RD Sharma Solutions Class 11 Maths Chapter 32 Ex 32.6

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Statistics Ex 32.6 Q1

CI	f	x	u=(x-A)/h	fu	u^2	fu^2
0-10	14	5	-2	-28	4	56
10-20	13	15	-1	-13	1	13
20-30	27	25	0	0	0	0
30-40	21	35	1	21	1	21
40-50	15	45	2	30	4	60
	90			**10**		**150**

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Here, $N = 90$, $A = 25$, $\Sigma f_i u_i = 10$, $\Sigma f_i u_i^2 = 150$ and $h = 10$

$\therefore$ Mean $= \bar{x} = A + h\left(\frac{1}{N}\Sigma f_i u_i\right)$

$\Rightarrow$ $\bar{x} = 25 + 10\left(\frac{10}{90}\right) = 26.11$

$$\text{var}(x) = h^2\left[\frac{1}{N}\Sigma f_i u_i^2 - \left(\frac{1}{N}\Sigma f_i u_i\right)^2\right] = 100\left[\frac{150}{90} - \left(\frac{10}{90}\right)^2\right] = 165.4$$

$\therefore$ $S.D. = \sqrt{\text{var}(x)} = \sqrt{165.4} = 12.86$

Statistics Ex 32.6 Q2

CI	f	x	u=(x-A)/h	f*u	u^2	fu^2
0-30	9	15	-3	-27	9	81
30-60	17	45	-2	-34	4	68
60-90	43	75	-1	-43	1	43
90-120	82	105	0	0	0	0
120-150	81	135	1	81	1	81
150-180	44	165	2	88	4	176
180-210	24	195	3	72	9	216
	300			137		665

Here, $N = 300$, $A = 105$, $\sum f_i u_i = 137$, $\sum f_i u_i^2 = 665$ and $h = 30$

$\therefore$ Mean $= \bar{x} = A + h\left(\frac{1}{N}\sum f_i u_i\right)$

$\Rightarrow$ $\bar{x} = 105 + 30\left(\frac{137}{300}\right) = 118.7$

$$\text{var}(x) = h^2\left[\frac{1}{N}\sum f_i u_i^2 - \left(\frac{1}{N}\sum f_i u_i\right)^2\right] = 900\left[\frac{665}{300} - \left(\frac{137}{300}\right)^2\right] = 1807.31$$

$\therefore$ $S.D. = \sqrt{\text{var}(x)} = \sqrt{1807.31} = 42.51$

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Statistics Ex 32.6 Q3

CI	f	x	u=(x-A)/h	f*u	u^2	fu^2
0-10	18	5	-3	-54	9	162
10-20	16	15	-2	-32	4	64
20-30	15	25	-1	-15	1	15
30-40	12	35	0	0	0	0
40-50	10	45	1	10	1	10
50-60	5	55	2	10	4	20
60-70	2	65	3	6	9	18
70-80	1	75	4	4	16	16
	79			-71		305

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Here, $N = 79, A = 35, \Sigma f_i u_i = -71, \Sigma f_i u_i^2 = 305$ and $h = 10$

$\therefore$ Mean $= \bar{x} = A + h\left(\frac{1}{N}\Sigma f_i u_i\right)$

$\Rightarrow$ $\bar{x} = 35 + 10\left(\frac{-71}{79}\right) = 26.01$

$$\text{var}(x) = h^2\left[\frac{1}{N}\Sigma f_i u_i^2 - \left(\frac{1}{N}\Sigma f_i u_i\right)^2\right] = 100\left[\frac{305}{79} - \left(\frac{-71}{79}\right)^2\right] = 305.30$$

$\therefore$ $S.D. = \sqrt{\text{var}(x)} = \sqrt{305.30} = 17.47$

Statistics Ex 32.6 Q4

We have, $n = 100$, $\bar{x} = 40$ and $\sigma = 5.1$

$\therefore \quad \bar{x} = \frac{1}{n}\Sigma x_i$

$\Rightarrow \quad \Sigma x_i = n\bar{x} = 100 \times 40 = 4000$

$\therefore$ Incorrect $\Sigma x_i = 4000$

and,

$\sigma = 5.1$

$\Rightarrow \quad \sigma^2 = 26.01$

$\Rightarrow \quad \frac{1}{n}\Sigma x_i^2 - (\text{Mean})^2 = 26.01$

$\Rightarrow \quad \frac{1}{100}\Sigma x_i^2 - 1600 = 26.01$

$\Rightarrow \quad \Sigma x_i^2 = 1626.01 \times 100$

$\therefore$ Incorrect $\Sigma x_i^2 = 162601$

When the incorrect observation 50 is replaced by 40:
We have, Incorrect $\Sigma x_i = 4000$

$\therefore$ Corrected $\Sigma x_i = 4000 - 50 + 40 = 3990$

and,

Incorrected $\Sigma x_i^2 = 162601$

$\therefore$ Corrected $\Sigma x_i^2 = 162601 - 50^2 + 40^2 = 161701$

Now, Corrected mean $= \frac{3990}{100} = 39.90$

Corrected variance $= \frac{1}{100}\left(\text{Corrected } \Sigma x_i^2\right) - (\text{Corrected mean})^2$

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$\Rightarrow$ Corrected variance $= \frac{161701}{100} - \left(\frac{3990}{100}\right)^2$

