Date 26/9/24

Unit-5

Statistical Measures :-

Measures of Averages :-

Mean:- Arithmetic mean or Arithmetic Average which is popularly known as Mean.

→ It is the value obtained by "The sum of the variables by no. of items" in the series.

→ Arithmetic mean is of two types

1. Simple Arithmetic mean.
2. Weighted Arithmetic mean.

→ Arithmetic mean is denoted by $\overline{X}$.

Simple Arithmetic Mean:-

All the values are added at the sum is divided by no-of items

$$\rightarrow \overline{X} = \frac{x_1 + x_2 + x_3 \ldots x_n}{n} = \frac{\text{Total values of items}}{\text{total No. of items}}$$

Problems:-

1. The following are the marks of 10 students in mathematics calculate Arithmetic mean of the data.

Student	A	B	C	D	E	F	G	H	I	J
Marks	78	49	82	38	69	71	81	82	40	50

A)

Student	Marks
A	78
B	49
C	82
D	38

E	69
F	71
G	81
H	82
I	40
J	50
	640

Contxt

$$\bar{X} = \frac{x_1 + x_2 + x_3 \cdots x_n}{n}$$

$$= \frac{640}{10} = 64$$

2. Calculate Arithmetic mean for the following data.

SNO	1	2	3	4	5	6	7	8	9	10
X	0.82	0.96	1.01	1.80	1.90	2.09	2.11	2.98	3.05	3.99

SNO	X
1	0.82
2	0.96
3	1.01
4	1.80
5	1.90
6	2.09
7	2.11
8	2.98
9	3.05
10	3.99
	2071

W.K.T

$$\bar{x} = \frac{x_1 + x_2 + x_3 \cdots x_n}{n}$$

$$= \frac{2071}{10} = 20.71$$

3. From the following frequency distribution calculate Arithmetic mean.

X	2	4	6	8	10	12	14	16	18	20
F	1	2	5	11	10	9	7	2	2	1

A)

x	F	XF
2	1	2
4	2	8
6	5	30
8	11	88
10	10	100
12	9	108
14	7	98
16	2	32
18	2	36
20	1	20
	50	522

W.K.T

$$A.\text{mean} = \frac{\sum f_i}{\sum F} = \frac{\text{Total of frequencies multiplied with the respective variables}}{\text{total no. of frequencies}}$$

$$= \frac{522}{50} = 10.44$$

4. From the following frequency distribution obtain the average mark of students in a class test.

marks	0	1	2	3	4	5	6	7	8	9	10
No. of student	1	5	11	20	25	15	7	7	5	2	2

A)

Marks	No. of Student (x)
0	1
1	5
2	11
3	20
4	25
5	15
6	7
7	7
8	5
9	2
10	2
	100

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

$$= \frac{100}{11} = 9.09.$$

5. following are the heights of 100 students in a class. Calculate A.M of the data.

S.NO	1	2	3	4	5	6	7	8	9	10	11	12
H (inch)	60	61	63	64	66	67	68	69	70	71	72	73
No.of.S	2	3	4	9	18	20	17	14	5	3	3	2

A)

S.NO	H.(inch).	NO.of.std.	X.F
1	60	2	120
2	61	3	183
3	63	4	252
4	64	9	576
5	66	18	1188
6	67	20	1340
7	68	17	1156
8	69	14	966
9	70	5	350
10	71	3	213
11	72	3	216
12	73	2	146
		100	6706.

$$A.M = \frac{\Sigma fx}{Fx}$$

$$= \frac{6706}{100}$$

$$= 67.06$$

Note:-

If the data having class intervels along with their corresponding frequency then the data is known as continuous data.

Ex:-

marks	No.of students
0-10	2
10-20	5
20-30	6

In Direct method mean $(\bar{x}) = \frac{1}{N}\sum_{i=1}^{n} f_i x_i$, where N = total frequency

x_i = mid value.

Deviation method :-

$$\text{mean}(\bar{x}) = A + \left(\frac{\sum_{i=1}^{n} f_i d_i}{N}\right) \times C$$

where A = assumed value

$d_i = \frac{x_i - A}{C}$

C = width of the classes.

