

Chapter 14

Measures of Central Tendency and Dispersion

Past Trends

Attempt	Theory	Practical	Total
May 2018	4	3	7
Nov 2018	2	10	12
Jun 2019	3	9	12
Nov 2019	7	10	17
Nov 2020	5	4	9
Jan 2021	5	4	9
Jul 2021	1	11	12
Dec 2021	5	6	11
Jun 2022	3	6	9
Dec 2022	3	13	16
June 2023	0	15	15
Dec 2023	0	12	12

Central Tendency - Basics

Meaning	<ul style="list-style-type: none"> Central Tendency is the tendency of a given set of observations to cluster around a single central or middle value. The single value that represents the given set of observations is described as a measure of central tendency.
Different Measures of Central Tendency	<ul style="list-style-type: none"> Arithmetic Mean (AM) Median (Me) Mode (Mo) Geometric Mean (GM) Harmonic Mean (HM)
Types of Formula based Questions	<ul style="list-style-type: none"> Discrete Observations Simple Frequency Distribution Grouped Frequency Distribution

Arithmetic Mean

Discrete Observations	$\bar{x} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n}$	$\bar{x} = \frac{\sum x}{n}$
Frequency Distribution	$\bar{x} = \frac{\sum fx}{N}$	
	In case of simple frequency distribution	$x = \text{individual values}$
	In case of grouped frequency distribution	$x = \text{mid-point of class intervals}$
	$N = \text{total number of observations}$	$N = \sum f$

PYQ Nov. 18

- (4) The mean of 20 items of a data is 5 and if each item is multiplied by 3, then the new mean will be
- | | | | |
|----|----|----|----|
| a. | 5 | b. | 10 |
| c. | 15 | d. | 20 |

MTP May 19, ICAI SM

- (5) If the relationship between two variables u and v are given by $2u + v + 7 = 0$ and if the AM of u is 10, then the AM of v is
- | | | | |
|----|-----|----|-----|
| a. | 17 | b. | -17 |
| c. | -27 | d. | 27 |

PYQ Nov. 18

- (6) The algebraic sum of the deviation of a set of values from their arithmetic mean is
- | | | | |
|----|------|----|---------------|
| a. | >0 | b. | $= 0$ |
| c. | <0 | d. | None of these |

MTP Oct 21

- (7) Pooled Mean is also called
- | | |
|----|----------------|
| a. | Mean |
| b. | Geometric Mean |
| c. | Grouped Mean |
| d. | none |

MTP Nov 19, ICAI SM

- (8) The average salary of a group of unskilled workers is Rs.10,000 and that of a group of skilled workers is Rs.15,000. If the combined salary is Rs.12,000, then what is the percentage of skilled workers?
- | | | | |
|----|-----|----|---------------|
| a. | 40% | b. | 50% |
| c. | 60% | d. | None of these |

MTP Nov 21

- (9) At ABC ltd, the average age of employees is 36. Average age of male employees is 38 and that of females is 32. Find the ratio of female to male in the company.
- | | | | |
|----|-----|----|-----|
| a. | 1:3 | b. | 2:1 |
| c. | 1:2 | d. | 3:1 |

PYQ June 19

- (10) The AM of 15 observation is 9 and the AM of first 9 observation is 11 and then AM of remaining observation is
- | | | | |
|----|----|----|---|
| a. | 11 | b. | 6 |
| c. | 5 | d. | 9 |

PYQ June 22

- (11) When each value does not have equal importance then
- | | |
|----|------------------|
| a. | AM |
| b. | GM |
| c. | HM |
| d. | Weighted Average |

PYQ June 22

- (12) The mean of 20 observation is 38. If two observation are taken as 84 and 36 instead of 48 and 63 find new means.
- | | | | |
|----|-------|----|-------|
| a. | 38.45 | b. | 41.15 |
| c. | 37.55 | d. | 40.05 |

MTP Nov 19

- (13) *The average weight of 8 person increases by 1.5 kg, if a person weighing 65 kg replaced by a new person, what would be the weight of the new person?*
- ☆
- | | | | |
|----|-------|----|---------------|
| a. | 76 kg | b. | 80 kg |
| c. | 77 kg | d. | None of these |

