Mean

STATEMENT :

Given an $\boxed{\texttt{data}}$ with $x = [4,5,6,7,8,9,10,11]$. Determine the $\boxed{\texttt{mean}}$ value using equation below:

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

where:

1. $\sum_{i=1}^{n} x_i$ or $\boxed{\texttt{total}}$ denotes the sum of all numbers in x or $\boxed{\texttt{data}}$

$$\begin{aligned} \sum_{i=1}^{n} x_i &= x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 \\ \boxed{\texttt{total}} &= 4+5+6+7+8+9+10+11 \\ \boxed{\texttt{total}} &= 60 \end{aligned}$$

2. $\boxed{\texttt{n}}$ denotes the lenght of numbers in x or $\boxed{\texttt{data}}$.

$$\begin{aligned} x &= \{x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8\} \\ \boxed{\texttt{n}} &= \{4,5,6,7,8,9,10,11\} \\ \boxed{\texttt{n}} &= 8 \end{aligned}$$

3. $\bar{x}$ or $\boxed{\text{mean}}$ denotes the calculate mean or average value for X or $\boxed{\texttt{data}}$

$$\begin{aligned} \bar{x} &= \frac{\sum_{i=1}^{n} x_i}{n} \\ \boxed{\texttt{mean}} &= \frac{\boxed{\texttt{total}}}{\boxed{\texttt{n}}} \\ \boxed{\texttt{mean}} &= \frac{60}{8} \\ \boxed{\texttt{mean}} &= 7 \end{aligned}$$

Median

STATEMENT :

Given a array list data (*index of data x_i starting from 0*)

$$odd = [x_1, x_2, x_3, x_4, x_5] = [1, 5, 3, 9, 4]$$
$$even = [x_1, x_2, x_3, x_4, x_5, x_6] = [2, 6, 4, 10, 8, 12]$$

Determine the $\boxed{\texttt{median}}$ value using equation below:

1. For an odd data which is $odd = \{x_0, x_1, x_2, x_3, x_4\} = \{1, 5, 3, 9, 4\}$ should be $\boxed{\texttt{sorted}}$ from smallest to largest with $\boxed{x_1}$=$\{1, 3, 4, 5, 9\}$ and $\boxed{n_1}$ is 5, then determine the median value with odd data or $\boxed{\texttt{modd}}$ using:

$$\boxed{\texttt{modd}} = x_{(\lfloor \frac{n_1}{2} \rfloor)} = x_{(\lfloor \frac{5}{2} \rfloor)} = x_2 = 4$$

2. For an even data which is $even = \{x_0, x_1, x_2, x_3, x_4, x_5\} = \{2, 6, 4, 10, 8, 12\}$ should be $\boxed{\texttt{sorted}}$ from smallest to largest with $\boxed{x_2}$=$\{2, 4, 6, 8, 10, 12\}$ and $\boxed{n_2}$ is 6, then determine the median value with even data or $\boxed{\texttt{meven}}$ using:

$$m_1 = x_{(\lfloor \frac{n_2}{2} - 1 \rfloor)} = x_{(\lfloor \frac{6}{2} - 1 \rfloor)} = x_2 = 6$$
$$m_2 = x_{(\lfloor \frac{n_2}{2} \rfloor)} = x_{(\lfloor \frac{6}{2} \rfloor)} = x_3 = 8$$

$$\boxed{\texttt{meven}} = \frac{m_1 + m_2}{2} = \frac{6 + 8}{2} = 7$$

Mode

STATEMENT :

Given an the dictionary with string data

$$\boxed{\texttt{data}} = \{"red","red","yellow","black","blue","red","red"\}$$

For $\boxed{\texttt{data}} = \{"red","red","yellow","black","blue","red","red"\}$.

1. Determine the frequency

$$\boxed{\texttt{f(x)}} = count\ of\ each\ element\ x\ in\ the\ \boxed{\texttt{data}}$$
$$\boxed{\texttt{frequency}} = f("red") = 4, f("yellow") = 1, f("black") = 1, f("blue") = 1$$

2. Determine of maximum frequency

$$\boxed{\texttt{maxs}} = \max_{x \in data}(f(x)) = f("red") = 4$$

3. Identification of mode

$$\boxed{\texttt{mode}} = \{x \mid f(x) = M\} = "red"$$

Variance

STATEMENT :

Given an array list $\boxed{\texttt{data}}$= $[9.2, 1.4, 5.3, 4.1, 12.5, 7.9, 8.7, 11.1]$. Determine the sample of variance or $\boxed{\texttt{var}}$ using equation below:

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

$$\boxed{\texttt{var}} = \frac{\sum_{i=1}^{n}(\boxed{\texttt{x}_i} - \boxed{\texttt{mean}})^2}{\boxed{\texttt{n}} - 1}$$

where:

1. Determine $\boxed{\texttt{n}}$ or length of the data is 8.
2. Calculate the $\boxed{\texttt{total}}$ with summarize all the numbers of data

$$\sum_{i=1}^{n} x_i = \sum_{i=1}^{n} x_8 = 9.2 + 1.4 + 5.3 + 4.1 + 12.5 + 7.9 + 8.7 + 11.1 = 60.19$$

3. Calculate $\boxed{\texttt{mean}}$ of the data with

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

$$\boxed{\texttt{mean}} = \frac{\boxed{\texttt{total}}}{\boxed{\texttt{n}}} = \frac{60.19}{8} = 7.52$$

4. Calculate the square of deviation s_i or $\boxed{\texttt{square}}$

$$s_i = \sum_{i=1}^{n}(x_i - \bar{x})^2$$

$$\boxed{\texttt{square}} = \sum_{i=1}^{n}(\boxed{\texttt{x}_i} - \boxed{\texttt{mean}})^2$$

$$\boxed{\texttt{square}} = (9.2 - 7.52)^2 + (1.4 - 7.52)^2 + (5.3 - 7.52)^2 + (4.1 - 7.52)^2 + (12.5 - 7.52)^2 + (7.9 - 7.52)^2 + (8.7 - 7.52)^2 + (11.1 - 7.52)^2 = 96.05$$

5. Calculate the variance

$$\boxed{\texttt{var}} = \frac{\boxed{\sum square}}{\boxed{\texttt{n}} - 1} = \frac{96.05}{8-1} = 13.72$$

Standard Deviation

STATEMENT :

Given an array list $\boxed{\texttt{data}}$ = [10, 2, 38, 23, 38, 23, 21]. Determine the sample of standard deviation or $\boxed{\texttt{std}}$ using equation below:

$$sd = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

$$\boxed{\texttt{std}} = \sqrt{\frac{\sum_{i=1}^{n}(\boxed{\texttt{x}_i} - \boxed{\texttt{mean}})^2}{\boxed{\texttt{n}} - 1}}$$

where:

1. Determine $\boxed{\texttt{n}}$ or length of the data is 7.
2. Calculate the $\boxed{\texttt{total}}$ with summarize all the numbers of data

$$\sum_{i=1}^{n} x_i = \sum_{i=1}^{n} x_7 = 10 + 2 + 38 + 23 + 38 + 23 + 21 = 155$$

3. Calculate $\boxed{\texttt{mean}}$ of the data with

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

$$\boxed{\texttt{mean}} = \frac{\boxed{\texttt{total}}}{\boxed{\texttt{n}}} = \frac{155}{7} = 22.14$$

4. Calculate the square of deviation $\boxed{\texttt{square}}$

$$\boxed{\texttt{square}} = \sum_{i=1}^{n}(\boxed{\texttt{x}_i} - \boxed{\texttt{mean}})^2$$

$$\boxed{\texttt{square}} = (10 - 22.14)^2 + (2 - 22.14)^2 + (38 - 22.14)^2 + (23 - 22.14)^2 + (38 - 22.14)^2 + (23 - 22.14)^2 + (21 - 22.14)^2 = 1058.85$$

5. Calculate the standard deviation

$$\boxed{\texttt{std}} = \sqrt{\boxed{\texttt{var}}} = \sqrt{\frac{\boxed{\sum square}}{\boxed{\texttt{n}} - 1}} = \sqrt{\frac{1058.85}{7-1}} = 13.28$$

Coefficient of Variation

STATEMENT :

Given an array list $\boxed{\texttt{data}}$ = $[11, 22, 33, 44, 55, 66]$. Determine the Coefficient of Variation using equation below:

$$cv = \frac{\sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}}{\bar{x}} \times 100\% = \frac{\boxed{\texttt{std}}}{\boxed{\texttt{mean}}} \times \boxed{\texttt{100 \%}}$$

where:

1. Calculate the $\bar{x}$ or $\boxed{\texttt{mean}}$ as follow

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

$$\boxed{\texttt{mean}} = \frac{\boxed{\texttt{total}}}{\boxed{\texttt{n}}} = \frac{231}{6} = 38.5$$

2. Calculate the $\boxed{\texttt{std}}$ as follow

$$\boxed{\texttt{std}} = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{2117.5}{5}} = 20.57$$