N = Total frequency.

Problems :-

1. Calculate Arithmetic mean to the following data.

marks	10-20	20-30	30-40	40-50	50-60
frequency	5	8	25	22	10

Direct method :-

A)

marks	frequency	x	xf
10-20	5	15	75
20-30	8	25	200
30-40	25	35	875
40-50	22	45	990
50-60	10	55	550
	N = 70		2690

from the table

N = total frequency.

$\sum fx = 2690$

W.K.T

$$\text{mean}(\bar{x}) = \frac{1}{N}\sum_{i=1}^{n} f_i x_i$$

$$= \frac{1}{70}(2690)$$

$$= 38.4285$$

Deviation method :-

Marks	frequency f	x	$d_i = \frac{x-A}{c}$	$f_i d_i$
10 - 20	5	15	-2	-10
20 - 30	8	25	-1	-8
30 - 40	25	35 A	0	0
40 - 50	22	45	1	22
50 - 60	10	55	2	20
	70		0	24

from the table N = total frequency.

$\sum_{1}^{1} f_i d_i = 24$, $C = 10$.

W.K.T $\text{Mean}(\bar{x}) = A + \left(\frac{\sum_{i=1}^{n} f_i d_i}{N}\right) \times C$

A = Assumed value

N = Total frequency.

$d_i = \frac{x_i - A}{C}$

C = width of the C.I

$\bar{x} = 35 + \left(\frac{24}{70}\right) \times 10$

$= 35 + 3.4285$

$= 38.4285$

2. calculate mean height of the following data. of height of 100 persons.

Height (cm)	48-52	52-56	56-60	60-64	64-68	68-72
No. of persons	6	12	28	30	20	4

A) Direct method :-

Height (cm)	No. of Persons.	x	xf
48-52	6	50	300
52-56	12	54	648
56-60	28	58	1624
60-64	30	62	1860
64-68	20	66	1320
68-72	4	70	280
	100		6032

from the table

N = total frequency

$\Sigma f x = 6032$

w.k.T

$$\text{mean } (\bar{x}) = \frac{1}{N} \sum_{i=0}^{n} f_i x_i$$

$$= \frac{1}{100} (6032)$$

$$= 60.32$$

(2.) Deviation method :-

Height (cm)	No. of (f_i) persons	x	$d_i = \frac{x-A}{C}$	$f_i d_i$
48-52	6	50	-2	-12
52-56	12	54	-1	-12
56-60	28	58 A	0	0
60-64	30	62	1	30
64-68	20	66	2	40
68-72	4	70	3	12
	N = 100			$f_i d_i = 58$

from the table N = Total frequency, $\Sigma f_i d_i = 58$, $C = 4$

w.k.T = $$\text{Mean } (\bar{x}) = A + \left(\frac{\sum_{i=1}^{n} f_i d_i}{N} \right) \times C$$

$$\bar{x} = 58 + \left(\frac{58}{100} \right) \times 4$$

$$= 58 + 0.58 \times 4 = 58 + 2.32 = \underline{60.32}$$

3. calculate the mean

C.I	0-10	10-20	20-30	30-40	40-50	50-60	60-70.
f	4	6	10	20	10	6	4.

1) Direct method.

C.I	f	mid value. x	xf
0-10	4	5	20
10-20	6	15	90
20-30	10	25	250
30-40	20	35	700
40-50	10	45	450
50-60	6	55	~~390~~ 330
60-70	4	65	260.
	60		2100

w.k.T

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

from the table

$n = \sum f = 60$

$\sum f_i x_i = 2100$

$\bar{x} = \frac{2100}{60}$

$= 35.$

2. Deviation method

C.I	f	x	$d_i = \frac{x-A}{c}$	$f_i d_i$.
0-10	4	5	-3	-12
10-20	6	15	-2	-12
20-30	10	25	-1	-10
30-40	20	35 A	0	0
40-50	10	45	1	10
50-60	6	55	2	12
60-70	4	65	3	12
	60			0

from the table N = Total frequency = 60, $\sum f_i d_i = 0$, C = 10.

w.k.t mean $(\bar{x}) = A + \left(\frac{\sum_{i=1}^{n} f_i d_i}{n}\right) \times C$

$= 35 + \left(\frac{0}{60}\right) \times 10 = \underline{35}$.