Median

Discrete Observations	<ul style="list-style-type: none"> If $n = \text{odd}$, then middle term If $n = \text{even}$, average of two middle terms 			
Simple Frequency Distribution	<ul style="list-style-type: none"> First make column of less than cumulative frequency Apply same formula as discrete 			
Grouped Frequency Distribution	<i>Median in case of grouped frequency distribution</i>			
	Step 1	Prepare a less than type cumulative frequency distribution		
	Step 2	Calculate $\frac{N}{2}$ and check between which class boundaries it falls and call it as Median Class		
	Step 3	l_1	N_u	N_l
	LCB of Median Class	Cum Freq. of Median Class	Cum. Freq. of Pre-Median Class	Class length of Median Class
Step 4	Apply Formula			
	$Me = l_1 + \left(\frac{\frac{N}{2} - N_l}{N_u - N_l} \right) \times C$			
Property 1	For a set of observations, the sum of absolute deviations is minimum, when the deviations are taken from the median. $\sum x - Me \text{ is minimum}$			
Property 2	Median is also affected by both change of origin and scale.			
General Review	<ul style="list-style-type: none"> Median is also called as positional average Median is not based on all observations Median is not affected by sampling fluctuations Median is best measure of central tendency in case of open-end classification 			

PYQ Jun 23

- (14) *For a given data set: 5, 10, 3, 6, 4, 8, 9, 3, 15, 2, 9, 4, 19, 11, 4; what is the median?*
- | | | | |
|----|---|----|---|
| a. | 8 | b. | 6 |
| c. | 4 | d. | 9 |

PYQ Nov. 18

- (15) *The median of the data 5, 6, 7, 8, 9, 10, 11, 12, 15, 18, 18 and 19 is*
- | | | | |
|----|------|----|------|
| a. | 10.5 | b. | 10 |
| c. | 11 | d. | 11.5 |

PYQ June 19

(16) For the distribution

x	1	2	3	4	5	6
f	6	9	10	14	12	8

The value of median is

- a. 3.5
b. 3
c. 4
d. 5

PYQ Nov. 19

(17) Find the median of the following:

Class	0-10	10-20	20-30	30-40	40-50
Freq.	5	15	28	10	2

- a. 10.57
b. 23.57
c. 25
d. None of these

ICAI SM

(18) Find the median of the following:

Marks	5-14	15-24	25-34	35-44	45-54	55-64
Freq.	10	18	32	26	14	10

- a. 28
b. 30
c. 33.69
d. 32.94

MTP Nov 19

(19) For open-end classification, which of the following is the best measure of central tendency?

- a. AM
b. GM
c. Median
d. Mode

Partition Values

Meaning	<ul style="list-style-type: none"> These may be defined as values dividing a given set of observations into number of equal parts When we want to divide the given set of observations into two equal parts, we consider median, similarly there are quartiles, deciles, percentiles 																				
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Formula – Discrete Observations	<ul style="list-style-type: none"> Rank Calculation $(n + 1)p^{\text{th}}$ term Value of p depends on partition value 																									
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MTP May 19

- (20) What is the value of the first quartile for observations 15, 18, 10, 20, 23, 28, 12, 16?
- | | |
|----------|-------|
| a. 17 | b. 16 |
| c. 12.75 | d. 12 |

PYQ June 22

- (21) The 3rd decile for the numbers 15, 10, 20, 25, 18, 11, 9, 12 is
- | | | | |
|----|-------|----|-------|
| a. | 13 | b. | 10.70 |
| c. | 11.00 | d. | 11.50 |

MTP Nov 21

- (22) Find D_6 for the following observations. 7, 9, 5, 4, 10, 15, 14, 18, 6, 20
- | | | | |
|----|-------|----|-------|
| a. | 11.40 | b. | 12.40 |
| c. | 13.40 | d. | 13.80 |

ICAI SM

- (23) The third quartile and 65th percentile for the following data are

Profits	<10	10-19	20-29	30-39	40-49	50-59
No. of firms	5	18	38	20	9	2

- | | | | |
|----|---------------|----|---------------|
| a. | 33.5 & 29.184 | b. | 33 & 28.68 |
| c. | 33.6 & 29 | d. | 33.25 & 29.25 |

Mode

Meaning	Mode is the <i>value</i> that occurs the maximum number of times						
Special Thing about Mode	<ul style="list-style-type: none"> If two or more observations are having maximum frequency then there are multiple modes [multimodal distribution] If there are exactly two modes then distribution is called as Bimodal Distribution If all observations are having same frequency then distribution has no mode We can say that Mode is not rigidly defined 						
Grouped Frequency Distribution	<ul style="list-style-type: none"> Find Modal Class: Class with highest frequency and obtain below values <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">f_{-1}</td> <td style="text-align: center;">f_0</td> <td style="text-align: center;">f_1</td> </tr> <tr> <td style="text-align: center;">frequency of pre modal class</td> <td style="text-align: center;">frequency of the modal class</td> <td style="text-align: center;">frequency of the post modal class</td> </tr> </table> <ul style="list-style-type: none"> Apply Formula $Mo = l_1 + \left(\frac{f_0 - f_{-1}}{2f_0 - f_{-1} - f_1} \right) \times C$	f_{-1}	f_0	f_1	frequency of pre modal class	frequency of the modal class	frequency of the post modal class
f_{-1}	f_0	f_1					
frequency of pre modal class	frequency of the modal class	frequency of the post modal class					
Property 1	If all the observations are constant, mode is also constant						
Property 2	Mode is also affected both due to change of origin and scale						
General Review	<ul style="list-style-type: none"> Mode is not based on all observations Mode is not rigidly defined Mode is not amenable to Mathematical Property 						

