Mode :

It is the most frequent /typical/ predominant value in the data. Hence it is preferable for most common size of shoes, readymade garment , family etc.

Mode is the value where frequency curve attains its peak. Hence it is possible to get more than one modal value for the distribution . Such distributions are known as bimodal or multimodal distributions

Mode for ungrouped data :

Mode is the value corresponding to the highest frequency.

Calculate mode for the following data

Size of Shoes	No. of shops
4	10
5	14
6	16
7	18
8	10
9	5

Mode = Value corresponding to highest frequency

= Value corresponding to 18

Mode = 7

Mode for grouped data :

$$Z = l_1 + \frac{(f_1 - f_0) * (l_2 - l_1)}{2f_1 - f_0 - f_2}$$

Modal class is the class with highest frequency

f_1 is the frequency of the modal class

f_0 is the frequency of the previous class

f_2 is the frequency of the next class

l_1 is the lower limit of the modal class

l_2 is the upper limit of the modal class

Make sure that the class intervals are of exclusive type.

Q. 1 Calculate mode for the following data

Sale in Rs	No. of Shops
100-200	12
200-300	21
300-400	27
400-500	13
500-600	7

Modal Class : 300-400

$$Z = l_1 + \frac{(f_1 - f_0) * (l_2 - l_1)}{2f_1 - f_0 - f_2}$$

$$= 300 + \frac{(27-21)*(400-300)}{2*27-21-13}$$

$$= 300 + \frac{6*100}{54-21-13}$$

$$= 300 + \frac{600}{20} = 300 + 30 = 330$$

Q. 2 Calculate mode for the following data

No. of calls	No. of hours
7 - 12	4
12 -17	9
17 – 22	16
22- 27	21
27 - 32	13
32- 37	9

Modal Class : 22-27

$$Z = l_1 + \frac{(f_1 - f_0) * (l_2 - l_1)}{2f_1 - f_0 - f_2}$$

$$= 22 + \frac{(21-16)*(27-22)}{2*21-16-13}$$

$$= 22 + \frac{(5)*(5)}{42-16-13}$$

$$22 + \frac{25}{13} = 23.92$$

Q. 3 Calculate modal wages for the following data

Weekly wages	No. of workers
500-599	2
600-699	8
700- 799	12
800-899	16
900-999	13
1000-1099	6
1100-1199	3

Here inclusive intervals have to be converted into exclusive type

Weekly wages	No. of workers
499.5-599.5	2
599.5-699.5	8
699.5- 799.5	12
799.5-899.5	16
899.5-999.5	13
999.5-1099.5	6
1099.5-1199.5	3

Modal Class : 799.5-899.5

$$Z = l_1 + \frac{(f_1 - f_0) * (l_2 - l_1)}{2f_1 - f_0 - f_2}$$

$$= 799.5 + \frac{(16-12)*(899.5-799.5)}{(2*16-12-13)}$$

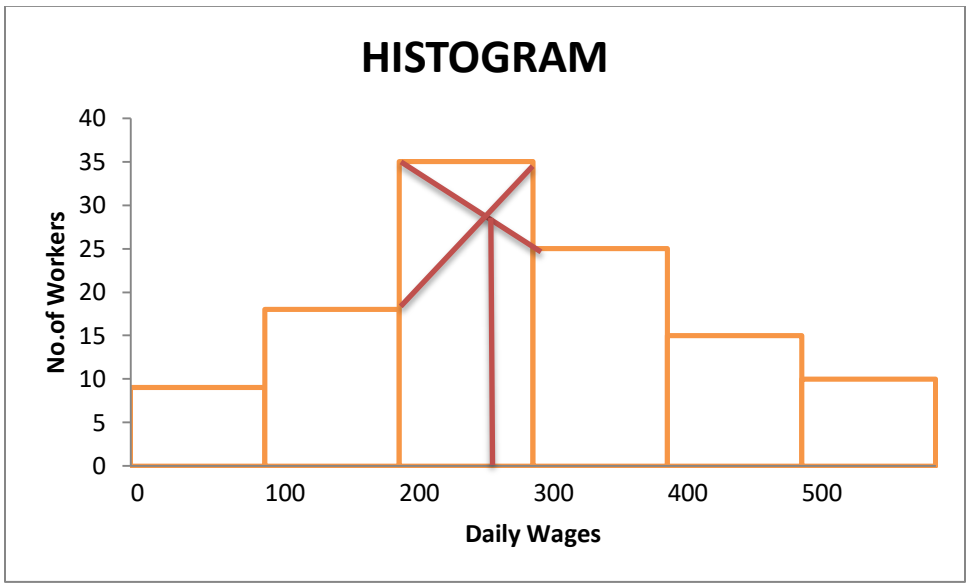
$$= 799.5 + \frac{(4)*(100)}{(32-12-13)}$$

