Measures of Central Tendency

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Measures of Central Tendency

- There are three averages or measures of central tendency

✓ Arithmetic mean

✓ Median

✓ Mode

Arithmetic Mean

- The most commonly used and familiar index of central tendency for a set of raw data or a distribution is the mean

- The mean is simple arithmetic average

- The arithmetic mean of a set of values is their sum divided by their number

Merits of the Use of Mean

- It is easy to understand
- It is easy to calculate
- It utilizes entire data in the group
- It provides a good comparison

Limitations

- In the absence of actual data it can mislead
- Abnormal difference between the highest and the lowest score would lead to fallacious conclusions
- A mean sometimes gives such results as appear almost absurd. e.g. 4.3 children
- Its value cannot be determined graphically

Types of Averages

1. Arithmetic Mean

   (a) Simple AM (b) Weighted AM

2. Median
3. Mode
4. Geometric Mean
5. Harmonic Mean

Calculation of Arithmetic Mean

- **For Ungrouped Data**

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

$$= \frac{X1+X2+\ldots\ldots.+Xn}{n}$$

- Calculate mean for 40, 45, 50, 55, 60, 68

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

$$= \frac{40+45+50+55+60+68}{6}$$

$$= \frac{318}{6}$$

Mean = 53

Arithmetic Mean

	Individual Series	Discrete Series	Continuous Series
Direct Method	$X = \frac{X_1 + X_2 + X_3}{N}$	$X = \frac{\Sigma f X}{N}$	$X = \frac{\Sigma f m}{N}$
Shortcut Method	$X = A \pm \frac{\Sigma d}{N}$	$X = A \pm \frac{\Sigma f d}{N}$	$X = A \pm \frac{\Sigma f d}{N}$
Step Deviation Method	$X = A \pm \frac{\Sigma d'}{N} * C$	$X = A \pm \frac{\Sigma f d'}{N} * C$	$X = A \pm \frac{\Sigma f d'}{N} * C$

- **For Grouped Data**
- **Mean = AM + $\dfrac{(\Sigma fd)}{N}$ i**

✓ d(deviation) = $\dfrac{X-AM}{i}$

✓ X = Midpoint, AM = Assumed Mean

✓ i = Class Interval size

✓ fd = Product of the frequency and the corresponding deviation

CI	f	Mid Point X	$d = \frac{X - AM}{i}$	fd
30 – 40	6	35	-3	-18
40 – 50	8	45	-2	-16
50 – 60	10	55	-1	-10
60 – 70	6	65	0	0
70 – 80	4	75	1	4
80 – 90	3	85	2	6
90 - 100	3	95	3	9
	N=40			$\Sigma fd = -25$

- **Mean** $= AM + \frac{(\Sigma fd)}{N} i$

$$= 65 + \frac{(-25)}{40} * 10$$

$$= 65 - 6.25$$

Mean = 58.75

Median

- When all the observation of a variable are arranged in either ascending or descending order the middle observation is Median.
- It divides whole data into equal portion. In other words 50% observations will be smaller than the median and 50% will be larger than it.

Merits of Median

- Like mean, median is simple to understand
- Median is not affected by extreme items
- Median never gives absurd or fallacious results
- Median is specially useful in qualitative phenomena

Limitations

- It is not suitable for algebraic treatment
- The arrangement of the items in the ascending order or descending order becomes very tedious sometimes
- It cannot be used for computing other statistical measures such as S.D or correlation

Calculation of Median

- **Un grouped data**

a. When there is an odd number of items

Median = The middle value item

b. When there is an even number of items

$$\text{Median} = \frac{\text{Sum of middle two scores}}{2}$$

- Calculate Median 7, 6, 9, 10, 4

  Arrange the given data in ascending order: 4, 6, 7, 9, 10

  N = 5 (odd number)

  Median = Middle term

  Median = 7

- Calculate Median 6, 9, 3, 4, 10, 5

  Arrange the given data in ascending order:

  3, 4, 5, 6, 9, 10

  N = 6 (even number)

  $$\textbf{Median} = \frac{\textbf{Sum of the middle two scores}}{\textbf{2}} = \frac{5+6}{2}$$

  Median = 5.5

- **Grouped Data**

$$\textbf{Median} = l + \frac{(N/2 - F)}{fm}\, i$$

- ✓ Where, l = exact lower limit of the CI in which Median lies
- ✓ F = Cumulative frequency up to the lower limit of the CI containing Median
- ✓ fm = Frequency of the CI containing Median
- ✓ i = Size of the class interval

CI	f	Cumulative Frequency
30 – 40	6	6
40 – 50	8	14
50 – 60	10	24
60 – 70	6	30
70 – 80	4	34
80 – 90	3	37
90 - 100	3	40
	N=40	

N/2=20

- **Median = $l + \dfrac{(N/2 - F)}{fm}\, i$**

Here, $l = 50$, $F = 14$, $fm = 10$, $i = 10$

$$\text{Median} = 50 + \frac{(20 - 14)}{10} * 10$$

$$= 50 + 6$$

Median = 56

Mode

- The observation which occurs most frequently in a series is Mode

Merits of Mode

- It can be easily located by mere inspection
- It eliminates extreme variations
- It is commonly understood
- Mode can be determined graphically

Limitations

- It is measure having very limited practical value
- It is not capable of further mathematical treatment
- It is ill-defined and indefinite and so trustworthy

Calculation of Mode

- Ungrouped Data

Mode = largest number of times that item appear

- Grouped Data

Mode = 3*Median – 2*Mean

- Calculate Mode for 100, 120, 120, 100, 124, 132, 120

  Mode = 120, since 120 occurs the largest number of times (3 times)

- Calculate Mode for 100, 101, 110, 111, 113, 101, 113, 115

  Mode = 101 & 113, since 101 and 113 occurs twice

- For grouped data let we consider the previous problem that we solved in Mean and Median

We have, Mean = 58.75 & Median = 56

Mode = 3*Median – 2*Mode

= 3*56 – 2*58.75

= 168 – 117.5

Mode = 50.5