**Variance and Standard deviation**

**Variance: mean of the squared deviations of the values from their mean**

$$Variance=S^{2}=\frac{\sum\_{}^{}\left(X-\overbar{X}\right)^{2}}{n}$$

For Grouped data

$$Variance=S^{2}=\frac{\sum\_{}^{}f.\left(X-\overbar{X}\right)^{2}}{\sum\_{}^{}f}$$

**Indirect Method**

$$Variance=S^{2}=\frac{\sum\_{}^{}X^{2}}{n}-\left(\frac{\sum\_{}^{}X}{n}\right)^{2}$$

For Grouped data

$$Variance=S^{2}=\frac{\sum\_{}^{}fX^{2}}{\sum\_{}^{}f}-\left(\frac{\sum\_{}^{}fX}{\sum\_{}^{}f}\right)^{2}$$

**Standard deviation: positive square root of the mean of the squared deviations of the values from their mean**

$$S.D=S=\sqrt{\frac{\sum\_{}^{}\left(X-\overbar{X}\right)^{2}}{n}}$$

For Grouped data

$$S.D=S=\sqrt{\frac{\sum\_{}^{}f.\left(X-\overbar{X}\right)^{2}}{\sum\_{}^{}f}}$$

**Indirect Method**

$$S.D=S=\sqrt{\frac{\sum\_{}^{}X^{2}}{n}-\left(\frac{\sum\_{}^{}X}{n}\right)^{2}}$$

For Grouped data

$$S.D=S=\sqrt{\frac{\sum\_{}^{}fX^{2}}{\sum\_{}^{}f}-\left(\frac{\sum\_{}^{}fX}{\sum\_{}^{}f}\right)^{2}}$$

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Class limits** | **Mid Points (X)** |  **frequency** | $$X-\overbar{X}=X-67.83$$ | $$\left(X-\overbar{X}\right)^{2}$$ | $$f.\left(X-\overbar{X}\right)^{2}$$ |
| 45-49 | 47 | 1 | $47-67.83=-$20.83 | 433.89 | 433.89 |
| 50-54 | 52 | 4 | -15.83 | 250.589 | 1002.36 |
| 55-59 | 57 | 17 | -10.83 | 117.289 | 1993.92 |
| 60-64 | 62 | 28 | -5.83 | 33.989 |  |
| 65-69 | 67 | 25 | -0.83 | 0.689 |  |
| 70-74 | 72 | 18 | 4.17 | 17.389 |  |
| 75-79 | 77 | 13 | 9.17 | 84.089 |  |
| 80-84 | 82 | 6 | 14.17 |  |  |
| 85-89 | 87 | 5 | 19.17 |  |  |
| 90-94 | 92 | 2 | 24.17 |  |  |
| 95-99 | 97 | 1 | 29.17 |  |  |
| **Sum** |  | $n=\sum\_{}^{}f=$**120** |  |  | **10866.668** |

$$S.D=S=\sqrt{\frac{\sum\_{}^{}f.\left(X-\overbar{X}\right)^{2}}{\sum\_{}^{}f}}$$

$$S.D=S=\sqrt{\frac{10866.668}{120}}=9.516$$