॥ जय श्री राधे कृष्णा जय श्री गिरिराज जी महाराज ॥

ULTIMATE MATHEMATICS: By AJAY MITTAL

CHAPTER : STATS Class No: 1

'Distribution

(1) Individual Series: $x : x_1, x_2, x_3 \dots x_n$

$n \rightarrow$ No of observations

(2) Discrete Series: $x = x_1, x_2 \dots$

$f = f_1, f_2 \dots$

(3) Continuous Series: C.I : 0-5, 5-10, ...

$f : f_1, f_2 \dots$

MEAN / AVERAGE

(1) Individual: $\bar{x} = \frac{\Sigma x}{n}$; $n \rightarrow$ No of observation

(2) Discrete: $\bar{x} = \frac{\Sigma fx}{\Sigma f}$

x	f	fx
	Σ	Σ

(3) Continuous $\bar{x} = a + \left(\frac{\Sigma fd'}{\Sigma f}\right) \times h$

$a = 17.5$

$d' = \frac{x-a}{h}$

C.I	f	x	d'	fd'
5-10	3	7.5	-2	-6
10-15	6	12.5	-1	-6
15-20	9	17.5	0	0
20-25	4	22.5	1	4
25-30	8	27.5	2	16
	30			8

$\bar{x} = 17.5 + \frac{(8)}{30} \times 5$

$\bar{x} = 17.5 + 1.33$

$\bar{x} = 18.83$ Ans

Median

(1) Individual : Arrays in Ascending order

If $n \rightarrow$ odd then Median $= \left(\frac{n+1}{2}\right)^{th}$ obs. value

If $n \rightarrow$ even then Median $= \frac{\left(\frac{n}{2}\right)^{th} + \left(\frac{n}{2}+1\right)^{th}}{2}$ obs.

eg x : 3, 5, 7, 4, 1, 8, 6, 10

x : 1, 3, 4, 5, 6, 7, 8, 10

$n = 8$

Median $= \frac{4^{th} + 5^{th}}{2} = \frac{5+6}{2} = 5.5$ Ans

(2) Discrete :

x	f	C.F
10	3	3
12	8	11
11	4	15
15	5	20
20	7	27
	27	

then $N = \Sigma f = 27$

$\frac{N+1}{2} = \frac{27+1}{2} = 14 \rightarrow$ go to CF table

$\therefore$ Median $= 11$ Ans

(3) Continuous

$$\text{Median} = l + \frac{\left(\frac{N}{2} - CF\right)}{f} \times h$$

C.I	f	CF
0-10	8	8
10-20	11	19
20-30	12	31
30-40	9	41
40-50	10	50
	50	

$\frac{N}{2} = \frac{50}{2} = 25 \rightarrow$ go to CF table

$f = 12$, $l = 20$; $CF = 19$; $h = 10$.

$$\text{Median} = 20 + \left(\frac{25-19}{12}\right) \times 10$$

$$= 20 + 5 = 25 \text{ Ans}$$

MEAN DEVIATION (M.D)

(1) M.D about Mean (2) Mean Deviation about Median

Individual $M.D = \frac{1}{n} \Sigma |x - \bar{x}|$

$M.D = \frac{1}{n} \Sigma |x - \text{Median}|$

Discrete $M.D = \frac{1}{N} \Sigma f|x - \bar{x}|$

$MD = \frac{1}{N} \Sigma f|x - \text{Median}|$

Continuous $M.D = \frac{1}{N} \Sigma f|x - \bar{x}|$

$MD = \frac{1}{N} \Sigma f|x - \text{Median}|$

Qus. 1 Find Mean deviation about Median

C.I : 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55

f : 5, 6, 12, 14, 26, 12, 16, 9

Sol:

C.I	f	c.f	x	$\lvert x-38 \rvert$	$f\lvert x-38 \rvert$
15.5 - 20.5	5	5	18	20	100
20.5 - 25.5	6	11	23	15	90
25.5 - 30.5	12	23	28	10	120
30.5 - 35.5	14	37	33	5	70
35.5 - 40.5	26	63	38	0	0
40.5 - 45.5	12	75	43	5	60
45.5 - 50.5	16	91	48	10	160
50.5 - 55.5	9	100	53	15	135
	$\Sigma f = 100$				$\Sigma f\lvert x-38 \rvert$

Median

$N = 100$

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

$M = 35.5 + \left(\frac{50 - 37}{26}\right) \times 5$

Median = 38

$M.D = \frac{735}{100} = 7.35$ Ans

$= 735$

Qn. 2 Find the Mean deviation about Mean

C.I	f	x	d'	fd'	$\|x-45\|$ $\|x-\bar{x}\|$	$f\|x-\bar{x}\|$
10-20	2	15	-3	-6	30	60
20-30	3	25	-2	-6	20	60
30-40	8	35	-1	-8	10	80
40-50	14	(45) = a	0	0	0	0
50-60	8	55	1	8	10	80
60-70	3	65	2	6	20	60
70-80	2	75	3	6	30	60
	$\Sigma f = 40$			$\Sigma fd' = 0$		$\Sigma f\|x-45\| = 400$

$$\text{Mean} = a + \left(\frac{\Sigma fd'}{\Sigma f}\right) \times h = 45 + 0 = 45$$

$$\text{M.D} = \frac{1}{N} \Sigma f|x - \text{Mean}| = \frac{400}{40} = 10 \text{ Ans}$$