4. Calculate Arithmetic mean for the following data.

C.I	0-20	20-40	40-60	60-80	80-100	100-120	120-140.
F	5	18	29	32	20	16	10.

A)

C.I.	f	(x) mid value.	xf	$d_i = \frac{x-A}{C}$	~~fidi~~. fidi
0-20	5	10	50	-3	~~-15~~
20-40	18	30	540	-2	-36
40-60	29	50	1450	-1	-29
60-80	32	70 A	2240	0	0
80-100	20	90	1800	1	20
100-120	16	110	1760	2	32
120-140	10	130	1300	3	30.
	130		9140		2

Direct method:-

w.k.T mean $\bar{X} = \frac{1}{N} \sum_{i=1}^{n} f_i x_i$ =

$\bar{x} = \frac{9140}{130} = \underline{70.30}$.

Deviation ~~Indirect~~ method:-

w.k.T mean $\bar{X} = A + \left(\frac{\sum_{i=1}^{n} f_i d_i}{n}\right) \times C$

$= 70 + \left(\frac{2}{130}\right) \times 20$

$= \underline{70.30}$

Combined Mean (or) Pooled Mean:-

If there are k groups containing $n_1, n_2 \dots n_k$ observation and $\bar{x}_1, \bar{x}_2 \dots \bar{x}_k$ or represented arithmetic mean or pooled mean of $n_1 + n_2 + \dots n_k$ is denoted by $\bar{x}$ and it is given by

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2 + \dots n_k\bar{x}_k}{n_1 + n_2 + \dots n_k}.$$

In perticular two groups, the combined arithmetic mean is given by $\bar{x}_{12} = \dfrac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$

Problems:

1. There are 3 sections BCA 2nd years in a college. The no. of students in each section and the avg marks obtained by the students in the examination as follows.

Section	A	B	C
Avg marks	75	60	50
No. of students	50	60	50

find combined mean

A) from the table.

$n_1 = 50, n_2 = 60, n_3 = 50.$

$\bar{x}_1 = 75, \bar{x}_2 = 60, \bar{x}_3 = 50.$

w.k.t, the combined mean.

$$\bar{x}_{123} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2 + n_3\bar{x}_3}{n_1 + n_2 + n_3}$$

$$= \frac{50(75) + 60(60) + 50(50)}{50 + 60 + 50}$$

$$= \frac{9850}{160} = 61.56.$$

Q. The mean wage of 100 labours working in a factory ~~mor~~ running two shifts 70 and 30 workers respectively is 84 ₹, the mean wages of 70 labours working in Morning shifts is 90 ₹ find the mean wage of 30 workers working in the evening shifts?

A) Given data,

$n_1 = 70$, $n_2 = 30$

$\bar{x}_1 = 90$, $x_2 = ?$

$\bar{x}_{12} = 84$

W.K.T, the combined mean,

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

$$84 = \frac{70(90) + 30\bar{x}_2}{70+30}$$

$$84 = \frac{6300 + 30\bar{x}_2}{100}$$

$\cancel{84 \times 100}$ $8400 = 6300 + 30\bar{x}_2$

$2100 = 30\bar{x}_2$

$\frac{2100}{30} = \bar{x}_2$

$\boxed{70 = \bar{x}_2}$

merits and Demerits of Arithmetic mean:-

Merits:-

1. It is rigidly (clear) defined.
2. It is easy to understand and easy to calculate.
3. It is based on all the observations.
4. It is more accurate and more ~~reliably~~ reliable.

Demerits:-

1. If a single observation is missed, The arithmetic mean can't be obtained with more accuracy.
2. It can not calculated for open ~~and~~ and end classes.

Median :-

median ~~of~~ a distribution is the value of the variable which devides into two equal parts

that is median is the ~~medile~~ middle value of the distribution and it is denoted by M.