$$= 799.5 + \frac{400}{7} \quad = 799.5 + 57.142 \quad = 856.642$$

Estimation of Mode using Histogram

Q1. Locate mode for the following data

Daily Wages	No. of workers
0 - 100	9
100 - 200	18
200 - 300	35
300 - 400	25
400 - 500	15
500 - 600	10



Mode = 260

Modal Class : 200-300

$$Z = l_1 + \frac{(f_1 - f_0) * (l_2 - l_1)}{2f_1 - f_0 - f_2}$$

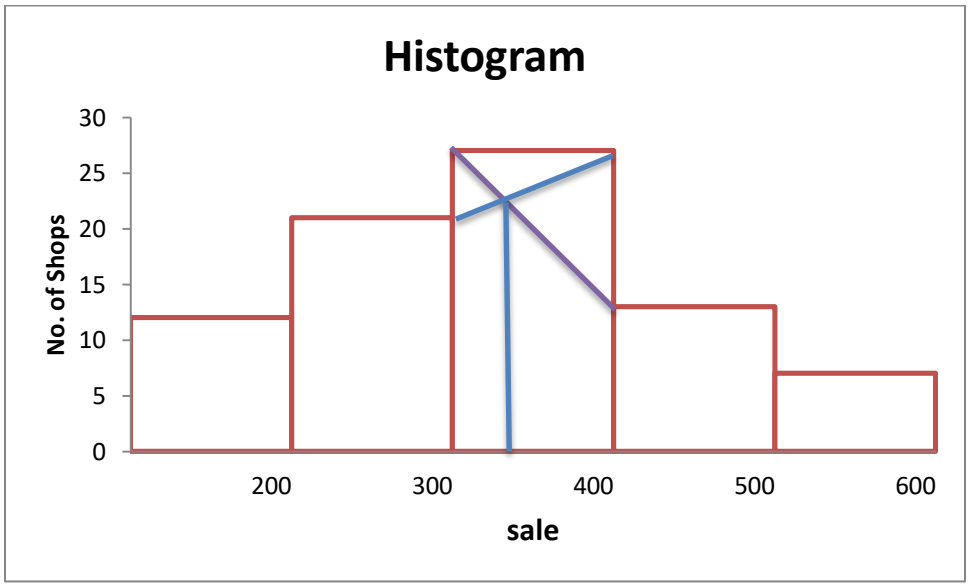
$$= 200 + \frac{(35-18)*(300-200)}{(2*35-18-25)}$$

$$=200 + \frac{(17)*(100)}{(70-18-25)}$$

$$= 200 + \frac{1700}{27} \quad = \quad 200 + 62.96 \quad = \quad 262.96$$

Q. 1 Locate mode for the following data

Sale in Rs	No. of Shops
100-200	12
200-300	21
300-400	27
400-500	13
500-600	7



Mode = 330

Modal Class : 300-400

$$Z = l_1 + \frac{(f_1 - f_0) * (l_2 - l_1)}{2f_1 - f_0 - f_2}$$

$$= 300 + \frac{(27-21)*(400-300)}{2*27-21-13}$$

$$= 300 + \frac{6*100}{54-21-13}$$

$$= 300 + \frac{600}{20} = 300 + 30 = 330$$

Median :

Median is a positional average. It divides the data into two equal parts , when the data is arranged in ascending or descending order of magnitude. It is the value such that no. of observations above it is equal to no. of observations below it.

