Median

1. Measure of Central Tendency.

- The median is determined by sorting the data set from lowest to highest values and taking the data point in the middle of the sequence.
- 3. Middle Value In Ordered Sequence
 - If Odd n, Middle Value of Sequence
 - If Even n, Average of 2 Middle Value
- 4.Not Affected by Extreme Values

Merits:

- It is rigidly defined
- It is easy to understand and easy to calculate.
- It is not at all affected by extreme values.
- It can be calculated for distributions with open-end classes.
- Median is the only average to be used while dealing with qualitative data.
- Can be determined graphically.

Demerits:

- In case of even number of observations median cannot be determined exactly.
- It is not based on all the observations.
- It is not capable of further mathematical treatment

For ungrouped data:-

Step-1

Arranged data in ascending or descending order.

Step:-2

If total no. of observations 'n' is odd then used the following formula for median

$$=\frac{n+1}{2}$$
 th observation.

Step:-3

If total no. of observations 'n' is even then used the following formula for median = arithmetic mean of two middle observations.

Median

If $X_1, X_2, X_3,...$, X_n are n observations arranged in ascending order of magnitude.

$$X_{(n+1)/2} \qquad \text{if n is odd} \\ Median = \left\{ \begin{array}{c} \\ X_{n/2} + X_{(n/2)+1} \\ \hline \end{array} \right. \qquad \text{if n is even}$$

Calculate the median for the following series:-

1,2,3,4,5,5,8.

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

The data on pulse rate per minute of 10 heal individuals are 82, 79, 60, 76, 63,81, 68, 74, 60, 75. n= 10

$$X_{n/2} + X_{(n/2)+1} / 2$$

Median =
$$\frac{74+75}{2}$$
 = 74.5

Find out the median for number of sports injuries happened in cricket in all teams

37, 57, 65, 46, 12, 14, 19, 23, 56, 78, 5, 33

For Grouped data:-

Median:-

$$l + \frac{\left(\frac{n}{2} - c\right)}{f}$$

I = lower limit of class interval where the median occurs

f = Frequency of the class where median occurs

h = Width of the median class

C= Cumulative frequency of the class preceding the median class (PCF)

Find the median weight of 590 infants born in a hospital in one year from the following table.

Weight of infant in kg	No of infants
2.0-2.5	37
2.5-3.0	117
3.0-3.5	207
3.5-4.0	155
4.0-4.5	48
4.5 and above	26

Weight of infants in kg	No of infants	Cumulative frequency
2.0-2.5	37	37
2.5-3.0	117	37+117=154
3.0-3.5	207	154+207=361
3.5-4.0	155	361+155=516
4.0-4.5	48	516+48=564
4.5 and above	26	564+26=590

$$l + \frac{\left(\frac{n}{2} - c\right)}{f}$$

$$= 3.0 + 0.34$$

For grouped Data:-Calculate the median for the following data series:-

Class interval	Frequency	
5-9	2	
10-14	11	
15-19	26	
20-24	17	
25-29	8	
30-34	6	
35-39	3	
40-44	2	
45-49	1	

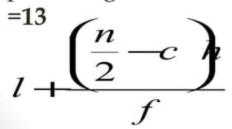
Solution:-

Class interval	Frequency	cumulative frequency
5-9	2	2
10-14	11	13
15-19	26	39
20-24	17	56
25-29	8	64
30-34	6	70
35-39	3	73
40-44	2	75
45-49	1	76

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n = 76
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1 = lower limit of class interval where the median occurs

- = 15
- \mathbf{h} = Width of the median class
- =4
- f = Frequency of the class where median occurs
- = 26
- **C** = Cumulative frequency of the class preceding the median class



Mode

- 1. Measure of Central Tendency
- The mode is the most frequently occurring value in the data set.
- 3. May Be No Mode or Several Modes

Merits:

- Mode is readily comprehensible and easy to calculate.
- Mode is not at all affected by extreme values.
- Mode can be conveniently located even if the frequency distribution has class intervals of unequal magnitude
- Open-end classes also do not pose any problem in the location of mode.
- Mode is the average to be used to find the ideal size.

