

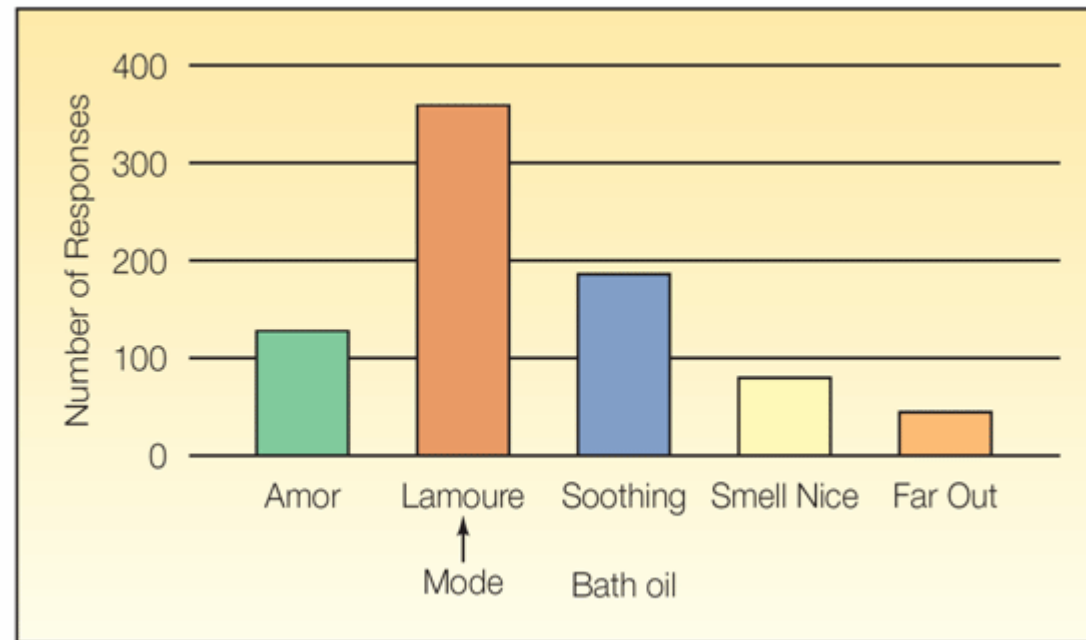
# Central Tendency

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**Mode**

# Mode

- **MODE:** The value of the observations that appears most frequently.
  - More specifically, mode is the observation around which the concentration/density of observations are maximum.
  - Mode is used when most typical value of the distribution is required
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Number of Respondents favouring various Bath Oils

# Mode

## ❖ Mode: In the Case of Individual Series - Example

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The annual salaries of quality-control managers in selected states are shown below. What is the modal annual salary?

State	Salary	State	Salary	State	Salary
Arizona	\$35,000	Illinois	\$58,000	Ohio	\$50,000
California	49,100	Louisiana	60,000	Tennessee	60,000
Colorado	60,000	Maryland	60,000	Texas	71,400
Florida	60,000	Massachusetts	40,000	West Virginia	60,000
Idaho	40,000	New Jersey	65,000	Wyoming	55,000

A perusal of the salaries reveals that the annual salary of \$60,000 appears more often (six times) than any other salary. The mode is, therefore, \$60,000.

# Mode

## ❖ Mode: In the Case of Discrete Series – Grouping Method

### ❖ Steps to Calculate Mode in Discrete Series:

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#### A. Prepare grouping table in following way:

1. Make six columns.
2. Frequency column to be marked as column I.
3. In column II, frequencies are grouped into two. At the end, if only one frequency is left, leave that.
4. In column III, leave the first frequency and then make group of two frequencies. At the end, if only one frequency is left, leave that.
5. Column IV is grouping of three frequencies starting from first observation. At the end, if only one or two frequency is left, leave that.
6. In column V, leave the first frequency and then make group of three frequencies. Leave if less than three frequencies are left at the end.
7. In column VI, leave the first two frequencies and then make group of three frequencies. Leave if less than three frequencies are left at the end.

# Mode

## B. Prepare analysis table in following way:

1. Prepare table consisting of seven rows and as many columns as the number of observations plus one.
2. In first column, write all the column numbers.
3. In successive columns, different observations are mentioned.
4. Put tally mark for each observations which as highest frequency in different columns of grouping table against respective column number.
5. Sum up number of tally mark of each observation.
6. The observation which has highest total tally mark is mode value.

# Mode

**Example:** From the following data of the height of following 124 persons in a commercial concern, determine modal height.

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Height in inches	58	60	61	62	63	64	65	66
No. of Persons	12	16	15	10	20	22	24	5

# Mode

Solution:

## Grouping Table

Height (inches)	Frequency I	II	III	IV	V	VI
58	12	28		43		
60	16		31		41	
61	15	25				45
62	10		30	52		
63	20	42			66	
64	22		46			51
65	24	29				
66	5					

# Mode

Analysis Table

Col. No.	58	60	61	62	63	64	65	66
I							I	
II					I	I		
III						I	I	
IV				I	I	I		
V					I	I	I	
VI						I	I	I
Total				1	3	5	4	1

Since, **64** has maximum total frequency, hence is modal height.