PYQ Nov. 19

(24) Find the mode of the following:

0-10	10-20	20-30	30-40	40-50	50-60
7	14	22	34	20	19

- a. 32
 b. 34.61
 c. 25.42
 d. 35

PYQ Jan. 21

(25) From the record on sizes of shoes sold in a shop, one can compute the following to determine the most preferred shoe size.

☆

- a. Mean
 b. Median
 c. Mode
 d. Range

MTP Oct 21

 (26) If x and y are related by $x - y - 10 = 0$ and mode of x is known to be 23, then the mode of y is

- a. 20
 b. 13
 c. 3
 d. 23

MTP June 2023 Series I

(27) Mode is:

- a. Least frequent value
 b. Middle Most value
 c. Most frequent Value
 d. None of these

Relationship between Mean, Median and Mode

In case of Symmetric Distribution	Mean = Median = Mode
In case of Moderately Skewed Distribution (Empirical relationship)	Mean – Mode = 3 (Mean – Median) OR Mode = 3 Median – 2 Mean

PYQ May 18

(28) Relation between mean, median and mode is

- a. mean-mode = 2 (mean-median)
 b. mean-median = 3 (mean-mode)
 c. mean-median = 2 (mean-mode)
 d. mean-mode = 3 (mean-median)

PYQ Nov. 18

(29) If in a moderately skewed distribution, the values of mode and mean are 32.1 and 35.4 respectively, then the value of the median is

- a. 34.3
 b. 33.3
 c. 34
 d. 33

PYQ June 19

(30) For a symmetric distribution

- a. Mean = Median = Mode
 b. Mode = 3 Median = 2 Mean
 c. Mode = $\frac{1}{3}$ Median = $\frac{1}{2}$ Mean
 d. None of these

PYQ Dec. 21

(31) For a moderately skewed distribution the median is twice the mean, then the mode is
 ☆ _____ times the median.

- | | |
|--------|--------|
| a. 3 | b. 2 |
| c. 2/3 | d. 3/2 |

MTP June 22

(32) If the difference between mean and mode is 33, then the difference between Mean and
 ☆ Median will be _____

- | | |
|-------|------------------|
| a. 63 | b. 31.5 |
| c. 11 | d. None of these |

Geometric Mean

Definition	For a given set of n positive observations , the geometric mean is defined as the n^{th} root of the product of the observations
Formula – Discrete	$G = (x_1 \times x_2 \times \dots \times x_n)^{1/n}$
Formula – Frequency Distribution	$G = (x_1^{f_1} \times x_2^{f_2} \times \dots \times x_n^{f_n})^{1/N}$
Property 1	Logarithm of G for a set of observations is the AM of the logarithm of the observations $\log G = \frac{1}{n} \sum \log x$
Property 2	If all the observations are constant, GM is also constant
Property 3	If $z = xy$, then GM of $z = \text{GM of } x \times \text{GM of } y$
Property 4	If $z = x/y$, then $\text{GM of } z = \frac{\text{GM of } x}{\text{GM of } y}$

PYQ Nov. 18

(33) The Geometric mean of 3, 6, 24 and 48 is

- | | |
|-------|-------|
| a. 8 | b. 12 |
| c. 24 | d. 6 |

MTP Nov 18

(34) The Geometric mean of the series $1, k, k^2, k^3, \dots, k^n$ where k is constant is

- | | |
|----------------------------|----------------|
| ☆ a. $k^{\frac{(n+1)}{2}}$ | b. $k^{n+0.5}$ |
| c. k^{n+1} | d. k^{n+2} |

MTP March 21

(35) G.M is a better measure than others when,

- a. Ratios and percentages given
- b. Interval of scale is given
- c. Both (a) and (b)
- d. Either (a) or (b)

MTP Nov 21

- (36) If the rates return from three different shares are 100%, 200% and 400% respectively.
 ☆ The average rate of return will be.
- | | |
|---------|------------|
| a. 350% | b. 233.33% |
| c. 200% | d. 300% |

