MEASURES OF CENTRAL TENDENCY

Measures of Central Tendency

Measures of central tendency provide a very convenient way of describing a set of scores with a single number that describes the **PERFORMANCE** of the group.

Definition

"Measure of central tendency is a statistic calculated from a set of distinct and independent observations and measurements of a certain items or entity and intended to typify those observations."

"केन्द्रीय प्रवृत्ति का माप किसी विशिष्ट एकांश अथवा वस्तु के भिन्न और स्वतंत्र प्रेक्षणों अथवा मापनों के समुच्चय से गणना किया गया ऐसा आंकड़ा है जो एक आदर्श के रूप में उन प्रेक्षणों का प्रतिनिधित्व करता है ।"

English & English

Importance of Central Tendency-

- To find representative value
- To make more concise data
- To make comparisons
- Helpful in further statistical analysis

There are three commonly used measures of central tendency. These are the following-
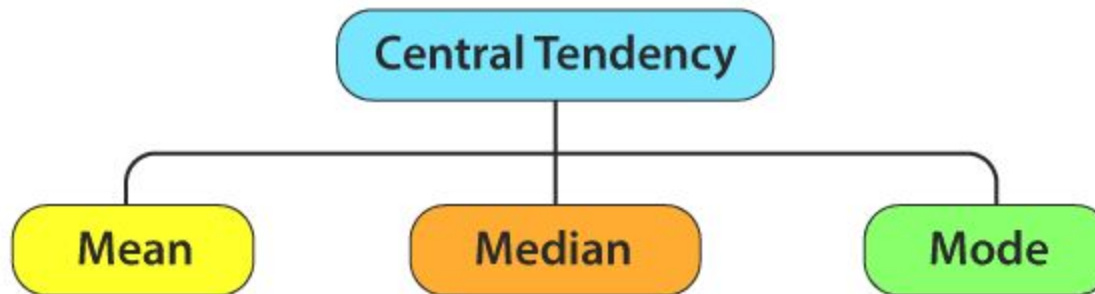
MEAN

"The arithmetic mean, or more simply the mean, is the sum of the separate scores or measures divided by their number."

"समान्तर माध्य, जिसे संक्षेप में माध्य भी कहा जाता है, विभिन्न प्राप्तांकों का ऐसा योग है जिसे   प्राप्तांकों की संख्या से विभाजित किया गया हो I"

Garrett

Calculation of Mean when Data are Ungrouped

$$M = \frac{\sum X}{N}$$

M= Mean (माध्य)
∑= Sum of (योग)
X= Score (प्राप्तांक)
N= Number (प्राप्तांकों की संख्या)

Ex. 15, 18, 11, 19, 12, 15, 11, 13, 17, 14

$$M = \frac{\sum X}{N}$$

$$= \frac{15 + 18 + 11 + 19 + 12 + 15 + 11 + 13 + 17 + 14}{10}$$

$$= \frac{145}{10}$$

$$= 14 \cdot 5$$

Calculation of Mean from Grouped Data

There are two methods of calculating the mean-

- Long Method (दीर्घ विधि)
- Short Method or Assumed Mean Method (लघु विधि अथवा अभिगृहीत माध्य विधि)

Calculation of Mean by Long Method

60 छात्रों की बुद्धिलब्धियों का माध्य (दीर्घ विधि)

Class Interval C.I.	Frequency f	Mid Point x	fx
120-124	3	122	366
115-119	4	117	468
110-114	6	112	672
105-109	8	107	856
100-104	15	102	1530
95-99	10	97	970
90-94	7	92	644
85-89	4	87	348
80-84	3	82	246
	N=60		**∑=6100**

$$M = \frac{\sum fx}{N}$$

$$= \frac{6100}{60}$$

$$= 101 \cdot 67$$

Calculation of Mean by Short Method

60 छात्रों की बुद्धिलब्धियों का माध्य (लघु विधि)

Class Interval (C.I.)	Frequency (f)	Mid Point (x)	Variance (x')	(f x')
120-124	3	122	4	12
115-119	4	117	3	12
110-114	6	112	2	12
105-109	8	107	1	8
100-104	15	102	0	0 +44
95-99	10	97	-1	-10
90-94	7	92	-2	-14
85-89	4	87	-3	-12
80-84	3	82	-4	-12 -48
	N=60			$\sum$= - 4

$$M = AM + \frac{\sum fx'}{N} \times i$$

$$= 102 + \frac{(-4)}{60} \times 5$$

$$= 102 + (-\cdot066) \times 5$$

$$= 102 - \cdot 33$$

$$= 101 \cdot 67$$

Properties of Mean-

- Mean can be calculated for any set of numerical data, so it always exists.

- A set of numerical data has one and only one mean.

- Mean is the most reliable measure of central tendency since it takes into account every item in the set of data.

- It is greatly affected by extreme or deviant values (outliers)

- It is used only if the data are interval or ratio.

Use of Mean-

- Sampling stability is desired.

- Other measures are to be computed such as standard deviation, coefficient of variation and skewness.

Median

"Median is the value that separates all the cases in a ranked distribution into halves."

