Assignment – 8.

Q1 The distance in meters for eight throws of a shotputter are given as seven.

x_i	$(x_i - \bar{x})^2$
15.92	0.1521
16.27	0.0016
15.41	0.81
18.48	4.7089
17.28	0.9409
14.98	1.7689
15.85	0.2116
	8.594

(i) Calculate sample mean.

formula for sample mean $\bar{x} = \frac{\sum x_i}{n}$

$\bar{x} = 16.31$

(ii) Sample standard deviation.

formula for sample standard deviation

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

$$s = \sqrt{\frac{8.594}{6}} = 1.19$$

Q2. find Median

C.I	f	c.f
0-10	30	30
10-20	50	80
20-30	54	134 ← c.f
30-40	67 ← f	201
40-50	59	260
50-60	48	308
60-70	39	347
70-80	30	377 = N
	377	

l → 30, h = 40-30 = 10

$$\text{Med} = 30 + \left(\frac{188.5 - 134}{67}\right) \times 10$$

$$= 38.13$$

Formula for Median

(i) Construct cummulative freq. column.

(ii) find $\frac{N}{2} = \frac{377}{2} = 188.5$

(iii) Select class interval containing 188.5^{th} item 30-40.

(iv) Apply Median formula.

$$l + \frac{N/2 - c.f}{f} \times h$$

h → length of interval

f → freq. of class inter.

where l = lower limit of Median selected class interval

c.f → previous cummulative freq. to selected inter.

Q3 X, Y, Z are independent Chi-Square with deg. 1, 4, 9. Then distribution of X+Y+Z is

$X \sim \chi^2(1)$
$Y \sim \chi^2(4)$
$Z \sim \chi^2(9)$

For addition of χ^2 distribution then resultant distribution is also χ^2 with degree as addition of degrees

$\chi^2(k_1) + \chi^2(k_2) + \text{---} \chi^2(k_n)$

$= \chi^2(k_1 + k_2 + \text{---} k_n)$

$\therefore$ in this case $X+Y+Z \sim \chi^2(1+4+9)$

i.e $\chi^2(14)$.

Q4 Find Median 31, 6, 12, 27, 17, 15, 21, 13, 2

for individual series first arrange data either in ascending or descending order.

2, 6, 12, 13, 15, 17, 21, 27, 31

Find middle term (as no. of terms odd). $\frac{n+1}{2} = \frac{9+1}{2} = 5^{th}$ term $= 15$.

if even (two middle terms and take their avg.)

Q5 Mode for Question-2. Formula for Mode $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$

Modal class → higher freq.
l → modal class
f_1 → freq. of modal class
f_0 → freq. previous to modal class
f_1 → " proceeding " "

$80 + \frac{67-54}{(2\times67)-54-59} \times 10$

$= 36.19$

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Q6

A: 200 300 500 700 900

B: 100 150 270 800 500

Mean $\bar{x}_A = \frac{\sum x_i}{5} = \frac{2600}{5} = 520$

Mean $\bar{x}_B = \frac{\sum x_i}{5} = \frac{1820}{5} = 364.$

standard deviation $= \sqrt{\frac{1}{n-1}\sum(x_i - \bar{x})^2}$

A	$(x_i - \bar{x}_A)^2$	B	$(x_i - \bar{x}_B)^2$
200	102,400	100	69696
300	48,400	150	45796
500	400	270	8836
700	32,400	800	190096
900	144,400	500	18496
	328,000		332920

S.D of A $= \sqrt{\frac{328000}{4}} = 286.3564.$

S.D of B $= \sqrt{\frac{332920}{4}} = \sqrt{83,230} = 288.4961.$

Cov. of A $= \frac{S.D}{\bar{x}_A} = 0.550685$

Cov of B $= \frac{S.D}{\bar{x}_B} = 0.792572$

$\Rightarrow$ $Cov_B > Cov_A$ and Mean of A > mean of B.

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Q7 15 x 21 x+10 30 39

Given Median = 24.

We know that no. of elements are even.

$\therefore$ Median = $\frac{\text{Size of } (3^{rd} + 4^{th}) \text{ element}}{2} = \frac{\text{Size of } \left[\left(\frac{n}{2}\right)^{th} + \left(\frac{n}{2}+1\right)^{th}\right]}{2}$

$$24 = \frac{21 + x + 10}{2}$$

$$48 = 31 + x$$

$$\Rightarrow x = 17$$

Q8

C.I	No. of students f
30.5 – 35.5	10
35.5 – 40.5	16
40.5 – 45.5	12
45.5 – 50.5	19
50.5 – 55.5	15
55.5 – 60.5	8

Here the class interval 45.5 – 50.5 is having maximum frequency, so this is the modal class

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

where l is the lower limit of the modal class
f_1 is the frequency of modal class
f_0 is the frequency of preceeding modal class.

f_2 is the frequency of the succeeding modal class

$\therefore l = 45.5$

$f_1 = 19 \quad f_0 = 12 \quad f_2 = 15 \quad , h = 5$

$$\therefore \text{Mode} = 45.5 + \left[\frac{19-12}{2\times19 - 12 + 15}\right] \times 5$$

$$= 48.68$$

Q29

95°C	100°C	Difference in temperature	$(x_i - \bar{x})^2$
11.76	6.56	5.2	5.180
6.85	7.58	-0.73	18.352
9.45	5.62	3.83	0.821
12.21	11.05	1.16	3.112
7.59	9.14	-1.55	20.017
10.754	7.85	2.904	0.0004
9.35	3.78	5.57	7.001
11.22	4.21	7.01	16.695
		23.394	66.1784

$$\text{Mean} = \frac{\sum x_i}{8} = \frac{23.394}{8} = 2.924$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{66.1784}{7}}$$

$$= \sqrt{9.454} = 3.075$$

Q10 Data in ascending order is

1, 2, 5, 15, 15, 15, 17, 29, 62, 71, 115

Median = Size of $\frac{(n+1)}{2}^{th}$ item

= Size of 6^{th} item

= 15

Mode = 15

Mean = $\frac{\Sigma x_i}{11} = \frac{347}{11} = 31.545$