3. Calculate the coefficient of variation or $\boxed{\texttt{cv}}$ as follow

$$cv = \frac{\sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}}{\bar{x}} \times 100\% = \frac{\boxed{\texttt{std}}}{\boxed{\texttt{mean}}} \times \boxed{\texttt{100 \%}} = \frac{20.57}{38.5} \times 100\% = 53.45\%$$

Range

STATEMENT :

Given an array list $\boxed{\texttt{data}}$ = $[40, 10.5, 5, 60, 72, 81, 4.5]$. Determine the Range value (R) or $\boxed{\texttt{range}}$ using equation below:

$$R = x_{max} - x_{min}$$
$$\boxed{\texttt{range}} = \boxed{\texttt{xmax}} - \boxed{\texttt{xmin}}$$

where:

1. Determine the maximum and minimum value from the data $\boxed{\texttt{xmax}} = 81$ and $\boxed{\texttt{xmin}}$ 4.5.
2. Calculate the $\boxed{\texttt{range}}$ value as follow

$$\begin{aligned} R &= x_{max} - x_{min} \\ \boxed{\texttt{range}} &= \boxed{\texttt{xmax}} - \boxed{\texttt{xmin}} \\ &= 81 - 4.5 \\ &= 76.5 \end{aligned}$$

Quartile 1

STATEMENT :

Given an array list $\boxed{\texttt{data}}$= $[1,3,5,7,9,2,4,6,8,10]$. Determine the Quartile 1 using equation below:

1. Sorting the $\boxed{\texttt{data}}$ $= [1,2,3,4,5,6,7,8,9,10]$
2. Determine the length of the $\boxed{\texttt{data}}$ $= [1,2,3,4,5,6,7,8,9,10]$ is

$$\boxed{\texttt{n}} = 10$$

3. Determine the Position of Quartile 1 or $\boxed{P_{Q1}}$ in the data using

$$\boxed{\texttt{P}_{Q1}} = \frac{1}{4}(n+1) = \frac{1}{4}(10+1) = \frac{11}{4} = 2.75$$

4. The $\boxed{P_{Q1} = 2.75}$ is not integer.
5. Calculate the value of quartile 1 using equation below

$$\begin{aligned}
\boxed{Q_1} &= \boxed{x_{\lfloor p1 \rfloor}} + \boxed{(x_{\lceil p2 \rceil}} - \boxed{x_{\lfloor p1 \rfloor})} \times (\boxed{P_{Q1}} - \lfloor \boxed{P_{Q2}} \rfloor) \\
&= xp1 + (xp2 - xp1) \times (PQ1 - PQ2) \\
&= x_3 + (x_3 - x_2) \times (PQ1 - PQ2) \\
&= 3 + (4-3) \times (2.75 - 2) \\
&= 3 + (1 \times 0.75) \\
&= 3.75
\end{aligned}$$

where:

- x_3 is the third element if counted from 0 in the data array list.
- x_2 is the second element if counted from 0 in the data array list.

Quartile 2

STATEMENT :

Given an array list $\boxed{\texttt{data}}$ $= [1,3,5,7,9,2,4,6,8,10]$. Determine the Quartile 2 using equation below:

1. Sorting the $\boxed{\texttt{data}}$ $= [1,2,3,4,5,6,7,8,9,10]$
2. Determine the length of the $\boxed{\texttt{data}}$ $= [1,2,3,4,5,6,7,8,9,10]$ is

$$\boxed{\texttt{n}} = 10$$

3. Determine the Position of Quartile 2 or $\boxed{P_{Q2}}$ in the data using

$$\boxed{\texttt{P}_{Q2}} = \frac{2}{4}(n+1) = \frac{2}{4}(10+1) = \frac{11}{2} = 5.5$$

4. The $\boxed{P_{Q2} = 5.5}$ is not integer.
5. Calculate the value of quartile 2 using equation below

$$\begin{aligned}
\boxed{Q_2} &= \boxed{x_{\lfloor p1 \rfloor}} + \boxed{(x_{\lceil p2 \rceil}} - \boxed{x_{\lfloor p1 \rfloor})} \times (\boxed{P_{Q2}} - \lfloor \boxed{P_{Q3}} \rfloor) \\
&= xp1 + (xp2 - xp1) \times (PQ2 - PQ3) \\
&= x_5 + (x_6 - x_5) \times (PQ2 - PQ3) \\
&= 6 + (7-6) \times (5.5 - 5) \\
&= 6 + (1 \times 0.5) \\
&= 6.5
\end{aligned}$$

where:

- x_6 is the seventh element if counted from 0 in the data array list.
- x_5 is the sixth element if counted from 0 in the data array list.