Median for an ungrouped data:-

If the no. of observations are "n"

→ arrange the observations assending order or desending order

→ median $M = \left(\frac{n+1}{2}\right)^{th}$ observation, if n is odd.

→ median $m =$ average $\left(\frac{n}{2}, \frac{n}{2}+1\right)^{th}$ observation, if n is even.

Problems:-

1. find the median for the following values 25, 30, 35, 10, 15.

A) Given observation.

25, 30, 35, 10, 15

Assending order.

10, 15, 25, 30, 35

n = 5 (odd

$m = \left(\frac{n+1}{2}\right)$

$m = \left(\frac{5+1}{2}\right)$

$m = \frac{\cancel{6}\,3}{\cancel{2}} = 3^{rd}$ observation $= \underline{25}$

2. find the median for the following values 26, 8, 12, 15, 32, 6.

A) n = 6

Order = 6, 8, 12, 15, 26, 32

median $m = avg\left(\frac{n}{2}, \frac{n}{2}+1\right)^{th}$ observation

$m = avg\left(\frac{6}{2}, \frac{6}{2}+1\right)^{th}$ observation.

$M = avg\ (3, 4)^{th}$ observation.

$= \left(\frac{12+15}{2}\right)$

$= \underline{13.5}$

3. 391, 384, 591, 407, 672, 522, 777, 753, 2488, 1490.

A) n = 10 (even)

order = 384, 391, 407, 522, 591, 672, 753, 777, 1490, 2488.

$M = \left(\frac{n}{2}, \frac{n+1}{2}\right)^{th}$ observation.

$= \left(\frac{10}{2}, \frac{11}{2}\right) = (5, 5.5)^{th} = 631.5$

4. 25, 20, 15, 35, 18, 13, 38

A) n = 7 (odd)

order = 13, 15, 18, 20, 25, 35, 38.

$= \left(\frac{n+1}{2}\right) = \frac{7+1}{2} = \frac{8}{2} = 4^{th}$ observation

$M = \underline{\underline{20}}$

median for a grouped data :-

Case 1: For discrete frequency distribution we can find the median through the following steps:

1. arrange the data in ascending (or) discending order of observation.
2. Find commulative frequency.
3. find $\frac{N}{2}$, consider the commulative frequency just grater than $\frac{N}{2}$.
4. The corresponding value of x is median.

Case 2: For continuous frequency distribution, the median is obtained by considering the median class..

The class corresponding to commulative frequency (CF) just grater than $\frac{N}{2}$ is called median class.

$$\text{median } (M) = l + \left(\frac{\frac{N}{2} - m}{f}\right) \times C$$

where l = lower limit of median class
f = frequency of median class
C = width of the median class.
m = commulative frequency preceeding to the median class.

Problems :-

1. obtain median from the following data.

x	5	8	11	14	17	20	23
f	2	8	12	20	10	6	3

A)

x	f	c.f
5	2	2
8	8	10
11	12	22
14	20	42
17	10	52
20	6	58
23	3	61
	61	

~~$\frac{N}{2} = \frac{61}{2} = 30.5$~~

$\frac{N}{2} = \frac{61}{2} = 30.5$

in commulative frequency just grater than $\frac{N}{2}$ is 42 and the value of x corresponding is 14

median (M) = 14

2. find the median from the following data.

x	1	2	3	4	5	6	7	8	9
f	8	10	11	16	20	25	15	9	6

A)

x	f	cf
1	8	8
2	10	18
3	11	29
4	16	45
5	20	65
6	25	90
7	15	105
8	9	114
9	6	120
	$n=120$	

$\frac{N}{2} = \frac{120}{2} = 60$

In cummulative frequency just graterthan $\frac{N}{2}$ is 65 and value of x corresponding to 65 is 5.

$\therefore$ median (m) = 5.