Harmonic Mean

Definition	For a given set of non-zero observations, harmonic mean is defined as the reciprocal of the AM of the reciprocals of the observation
Formula – Discrete	$H = \frac{n}{\Sigma(\frac{1}{x})}$
Formula – Frequency Distribution	$H = \frac{N}{\Sigma(\frac{f}{x})}$
Property 1	If all observations are constant HM is also constant
Property 2	$\text{Combined HM} = \frac{n_1 + n_2}{\frac{n_1}{H_1} + \frac{n_2}{H_2}}$

PYQ Nov. 20

- (37) Given the weights for the numbers 1, 2, 3n are respectively 1², 2², 3².....n² then weighted HM is _____
- ☆
- | | |
|---------------------|--|
| a. $\frac{2n+1}{4}$ | |
| b. $\frac{2n+1}{6}$ | |
| c. $\frac{2n+1}{3}$ | |
| d. $\frac{2n+1}{2}$ | |

PYQ Nov. 20

- (38) The harmonic mean A and B is 1/3 and harmonic mean of C and D is 1/5. The harmonic mean of ABCD is
- ☆
- | | |
|---------|--------|
| a. 8/15 | b. 1/4 |
| c. 1/15 | d. 5/3 |

MTP May 18

- (39) A man travels from Delhi to Agra at an average speed of 30km per hour and back at an average speed of 60 km per hour. What's the average Speed.
- | | |
|-------------|-------------|
| a. 48 km/hr | b. 40 km/hr |
| c. 45 km/hr | d. 35 km/hr |

MTP Nov 20

- (40) If there are two groups with 75 and 65 as harmonic means containing 15 and 13 observation, then combined HM is given by
- | | | | |
|----|----|----|-------|
| a. | 70 | b. | 72.25 |
| c. | 78 | d. | 76 |

Use of GM and HM

Both	Both are used for calculating average rates
GM	Appropriate for rates having percentages
HM	Appropriate for rates other than percentages

Relationship between AM, GM, and HM

Relation	Scenario	Relation
	When all the observations are same	$AM = GM = HM$
	When observations are distinct	$AM > GM > HM$
	In question is silent	$AM \geq GM \geq HM$
Special Relation	If there are only two observations: $AM \times HM = (GM)^2$	

MTP May 19

- (41) Which of the following results hold for a set of distinct positive observations?
- | | |
|----|----------------------|
| a. | $AM \geq GM \geq HM$ |
| b. | $HM \geq GM \geq AM$ |
| c. | $AM > GM > HM$ |
| d. | $GM > AM > HM$ |

PYQ Nov. 20

- (42) If the AM and HM of two numbers are 6 and 9 respectively, then GM is
- | | | | |
|----|------|----|---------------|
| a. | 7.35 | b. | 8.5 |
| c. | 6.75 | d. | None of these |

Weighted Average

When to use	If the observations are not of equal importance and we need to treat observations according to their hierarchical importance, then we use Weighted Average
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Formulas	Weighted AM	$\frac{\sum wx}{\sum w}$
	Weighted GM	$\left(x_1^{w_1} \times x_2^{w_2} \times x_3^{w_3} \times \dots \times x_n^{w_n}\right)^{\frac{1}{\sum w}}$
	Weighted HM	$\frac{\sum w}{\sum \left(\frac{w}{x}\right)}$

Central Tendency Theory

ICAI SM
(43) Measures of central tendency for a given set of observations measures a. The scatterness of the observations b. The central location of the observations c. Both (a) and (b) d. None of these
ICAI SM
(44) While computing the AM from a grouped frequency distribution, we assume that a. The classes are of equal length b. The classes have equal frequency c. All the values of a class are equal to the mid-value of that class d. None of these
ICAI SM
(45) Which of the following statements is wrong? a. Mean is rigidly defined b. Mean is not affected due to sampling fluctuations c. Mean has some mathematical properties d. None of these
ICAI SM
(46) Which of the following statements is true? a. Usually mean is the best measure of central tendency b. Usually median is the best measure of central tendency c. Usually mode is the best measure of central tendency d. Normally GM is the best measure of central tendency
ICAI SM
(47) For open-end classification, which of the following is the best measure of central tendency? a. AM b. GM c. Median d. Mode
ICAI SM
(48) The presence of extreme observations does not affect a. AM b. Median c. Mode d. Any of these