Median for ungrouped data:

Steps:

1. Arrange the observations in ascending or descending order.
2. Median = value of $\frac{n+1}{2}$ th observation if n is odd
3. = Average of $(\frac{n}{2})$ th & $(\frac{n}{2}+1)$th observations if n is even

Median = $\frac{\left(\frac{n}{2}\right)\text{th observation}+\left(\frac{n}{2}+1\right)\text{th observation}}{2}$ if n is even

Q1. Calculate Median for the following data

17, 18, 17, 20, 21, 19, 18, 24, 26

n = 9 , odd

Arrange the observations in ascending order.

17, 17, 18, 18, 19, 20, 21, 24, 26

Median = value of $\frac{n+1}{2}$ th observation

= value of $\frac{9+1}{2}$ th observation = value of 5^{th} observation = 19

Q2. Calculate Median for the following data

30, 43, 65, 35, 50, 45, 55, 48, 58, 38

n = 10 , even

Arrange the observations in ascending order.

30 , 35, 38, 43, 45, 48, 50, 55, 58, 65

$$\text{Median} = \frac{\left(\frac{10}{2}\right)\text{th observation} + \left(\frac{10}{2}+1\right)\text{th observation}}{2}$$

$$= \frac{(5)\text{th observation} + (6)\text{th observation}}{2} = \frac{45+48}{2} = 46.5$$

Q3. Calculate Median for the following data

x	f	lcf
15	3	3
17	5	8
19	6	14
22	8	22
24	5	27
26	3	30

N= 30 , Even

$$\text{Median} = \frac{\left(\frac{30}{2}\right)\text{th observation} + \left(\frac{30}{2}+1\right)\text{th observation}}{2}$$

$$= \frac{(15)\text{th observation} + (16)\text{th observation}}{2} = \frac{22+22}{2} = 22$$

Q4. Calculate Median for the following data

x	f	lcf
5	3	3
10	7	10
15	13	23
20	17	40
25	12	52
30	7	59

N = 59 , Odd

Median = value of $\frac{n+1}{2}$ th observation

= value of $\frac{59+1}{2}$ th observation

= value of 30^{th} observation = 20

Median for grouped data:

$$M = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

Median class is the class containing N/2 th observation

N is the total number of observations

l_1 is the lower limit of the median class

l_2 is the upper limit of the median class

cf is the cumulative frequency of the pre median class

Make sure that the class intervals are of exclusive type.

Q1. Calculate median for the following data

Age	No. of persons	l.c.f
10-20	5	5
20-30	15	20
30-40	20	40
40-50	35	75
50-60	15	90
60-70	10	100

Median class is the class containing N/2 th = 50^{th} observation

Median class is 40-50

$$M = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

$$= 40 + \frac{\left(\frac{100}{2} - 40\right) * (50 - 40)}{35}$$

$$= 40 + \frac{(50 - 40) * (50 - 40)}{35}$$

$$= 40 + \frac{(10) * (10)}{35} = 40 + 2.857 = 42.857$$

Q2. Calculate median for the following data

Saving in Rs.	No. of employees	l.c.f
0-400	8	8
400-800	10	18
800-1200	12	30
1200-1600	6	36
1600-2000	4	40