Demerits:

- Mode is ill defined.
- It is not based upon all the observations.
- It is not capable of further mathematical treatment.
- As compared with mean, mode is affected to a great extent by fluctuations of sampling.

Mode Example

No Mode						
Raw Data:	10.3	4.9	8.9	11.7	6.3	7.7
One Mode						
Raw Data:	6.3	4.9	8.9	6.3	4.9	4.9
More Than 1 Mo	de					
Raw Data:	21	28	28	41	43	43

Mode for ungrouped data:-

2,2,3,4,6,7,4,4,4,4,8,9,0 10,10,3,3,4,2,1,6,7 10,34,23,12,11,3,4 mode is 4 mode is 10 and 3 no mode

Mode for Group Data

$$F_m - F_1$$
Mode = $L_1 + ---- * c$
 $2F_m - F_1 - F_2$

Where

- •F_m is mode freq.
- F₁ is freq. just lower mode class.
- •F₂ is freq. after mode class.
- L₁ is lower limit of mode class
- ·C is class difference.

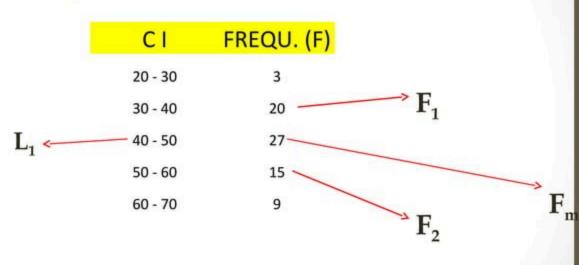
Q. Find the Mode for group data

Age group 20-30 30-40 40-50 50-60 60-70 No. of persons 3 20 27 15 9

CI	FREQU. (F)
20 - 30	3
30 - 40	20
40 - 50	27
50 - 60	15
60 - 70	9

Q. Find the Mode for group data

Age group 20-30 30-40 40-50 50-60 60-70 No. of persons 3 20 27 15 9



$$F_m - F_1$$
Mode = $L_1 + ---- * c$
 $2F_m - F_1 - F_2$

$$Mode = 43.68$$

Calculate the mode for the following frequency distribution:-

IQ Range	Frequency
90-100	11
100-110	27
110-120	36
120-130	38
130-140	43
140-150	28
150-160	16
160-170	1

Modal class by inspection is 130-140

$$f_m = 43$$

$$f_1 = 38$$

$$f_2 = 28$$

$$C = 10$$

$$1 = 130$$

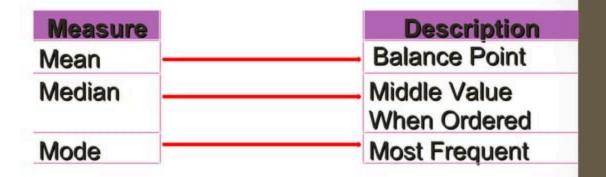
$$l + \left(\frac{(f_m - f_1)}{2f_m - (f_1 - f_2)}\right)^2$$

=130.6579

Relationship between Mean, Median and Mode

Mode = 3 Median – 2 Mean

Summary of Central Tendency Measures



Ex. Calculate Mean, Median, Mode.

	No. of		
Age Group	Patients		
25-30	4		
30-35	3		
35-40	2		
40-45	3		
45-50	4		
50-55	8		
55-60	6		

Age Group	No. of Patients (F)	Х	F*X	C.F
25-30	4	27.5	110	4
30-35	3	32.5	97.5	7
35-40	2	37.5	75	9
40-45	3	42.5	127.5	12
45-50	4	47.5	190	16
50-55	8	52.5	420	24
55-60	6	57.5	345	30
	30		1365	
MEAN =1365/30 = 45.5				
MEDIAN = 45+ (15-12)*5/4 = 48.75				

MEDIAN = 45+ (15-12)*5/4 = 48.75 MODE=50 + [(8-4)*5/(2*8-4-6)]=53.34 Ex. The following table gives the frequency distribution of marks obtained by 2300 medical students of Gujarat in MCQ of PSM exam. Find Mean, Median and Mode.

	NI C
	No. of
Marks	students
11-20	141
21-30	221
31-40	439
41-50	529
51-60	495
61-70	322
71-80	153