Quartile 3

STATEMENT :

Given an array list $\boxed{\texttt{data}}$ = $[1, 3, 5, 7, 9, 2, 4, 6, 8, 10]$. Determine the Quartile 3 using equation below:

1. Sorting the $\boxed{\texttt{data}}$ $= [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]$
2. Determine the length of the $\boxed{\texttt{data}}$ $= [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]$ is

$$\boxed{\texttt{n}} = 10$$

3. Determine the Position of Quartile 3 or $\boxed{P_{Q3}}$ in the data using

$$\boxed{\texttt{P}_{Q3}} = \frac{3}{4}(n+1) = \frac{3}{4}(10+1) = \frac{33}{4} = 8.25$$

4. The $\boxed{P_{Q3} = 8.25}$ is not integer.
5. Calculate the value of quartile 3 using equation below

$$\begin{aligned}
\boxed{Q_3} &= \boxed{x_{\lfloor p1 \rfloor}} + \boxed{(x_{\lceil p2 \rceil}} - \boxed{x_{\lfloor p1 \rfloor})} \times (\boxed{P_{Q3}} - \lfloor \boxed{P_{Q4}} \rfloor) \\
&= xp1 + (xp2 - xp1) \times (PQ3 - PQ4) \\
&= x_8 + (x_9 - x_8) \times (PQ3 - PQ4) \\
&= 9 + (10 - 9) \times (8.25 - 8) \\
&= 9 + (1 \times 0.25) \\
&= 9.25
\end{aligned}$$

where:

- x_9 is the tenth element if counted from 0 in the data array list.
- x_8 is the ninth element if counted from 0 in the data array list.

Decile

STATEMENT :

Given an array list $\boxed{\texttt{data}}= [1,3,5,7,9,2,4,6,8,10]$. Determine the Decile when $\boxed{\texttt{k}}$-value is 3 (*k-value is between 1-10*) using equation below:

1. Sorting the $\boxed{\texttt{data}} = [1,2,3,4,5,6,7,8,9,10]$
2. Determine the length of the $\boxed{\texttt{data}} = [1,2,3,4,5,6,7,8,9,10]$ is

$$\boxed{\texttt{n}} = 10$$

3. Determine the Position of Decile or $\boxed{Dk}$ when $\boxed{\texttt{k}}$-value is 3 using equation below:

$$\boxed{\texttt{Dk}} = \frac{k \times (n+1)}{10} = \frac{3 \times (10+1)}{10} = \frac{33}{10} = 3.3$$

4. The $\boxed{Dk = 3.3}$ is not integer.
5. Calculate the value of decile using equation below

$$\begin{aligned}
\boxed{Dv} &= \boxed{x_{\lfloor p1 \rfloor}} + \boxed{(x_{\lceil p2 \rceil}} - \boxed{x_{\lfloor p1 \rfloor})} \times (\boxed{Dk} - \lfloor\boxed{Dm}\rfloor) \\
&= xp1 + (xp2 - xp1) \times (Dk - Dm) \\
&= x_3 + (x_4 - x_3) \times (Dk - Dm) \\
&= 4 + (5-4) \times (3.3-3) \\
&= 4 + (1 \times 0.3) \\
&= 4.3
\end{aligned}$$

where:

- x_4 is the fifth element if counted from 0 in the data array list.
- x_3 is the fourth element if counted from 0 in the data array list.

Percentile

STATEMENT :

Given an array list $\boxed{\texttt{data}}$= $[1,3,5,7,9,2,4,6,8,10]$. Determine the Percentile when $\boxed{\texttt{p}}$-value is 60 (*p-value is between 1-100*) using equation below:

1. Sorting the $\boxed{\texttt{data}}$ $= [1,2,3,4,5,6,7,8,9,10]$
2. Determine the length of the $\boxed{\texttt{data}}$ $= [1,2,3,4,5,6,7,8,9,10]$ is

$$\boxed{\texttt{n}} = 10$$

3. Determine the Position of Percentile or $\boxed{Pp}$ when $\boxed{\texttt{p}}$-value is 60 using equation below:

$$\boxed{\texttt{Pp}} = \frac{p \times (n+1)}{10} = \frac{60 \times (10+1)}{100} = \frac{660}{100} = 6.6$$

4. The $\boxed{Pp = 6.6}$ is not integer.
5. Calculate the value of percentile using equation below

$$\begin{aligned}
\boxed{Pv} &= \boxed{x_{\lfloor p1 \rfloor}} + \boxed{(x_{\lceil p2 \rceil}} - \boxed{x_{\lfloor p1 \rfloor})} \times (\boxed{Pp} - \lfloor \boxed{Pr} \rfloor) \\
&= xp1 + (xp2 - xp1) \times (Pp - Pr) \\
&= x_6 + (x_7 - x_6) \times (Pp - Pr) \\
&= 7 + (8-7) \times (6.6-6) \\
&= 7 + (1 \times 0.6) \\
&= 7.6
\end{aligned}$$

where:

- x_7 is the eighth element if counted from 0 in the data array list.
- x_6 is the seventh element if counted from 0 in the data array list.

