DAY 55

MCA CET 2025

MATHS

STATISTICS

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Statistics

Statistics → collection, analysing & interpretation of data.

Measure of Central Tendency.

- Mean
  - Arithmetic
  - Geometric
  - Harmonic
- Median
- Mode

Arithmetic Mean

a. for individual data

$x_1 \quad x_2 \quad x_3 \quad \ldots\ldots \quad x_n$

$$\text{mean } (\bar{x}) = \frac{x_1 + x_2 + x_3 + \ldots\ldots + x_n}{n}$$

LL ⟸ 20 - 30 ⟹ UL   CLASSMARK = $\frac{UL + LL}{2}$ = 25 ⟸ x

Arithmetic Mean

b. For weighted freq. / freq. distribution.

w/ x	f_i

$$\bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}$$

Geometric Mean

(a.) $x_1 \quad x_2 \quad x_3 \; - - - - \; x_n$

$$Gm = (x_1 \cdot x_2 \cdot x_3 \cdots\cdots x_n)^{1/n}$$

$$= \text{antilog}\left(\frac{1}{n}\sum_{i=1}^{n} \log x_i\right)$$

Geometric Mean

(b) for freq. distribution.

$$GM = \text{antilog}\left[\frac{1}{\Sigma f_i} \sum_{i=1}^{n} (f_i \cdot \log x_i)\right]$$

Harmonic Mean

$x_1 \quad x_2 \quad x_3 \quad \ldots \quad \ldots \quad x_n$

(a)

For individual

$$HM = \frac{1}{\frac{1}{n} \cdot \sum_{i=1}^{n} \left(\frac{1}{x_i} \right)}$$

Harmonic Mean

(b) for freq. distribution.

$$HM = \frac{1}{\frac{1}{\sum f_i} \cdot \sum_{i=1}^{n} \left(\frac{f_i}{x_i} \right)}$$

Relation between AM, GM & HM

$$AM \geq GM \geq HM$$

COMBINED MEAN (ARITHMETIC MEAN).

$\underbrace{x_1, x_2, x_3, \ldots\ldots x_{10}}_{①} \,/\, \underbrace{x_{11} \ldots x_{20}}_{②}$

$\bar{x}_1$ = mean of first set of obs.

$n_1 = 10$ = no. of obs. in first set.

$\bar{x}_2$ = mean of second set of obs.

$n_2 = 10$ = no. of obs. in second set.

$$\bar{x}_{12} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$$

Median

(a) For individual data.

1 ⇒ arrange the data in ascending order.

2 ⇒ n = no. of obs.

n = even

$$\text{Median} = \frac{\text{value of } \left(\frac{n}{2}\right)^{th} + \text{value of } \left(\frac{n}{2}+1\right)^{th}}{2}$$

n = odd

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

LL – UL   Class width = UL – LL

Median

(b) For continuous series of class.

$$\text{Median} = L + \left[\frac{n/2 - cf}{f}\right] \times h$$

h = class width.

L = lower limit of median class.

$\frac{N}{2}$ = $\frac{\text{total of frequency}}{2}$

cf = cumulative freq. preceeding to median class.

f = Freq. of median class

Mode

ⓐ. For individual data.

Mode = Highest recurring obs.

ⓑ For continuous series.

$$\text{mode} = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h.$$

Mode

L = lower limit of modal class

class	f_i
0-10	3 ← f_0
10-20	7 ← f_1
20-30	4 ← f_2
30-40	2
40-50	3

modal class ⇒ 10-20 (L = 10)

$$\text{Mode} = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

h = width
$= 20 - 10 = 10$

Relation b/n Mean, Median, Mode

$$\text{MODE} = 3(\text{MEDIAN}) - 2(\text{MEAN})$$

Measure of Dispersion

- Range
- Quartile Deviation
- Mean deviation
- Standard Deviation

Range

$x_1, x_2, x_3 \ldots\ldots x_n$

min. (S) — max (L)

$$\text{Range} = L - S$$

$$\text{Co-efficient of range} = \frac{L-S}{L+S}$$

Quartile Deviation

$$Q = \frac{1}{2}(Q_3 - Q_1)$$

Q_1 → first quartile

Q_3 → third quartile

$$\text{co-efficient of } Q = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

Quartile Deviation

x

x	f	cf
2	3	3
3	4	7
4	8	15
5	4	19
6	1	20

$N = \Sigma f_i$

Find quartile deviation

$N = 20$

$\frac{N}{4} = \frac{20}{4} = 5$

$Q_1 = 3$

$\frac{3N}{4} = \frac{3 \times 20}{4} = 15$

$Q_3 = 5$

$Q = \frac{1}{2}(Q_3 - Q_1) = \frac{1}{2}(2) = 1$

Mean deviation

A = Mean / Mode / Median

$$MD = \frac{\sum_{i=1}^{n} f_i \left| x_i - A \right|}{\sum_{i=1}^{n} f_i}$$

$$\text{Co-efficient of MD} = \frac{MD}{\text{Avg. from which it is calculated.}}$$

Standard Deviation

(a). For ungrouped data.

$$SD(\sigma) = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}}$$

Standard Deviation

$N = \sum f_i$

(b) for grouped data

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} f_i (x_i - \bar{x})^2}{\sum f_i}}$$