3. Calculate median for the following data.

Class Interval	40-50	50-60	60-70	70-80	80-90.
frequency.	5	12	23	8	2

A)

C.I	frequency	c.f
40-50	5	5
50-60	12	17
l 60-70	23 f	40 - M.C
70-80	8	48
80-90	2	50
	50	

$\frac{N}{2} = \frac{50}{2} = 25$

In cummulative frequency just graterthan $\frac{N}{2}$ is 40

Here $l = 60$, $\frac{N}{2} = 25$, $m = 17$, $c = 10$, $f = 23$

median $m = l + \left(\frac{\frac{N}{2} - m}{f}\right) \times c$

$= 60 + \left(\frac{25-17}{23}\right) \times 10$

$= 60 + 0.3478 \times 10$

$= 63.478$

4. Calculate median for the following data.

C.I	20-30	30-40	40-50	50-60	60-70
frequency	3	5	20	10	5

A)

C.I	frequency	c.f
20-30	3	3
30-40	5	8 m
l 40-50	20 f	28 → median class
50-60	10	38
60-70	5	43
	43	

$\frac{N}{2} = \frac{43}{2} = 21.5$

In c.f just grater than $\frac{N}{2}$ is 28.

Here, $l = 40$, $\frac{N}{2} = 21.5$, $m = 8$, $c = 10$, $f = 20$.

$= 40 + \left(\frac{21.5 - 8}{20}\right) \times 10$

$= 40 + 0.675 \times 10$

$= 40 + 6.75$

$M = 46.75$

5. Calculate median for following data.

marks	~~9.5~~-19.5	20-29	30-39	40-49	50-59	60-69
no. of students	8	16	24	33	12	5

A)

marks	No. of students	c.f
9.5-19.5	8	8
19.5-29.5	16	24
29.5-39.5	24	48 m
39.5-49.5	33 f	81 median class
49.5-59.5	12	93
59.5-69.5	5	98
	98	

l

$\frac{N}{2} = \frac{98}{2} = 49$, If c.f just grater than $\frac{N}{2}$ is 48

Here, $l = 39.5$, $\frac{N}{2} = 49$,

$m = 48$, $c = 10$, $f = 33$.

$M = 39.5 + \left(\frac{49-48}{33}\right) \times 10$

$= 39.5 + 0.03 \times 10$

$= 39.5 + 0.3$

$= 39.80$

6. The median value of data is 307.5 find the missing frequency.

C.I	0-100	100-200	200-300	300-400	400-500	500-600
frequency	6	10	15	?	10	4

A)

C.I	f	c.f
0-100	6	6
100-200	10	16
200-300	15	31 m
l 300-400	f_4 f	$31+f_4$ → median
400-500	10	$41+f_4$
500-600	4	$45+f_4$

from the table:-

$l = 300$, $f = f_4$, $m = 31$, $C = 100$, $\frac{N}{2} = \frac{45+f_4}{2}$

w.k.T

$$\text{median } (M) = l + \left(\frac{\frac{N}{2} - m}{f}\right) \times C$$

$$307.5 = 300 + \left(\frac{\frac{45+f_4}{2} - 31}{f_4}\right) \times 100$$

$$307.5 - 300 = \left(\frac{\frac{45+f_4}{2} - 31}{f_4}\right) \times 100$$

$$7.5 = \left(\frac{\frac{45+f_4-62}{2}}{f_4}\right) \times 100$$

$$7.5 = \left(\frac{-17+f_4}{2f_4}\right) \times 100$$

$$7.5 f_4 = (-17 + f_4) 50$$

$$7.5 f_4 = -850 + 50 f_4$$

$$7.5 f_4 - 50 f_4 = -850$$

$$+42.5 f_4 = +850$$

$$f_4 = \frac{850}{42.5}$$

$$\boxed{f_4 = 20}$$

merits:-

* It is rigidly defined.
* It is easy to understand & easy to calculate.
* It can be calculated for the distributions with open end classes.

mode for a ungrouped data :-

mode for an ungrouped data is calculated by the value of the variable which repeats maximum no. of times. It is denoted by 'Z'.

mode for a grouped data :-

Case 1 :- In case of ~~frequency~~ descrept frequency distribution the mode can be obtained by inspection, the value of the variable having the maximum frequency is known as modal value.