		ICAI SM
(49)	<p>In case of an even number of observations which of the following is median?</p> <p>a. Any of the two middle-most value</p> <p>b. The simple average of these two middle values</p> <p>c. The weighted average of these two middle values</p> <p>d. Any of these</p>	
		ICAI SM
(50)	<p>The most commonly used measure of central tendency is</p> <p>a. AM</p> <p>b. Median</p> <p>c. Mode</p> <p>d. Both GM and HM</p>	
		ICAI SM
(51)	<p>Which one of the following is not uniquely defined?</p> <p>a. Mean</p> <p>b. Median</p> <p>c. Mode</p> <p>d. All of these measures</p>	
		ICAI SM
(52)	<p>Which of the following measure of the central tendency is difficult to compute?</p> <p>a. Mean</p> <p>b. Median</p> <p>c. Mode</p> <p>d. GM</p>	
		ICAI SM
(53)	<p>Which measure(s) of central tendency is(are) considered for finding the average rates?</p> <p>a. AM</p> <p>b. GM</p> <p>c. HM</p> <p>d. Both (b) and (c)</p>	
		ICAI SM
(54)	<p>For a moderately skewed distribution, which of the following relationship holds?</p> <p>a. Mean – Mode = 3 (Mean – Median)</p> <p>b. Median – Mode = 3 (Mean – Median)</p> <p>c. Mean – Median = 3 (Mean – Mode)</p> <p>d. Mean – Median = 3 (Median – Mode)</p>	
		ICAI SM
(55)	<p>Weighted averages are considered when</p> <p>a. The data are not classified</p> <p>b. The data are put in the form of grouped frequency distribution</p> <p>c. All the observations are not of equal importance</p> <p>d. Both (a) and (c)</p>	
		ICAI SM
(56)	<p>Which of the following results hold for a set of distinct positive observations?</p> <p>a. $AM \geq GM \geq HM$</p> <p>b. $HM \geq GM \geq AM$</p> <p>c. $AM > GM > HM$</p> <p>d. $GM > AM > HM$</p>	

		ICAI SM
(57)	When a firm registers both profits and losses, which of the following measure of central tendency cannot be considered?	
a.	AM	b. GM
c.	Median	d. Mode
		ICAI SM
(58)	Quartiles are the values dividing a given set of observations into	
a.	Two equal parts	
b.	Four equal parts	
c.	Five equal parts	
d.	None of these	
		ICAI SM
(59)	Quartiles can be determined graphically using	
a.	Histogram	
b.	Frequency Polygon	
c.	Ogive	
d.	Pie chart	
		ICAI SM
(60)	Which of the following measure(s) possesses (possess) mathematical properties?	
a.	AM	b. GM
c.	HM	d. All of these
		ICAI SM
(61)	Which of the following measure(s) satisfies (satisfy) a linear relationship between two variables?	
a.	Mean	b. Median
c.	Mode	d. All of these
		ICAI SM
(62)	Which of the following measures of central tendency is based on only fifty percent of the central values?	
a.	Mean	b. Median
c.	Mode	d. Both (a) & (b)

Measures of Dispersion

Meaning of Measure of Dispersion

- Dispersion for a given set of observations may be defined as
- the **amount of deviation** of the observations,
- usually, from an **appropriate** measure of **central tendency**

Types of Measure of Dispersion	Absolute Measures of Dispersion	<ul style="list-style-type: none"> • These are with units • These are not useful for comparison of two variables with different units. • Example: Range, Mean Deviation, Standard Deviation, Quartile Deviation
	Relative Measures of Dispersion	<ul style="list-style-type: none"> • These are unit free measures • These are useful for comparison of two variables with different units. • Example: Coefficient of Range, Coefficient of Mean Deviation, Coefficient of variation, Coefficient of Quartile Deviation

Range

Discrete – Formula	$L - S$ where L: Largest Observation, S: Smallest Observation
Grouped Frequency Distribution – Formula	$L - S$ where Largest Observation = UCB of last class interval, Smallest Observation = LCB of first-class interval
Coefficient of Range	$\frac{L - S}{L + S} \times 100$
Property 1	<ul style="list-style-type: none"> • Not affected by change of origin • Affected by change of scale (only value) • No impact of sign of change of scale • Note: Measure of Dispersion can never be negative
General Review	<ul style="list-style-type: none"> • Not Based on All Observations • Easy to Compute

MTP May 19 Series II

- (63) The range of 15, 12, 10, 9, 17, 30 is
- | | |
|-------|-------|
| a. 5 | b. 12 |
| c. 13 | d. 21 |

MTP Mar 21, MTP Apr 21

- (64) What is the coefficient of range for the following distribution?