# Mode

## Mode: In the Case of Continuous Series – Grouping Method

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### ❖ Steps:

- First, we find modal class. The procedure to find modal class **in the case of continuous series** is same as that of estimating modal value in the case of discrete series but by replacing the discrete values of observations by class limits.
- Then, we estimate the modal value from modal class by using following formula.

$$M_o = L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

# Mode

Where,

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$M_o$  is modal value;

$L$  is lower limit of modal class;

$f_1$  frequency of modal class ;

$f_2$  frequency of class preceding the modal class;

$f_3$  frequency of class following modal class; and

$i$  is class interval of modal class.

# Mode

**Example:** From the following data of the marks of following 121 students in a class, determine modal marks.

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Height in inches	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of Persons	12	16	15	10	20	22	21	5

# Mode

Solution:

Grouping Table

Height (inches)	Frequency I	II	III	IV	V	VI
10-20	12	28		43		
20-30	16		31		41	
30-40	15	25				45
40-50	10		30	52		
50-60	20	42			63	
60-70	22		43			48
70-80	21	26				
80-90	5					

# Mode

Analysis Table

Col. No.	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
I						I		
II					I	I		
III						I	I	
IV				I	I	I		
V					I	I	I	
VI						I	I	I
Total				1	3	<b>6</b>	3	1

Since, **60-70** has maximum total frequency, hence is modal class.

# Mode

Now from modal class (60-70), following formula will give the value of modal marks:

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$$M_o = L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

$$M_o = 60 + \frac{22 - 20}{2 \times 22 - 20 - 21} \times 10$$

$$M_o = 60 + \frac{2}{44 - 41} \times 10$$

$$M_o = 60 + \frac{20}{3}$$

$$M_o = 66.67 \text{ Ans}$$

# Mode

- ❖ In case of bi-modal class (value), we can use following formula to estimate modal class (value)

$$Mode = 3Median - 2Mean$$

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- ❖ Locating Mode Graphically: From Histogram:

- **Steps:**

1. Draw histogram of the given data.
2. Draw two lines diagonally in the inside of the modal class bar, starting from each upper corner of the bar to upper corner of the adjacent bar.
3. Draw perpendicular line from the intersection of the two diagonal lines to the X-axis (horizontal scale) which gives the modal value.

- ❖ Mode can also be estimated from frequency polygon by drawing perpendicular line from the apex of the polygon on the base. The point where it meets the base give mode value. But in the case of two or more classes having highest frequency, mode cannot be estimated by diagrammatically.

# Mode

## ❖ Mode Determination Graphically - Histogram

- Example: Find the modal marks of the following distribution:

Marks (Inclusive Series) X	Frequency (f)	Marks (Exclusive Series) X
10-19	10	9.5-19.5
20-29	12	19.5-29.5
30-39	18	29.5-39.5
40-49	30	39.5-49.5
50-59	16	49.5-59.5
60-69	6	59.5-69.5
70-79	8	69.5-79.5



# Mode

## ❖ Mode Determination Graphically - Histogram

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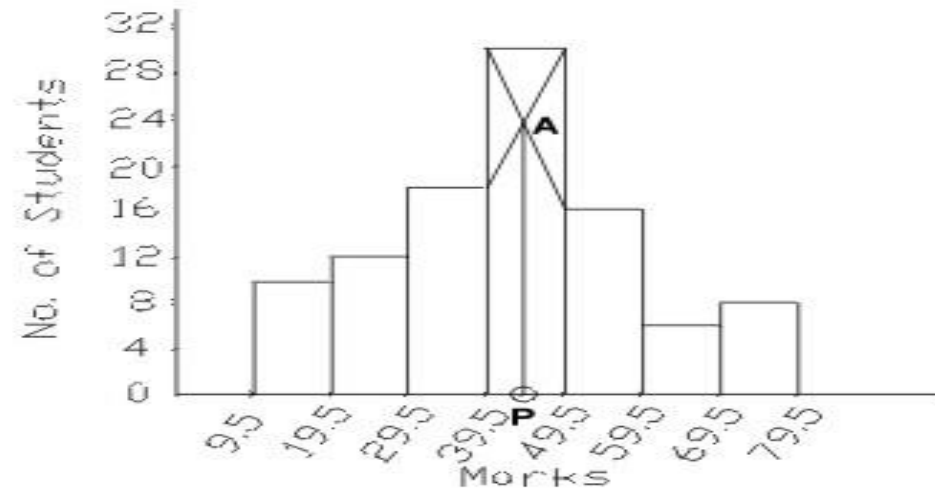
### ■ Steps:

1. Convert the inclusive series into exclusive series.
2. Represent the exclusive series in the form of histogram. The height of the histogram is represented by frequency of respective class limits.
3. Identify the highest rectangle. This corresponds to modal class.
4. Join the top corners of the highest rectangle with the immediately next corners of the adjacent rectangles.
5. Draw a perpendicular line from the intersection point of two joining lines on to X-axis as is represented by point 'P' in diagram shown in next slide.
6. The value corresponding to point P is mode.

# Mode

- Solution:

Histogram



Mode = 44.12