Case 2 :- In case of continuous frequency distribution the mode is calculated by using the following formula

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times c$$

where l = lower limit of modal class

c = width of the modal class interval

f_1 = frequency of modal class.

f_2 = frequency of succeeding the moded class

f_0 = frequency of preceeding the modal class.

Merits :-

→ It is easy to calculate;

→ It can be calculated for open-end classes

→ It is not effected by extreame values.

Demerits :-

→ It is not based on all observation

→ As compared with mean mode is affected.

much by fluctuations of samplings.

→ If the data is ill defined if it not possible to find clearly defined mode.

problems :-

1. obtain mode of the following values 10, 12, 15, 20, 12, 16, 18, 18, 15, 12, 10, 16, 20, 12, 24.

A) mode is the value which occurs the maximum no. of times in the series.

The value 12 repeated 4 times which is maximum frequently occured than any other observation.

$\therefore$ Mode $(Z) = 12$

2. Find the mode to the following data 650, 275, 384, 425, 515, 796, 210, 775, 825, 796, 500, 918, 769, 524, 425, 750, 211, 318, 593, 425, 550, 738, 975.

A) mode is the value In the given data 425 & 796 are equally repeated $\therefore$ It is called ~~Bymode~~ Bi-mode (or) double mode.

$\therefore$ mode $(Z) = 425, 796$

3. find the mode to the following data. 84, 46, 53, 96, 122, 35, 16, 72, 88, 91, 60, 40, 52, 75, 66.

A) From the given any value is not repeated hence it is not possible to define mode.

4. find mode to the following frequency distribution.

x	1	2	3	4	5	6	7	8
f	4	9	16	25	22	15	7	3

A) Given that

x	1	2	3	4	5	6	7	8
f	4	9	16	25	22	15	7	3

The maximum frequency is 25

The value of x corresponding to maximum frequency is – 4.

Hence mode (z) = $\underline{4}$

5. Find mode to the following data.

C.I	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
frequency.	5	7	10	18	20	12	8	2

A)

C.I	frequency
0-5	5
5-10	7
10-15	10
15-20	18 f_0
20-25	20 f_1 → mode class.
25-30	12 f_2
30-35	8
35-40	2

W.K.T

$$\text{mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times c$$

where

l = lower limit of modal class

c = width of the modal class

f_1 = frequency of modal

f_2 = frequency of succeeding the modal class

f_0 = frequency of preceding the modal class

$$\text{Mode} = 20 + \left(\frac{20-18}{2(20)-18-12}\right) \times 5$$

$$= 20 + \frac{2}{10} \times 5$$

$$\text{mode}(z) = 20 + 1 = \underline{\underline{21}}$$

6. find mode to the following data.

C.I	1-3	3-5	5-7	7-9	9-11
frequency.	7	8	2	2	1

A)

C.I	frequency
1-3	7 f_0
l 3-5	8 f_1
5-7	2 f_2
7-9	2
9-11	1

W.K.T

$$\text{mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times c$$

$$= 3 + \left(\frac{8-7}{2(8)-7-2}\right) \times 2$$

$$= 3 + \left(\frac{1}{7}\right) \times 2$$

$$= 3.285$$

7. find mode to the following data.

C.I	1-10	10-20	20-30	30-40	40-50	50-60	60-70
frequency	25	34	50	42	38	14	10

A)

C.I	frequency
1-10	25
10-20	34 f_0
l 20-30	50 f_1
30-40	42 f_2
40-50	38
50-60	14
60-70	10

W.K.T

$$\text{mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times c$$

$$= 20 + \left(\frac{50-34}{2(50)-34-42}\right) \times 10$$

$$\text{mode} = 20 + \frac{16}{24} \times 10 = 26.6$$

Empirical Relation between Mean, median and mode

A) The mean, median and mode relationship is known as the empirical relationship

→ In case of a moderately skewed distribution, the d/f between mean and mode is almost equal to 3 times the difference b/w the mean and median. that is

$$\text{Mean} - \text{mode} = 3(\text{mean} - \text{median})$$

mean − mode = 3 mean − 3median

− mode = 3 mean − 3 median − mean.