Class	10-19	20-29	30-39	40-49	50-59
Freq.	11	25	16	7	3

- | | |
|----------|----------|
| a. 22 | b. 50 |
| c. 75.82 | d. 72.46 |

PYQ July 21

- (65) If the relationship between x and y is given by $2x + 3y = 10$ and the range of y is 10, then what is the range of x?
- | | |
|-------|-------|
| a. 10 | b. 18 |
| c. 8 | d. 15 |

PYQ Nov. 18

- (66) If the range of a set of values is 65 and maximum value in the set is 83, then the minimum value in the set is
- | | | | |
|----|----|----|---------------|
| a. | 74 | b. | 9 |
| c. | 18 | d. | None of these |

Mean Deviation

Meaning	<ul style="list-style-type: none"> • Mean deviation is defined as the • arithmetic mean of the • absolute deviations of the observations • from an appropriate measure of central tendency
Formula – Discrete	$MD_A = \frac{1}{n} \sum x - A $ <p>where, A = Appropriate Central Tendency Measure</p>
Formula – Frequency Distribution	$MD_A = \frac{1}{N} \sum f x - A $
Coefficient of Mean Deviation	<p>Coefficient of Mean Deviation: $\frac{\text{Mean Deviation about } A}{A} \times 100$</p>
Property 1	<p>Mean Deviation takes its minimum value when deviations are taken from Median</p>
Property 2	<p>Change of Origin – No Affect, Change of Scale – Affect of value not sign</p>
General Review	<ul style="list-style-type: none"> • Based on all observations • Improvement over Range • Difficult to compute • Not amenable to Mathematical Property because of usage of Modulus

PYQ July 21

- (67) The mean deviation of the numbers 3, 10, 6, 11, 14, 17, 9, 8, 12 about the mean is (correct to one decimal place):
- | | | | |
|----|-----|----|-----|
| a. | 8.7 | b. | 4.2 |
| c. | 3.1 | d. | 9.8 |

PYQ June 22

- (68) Mean Deviation of data 3, 10, 10, 4, 7, 18, 5 from mode is
- | | | | |
|----|------|----|------|
| a. | 4.39 | b. | 4.70 |
| c. | 4.14 | d. | 5.24 |

CAI SM

- (69) Mean Deviation of data 82, 56, 75, 70, 52, 80, 68 from median is
- | | | | |
|----|-------|----|-------|
| a. | 16.49 | b. | 12.45 |
| c. | 87.14 | d. | 78.45 |

MTP Dec 22 – Series I

- (70) Which measure of dispersion is based on the absolute deviation only?
- Range
 - Standard Deviation
 - Mean Deviation
 - Quartile Deviation

ICAI SM

(71) What is the mean deviation about median for the following data?

<i>x</i>	3	5	7	9	11	13	15
<i>f</i>	2	8	9	16	14	7	4

- | | | | |
|----|------|----|------|
| a. | 2.50 | b. | 2.46 |
| c. | 2.43 | d. | 2.37 |

Standard Deviation

Meaning	<ul style="list-style-type: none"> Improvement over Mean Deviation It is defined as the root mean square deviation when the deviations are taken from the AM of the observations
Formula – Discrete	$\sigma_x = SD_x = \sqrt{\frac{\sum(x - \bar{x})^2}{n}}$ $\sigma_x = SD_x = \sqrt{\frac{\sum x^2}{n} - (\bar{x})^2}$
Formula – Frequency Distribution	$\sigma_x = SD_x = \sqrt{\frac{\sum f(x - \bar{x})^2}{N}}$ $\sigma_x = SD_x = \sqrt{\frac{\sum fx^2}{N} - (\bar{x})^2}$
Coefficient of Variation	$\frac{SD_x}{\bar{x}} \times 100$
SD for any two numbers	$SD = \frac{Range}{2}$
SD for first <i>n</i> natural numbers	$s = \sqrt{\frac{n^2 - 1}{12}}$
Property 1	If all the observations are constant, SD is ZERO
Property 2	No effect of change of origin but affected by change of scale in the magnitude (ignore sign)
Property 3	$SD_c = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2 + n_1 d_1^2 + n_2 d_2^2}{n_1 + n_2}}$ $d_1 = \bar{x}_c - \bar{x}_1, d_2 = \bar{x}_c - \bar{x}_2$

PYQ Nov. 18

- (72) Standard Deviation for the marks obtained by a student in monthly test in mathematic (out of 50) as 30, 35, 25, 20, 15 is
- | | | | |
|----|-------------|----|-------------|
| a. | 25 | b. | $\sqrt{50}$ |
| c. | $\sqrt{30}$ | d. | 50 |

PYQ June 19

- (73) S.D of first five consecutive natural numbers is
- | | | | |
|----|-------------|----|------------|
| a. | $\sqrt{10}$ | b. | $\sqrt{8}$ |
| c. | $\sqrt{3}$ | d. | $\sqrt{2}$ |