Median class is the class containing N/2 th = 20^{th} observation

Median class is 800-1200

$$M = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

$$= 800 + \frac{\left(\frac{40}{2} - 18\right) * (1200 - 800)}{12}$$

$$= 800 + \frac{(20 - 18) * (400)}{12}$$

$$= 800 + \frac{800}{12} = 800 + 66.66 = 866.66$$

Q3. Calculate median for the following data

Life in hrs.	No. of electric bulbs	l.c.f
500-1000	3	3
1000-1500	8	11
1500-2000	14	25
2000-2500	18	43
2500-3000	10	53
3000-3500	5	58
3500-4000	2	60

Median class is the class containing N/2 th = 30^{th} observation

Median class is 2000-2500

$$M = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

$$= 2000 + \frac{\left(\frac{60}{2} - 25\right) * (2500 - 2000)}{18}$$

$$= 2000 + \frac{(30 - 25) * (500)}{18}$$

$$= 2000 + \frac{2500}{18} = 2000 + 138.88 = 2138.88$$

Q4. Calculate median for the following data

Intervals	frequency
1-99	7
100-199	13
200-299	25
300-399	40
400-499	20
500-599	15

Here inclusive intervals have to be converted into exclusive type

Intervals	frequency	l.c.f
0.5-99.5	7	7
99.5- 199.5	13	20
199.5-299.5	25	45
299.5-399.5	40	85
399.5-499.5	20	105
499.5-599.5	15	120

Median class is the class containing N/2 th = 60^{th} observation

Median class is 299.5-399.5

$$M = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

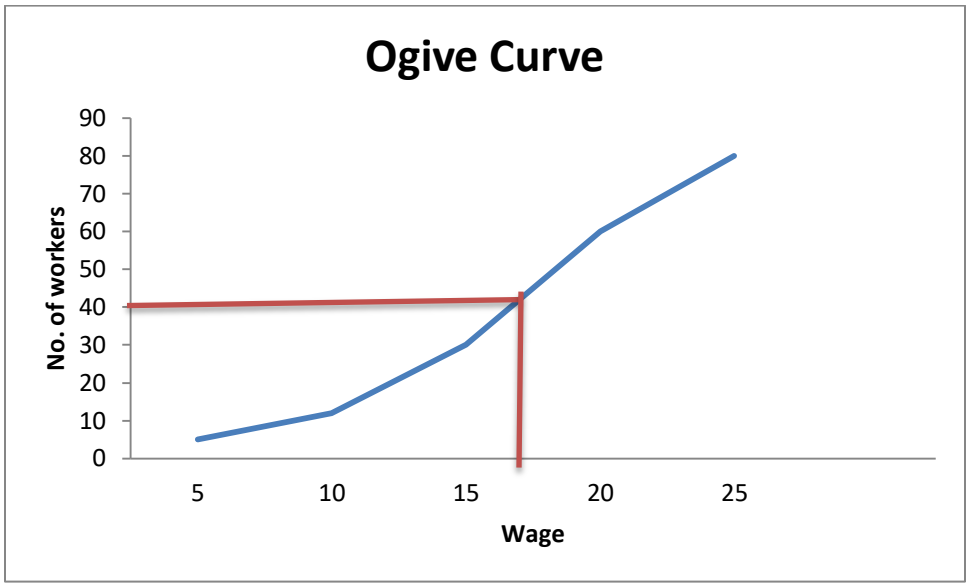
$$= 299.5 + \frac{\left(\frac{100}{2} - 45\right) * (399.5 - 299.5)}{40}$$

$$= 299.5 + \frac{(60 - 45) * (100)}{40}$$

$$= 299.5 + \frac{1500}{40} = 299.5 + 37.5 = 337$$

Locating Median using Ogive Curve:

Wages	No. of workers	lcf
0 – 5	5	5
5 - 10	7	12
10 – 15	18	30
15 – 20	30	60
20 – 25	20	80