$\Rightarrow$ Corrected variance $= \frac{161701 \times 100 - (3990)^2}{(100)^2}$

$\Rightarrow$ Corrected variance $= \frac{16170100 - 15920100}{10000} = 25$

$\therefore$ Corrected standard deviation $= \sqrt{25} = 5$

Statistics Ex 32.6 Q5

CI	$Freq$	$MidValue$	u_i	f_iu_i	$f_iu_i^2$
31–35	2	33	−4	−8	32
36–40	3	38	−3	−9	27
41–45	8	43	−2	−16	32
46–50	12	48	−1	−12	12
51–55	16	53	0	0	0
56–60	5	58	1	5	5
61–65	2	63	2	4	8
66–70	2	68	3	6	18
	$N = 50$			$Total = -30$	$Total = 134$

$Mean = 53 + 5 \times \frac{-30}{50} = 50$

$Var = 25 \times \left(\frac{134}{50} - \frac{9}{25}\right) = 58$

$SD = \sqrt{58} = 7.62$

Statistics Ex 32.6 Q6

Converting the given data into continuous frequency distribution by subtracing 0.5 from the lower limit and adding 0.5 to the upper limit of each class interval.

Class interval	f_i	Mid-value x_i	$u_i = \frac{x_i - 5.5}{1}$	f_iu_i	u_i^2	$f_iu_i^2$
1 – 2	6	1.5	−4	−24	16	96
3 – 4	4	3.5	−2	−8	4	16
5 – 6	5	5.5	0	0	0	0
7 – 8	1	7.5	2	2	4	4
	$N = \sum f_i = 16$			$\sum f_iu_i = -30$		$\sum f_iu_i^2 = 116$

$N = 16$, $\sum f_iu_i = -30$, $\sum f_iu_i^2 = 116$, $A = 5.5$ and $h = 1$

$\text{Mean} = A + h\left(\frac{1}{N}\sum f_iu_i\right) = 5.5 + 1\left(\frac{1}{16} \times (-30)\right) = 3.625$

$Var(X) = h^2\left\{\left(\frac{1}{N}\sum f_iu_i^2\right) - \left(\frac{1}{N}\sum f_iu_i\right)^2\right\} = 1\left\{\left(\frac{1}{16} \times 116\right) - \left(\frac{1}{16} \times (-30)\right)^2\right\} = \{7.25 - 3.51\} = 3.74$

Note: Answer given in the book is incorrect.

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Statistics Ex 32.6 Q7

CI	x_i	f_i	u_i	f_iu_i	$f_iu_i^2$
200 – 201	200.5	13	−1.5	−19.5	29.25
201 – 202	201.5	27	−1	−27	27
202 – 203	202.5	18	−0.5	−9	4.5
203 – 204	203.5	10	0	0	0
204 – 205	204.5	1	0.5	0.5	0.25
205 – 206	205.5	1	1	1	1
		$N = 70$		$Total = -54$	$Total = 62$

$$Mean = 203.5 + 2\left(\frac{-54}{70}\right) = 201.9$$

$$Var = 4\left(\frac{62}{70} - \left(\frac{-54}{70}\right)^2\right) = 0.98$$

$$SD = \sqrt{0.98} = 0.99$$

Statistics Ex 32.6 Q8

$Mean = 40$

$SD = 10$

$n = 100$

$\sum x_i = 40 \times 100 = 4000$

$Corrected\ Sum = 4000 - 30 - 70 + 3 + 27 = 3930$

$$Corrected\ \ Mean = \frac{3930}{100} = 39.3$$

$Variance = 100$

$$100 = \frac{\sum x_i^2}{100} - (40)^2$$

$Incorrect \sum x_i^2 = 170000$

$Corrected \sum x_i^2 =$

$Incorrect \sum x_i^2 - (\text{Sum of squares of incorrect values}) +$

(Sum of squares of corrected values)

$Corrected \sum x_i^2 = 170000 - (900 + 4900) + (9 + 729)$

$Corrected \sum x_i^2 = 164938$

$$Corrected\ \sigma = \sqrt{\frac{Corrected \sum x_i^2}{n} - (Corrected\ \ Mean)^2}$$

$$Corrected\ \sigma = \sqrt{\frac{164938}{100} - (39.3)^2} = 10.24$$

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Statistics Ex 32.6 Q9

$Mean = 45$

$Variance = 16$

$n = 10$

$\sum x_i = 450$

$Corrected\ Sum = 450 - 52 + 25 = 423$

$Corrected\ Mean = 42.3$

$Variance = 16$

$$16 = \frac{\sum x_i^2}{10} - (45)^2$$

$Incorrect \sum x_i^2 = 20410$

$Corrected \sum x_i^2 =$

$Incorrect \sum x_i^2 - (\text{Sum of squares of incorrect values}) +$

(Sum of squares of corrected values)

$Corrected \sum x_i^2 = 20410 - 2704 + 625 = 18331$

$$Corrected\ \sigma = \sqrt{\frac{Corrected \sum x_i^2}{n} - (Corrected\ Mean)^2}$$

$$Corrected\ \sigma = \sqrt{\frac{18331}{10} - (42.3)^2} = 6.62$$

$Corrected\ Variance = 6.62 * 6.62 = 43.82$

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