Skewness

STATEMENT :

Given a $\boxed{\texttt{data}}$ with $x = [1, 5, 10, 15, 20]$ and $\boxed{\texttt{n}} = 5$. Determine the skewness!

1. Calculate mean

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{1+5+10+15+20}{5} = \frac{51}{5} = 10.2$$

where:

- $\bar{x}$: $\boxed{\texttt{mean}}$
- $\sum_{i=1}^{n} x_i$: $\boxed{\texttt{total}}$ of sum all the data
- $\boxed{\texttt{n}}$: length of data

2. Calculate standard deviation

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{(1-10.2)^2 + (5-10.2)^2 + ... + (20-10)^2}{5-1}}$$
$$= \sqrt{\frac{229.72}{4}} = \sqrt{57.43} = 7.59$$

where:

- s : $\boxed{\texttt{std}}$ (*standard deviation*)

3. Calculate skewness

$$\boxed{\texttt{G1}} = \frac{\boxed{\texttt{n}}}{(\boxed{\texttt{n}}-1)(\boxed{\texttt{n}}-2)} \times \frac{\sum_{i=1}^{n}(x_i - \bar{x})^3}{s^3}$$
$$= \frac{5}{(5-1)(5-2)} \times \frac{((1-10.2)^3 + (5-10.2)^3 + ... + (20-10.2)^3)}{(7.58)^3}$$
$$= \frac{5}{12} \times \frac{158.136}{434.415}$$
$$= 0.15$$

where:

- $\sum_{i=1}^{n}(x_i - \bar{x})^3$: $\boxed{\texttt{cube}}$ is deviation between x_i and $\boxed{\texttt{mean}}$ with number of degree $\boxed{3}$.
- s : $\boxed{\texttt{std}}$ (*standard deviation*) with number of degree $\boxed{3}$.

Kurtosis

STATEMENT :

Given a $\boxed{\texttt{data}}$ with $x = [1, 5, 10, 15, 20]$ and $\boxed{\texttt{n}} = 5$. Determine the kurtosis!

1. Calculate mean

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{1 + 5 + 10 + 15 + 20}{5} = \frac{51}{5} = 10.2$$

   where:

   - $\bar{x}$: $\boxed{\texttt{mean}}$
   - $\sum_{i=1}^{n} x_i$: $\boxed{\texttt{total}}$ of sum all the data
   - $\boxed{\texttt{n}}$: length of data

2. Calculate standard deviation

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{(1-10.2)^2 + (5-10.2)^2 + ... + (20-10.2)^2}{5-1}}$$
$$= \sqrt{\frac{229.72}{4}} = \sqrt{57.43} = 7.58$$

   where:

   - s : $\boxed{\texttt{std}}$ (*standard deviation*)

3. Calculate kurtosis

$$\boxed{\texttt{G2}} = \left(\frac{\boxed{\texttt{n}}\,(\boxed{\texttt{n}}+1)}{(\boxed{\texttt{n}}-1)(\boxed{\texttt{n}}-2)(\boxed{\texttt{n}}-3)} \times \frac{\sum_{i=1}^{n}(x_i - \bar{x})^4}{s^4}\right) - \frac{3(n-1)^2}{(n-2)(n-3)}$$
$$= \left(\frac{5(5+1)}{(5-1)(5-2)(5-3)} \times \frac{((1-10.2)^4 + ... + (20-10.2)^4)}{(7.58)^4}\right) - \frac{3(5-1)^2}{(5-2)(5-3)}$$
$$= \left(\frac{30}{24} \times \frac{17,969.7872}{3,318.8457}\right) - 8$$
$$= 6.7675 - 8 = -1.3733$$

   where:

   - $\sum_{i=1}^{n}(x_i - \bar{x})^4$: $\boxed{\texttt{quad}}$ is deviation between x_i and $\boxed{\texttt{mean}}$ with number of degree $\boxed{4}$.
   - s : $\boxed{\texttt{std}}$ (*standard deviation*) with number of degree $\boxed{4}$.