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STA 132

MECHATRONICS ENGINEERING

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A study of yellow fever disease (YFD) was conducted. The study was restricted to patients under the age of 40. One purpose was to compare the distribution of cases by age in group A to that of group B. The group data are given below

| CI | Group A | Group B |
|-------|---------|---------|
| 1-5 | 0 | 2 |
| 6-10 | 7 | 4 |
| 11-15 | 10 | 7 |
| 16-20 | 2 | 20 |
| 21-25 | 1 | 16 |
| 26-30 | 5 | 10 |
| 31-35 | 4 | 4 |

Calculate

- i) The mean and standard deviation for each group
- ii) The coefficient of variation for each group.
- iii) Which group has ^{less} variable distribution.

Solution

for Group A

| CI | x | f | fx | $f x-\bar{x} $ | $f x-\bar{x} ^2$ | $ x-\bar{x} ^2$ | $f x-\bar{x} ^2$ |
|-------|-----|-----|------|----------------|------------------|-----------------|------------------|
| 1-5 | 3 | 0 | 0 | 15.8 | 0 | 249.64 | 0 |
| 6-10 | 8 | 7 | 56 | 9.8 | 68.6 | 96.04 | 672.28 |
| 11-15 | 13 | 10 | 130 | 4.8 | 48 | 23.04 | 230.4 |
| 16-20 | 18 | 2 | 36 | 0.2 | 0.4 | 0.04 | 0.08 |
| 21-25 | 23 | 1 | 23 | 5.2 | 5.2 | 27.04 | 27.04 |
| 26-30 | 28 | 5 | 140 | 10.2 | 51 | 104.04 | 520.2 |
| 31-35 | 33 | 4 | 132 | 15.2 | 60.8 | 231.04 | 924.16 |

$$\sum f = 29 \quad \sum fx = 517$$

$$\sum f|x-\bar{x}| = 234$$

$$\sum f|x-\bar{x}|^2 =$$

$$2374.16$$

$$\text{Mean} = \bar{x} = \frac{\sum fx}{\sum f} = \frac{517}{29} = 17.8$$

$$\text{Mean deviation for group A} = \frac{234}{29} = 8.069 \quad \frac{\sum f|x-\bar{x}|}{\sum f}$$

$$M.D = 8.069 \text{ (for group A)}$$

$$\text{Variance} = \frac{2374.16}{29-1} = \frac{2374.16}{28} = \frac{\sum f|x-\bar{x}|^2}{\sum f - 1}$$

$$\text{Variance} = 84.79$$

$$\text{Standard deviation for group A} = \sqrt{\text{Variance}} = \sqrt{84.79}$$

$$S.D = 9.208 \text{ (for group A)}$$

for Group B

| CI | x | f | fx | x - \bar{x} | f x - \bar{x} | x - \bar{x} ² | f x - \bar{x} ² |
|-------|----|----|-----|---------------|-----------------|------------------------------|--------------------------------|
| 1-5 | 3 | 2 | 6 | 17.14 | 34.28 | 293.78 | 587.56 |
| 6-10 | 8 | 4 | 32 | 12.14 | 48.56 | 147.38 | 589.52 |
| 11-15 | 13 | 7 | 91 | 7.14 | 49.98 | 50.98 | 356.86 |
| 16-20 | 18 | 20 | 360 | 2.14 | 42.8 | 4.58 | 91.6 |
| 21-25 | 23 | 16 | 368 | 2.86 | 45.76 | 8.18 | 130.88 |
| 26-30 | 28 | 10 | 280 | 7.86 | 78.6 | 61.78 | 617.8 |
| 31-35 | 33 | 4 | 132 | 12.86 | 51.44 | 165.38 | 661.52 |

$$\sum f = 63 \quad \sum fx = 1269$$

$$\sum f|x-\bar{x}| = 351.42$$

$$\sum f|x-\bar{x}|^2 = 3035.74$$

$$\text{mean} = \bar{x} = \frac{\sum fx}{\sum f} = \frac{1269}{63} = 20.14$$

$$\text{Mean deviation for group B} = \frac{\sum f|x-\bar{x}|}{\sum f} = \frac{351.42}{63}$$

$$M.D = 5.578$$

$$\text{Variance} = \frac{\sum f|x-\bar{x}|^2}{\sum f - 1} = \frac{3035.74}{63-1} = \frac{3035.74}{62}$$

$$= 48.96$$

$$\text{Standard deviation for group B} = \sqrt{\text{Variance}} = \sqrt{48.96}$$

$$S.D = 6.997 \text{ (for group B)}$$

ii) The Coefficient of Variation for each group

Group A

$$C.V = \frac{S.D}{\text{mean}} \times 100$$

$$C.V = \frac{9.208}{17.8} \times 100$$

$$C.V = 51.73 \%$$

Group B

$$C.V = \frac{S.D}{\text{mean}} \times 100$$

$$= \frac{6.997}{20.14} \times 100$$

$$= 34.74 \%$$

iii) Group B has less variable and is said to be uniform and homogenous