− mode = 2 mean − 3 median.

f mode = f (− 2 mean + 3 median)

mode = − 2 mean + 3 median.

mode = 3 median − 2 mean (or) $Z = 3M - 2\bar{X}$

Problems:-

1. In a moderative skew distribution (median is 20 and the mean is 22.5 using these values find the approximate value of mode.

A) Given that

mean = 22.5

median = 20

mode = ?

w.k.T Empirical Relationships b/w mean, median & mode is

mode = 3 median − 2 mean

= 3 (20) − 2 (22.5)

= 60 − 45 = 15

mode = 15

2. In a moderatly symmatrical (skew) distribution the mode and median are 20 & 20 respectively. then calculate the mean.

A) Given that

median = 20

mode = 20

mean = ?

w.k.T Empirical Relationships b/w mean, median & mode is

mode = 3 median − 2 mean.

20 = 3(20) − 2 mean.

20 = 60 − 2 mean.

−40 = −2 mean

$\frac{-40}{-2}^{20}$ = mean = 20.

3. If mean and mode of a series is 30 and 25 respectively then find the median.

Given that

median = ?

mode = ~~30~~25

mean = 30

The empirical relationship b/w mean, median & mode is

mode = 3 median − 2 mean.

25 = 3 median − 2 (30)

25 = 3 median − 60

25 + 60 = 3 median.

85 = 3 median.

$\frac{85}{3}$ = median = 28.33

$$\begin{array}{r} 60 \\ 25 \\ \hline 85 \end{array}$$

4. If the mean & median of a series are (26.8) & (27.9) respectively calculate the value of mode?

A) Given that

median = 27.9

mode = ?

mean = 26.8

The empirical relationship b/w mean, median & mode is

mode = 3 median − 2 mean.

Mode = 3 (27.9) − 2 (26.8)

mode = 30.1

Quartiles :-

→ A quartiles devides a sorted data set into 4 equal parts so that each part represents $\frac{1}{4}$ of the data set

→ The four equal parts are denoted by Q_1, Q_2, Q_3, Q_4

→ The quartile deviation is defined as the half of the d/f b/w the third quartile and first quartile that is quartile deviation (QD) = $\frac{Q_3 - Q_1}{2}$

→ The coefficient of quartile deviation is $\frac{Q_3 - Q_1}{Q_3 + Q_1}$

Quartile deviation for ungrouped data :-

$Q_1 = \left(\frac{n+1}{4}\right)^{th}$ observation.

$Q_3 = 3\left(\frac{n+1}{4}\right)^{th}$ observation.

Quartile deviation for Grouped data :-

Case 1 :- For ~~discrete~~ discreat data $Q_1 = \left(\frac{N+1}{4}\right)^{th}$ observation

$Q_3 = 3\left(\frac{N+1}{4}\right)^{th}$ observation.

Case 2 :- For continuous data $Q_1 = l_1 + \left(\frac{\frac{N}{4} - m_1}{f_1}\right) \times c$

$Q_3 = l_3 + \left(\frac{\frac{N}{4} - m_3}{f_3}\right) \times c$

where → l_1, l_3 are lower limits of first and third quartile class.

→ c is the width of the quartile class.

→ f_1, f_3 are frequencies of first and third quartile class.

→ m_1, m_3 are commulative frequencies of first and third quartile preceeding the quartile class.

→ N is the ~~total~~ Total frequency.

Problems :-

1. find quartile deviation of the value 2, 4, 10, 8, 6, 12, 5.

A) Given that 2, 4, 10, 8, 6, 12, 5

Assending order :- 2, 4, 5, 6, 8, 10, 12

Here $n = 7$

$Q_1 = \left(\frac{n+1}{4}\right)^{th}$ observation

$= \left(\frac{7+1}{4}\right)^{th}$ 2nd observation.

$Q_1 = 4$.

$Q_3 = 3\left(\frac{n+1}{4}\right)^{th}$ observation.

$= 3\left(\frac{7+1}{4}\right)^{th}$ observation

$= 3(2)$ observation.