"माध्यिका वह मान है जो एक कोटिबद्ध वितरण के सभी प्राप्तांकों को दो बराबर भागों में बाँट देता है।"

Warren

Calculation of Median from Ungrouped Data

$$\textbf{Mdn} = \text{the } \frac{\textbf{(N + 1)}}{\textbf{2}} \text{ th measure in order of size}$$

Ex. 16, 10, 18, 22, 19, 21, 17

Solution   10, 16, 17, **18**, 19, 21, 22

N= 7

$$\text{Mdn} = \frac{(N+1)}{2}$$

$$= \frac{7+1}{2}$$

$$= \frac{8}{2}$$

$$= 4$$

Calculation of Median from Grouped Data

60 छात्रों की बुद्धिलब्धियों की माध्यिका

Class Interval C.I.	Frequency f	Cumulative Frequency F
120-124	3	60
115-119	4	57
110-114	6	53
105-109	8	47
100-104	15	39
95-99	10	24
90-94	7	14
85-89	4	7
80-84	3	3
	N=60	

Solution:
$$Mdn = l + \left(\frac{N/2 - F_1}{fm}\right) \times i$$

$$= 99{\cdot}5 + \left(\frac{60/2 - 24}{15}\right) \times 5$$

$$= 99{\cdot}5 + {\cdot}4 \times 5$$
$$= 99{\cdot}5 + 2{\cdot}0$$
$$= 101{\cdot}5$$

Advantages of Median-
- Median can be calculated in all distributions.
- Median can be understood even by common people.
- Median can be ascertained even with the extreme items.
- It can be located graphically.
- It is most useful dealing with qualitative data.

Disadvantages of Median-
- It is not based on all the values.
- It is not capable of further mathematical treatment.
- It is affected fluctuation of sampling.
- In case of even no. of values it may not the value from the data.

Use of Median-
- The exact midpoint of the score distribution is desired.
- There are extreme scores in the distribution.

Mode

"The mode is strictly defined as the scale of measurement with maximum frequency in a distribution."

"बहुलक की यथार्थ परिभाषा मापन के पैमाने पर एक ऐसे बिंदु से की जा सकती है, जिस पर वितरण की सर्वाधिक आवृत्ति हो ।"

Guilford

Calculation of Mode from Ungrouped Data

Ex. 7, 8, 8, 8, 9, 9, **10**, **10**, **10**, **10**, 11, 11, 12, 12, 12, 13

Ans. 10   (4 times)

Calculation of Mode from Grouped Data

60 छात्रों की बुद्धिलब्धियों का बहुलक

Class Interval C.I.	Frequency f
120-124	3
115-119	4
110-114	6
105-109	8
(100-104)	15 - Mode
95-99	10
90-94	7
85-89	4
80-84	3
	N=60

$Mo = (Mode)$ बहुलक

$x = (Midpoint)$ बहुलक वर्ग-अन्तराल का मध्यबिंदु

$i = (Interval)$ वर्ग-अन्तराल का आकार

$f_0 =$ बहुलक वर्ग-अन्तराल की आवृत्ति

$f_1 =$ बहुलक वर्ग-अन्तराल से ठीक ऊपर वाले वर्ग-अन्तराल की आवृत्ति

$f_{-1} =$ बहुलक वर्ग-अन्तराल से ठीक नीचे वाले वर्ग-अन्तराल की आवृत्ति

$$Mo = X + \frac{i}{2} \left(\frac{f_1 - f_{-1}}{2f_0 - f_1 - f_{-1}} \right)$$

$$= 102 \cdot 0 + \frac{5}{2} \left(\frac{8 - 10}{2 \times 15 - 8 - 10} \right)$$

$$= 102 \cdot 0 + 2 \cdot 5 \left(\frac{-2}{12} \right)$$

$$= 102 \cdot 0 - \cdot 42$$

$$= 101 \cdot 58$$

Advantages of Mode-

- Mode is readily comprehensible and easily calculated.
- It is the best representative of data.
- It is not at all affected by extreme value.
- The value of mode can also be determined graphically.
- It is usually an actual value of an important part of the series.

Disadvantages of Mode-

- It is not based on all observations.
- It is not capable of further mathematical manipulation.
- Mode is affected to a great extent by sampling fluctuations.
- Choice of grouping has great influence on the value of mode.

Properties of Mode-

• It is used when you want to find the value which occurs most often.

• It is a quick approximation of the average.

• It is an inspection average.

• It is the most unreliable among the three measures of central tendency because its value is undefined in some observations.

Uses of Mode-

• When the "typical" value is desired.

• When the data set is measured on a nominal scale.

Conclusion-

- A measure of central tendency is a measure that tells us where the middle of a bunch of data lies.

- Mean is the most common measure of central tendency. It is simply the sum of the numbers divided by the number of numbers in a set of data. This is also known as average

- Median is the number present in the middle when the numbers in a set of data are arranged in ascending or descending order. If the number of numbers in a data set is even, then the median is the mean of the two middle numbers.

- Mode is the value that occurs most frequently in a set of data.

References-

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