PYQ Nov. 19

- (74) SD from numbers 1, 4, 5, 7, 8 is 2.45. If 10 is added to each then SD will be:
- | | |
|----|-----------------|
| a. | 12.45 |
| b. | 24.5 |
| c. | 12 |
| d. | Will not change |

PYQ June 22

- (75) Find the standard deviation and coefficient of variation for. 1, 9, 8, 5, 7
- | | | | |
|----|--------------|----|--------------|
| a. | 2.828, 49.32 | b. | 2.828, 48.13 |
| c. | 2.828, 47.13 | d. | 2.828, 50.13 |

PYQ Dec 22

- (76) If the sum of square of the values equals to 3390, Number of observations are 30 and Standard deviation is 7, what is the mean value of the above observations?
- | | | | |
|----|----|----|----|
| a. | 14 | b. | 11 |
| c. | 8 | d. | 5 |

MTP May 18

- (77) if the mean and SD of X are a and b respectively, then the S.D of $\frac{x-a}{b}$ is
- | | | | |
|----|-------|----|----|
| a. | a/b | b. | -1 |
| c. | 1 | d. | ab |

MTP May 19 Series II

- (78) If the profits of a company remain the same for the last ten months, then the standard deviation of profits for these ten months would be?
- | | |
|----|----------|
| a. | positive |
| b. | negative |
| c. | zero |
| d. | A or C |

ICAI SM, MTP May 19 Series II

- (79) If x and y are related by $y = 2x + 5$ and the SD and AM of x are known to be 5 and 10 respectively, then the coefficient of variation of y is
- | | | | |
|----|----|----|----|
| a. | 25 | b. | 30 |
| c. | 40 | d. | 20 |

MTP Nov 19

- (80) If the values of all observations are equal then the Standard Deviation of the given observations is
- | | | | |
|----|---|----|---------------|
| a. | 0 | b. | 2 |
| c. | 1 | d. | None of these |

MTP March 21

- (81) The sum of squares of deviation from mean of 10 observations is 250. Mean of the data is 10. Find the coefficient of variation
- ☆
- | | | | |
|----|-----|----|-----|
| a. | 10% | b. | 25% |
| c. | 50% | d. | 0% |

MTP Dec 22 – Series I

- (82) What is the SD of the following series :

☆

Meas.	0-10	10-20	20-30	30-40
Freq.	1	3	4	2

a.	81	b.	7.6
c.	9	d.	2.26

Quartile Deviation

Formula	$QD_x = \frac{Q_3 - Q_1}{2}$
Calculation	Quartiles are calculated same as we studied in Central Tendency
Coefficient of Quartile Deviation	$\frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$
General Review	<ul style="list-style-type: none"> It is the best measure of dispersion for open-end classification It is also less affected due to sampling fluctuations Like other measures of Dispersion, QD is also not affected by change of origin but affected by scale ignoring sign
Relationship between SD, MD and QD	$4SD = 5MD = 6QD$ <p style="text-align: center;">or</p> $SD : MD : QD = 15 : 12 : 10$

MTP May 19

- (83) The quartiles of a variable are 45, 52 and 65 respectively. Its quartile deviation is
- | | | | |
|----|----|----|------|
| a. | 10 | b. | 20 |
| c. | 25 | d. | 8.30 |

PYQ June 23

- (84) If the first quartile is 42.75 and the third quartile is 74.25, then the coefficient of quartile deviation is:
- | | | | |
|----|-------|----|-------|
| a. | 29.62 | b. | 15.75 |
| c. | 17.57 | d. | 26.92 |

PYQ June 19

- (85) Coefficient of quartile deviation is 1/4 then Q_3 / Q_1 is
- ☆
- | | | | |
|----|-----|----|-----|
| a. | 5/3 | b. | 4/3 |
| c. | 3/4 | d. | 3/5 |

		MTP Apr 21
(86)	Interval Quartile Range is _____ of Quartile Deviation	
★	a. Half	b. Double
	c. Triple	d. Equal
		MTP Dec 22 – Series I
(87)	The approximate ratio of SD, MD, QD is	
	a. 2:3:4	b. 3:4:5
	c. 15:12:10	d. 5:6:7

