

Mean and variance from frequency table

Example

x	Frequency
0	40
2	10
3	20
4	30
Total	100

Mean:

$$\begin{aligned}\bar{x} &= \frac{1}{100} (0 \times 40 + 2 \times 10 + 3 \times 20 + 4 \times 30) \\ &= 2\end{aligned}$$

That is,

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

Variance:

$$\begin{aligned}s^2 &= \frac{1}{99} ((0 - 2)^2 \times 40 + (2 - 2)^2 \times 10 + (3 - 2)^2 \times 20 + (4 - 2)^2 \times 30) \\ &= 3.03\end{aligned}$$

That is,

$$s^2 = \frac{1}{n - 1} \sum_{i=1}^k (x_i - \bar{x})^2 f_i$$

Exercise

Calculate mean deviation (from mean) from the above frequency table.

Solution:

Do it yourself.

Example

Class	Frequency
0 – 5	40
5 – 10	20
10 – 15	10
15 – 20	30
Total	100

We use mid-values of each class in our calculation.

Mean:

$$\begin{aligned}\bar{x} &= \frac{1}{100} (2.5 \times 40 + 7.5 \times 20 + 12.5 \times 10 + 17.5 \times 30) \\ &= 9\end{aligned}$$

That is,

$$\bar{x} = \frac{1}{n} \sum_{i=1}^k m_i f_i$$

Here, m_i is the mid-value of the i th class.

Variance:

$$\begin{aligned}s^2 &= \frac{1}{99} ((2.5 - 9)^2 \times 40 + (7.5 - 9)^2 \times 20 + (12.5 - 9)^2 \times 10 \\ &\quad + (17.5 - 9)^2 \times 30) \\ &= 40.66\end{aligned}$$

$$MD = \frac{1}{n} \sum_{i=1}^k \frac{f_i}{h_i} \times \frac{h_i}{2}$$

That is,

$$s^2 = \frac{1}{n-1} \sum_{i=1}^k (m_i - \bar{x})^2 f_i$$

Exercise

Calculate mean deviation (from mean) from the above frequency table.

Solution

Do it yourself.

$$MD = \frac{1}{n} \sum f_i |x_i - \bar{x}|$$

Assignment (not to be handed in)

1. Learn 'stem and leaf plot' from textbook. Find out its advantage and disadvantage when it is compared to histogram.
2. Learn 'cumulative frequency polygon' (also called 'ogive') and 'cumulative relative frequency polygon' from the textbook. Find out one of its uses.