-x-

(.) Variance & Standard deviation

(.) Standard deviation $(\sigma) = \sqrt{\text{variance}}$

Variance (σ^2)

(1) Individual: (Imp) $\text{Var}(x) = \frac{1}{n} \Sigma x^2 - (\text{Mean})^2$

where $\text{Mean} = \frac{\Sigma x}{n}$

(OR) $\text{Var}(x) = \frac{1}{n} \Sigma (x - \bar{x})^2$

(2) Discrete $\quad var(x) = \frac{1}{N} \Sigma f(x-\bar{x})^2$

when $\bar{x} = \frac{\Sigma fx}{\Sigma f}$

(3) Continuous $\quad var(x) = h^2\left[\frac{1}{N}\Sigma fd'^2 - \left(\frac{1}{N}\Sigma fd'\right)^2\right]$

✓ (Imp)

Qn. 3 Calculate Mean, variance and standard deviation of the given series

C.I	f	x	d'	fd'	fd'²
30-40	3	35	-3	-9	27
40-50	7	45	-2	-14	28
50-60	12	55	-1	-12	12
60-70	15	(65)	0	0	0
70-80	8	75	1	8	8
80-90	3	85	2	6	12
90-100	2	95	3	6	18
	$\Sigma f = 50$			$\Sigma fd' = -15$	$\Sigma fd'^2 = 105$

Mean

$= a + \frac{\Sigma fd'}{\Sigma f} \times h$

$= 65 - \frac{15}{50} \times 10$

$= 65 - 3$

Mean = 62

$var(x) = h^2\left[\frac{1}{N}\Sigma fd'^2 - \left(\frac{1}{N}\Sigma fd'\right)^2\right]$

$= 100\left[\frac{1}{50} \times 105 - \left(\frac{-15}{50}\right)^2\right]$

$= 100\left(\frac{105}{50} - \frac{9}{100}\right) = 100\left[\frac{210-9}{100}\right]$

variance = 201

$S.D = \sqrt{201} = 14.18$ (Ans)

	14.18	
1	201	
	1	
24	101	
	96	
281	500	
	281	
2828	21900	

Qn.4 The mean and standard deviation of 100 observations (6)
Imp were calculated as 40 and 5.1 respectively by a student who took by ~~Mistake~~ mistake 50 instead of 40 for one observation. what are the correct Mean and correct Standard deviation!

Soln Given $n = 100$

Inc. Mean $= 40$

Inc. S.D $= 5.1$

Inc. Variance $= (5.1)^2 = 26.01$

✓ Inc. Mean $= \frac{\text{Inc. } \Sigma x}{n}$

$40 = \frac{\text{Inc } \Sigma x}{100}$

Inc. $\Sigma x = 4000$

Correct $\Sigma x = 4000 - 50 + 40$

Corr. $\Sigma x = 3990$

Corr. Mean $= \frac{3990}{100} = 39.9$ ✓

$\Rightarrow 1626.01 = \frac{1}{100}$ Inc Σx^2

$\Rightarrow$ Inc $\Sigma x^2 = 162601$

Corr $\Sigma x^2 =$ ~~1601~~ $=$

$162601 - 2500 + 1600$

Corr $\Sigma x^2 = 161701$

Corr. variance $= \frac{1}{100}(161701) - (39.9)^2$

$= 1617.01 - 1592.01$

Corr. variance $= 25$

Corr. SD $= \sqrt{25} = 5$ Ans

$=$

$\text{var}(x) = \frac{1}{n}\Sigma x^2 - (\text{Mean})^2$

✓ Inc. variance $= \frac{1}{n}$ Inc. $\Sigma x^2 - ($Inc. Mean$)^2$

$26.01 = \frac{1}{100}$ Inc. $\Sigma x^2 - 1600$

WORKSHEET No: 1

Qn:1 Find Mean deviation about Mean

x:	5	10	15	20	25
f:	7	4	6	3	5

Ans- 6.32

Qn.2 → Find Mean deviation about Median

x:	15	21	27	30	35
F:	3	5	6	7	8

Ans = 5.1

Qn.3 → Find the ~~Mean~~ Mean deviation about Median

x: 36, 72, 46, 42, 53, 60, 45, 51, 49

Ans = 7

Qn.4 → Find the Mean deviation about Mean

C.I: 95-105	105-115	115-125	125-135	135-145	145-155
f: 9	13	26	30	12	10

Ans 11.28

Qn.5 Find the Mean deviation about Median

C.I	0-10	10-20	20-30	30-40	40-50	50-60
f:	6	8	14	16	4	2

Ans 10.34

Qn.6 → Find the Mean vaurance & standard deviation

C.I	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	110-115
f	3	4	7	7	15	9	6	6	3

Ans Mean = 93 ; Var = 105.52 ; S.D = 10.27

Q.N=7 → Find the Mean & Standard deviation

C.I	33-36	37-40	41-44	45-48	49-52
f	15	17	21	22	25

Ans
Mean = 43.5
SD = 5.55

Q.N=8 → The mean and Standard deviation of 20 observations are found to be 10 and 2. On rechecking, it was found that an observation 8 was incorrect. Calculate the correct Mean and Correct Standard deviation

(i) If Wrong item is replaced by 12

(ii) If the wrong item is ommited

Ans (1) 10.2, 1.98

(2) 10.1, 1.99

—x—