Dispersion Theory

		ICAI SM
(88)	Which of the following statements is correct?	
	a. Two distributions may have identical measures of central tendency and dispersion	
	b. Two distributions may have the identical measures of central tendency but different measures of dispersion.	
	c. Two distributions may have the different measures of central tendency but identical measures of dispersion	
	d. All the statements (a), (b) and (c)	
		ICAI SM
(89)	Dispersion measures	
	a. The scatterness of a set of observations	
	b. The concentration of a set of observations	
	c. Both (a) and (b)	
	d. Neither (a) and (b).	
		ICAI SM
(90)	When it comes to comparing two or more distributions, we consider	
	a. Absolute measures of dispersion	
	b. Relative measures of dispersion	
	c. Both (a) and (b)	
	d. Either (a) or (b)	
		ICAI SM
(91)	Which one is easier to compute?	
	a. Relative measures of dispersion	
	b. Absolute measures of dispersion	
	c. Both (a) and (b)	
	d. Range	
		ICAI SM
(92)	Which one is an absolute measure of dispersion?	
	a. Range	
	b. Mean Deviation	
	c. Standard Deviation	
	d. All these measures	

		ICAI SM
(93)	Which measure of dispersion is most useful? a. Standard deviation b. Quartile deviation c. Mean deviation d. Range	
		ICAI SM
(94)	Which measures of dispersions is not affected by the presence of extreme observations? a. Range b. Mean deviation c. Standard deviation d. Quartile deviation	
		ICAI SM
(95)	Which measure of dispersion is based on the absolute deviations only? a. Standard deviation b. Mean deviation c. Quartile deviation d. Range	
		ICAI SM
(96)	Which measure is based on only the central fifty percent of the observations? a. Standard deviation b. Quartile deviation c. Mean deviation d. All these measures	
		ICAI SM
(97)	Which measure of dispersion is based on all the observations? a. Mean deviation b. Standard deviation c. Quartile deviation d. (a) and (b) but not (c)	
		ICAI SM
(98)	The appropriate measure of dispersion for open-end classification is a. Standard deviation b. Mean deviation c. Quartile deviation d. All these measures	
		ICAI SM
(99)	The most commonly used measure of dispersion is a. Range b. Standard deviation c. Coefficient of variation d. Quartile deviation	

			ICAI SM
(100)	Which measure of dispersion has some desirable mathematical properties?		
	a. Standard deviation		
	b. Mean deviation		
	c. Quartile deviation		
	d. All these measures		
			ICAI SM
(101)	If the profits of a company remains the same for the last ten months, then the standard deviation of profits for these ten months would be?		
	a. Positive	b. Negative	
	c. Zero	d. (a) or (c)	
			ICAI SM
(102)	Which measure of dispersion is considered for finding a pooled measure of dispersion after combining several groups?		
	a. Mean deviation		
	b. Standard deviation		
	c. Quartile deviation		
	d. Any of these		
			ICAI SM
(103)	A shift of origin has no impact on		
	a. Range		
	b. Mean deviation		
	c. Standard deviation		
	d. All these and quartile deviation		
			ICAI SM
(104)	The range of 15, 12, 10, 9, 17, 20 is		
	a. 5	b. 12	
	c. 13	d. 11	
			ICAI SM
(105)	The standard deviation of 10, 16, 10, 16, 10, 10, 16, 16 is		
	a. 4	b. 6	
	c. 3	d. 0	
			ICAI SM
(106)	For any two numbers SD is always		
	a. Twice the range		
	b. Half of the range		
	c. Square of the range		
	d. None of these		
			ICAI SM
(107)	If all the observations are increased by 10, then		
	a. SD would be increased by 10		
	b. Mean deviation would be increased by 10		
	c. Quartile deviation would be increased by 10		
	d. All these three remain unchanged		

ICAI SM

- (108) If all the observations are multiplied by 2, then
- New SD would be also multiplied by 2
 - New SD would be half of the previous SD
 - New SD would be increased by 2
 - New SD would be decreased by 2.

Answer Key

1	a	2	b	3	a
4	c	5	c	6	b
7	c	8	a	9	c
10	b	11	d	12	c
13	c	14	b	15	a
16	c	17	b	18	d
19	c	20	c	21	b
22	b	23	a	24	b
25	c	26	b	27	c
28	d	29	a	30	a
31	b	32	c	33	b
34	a	35	a	36	c
37	c	38	b	39	b
40	a	41	c	42	a
43	b	44	c	45	b
46	a	47	c	48	b
49	b	50	a	51	c
52	d	53	d	54	a
55	c	56	c	57	b
58	b	59	c	60	d
61	d	62	b	63	d
64	d	65	d	66	c
67	c	68	c	69	c
70	c	71	d	72	b
73	d	74	d	75	c
76	c	77	c	78	c
79	c	80	a	81	c
82	c	83	a	84	d
85	a	86	b	87	c
88	d	89	a	90	b
91	d	92	d	93	a
94	d	95	b	96	b
97	d	98	c	99	b
100	a	101	c	102	b
103	d	104	d	105	c
106	b	107	d	108	a