Variance = σ^2

The frequency distribution of some given numbers is

value	f	$f_i x_i$
1	5	5
2	4	8
3	6	18
4	f	4f

$$\frac{\sum f_i x_i}{\sum f_i} = \frac{31+4f}{15+f} = 3$$

If the mean is known to be 3, then the value of fis

(a) 3 (b) 7 (c) 10 (d) 14

$$31+4f = 3(15+f)$$

$$31+4f = 45+3f$$

$$f = 14$$

The mean of 30 given numbers, when it is given that the mean of 10 of them is 12 and the mean of the remaining 20 is 9, is equal to

(a) 11 (b) 10 (c) 9 (d) 5

$\bar{x}_1 = 12 \quad n_1 = 10$

$\bar{x}_2 = 9 \quad n_2 = 20$

$$\bar{x}_{12} = \frac{\bar{x}_1 \cdot n_1 + \bar{x}_2 \cdot n_2}{n_1 + n_2} = \frac{120 + 180}{30} = \frac{300}{30}$$

$= 10$

Mean of 100 observations is 45. It was later found that two observations 19 and 31 were incorrectly recorded as 91 and 13. The correct mean is

(a) 44 (b) 45 (c) 44.46 (d) 45.54

$$\frac{\sum f_i}{N} = 45 \qquad \frac{\sum f_i}{100} = 45 \qquad \sum f_i = 4500$$

$$4500 - 91 - 13 + 19 + 31$$

$$4500 - 104 + 50 = 4500 - 54$$

$$= \frac{4446}{100} = 44.46$$

What is the geometric mean of the data 2, 4, 8, 16 and 32?

(a) 2

(c) 8

(b) 4

(d) 16

$(2 \cdot 4 \cdot 8 \cdot 16 \cdot 32)^{1/5}$

$= (2^1 \cdot 2^2 \cdot 2^3 \cdot 2^4 \cdot 2^5)^{1/5}$

$= (2^{15})^{1/5} = 2^{15/5} = 2^3 = 8$

What is the mean deviation of the data 2, 9, 9, 3, 6, 9 and 4?

(a) 2.23

(b) 2.57

(c) 3.23

(d) 3.57

$$MD = \frac{\sum |x_i - A|}{N}$$

$$\frac{42}{7} = 6$$

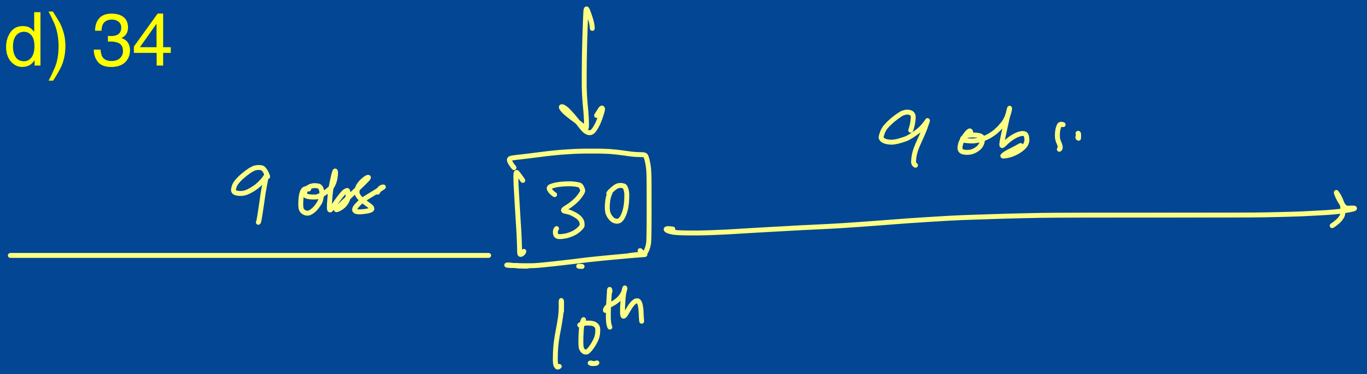
$$MD = \frac{4+3+3+3+0+3+2}{7}$$

$$= \frac{18}{7} = 2.57$$

n = odd. $\left(\frac{n+1}{2}\right) = \frac{20}{2} = 10^{th}$

The median of 19 observations is 30. Two more observations are made and the values of these are 8 and 32. The median of the 21 observations taken together is equal to

(a) 28 (b) 30 (c) 32 (d) 34



In a batch of 15 students, If the marks of 10 students, who passed are 70, 50, 95, 40, 60, 70, 80, 90, 75, 80, then the median marks of the all 15 students is

(a) 40 (b) 50 (c) 60 (d) 70

$n = odd = 15$

5 student fail..

□ □ □ □ □, 40, 50, 60, 70, 70, 75, 80, 80, 90, 95

$$median = \left(\frac{n+1}{2}\right) = \frac{15+1}{2} = \frac{16}{2}$$

$= 8^{th}$ place

What is the standard deviation of numbers 7, 9, 11, 13 and 15?

(a) 2.2 (b) 2.4 (c) 2.6 (d) 2.8

$\frac{55}{5} = 11$

$\bar{x} = 11$

$SD(\sigma) = \sqrt{\frac{\sum (x_i - \bar{x})^2}{N}}$ ← mean

$\sqrt{\frac{16 + 4 + 0 + 4 + 16}{5}}$

$= \sqrt{\frac{40}{5}} = \sqrt{8} = \sqrt{2 \times 2 \times 2} = 2\sqrt{2}$ → 1.41

$= 2 \times 1.41 = 2.82$

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