is applicable only if ;

(1) There is a gradual rise or fall in the sequence of frequencies.

(2) The highest frequency and the next highest frequency are not too close

(3) Maximum frequency is not repeated.

Example 1. Find Mode for following data

X :	4	7	11	16	25
f :	3	9	14	21	13

Solution:

In the above given series highest frequency is 21 and variable corresponding to i this frequency is 16. Thus Mode (Z) is 16.

For such a distribution we have to prepare (1) grouping Table and (2) Analysis

Grouping Table: It has Six Steps as given below.

(1) Frequencies are taken.

(2) Frequencies are added in two(s).

(3) Leaving first item, frequencies are added in two(s)

(4) Frequencies are added in threes.

(5) Leaving first frequency, frequencies are added in three (s)

(6) Leaving first two frequencies, frequencies are added in three (s).

In each case, take maximum total and put it in a circle or a box to distinguish it from others.

Analysis Table:

It has following steps:

Step I. Note highest total in each column.

Step II. Note the variable and/or variable in each column corresponding to that total.

Step III. Check if that total is of individual term or more (2 or 3) terms.

Step IV. If the total consists of 2 or more frequencies, all such variables have to be marked as V or x

Step V. Count a/ or x marks in each column.

Step VI. Variable with maximum √ or x marks denotes mode.

Example 2. Find Mode from the following data

x :	5	10	15	20	25	30	35	40	45
f :	1	3	4	9	11	12	3	2	2

Grouping Table

X	f(I)	II	III	IV	V	VI
5	1					
10	3	4		8		
15	4		7		16	
20	9	13				
25	11		20	32		24
30	12	23			26	
35	3		15			
40	2	5		7		17
45	2		4			

Analysis Table

Column X	I	II	III	IV	V	VI	Total
5							–
10							–
15						X	1
20			X	X		X	3
25		X	X	X	X	X	5
30	X	X		X	X		4
35					X		1
40							–
45							–

Here 25 has occured maximum times (5), thus Modal Value is **25.**

C. Continuous Series

In the case of Continuous Series, we go only one step ahead of the method for discrete series. We get the value of Mode by Interpolation as is the case with Median. The following formula is used to calculate Mode (Z)

$$\textit{Mode (Z)} = L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

Where ; L = is the lower limit of Modal Interval

f_1 is the frequency corresponding to Modal Interval

f_0 is the frequency preceding Modal Interval.

f_2 is the frequency succeeding Modal Interval.

i is the length of Modal Interval.

We can put this formula in following shape also :

Mode $$Z = L + \frac{D_1}{D_1 + D_2} \times i$$

Here ; $D_1 = |f_1 - f_0|$ and $D_2 = |f_1 - f_2|$

Points to remember while calculating mode

(1) Classes should be **exclusive.**
(2) Length of classes should be **equal.**
(3) Series should be in **ascending order.**
(4) If series is cumulative, convert it into continuous series.
(5) If first class is the modal class then f_0 will be zero.

Similarly if last class is modal class, then f_2 is zero.

Important Note : Class Intervals must be exclusive, equal, in ascending order, not cumulative.

Important If Modal Value lies in any other interval than with highest frequency, the following method can also be suggested to calculate Mode. But its use is almost neglegible.

$$\textbf{Mode (Z)} = L + \frac{f_2}{f_0 + f_2} \times i$$

Example 1. Calculate Mode from the following data :

Marks :	0–10	10 –20	20–30	30–40	40–50	50–60	60–70	70–80
Students :	2	18	30	45	35	20	6	4

Solution

C.I.	I	II	III	IV	V	VI
0–10	2					
10–20	18	20				
20–30	30		48	50	93	
30–40	45	75				110
40–50	35		80			
50–60	20	55		100	61	
60–70	6		26			30
70–80	4	10				

C.I.	FI	II	III	IV	V	VI	Total
0–10							0
10–20					x		1
20–30		x			x	x	3
30–40	x	x	x	x	x	x	6
40–50			x	x		x	3
50–60				x			1
60–70							0
70–80							0

Modal Interval = 30 – 40

$$Z = L + \frac{D_1}{D_1 + D_1} \times i$$

$L = 30$; $D_1 = 45 - 30 = 15$

$D_2 = 45 - 35 = 10$; $i = 10$

$$Z_2 = 30 + \frac{15}{15+10} \times 10$$

$$= 30 + \frac{150}{35} = 30 + 6 = 36$$