Median = 17

Median class is 15 – 20

$$M = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

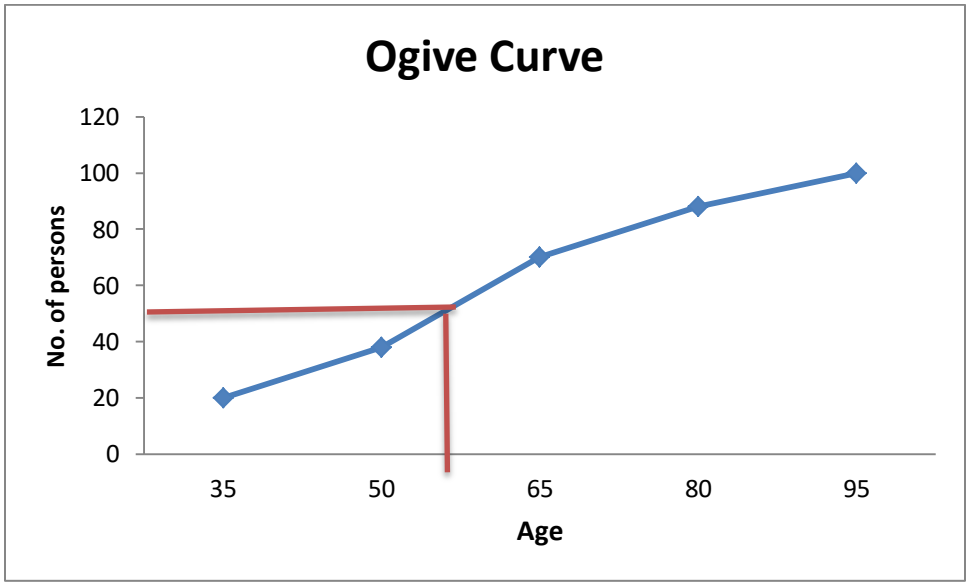
$$= 15 + \frac{\left(\frac{80}{2} - 30\right) * (20 - 15)}{30}$$

$$= 15 + \frac{(40 - 30) * (5)}{30}$$

$$= 15 + \frac{50}{30} = 15 + 1.66 = 16.66$$

Locating Median using Ogive Curve:

Age	No. of persons	lcf
Below 35	20	20
35 - 50	18	38
50 – 65	32	70
65 – 80	18	88
Above 80	12	100



Median = 57

Median class is 50 – 65

$$M = l_1 + \frac{\left(\frac{N}{2} - cf\right) * (l_2 - l_1)}{f}$$

$$= 50 + \frac{\left(\frac{100}{2} - 38\right) * (65 - 50)}{32}$$

$$= 50 + \frac{(50 - 38) * (15)}{32}$$

$$= 50 + \frac{180}{32} = 50 + 5.625 = 55.625$$

Merits of Arithmetic Mean

- It is easy to understand , simple to calculate.
- It is rigidly defined to get unique value.
- It is based on all observations.
- It is capable of further mathematical treatment.

Demerits of Arithmetic Mean

- It can not be calculated if some values are missing
- It can not be calculated for open ended intervals
- It may not be actually present in the data
- It is affected by extreme values
- Sometimes it gives absurd values

Merits of Mode

- It is easy to understand , simple to calculate.
- It is the most typical value.
- It can be used for even qualitative data.
- It can be calculated for even open ended intervals
- It can be located graphically.

Demerits of Mode

- It is not rigidly defined to give unique value, hence bimodalor multimodal distributions are possible.
- It is not based on all observations.
- It is affected by sampling fluctuations.
- It is not capable of further mathematical treatment.

Merits of Median

- It is easy to understand , simple to calculate.
- It exists in the data most of the times.
- It can be used for even qualitative data.
- It can be calculated for even open ended intervals
- It can be calculated even if some values are missing.
- It can be located graphically.

Demerits of Median

- It is not based on all observations.
- It is affected by sampling fluctuations.
- It is not capable of further mathematical treatment.
- Its calculation requires prior arrangement of data in ascending or descending order.