$=$ 6th observation

$Q_3 = 10.$

$$Q.D = \frac{Q_3 - Q_1}{2} = \frac{10-4}{2} = \frac{6}{2} = 3$$

$$\text{coefficient of } Q.D = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{10-4}{10+4} = \frac{6}{14} = \frac{3}{7}$$

(2) The marks obtained by 11 students as follows calculate Quartile divation and coefficients. 43, 25, 72, 38, 12, 86, 54, 52, 65, 70, 92.

A) Given that 45, 25, 72, 38, 12, 86, 54, 52, 65, 70, 92.

Ascending order : 12, 25, 38, 43, 52, 54, 65, 70, 72, 86, 92.

Here $n = 11$

$$Q_1 = \left(\frac{n+1}{4}\right)^{th} \text{observation} = \left(\frac{11+1}{4}\right) = 38.$$

$$Q_3 = 3\left(\frac{n+1}{4}\right) = 3\left(\frac{11+1}{4}\right) = 3\left(\frac{12}{4}\right)$$

C. Chaudri
2/11/24

(3) calculate the Quartile diviation and co-efficent from the following data.

Size	3.5	4.5	5.5	6.5	7.5	8.5	9.5
frequency	5	7	22	60	85	32	8

A)

size	frequency	C.F
3.5	5	5
4.5	7	12
5.5	22	34
6.5	60	94
7.5	85	179
8.5	32	211
9.5	8	219
	N=219	

$Q_1 = \left(\frac{N+1}{4}\right)^{th}$ observation

$= \left(\frac{219+1}{4}\right)^{th}$ observation

$= 55^{th}$ observation

In commolative frequency just greater than 55 is 94, the value of x corresponding to 94 is 6.5 - $Q_1 = 6.5$

$Q_3 = 3\left(\frac{N+1}{4}\right)^{th}$ observation

$= 3\left(\frac{219+1}{4}\right)$ observation $= 3(55) = 165 = Q_3 = 7.5$

In commolative frequency just grater than 165 is 179, the value of x corresponding to 179 is 7.5

$Q_3 = 7.5$

$Q.D = \frac{Q_3 - Q_1}{2} = \frac{7.5 - 6.5}{2} = \frac{1}{2} = 0.5$

coefficient of $QD = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{7.5 - 6.5}{7.5 + 6.5} = \frac{1}{14} = 0.071$

Find quartile deviation and its co-efficient for the following data.

C.I	0-20	20-40	40-60	60-80	80-100
frequency	10	25	40	15	10

A)

C.I	frequency	C.F
0-20	10	10
20-40	25	35
40-60	40	75
60-80	15	90
80-100	10	100
	$N = 100$	

$\frac{N}{4} = \frac{100}{4}$

In cummulative frequency just grater than 25 is 35 then the corresponding class interval to 35 is 20-40.

Here $l_1 = 20$, $f_1 = 25$, $m_1 = 10$, $c = 20$.

$$Q_1 = l_1 + \left(\frac{\frac{N}{4} - m_1}{f_1}\right) \times c$$

$$= 20 + \left(\frac{100}{4} - 10\right) \times 20$$

$$= 20 + \left(\frac{25 - 10}{25}\right) \times 20.$$

$$= 20 + 12$$

$$Q_1 = 32$$

In cummulative frequency just grater than 75 is 90 then the corresponding class interval to 90 is 60-80.

Here $l_3 = 60$, $f_3 = 15$, $m = 75$

$$Q_3 = l_3 + \left(\frac{3\left(\frac{N}{4}\right) - m_3}{f_3}\right) \times c$$

$$= 60 + \left(\frac{3\left(\frac{100}{4}\right) - 75}{15} \right) \times 20$$

$$= 60 + \left(\frac{3(25) - 75}{15} \right) \times 20$$

$$= 60 - 0$$

$$Q_3 = 60.$$

$$Q.D = \frac{Q_3 - Q_1}{2} = \frac{60 - 32}{2} = \frac{28}{2} = 14.$$

Checked
2/11/24